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Report of Activities
1992
Resident Geologists

Ontario Geological Survey
Miscellaneous Paper 161

edited by
K.G. Fenwick, J.W. Newsome and A.E. Pitts

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Contents

1. FIELD SERVICES SECTION, NORTHWESTERN ONTARIO
   Introduction ........................................................................................................... 1

2. KENORA RESIDENT GEOLOGIST'S DISTRICT—1992
   Introduction ........................................................................................................... 3
   Mining and Quarrying Activity ........................................................................... 6
   Dimension Stone ................................................................................................... 6
   Decorative Aggregate Stone ................................................................................ 7
   High-Purity Quartz .............................................................................................. 7
   Small-Scale Mining ............................................................................................. 7
   Peat ....................................................................................................................... 7
   Advanced Exploration and Development ........................................................... 7
   Western Troy Capital Resources Inc., Menary Township ................................... 7
   Consolidated Professor Mines Ltd., Shoal Lake ................................................ 7
   Exploration activities .......................................................................................... 7
   Gold and Base Metals ......................................................................................... 7
   Lake of the Woods Area ...................................................................................... 7
   Manitou-Wabigoon-Eagle Lakes Area ............................................................... 8
   Bruin-Wildrice Lakes Area ................................................................................ 9
   Umfreville-Treelined Lakes Area ....................................................................... 9
   Mine Centre Area ............................................................................................... 9
   Menary Township Area ....................................................................................... 10
   Bluffpoint Lake Area .......................................................................................... 11
   Dogpaw Lake Area ............................................................................................. 11
   Cedar Lake Area ................................................................................................ 11
   Industrial Minerals ............................................................................................. 11
   Soapstone .......................................................................................................... 11
   Silica-Fluorite-Tungsten ................................................................................... 11
   Ontario Government Incentive Programs .......................................................... 11
   Resident Geologist's Staff Activities ................................................................. 11
   Acknowledgments .............................................................................................. 12
   Property Examinations ....................................................................................... 13
   Wagg Gold Prospect ........................................................................................... 13
   Kawashegamuk Lake Silica-Fluorite-Tungsten Occurrence ................................ 15
   Thunder Lake Gold-Zinc Prospect ..................................................................... 16
   Lobstick Bay Gold-Fluorite Prospect .................................................................. 17
   Plomp Zinc-Copper-Gold Occurrence ................................................................ 18
   Hupchuck Copper Occurrence .......................................................................... 19
   Mironsky Copper-Zinc Prospect ....................................................................... 19
   Pocket Pond Zinc-Copper Prospect .................................................................... 21
   Volcanogenic Massive Sulphide Compilation Study ....................................... 23
   Introduction ........................................................................................................ 23
   Rice Bay Area ...................................................................................................... 23
   Stormy Lake Area ............................................................................................... 24
   Phinney-Dash Lakes Area ................................................................................... 25
   Outer Bay–Lake of the Woods .......................................................................... 26
   Zigzag Island–Lake of the Woods ...................................................................... 27
   Mineral Deposits Not Being Mined in the Kenora Resident Geologist's District 27
   Drill Core Storage Program ............................................................................... 32
   Recommendations for Exploration ..................................................................... 34
   Ontario Geological Survey—Geoscience Branch Activities ............................. 35
   Research by Other Agencies ............................................................................. 36
   University Theses ............................................................................................... 36
   MSc and MA Theses ......................................................................................... 36
   PhD Thesis ......................................................................................................... 36
   Other Research .................................................................................................. 36
Selected Publications Received During 1992 ............................................................... 36
References .................................................................................................................. 36

TABLES
2.1. Summary of claims recorded and assessment work credit ............................... 5
2.2. Exploration activity during 1992 ................................................................. 5
2.3. Results of some of the Champion Bear Resources Ltd.'s diamond drilling...... 10
2.4. Property and other visits ............................................................................. 13
2.5. Mineral deposits not being mined ............................................................... 28
2.6. Drill core collection sites ............................................................................ 33
2.7. Maps and reports pertaining to the Kenora Resident Geologist's District
    issued by the Ontario Geological Survey, 1992 ............................................ 36

FIGURES
2.1. Kenora Resident Geologist's District: claim-staking, exploration activity,
    advanced exploration and small-scale mining ................................................. 4
2.2. Kenora Resident Geologist's District: property visits, diamond-drill core
    collection sites, OGS field work ................................................................. 14
2.3. General geology and mineral occurrences, Rice Bay area .......................... 20
2.4. Areas recommended for exploration for volcanogenic massive sulphide
    mineralization ......................................................................................... 22
2.5. Stormy Lake area general geology .............................................................. 24
2.6. General geology and mineral occurrences of the Phinney–Dash lakes area.... 26

3. RED LAKE RESIDENT GEOLOGIST'S DISTRICT—1992
Introduction ............................................................................................................. 39
Mining Activities .................................................................................................. 39
    Placer Dome Inc. — Campbell Mine ............................................................. 39
    Dickenson Mines Ltd. — Arthur W. White Mine .......................................... 39
Advanced Exploration and Development .............................................................. 44
Exploration Activities .......................................................................................... 45
Resident Geologist's Staff Activities .................................................................. 45
Acknowledgments ............................................................................................... 46
Reconnaissance of the Zionz Lake–Jackpine Lake Area ....................................... 46
    Introduction ............................................................................................... 46
    Previous Work ........................................................................................... 46
    Quaternary Geology ................................................................................... 46
    Geology ....................................................................................................... 46
Mineral Occurrences ............................................................................................ 48
    Fort Reliance Minerals Ltd. ........................................................................ 48
Conifer Lake Stock ............................................................................................... 49
    Previous Work ........................................................................................... 49
    Geology ....................................................................................................... 50
    Structure ..................................................................................................... 50
    Mineralization ............................................................................................ 50
Property Examinations .......................................................................................... 51
    Gold Occurrences and Prospects ............................................................... 51
    Intelsano Property, Bateman Township ....................................................... 51
    Geology ....................................................................................................... 51
    Mineralization ............................................................................................ 51
    Wolf Bay Property, Todd Township ............................................................ 52
    Previous Work ........................................................................................... 52
    Geology ....................................................................................................... 52
Base Metal Prospects ............................................................................................ 53
    Dixie 3, 17, 18, 19 Prospects ...................................................................... 53
    Location and Access .................................................................................... 53
    Previous Work ........................................................................................... 53
    Geology ....................................................................................................... 53
    Mineralization ............................................................................................ 55
4. SIOUX LOOKOUT RESIDENT GEOLOGIST’S DISTRICT—1992

Introduction ................................................................. 61
Mining Activity ............................................................ 61
Exploration Activity ...................................................... 61
Northern Greenstone Belt ........................................... 65
Central Uchi Greenstone Belt ...................................... 65
Wabigoon Subprovince ............................................... 65
Savant Lake area ........................................................ 65
Resident Geologist’s Staff Activities ............................. 66
Property Examinations ................................................ 67
Regional Geology of Sturgeon Lake Area .................... 67
The Douglas Mining Company Prospect (Belmore Bay of Sturgeon Lake) .......................... 67
Location and Access .................................................... 68
Exploration History ..................................................... 68
Geology ........................................................................... 68
Armstrong-Best Prospect, King Bay of Sturgeon Lake ...................................................... 70
Location and Access .................................................... 70
Introduction .................................................................... 70
4.12. Location map for the Albany shaft area, Pickle Crow property and the First Loon Lake “Exhalitive” horizon ................................................. 81
4.13. General geology of the Albany shaft area, Pickle Crow property .......... 82
4.14. Geology of the “D” Zone area, Pickle Crow property .......................... 84
4.15. Geology of the “E” Zone trench, Pickle Crow property, with sample locations ................................................................. 84
4.16. Generalized geology of the Albany porphyry, North Contact trench ...... 86

5. THUNDER BAY RESIDENT GEOLOGIST’S DISTRICT—1992

Introduction ........................................................................................................... 91
Mining Activity ....................................................................................................... 91
Shebandowan Mine .............................................................................................. 91
Amethyst ................................................................................................................ 91
Advanced Exploration Activity and Development .................................................... 91
Madeleine Mines Ltd.–Lac des Iles Platinum Group Metals ..................................... 91
Central Crude Limited–Moss Lake Project .............................................................. 91
Ontario Prospectors Assistance Program ............................................................... 93
Ontario Mineral Incentive Program ....................................................................... 93
Exploration Activity .............................................................................................. 93
Resident Geologist’s Staff Activities .................................................................... 93
Property Examinations ......................................................................................... 96
  Fisher Lake Gold Occurrence, Moss Township (Akiko Gold Resources Ltd.) .... 96
    History ............................................................................................................. 96
    Location .......................................................................................................... 96
    Geology .......................................................................................................... 96
  E. Ranta, Moss Lake .......................................................................................... 96
  Obadinaw Property (Elephant Lake) ................................................................. 97
  North Gold Showing, Saganaga Lake .............................................................. 97
    History ............................................................................................................. 97
    Geology .......................................................................................................... 97
Thunder Bay Drill Core Library ............................................................................. 98
  Introduction ....................................................................................................... 98
  Drill Core Inventory ......................................................................................... 98
  Catalogues ........................................................................................................ 98
  Analysis of Drill Core ...................................................................................... 99
  Donation of Drill Core .................................................................................... 99
  Remote Core Storage ....................................................................................... 99
  Core Collected in 1992 ................................................................................... 99
    Can–Fer Mines Ltd. and Algoma Steel Corporation Limited, ................. 100
    Can–Fer Property, Suni Township .............................................................. 99
    Cold Spring Granite (Canada) Ltd., Coldwell, McCoy and O’Neill Townships.. 101
    Bond Gold Canada Inc., Hemlo West Property, Lecours Township ........ 101
    Algoma Steel Corporation Limited, Geraldton Property, Errington Township .... 101
    Ventex Energy Limited, Olcott Property, McCaul Township ..................... 101
Recommendations for Exploration ...................................................................... 102
  Amethyst .......................................................................................................... 102
  Proterozoic Base Metals ............................................................................... 103
Current Research ................................................................................................ 103
  Ontario Geological Survey ........................................................................... 103
  Lakehead University ....................................................................................... 103
References ......................................................................................................... 103

TABLES
  5.1. Exploration activity .................................................................................... 94
  5.2. Drill core collected by Thunder Bay Drill Core Library staff during 1992 ...... 100

FIGURES
  5.1. Thunder Bay Resident Geologist’s District ............................................... 92
  5.2. Fisher Lake gold occurrence .................................................................... 97
  5.2. Fisher Lake gold occurrence .................................................................... 97
6. BEARDMORE–GERALDTON RESIDENT GEOLOGIST’S DISTRICT—1992

Introduction .................................................................................................................. 105
Exploration Activity ..................................................................................................... 106
Resident Geologist’s Staff Activities ........................................................................ 106
Property Examinations .................................................................................................. 111
   General Geology and Structure .............................................................................. 111
   Beardmore–Geraldton Belt ..................................................................................... 111
   Nordic Lake Occurrence ......................................................................................... 111
   Wenzoski Occurrence ............................................................................................. 112
   Onaman–Tashota Metavolcanic Belt ....................................................................... 113
   O’Neil Creek (Bat Lake) Occurrence ..................................................................... 113
   Onaman River Property ........................................................................................ 114
   Sachigo Subprovince .............................................................................................. 116
   Blue Heron (Lansdowne House) Project ................................................................. 116
Recommendation for Exploration ............................................................................... 118
Base Metals and Gold ................................................................................................. 118
Industrial Minerals .................................................................................................... 118
Acknowledgments ....................................................................................................... 119
Selected Publications Received ................................................................................... 119
References .................................................................................................................. 119

TABLES
   6.1. Exploration activity .......................................................................................... 107
   6.2. Assay values for the Blue Heron (Lansdowne House) project ......................... 118

FIGURES
   6.3. Property visits, Beardmore–Geraldton Resident Geologist’s District (south map) ......................................................................................................................... 110
   6.4. Onaman River property .................................................................................... 115

7. SCHREIBER–HEMLO RESIDENT GEOLOGIST’S DISTRICT—1992

Introduction .................................................................................................................. 121
Acknowledgments ....................................................................................................... 126
Mining Activity ............................................................................................................ 126
   Geco Division (Noranda Inc.) ................................................................................ 126
   Winston Lake Division (Minnova Inc.) .................................................................. 126
   Hemlo Area Mines ................................................................................................ 126
   David Bell Mine (Teck–Corona Operating Corporation) ....................................... 126
   Golden Giant Mine (Hemlo Gold Mines Inc.) ....................................................... 126
   Williams Mine (Williams Operating Corporation) ............................................... 126
Exploration Activity ................................................................................................... 126
   Gold Exploration .................................................................................................... 127
   Base Metal Exploration ......................................................................................... 128
   Platinum Group Element Exploration ................................................................... 128
   Industrial Minerals Exploration ........................................................................... 128
General Geology .......................................................................................................... 128
Resident Geologist’s Staff Activities ........................................................................ 128
Property Examinations—1992 ................................................................................... 131
   Twomney Occurrences .......................................................................................... 131
   Iron Formation-Hosted Gold Mineralization ......................................................... 131
   Vein-Hosted Gold Mineralization (Power Line Occurrence) .............................. 132
   McKenna–McCann and/or W3 Vein and W3 Extension Area ............................... 132
Nicopor Prospect ................................................................. 133
Ansell Lake (Mitto) Occurrence ............................................ 135
Recommendations for Exploration ........................................ 136
Gold .......................................................... 136
   Hemlo Area .................................................. 136
   Schreiber Area ............................................. 138
Base Metals .......................................................... 139
   Jackpine River–Gravel River Area ............................. 139
   Jackfish Area ................................................ 139
   Industrial Minerals ......................................... 140
Diamonds ........................................................... 141
The Manitouwadge Mineral Resource Geologist Project .......... 141
   Introduction .................................................. 141
   Acknowledgments ........................................... 143
Mining Activity .......................................................... 143
Exploration Activity ...................................................... 143
Gold Exploration ....................................................... 144
Base Metal Exploration .................................................. 144
Platinum Group Element Exploration ................................... 145
   Industrial Minerals Exploration .............................. 145
Property Examinations ..................................................... 145
   Kusins Lead-Zinc Occurrence ............................ 145
   McKay–Fowler Zinc Occurrence .......................... 149
   Beggs–Currie Copper-Nickel Occurrence ............... 151
   Rockbound Lake Copper Occurrence ................. 154
Recommendations for Exploration ........................................ 154
Gold .......................................................... 155
   Hemlo Area .................................................. 155
   Dead Otter Lake–Theresa Lake–Spruce Bay Area ........ 156
   Manitouwadge Area ....................................... 156
Base Metals .......................................................... 157
   Page Lake Area ............................................. 157
   Black River–Dotted Lake–Theresa Lake–Spruce Bay Area 157
   Manitouwadge Area ....................................... 158
Platinum Group Elements .................................................. 159
Ontario Geological Survey Activities ................................... 159
Geological Survey of Canada Activities ........................... 159
NSERC Strategic Grant Project ......................................... 160
Research by Other Agencies ............................................ 160
Ontario Geoscience Research Grant Program ...................... 160
University Theses .......................................................... 160
Selected Publications Received ........................................... 161
References ............................................................................. 162

TABLES
7.1. Exploration activity... (expressed as percentage of programs) ........... 124
7.2. Exploration activities .......................................................... 124
7.3. Drill results from the North Shores–Worthington Bay property ........ 128
7.4. Property examinations in 1992 .................................................. 130
7.5. Assay results from the Twomey power line occurrence ................ 132
7.6. Assay results from the Nicopor prospect ..................................... 135
7.7. Assay results from the Ansell Lake occurrence ............................ 136
7.9. Assay results for samples from the Kusins lead-zinc occurrence .... 148
7.10. Assay results for samples from the McKay–Fowler zinc occurrence ... 151
7.11. Assay results for samples collected from the Beggs–Currie copper-nickel occurrence ........................................... 153
7.12. Assay results for samples collected from the Rockbound Lake copper occurrence ........................................... 155
8. NORTHWESTERN ONTARIO INDUSTRIAL MINERALS PROJECT

Introduction ............................................................................................................. 167
Acknowledgments ................................................................................................... 167
Mining Activity ....................................................................................................... 167
Granite Dimension Stone ....................................................................................... 167
Quartz .................................................................................................................... 167
Crushed Granite .................................................................................................... 170
Peat ....................................................................................................................... 170
Soapstone .............................................................................................................. 170
Exploration Activity ............................................................................................. 170
Granite Dimension Stone ....................................................................................... 170
Silica ...................................................................................................................... 170
Spectrolite ............................................................................................................. 170
Other Commodities .............................................................................................. 171
Industrial Minerals Staff Activities ........................................................................ 171
Property Examinations ......................................................................................... 172
Bad Vermilion Lake Anorthosite ........................................................................... 172
Dickison Lake Quartz Occurrence ....................................................................... 172
Thomas Lake Road Graphite Occurrence ............................................................ 177
Shack Lake Spectrolite Occurrence ..................................................................... 178
Ear Falls Dimension-Stone Study ........................................................................ 179
CN Trax – 3 ......................................................................................................... 179
CN Trax – 4 ......................................................................................................... 179
McKenzie Bay – 1 .............................................................................................. 180
Wennesaga – 8 .................................................................................................... 180
Recommendations for explorations ....................................................................... 180
Dimension Stone ................................................................................................. 180
Graphite ............................................................................................................... 180
Silica ..................................................................................................................... 180
Other Commodities ........................................................................................... 180
References ............................................................................................................ 181

TABLES

8.1. Industrial mineral producers and seasonal producers—1992 ..................... 168
8.2. Exploration activity—1992 ........................................................................ 171
8.3. Industrial mineral property examinations—1992 ...................................... 173
8.4. Bad Vermilion Lake whole rock geochemistry—1992 .............................. 175
8.5. Dickison Lake whole rock geochemistry ..................................................... 177

FIGURES

8.1a. Northwestern Ontario Industrial Minerals Project (producing quarries and
exploration activity in 1992) .................................................................................. 168
8.1b. Northwestern Ontario Industrial Minerals Project ........................................ 169
8.1c. Northwestern Ontario Industrial Minerals Project ....................................... 169
8.2c. Northwestern Ontario Industrial Minerals Project (property visits in 1992) .. 174
9. FIELD SERVICES SECTION, NORTHEASTERN ONTARIO

Introduction.................................................................................................................. 183
Exploration and Mining Highlights........................................................................ 187
Timmins District ........................................................................................................ 187
Kirkland Lake ........................................................................................................... 189
 Sudbury District ........................................................................................................ 190
 Cobalt District ........................................................................................................... 191
Sault Ste. Marie ......................................................................................................... 192
Wawa District .............................................................................................................. 192

10. WAWA RESIDENT GEOLOGIST’S DISTRICT — 1992

Introduction.................................................................................................................. 195
Mining Activity .......................................................................................................... 195
G.W. MacLeod Mine ............................................................................................... 195
Magino Mine ............................................................................................................. 195
Advanced Exploration and Development ............................................................... 198
Monk Gold and Resources Limited ........................................................................ 198
Spirit Lake Explorations Limited ............................................................................ 198
Exploration Activity ................................................................................................ 198
Frewest Resources Inc. ............................................................................................ 198
Gold Giant Minerals Inc. .......................................................................................... 198
Noranda Exploration Company Ltd. .................................................................... 199
Spirit Lake Explorations Limited ............................................................................ 199
Wolverine Resources Inc. ......................................................................................... 199
Resident Geologist’s Staff Activities ...................................................................... 199
Abandoned Mines Hazard Abatement Program .................................................... 200
Property Descriptions .............................................................................................. 200
Molybdenite Lake Property, Andre Township ...................................................... 200
Gananoque Vein, Rabazo Township ..................................................................... 202
Barton Occurrence, McMurray Township .............................................................. 202
Recommendations for Exploration ......................................................................... 203
Research by Other Agencies .................................................................................... 204
Carleton University ................................................................................................. 204
University of Toronto .............................................................................................. 204
St. Lawrence University ........................................................................................... 204
University of Massachusetts .................................................................................... 204
Selected Publications Received ............................................................................ 204
References .................................................................................................................. 205

TABLES

10.1. Exploration activity.......................................................................................... 196

FIGURES

10.2. Location of mineral occurrences or properties described in this report .... 201
10.3. Location of and access to molybdenite showings, Molybdenite Lake area ...... 201
10.4. Land disposition in the Wawa Resident Geologist’s District ....................... 203

11. SAULT STE. MARIE RESIDENT GEOLOGIST’S DISTRICT—1992

Introduction.................................................................................................................. 207
Mining Activity .......................................................................................................... 207
Denison Mines Limited ............................................................................................ 207
Rio Algom Limited .................................................................................................... 207
Ontario Trap Rock Limited ....................................................................................... 208
Root River Sandstone Quarry ................................................................. 208
Exploration Activity ............................................................................. 208
Resident Geologist's Office Staff Activities ........................................ 212
Bruce Mines Tourism Project ................................................................. 213
Educational Activity ............................................................................... 213
Mine Hazards ......................................................................................... 214
Elliot Lake Geology Office ................................................................. 214
Property Examinations ........................................................................ 214
Copper Occurrences in Varley and Albanel Townships ..................... 214
The Falconer-Palkovits Properties: Whiskey Lake Greenstone Belt .... 215
Anomalous Gold Content in Huronian Conglomerate ...................... 215
Chalcopyrite in Dolostone in Fenwick Township .............................. 217
Introduction .......................................................................................... 217
Location and Field Methods ................................................................. 217
General Geology .................................................................................. 217
Chalcopyrite Mineralization ................................................................. 218
Barite Mineralization ........................................................................... 219
Stringer Lake Hematite Occurrence ................................................... 219
Northwest Stripped Area ..................................................................... 220
Central Stripped Area .......................................................................... 220
Stringer Lake Stripped Area ............................................................... 220
Property Mineralization ...................................................................... 221
Industrial Uses .................................................................................... 222
Glenrock Showing ................................................................................. 222
An Occurrence of Domeykite North of Sault Ste. Marie .................... 224
Geological Setting .............................................................................. 224
Mineralization ..................................................................................... 225
The Artisan (Alur) Molybdenite Prospect ............................................ 225
Previous Work ..................................................................................... 225
General Geology ................................................................................ 226
Carbonate Alteration ......................................................................... 226
Mineralization .................................................................................... 226
Conclusions ....................................................................................... 227
Observations ....................................................................................... 227
Doran Chalcopyrite Occurrence ....................................................... 227
The Sault Ste. Marie Drill Core Library Program .............................. 228
Suggestions for Prospectors ................................................................. 230
Ontario Geological Survey Activities ............................................... 231
Research by Other Agencies ............................................................... 231
Selected Publications Received .......................................................... 231
References .......................................................................................... 231

TABLES
11.1. Exploration activity .................................................................. 211
11.2. Gold, uranium and thorium content of volcanic and sedimentary rocks from the base of the Huronian Super group, Thessalon and Otter townships ......................................................... 216
11.3. Summary of drill core collected in 1992 .................................... 230

FIGURES
11.2. Geological map of part of Fenwick Township showing the location of disseminated chalcopyrite in dolostone ................................................................. 218
11.3. Copper content of some Proterozoic dolostones ...................... 219
11.4. Stringer Lake hematite occurrence ........................................... 221
11.5. Sketch of Glenrock showing, Noranda stripping ..................... 223
11.6. Sketch of a vertical section of a domeykite-bearing rhyolitic intrusion ......................................................... 225
11.7. Geological map of the Artisan molybdenite occurrence, Gaudette Township ......................................................... 227
11.8. A geological sketch map of the Doran chalcopyrite occurrence, Ryan Township ......................................................... 228
12. TIMMINS RESIDENT GEOLOGIST'S DISTRICT—1992

Introduction ............................................................................................................. 233
Claim Staking Activity ............................................................................................ 233
Claims Recorded in the Timmins Resident Geologist's District—1992 ................ 233
Mining Activity ....................................................................................................... 233
Base Metals ............................................................................................................. 233
Falconbridge Limited, Kidd Creek Mine ............................................................... 233
Timmins Nickel Incorporated, Redstone Mine ....................................................... 244
Precious Metals ...................................................................................................... 244
Falconbridge Gold Corporation, Bell Creek Mine ................................................... 244
Falconbridge Gold Corporation, Hoyle Pond Mine ............................................... 245
Falconbridge Gold Corporation, Owl Creek Mine ................................................... 245
Placer Dome Incorporated, Detour Lake Mine ....................................................... 245
History ..................................................................................................................... 245
Geology ................................................................................................................... 246
New Ore Zones ......................................................................................................... 246
Pebble Dikes ............................................................................................................ 247
Mining ....................................................................................................................... 247
Placer Dome Incorporated, Dome Mine ................................................................. 247
Royal Oak Mines Inc. Timmins Operations ............................................................. 248
St. Andrew Goldfields Limited, Stock Mine ............................................................ 249
Introduction ............................................................................................................. 249
History ..................................................................................................................... 249
Geology ................................................................................................................... 249
Mining and Development ........................................................................................ 251
Industrial Minerals .................................................................................................. 251
Luzenac Incorporated, Reeves Mine ....................................................................... 251
Advanced Exploration and Development .............................................................. 252
Claude Rundle Gold Mines Limited, Rundle Property ............................................. 252
Great White Minerals Ltd., Fripp–Price Townships ............................................... 252
General Geology .................................................................................................... 252
Activity in 1992 ....................................................................................................... 252
Great Lakes Kaolin Inc. (Mineral Research Canada), Kipling Township .............. 252
Exploration Activity ............................................................................................... 253
Introduction ............................................................................................................. 253
Asarco Exploration Co. of Canada Ltd. ................................................................. 253
BHP Minerals Canada Ltd. .................................................................................... 253
Cominco Limited .................................................................................................... 257
Cree Lake Resources .............................................................................................. 257
Falconbridge Limited ............................................................................................. 258
Homestake Canada Ltd. ......................................................................................... 258
Inco Exploration and Technical Services Limited .................................................. 258
KWG Resources Incorporated–Blue Falcon Mines Limited .................................... 259
Kennecott Canada Incorporated ............................................................................ 259
Kirkton Resources Corporation ............................................................................. 259
Moneta Porcupine Mines Incorporated ................................................................. 260
Noble Peak Resources Ltd. ................................................................................... 260
Noranda Exploration Company Limited ............................................................... 261
Noront Resources Limited–Galico Resources Incorporated, Hurdman Township ... 261
Placer Dome Incorporated ..................................................................................... 262
Rio Algom Exploration Inc. ...................................................................................... 262
Royal Oak Mines Incorporated .............................................................................. 262
Tri Origin Exploration Limited ............................................................................. 263
Resident Geologist's Staff Activities ....................................................................... 263
Property Examinations ............................................................................................ 264
Cogema Canada Limited–Moneta Porcupine Mines Incorporated, Tisdale Township ......................................................................................................................... 264
Introduction ............................................................................................................ 264
Location and Access ............................................................................................... 264
History ....................................................................................................................... 264
General Geology ........................................................................................................265
Property Geology ......................................................................................................265
Recent Program .......................................................................................................265
Galata Property, Keefer Township ..............................................................................266
Introduction .............................................................................................................266
Location and Access .................................................................................................266
General Geology .......................................................................................................266
History .......................................................................................................................266
Investigation .............................................................................................................266
Kaltwasser–Demarchi Occurrence, Sheraton Township ..............................................267
Introduction .............................................................................................................267
Location and Access .................................................................................................267
General Geology .......................................................................................................267
History .......................................................................................................................267
Investigation .............................................................................................................267
Keefer Lake Resources, Denton Township ..................................................................268
Introduction .............................................................................................................268
Location and Access .................................................................................................268
General Geology .......................................................................................................268
History .......................................................................................................................268
Investigation .............................................................................................................268
Drill Core Library Program ......................................................................................269
Recommendations for Exploration ............................................................................269
Potential for Nickel Discoveries in the Shaw Dome Area ..........................................269
Ontario Geological Survey–Geoscience Branch Activities ........................................270
Geology of Keith and Muskego Townships, Northern Swayze Greenstone Belt .......270
Quaternary Geology of the Foleyet Area, Northern Ontario ....................................271
Gold Mineralization in the Northern Night Hawk Lake area of the Abitibi Greenstone Belt ..............................................................................................................271
Research by Other Agencies .....................................................................................271
Western Abitibi Mineral Deposit Study .....................................................................271
Regional Geology and Structure of the Archean Swayze Greenstone Belt and Surrounding Granitoid Terranes: Implications for Mineralization ...........................................271
Selected Publications Received ..................................................................................271
References ...............................................................................................................271

TABLES
12.1. Summary of government incentive programs (OPAP and/or OMIP) ................240
12.2. Summary of claims recorded and assessment work credit for 1992 .................240
12.3. Production statistics for 1992 for active mining operations .........................241
12.4. Base metal production to the end of 1992 .....................................................242
12.5. Gold production to the end of 1991 ...............................................................242
12.7. Previously unlisted exploration data received in 1992 ..................................256
12.8. Additions to the Timmins Drill Core Library collection ..................................269
12.9. Maps and reports pertaining to the Timmins Resident Geologist’s area, issued by the Ontario Geological Survey in 1992 ......................................................270

FIGURES
12.1a. Timmins Resident Geologist’s District (northwest portion), no activity .......234
12.1b. Timmins Resident Geologist’s District (north-central portion) .................235
12.1c. Timmins Resident Geologist’s District (west-central portion) ....................236
12.1d. Timmins Resident Geologist’s District (east-central portion) .....................237
12.1e. Timmins Resident Geologist’s District (south portion) ...............................238
12.2. Exploration activity, property examinations, producing mines, and advanced exploration and development projects .........................................................239
13. KIRKLAND LAKE RESIDENT GEOLOGIST’S DISTRICT—1992

Introduction ....................................................................................................................... 273
Mining Activity .................................................................................................................. 273
  American Barrick Resources Corporation ................................................................. 273
  Deak Resources Corporation—GSR Mining Ltd. ......................................................... 273
  Extender Minerals of Canada Ltd. ................................................................................. 278
  Hedman Resources Ltd. ................................................................................................. 278
  Lac Minerals Ltd. ........................................................................................................... 279
  Northfield Minerals Inc.—Deak Resources Corporation ............................................. 279
  Tundra Granite and Marble Corporation ....................................................................... 279
Advanced Exploration and Development ......................................................................... 279
  Hemlo Gold Mines Inc.—Freewest Resources Inc.—Teddy Bear Valley Mines
  Limited ......................................................................................................................... 279
Exploration Activity ......................................................................................................... 280
  Government Incentive Programs .................................................................................. 280
Company Activities in 1992 ............................................................................................ 280
Gold Exploration .............................................................................................................. 280
Diamond Exploration ...................................................................................................... 289
Base Metal Exploration .................................................................................................... 290
Kimberlites, Lamproites and Diamonds in Kirkland Lake ........................................... 290
Introduction ...................................................................................................................... 290
Exploration History—Kirkland Lake .............................................................................. 291
Recent Exploration Developments .................................................................................. 291
Government-Funded Research ....................................................................................... 294
Resident Geologist’s Staff Activities .............................................................................. 294
Property Visits .................................................................................................................. 295
  Chartre-Dufresne Cairo Property (MDI No: T 1078) ................................................... 295
  Cook–Gamble Property (MDI No: T 0412) ................................................................. 295
  Kidston Gauthier Township Property (MDI No: T 0768, T 0774) .............................. 296
  Tundra Granite and Marble Corp.’s Green Carbonate Pit in Teck Township .............. 296
  Layered Basaltic Komatiite Flow, Boston Creek Area .................................................. 296
Resident Geologist’s Research Projects .......................................................................... 297
  Lightning Gold Zone ..................................................................................................... 297
  Study of Gauthier Group Volcanic Rocks .................................................................... 297
Drill Core Storage Program ............................................................................................. 298
Steel Pallet for Drill Core Storage .................................................................................... 299
Recommendations for Exploration ................................................................................... 299
  Recommendations for “Blind” Epigenetic Gold Deposit Exploration ........................ 299
   Epigenetic Gold Deposit Model—Holloway Township to Timmins .......................... 301
Matachewan Consolidated Mines Ltd. Tailings Spill ..................................................... 301
Health and Safety Hazard ............................................................................................... 302
Ontario Geological Survey Activities ........................................................................... 302
  Precambrian Geoscience Section ................................................................................ 302
  Canada—Ontario Northern Ontario Development Agreement (NODA) ................. 302
Research by Other Agencies ............................................................................................ 302
  Universities .................................................................................................................... 302
    McMaster University .................................................................................................. 302
    Queen’s University .................................................................................................... 303
    University of Ottawa ................................................................................................ 303
    University of Quebec—Chicoutimi ............................................................................ 303
    University of Saskatchewan ..................................................................................... 303
    University of Toronto ............................................................................................... 303
    University of Western Ontario .................................................................................. 303
Selected Publications Received during 1992 ............................................................... 303
References ......................................................................................................................... 304

TABLES
13.1. Gold production in the Kirkland Lake Resident Geologist’s
13.2. Past gold production ................................................................................................. 276
13.3. Gold reserves ................................................................. 277
13.4. Government incentive programs ...................................... 281
13.5. Summary of claims recorded and assessment work credit 282
13.6. Exploration activity ........................................................ 284
13.7. Significant exploration results in 1992 ............................. 288
13.8. Summary of documented Kimberlite and/or lamproite occurrences 292

FIGURES
13.1. Kirkland Lake Resident Geologist's District .......................... 274
13.2. Location of properties with past production and/or gold reserves 278
13.3. Claim staking history ......................................................... 282
13.4. Exploration activity .......................................................... 283
13.5. Kimberlite and/or lamproite occurrences ............................ 293
13.6. Location of drill holes for which cores are stored at the Kirkland Lake Drill Core Library ........................................... 300

PHOTO
13.1. Prototype of the steel pallet to be used for off-site drill core storage 300

14. COBALT RESIDENT GEOLOGIST'S DISTRICT—1992

Introduction .............................................................................. 307
Mining Activity ........................................................................ 307
Dymond Clay Products Limited, Bucke and Breault Quarries .......... 307
McLaren's Bay Mica Stone Quarries ........................................... 310
Thorne Brilliant Stone Quarry .................................................. 310
Advanced Exploration and Development .................................. 310
Gwen Resources Limited—Perrex Resources Inc., Strathy Township 310
Fort Knox Gold Resources Inc., Fawcett Township ..................... 311
Exploration Activities ............................................................... 311
Cobalt Area ............................................................................. 311
Chitaroni, A.L. ....................................................................... 311
Cyprus Canada Inc. ................................................................. 311
Gore, J.A. .............................................................................. 311
Haileybury School of Mines ..................................................... 313
KWG Resources Inc. ............................................................... 314
Englehart Area ....................................................................... 314
Dunn, G.C. and Korba, E. ......................................................... 314
Ellgring, F.H. ......................................................................... 314
Ewanchuck, J., Morris, J. and Swanson, F. ................................. 314
North Bay Area ...................................................................... 314
Kyanite Mining Corporation .................................................... 314
1886 Holdings Limited .............................................................. 315
Shining Tree Area ................................................................... 315
Claw Lake Partnerships ........................................................... 315
Donovan, P. ............................................................................ 315
Extender Minerals of Canada Ltd. ............................................. 315
KRL Resources Corp.—Cross Lake Minerals Inc. ....................... 315
LaCarte, A. ............................................................................ 316
LaCarte, A. and MacCallum, R. ............................................... 316
Suchanek, C. ......................................................................... 316
Tindale, J., Annett, R. and Ferguson, R. .................................... 316
Temagami Area ..................................................................... 316
Falconbridge Limited .............................................................. 316
Filo, K. and Jones, D. ............................................................... 317
Resident Geologist's Staff Activities ........................................ 317
Property Examinations ............................................................. 318
Chitaroni Granite Lake—James Lake Property, Best Township ........ 318
Background Information .......................................................... 318
Regional Geology .................................................................. 318
Geology ................................................................................. 318
Strip Zone 1 (North Zone) ........................................................ 318
Strip Zone 2 (Centre Zone) ........................................................ 319
INTRODUCTION

MINING ACTIVITY

15. SUDBURY RESIDENT GEOLOGIST'S DISTRICT—1992

FIGURES

TABLES

14.1. Exploration activity in 1992 ................................................................. 312
14.2. Sampling results from strip zone 3 of the Acana No.2 zone .................. 321
14.3. Summary of drill core stored at the Cobalt Core Storage facility .......... 331

FIGURES

14.1. Cobalt Resident Geologist's District ...................................................... 308
14.2. Claim-staking activity ........................................................................ 309
14.3. Exploration diamond drilling ............................................................... 309
14.4. Exploration activity ............................................................................ 309
14.5. Client services—number of visitors ...................................................... 309
14.6. Granite Lake–James Lake property, strip zone 3 .................................. 320
14.7. A. Decker gold occurrence, Knight Township ...................................... 322
14.8. Extender Minerals of Canada Ltd., barite occurrence, North Williams Township .......................................................... 325
14.9. Geology of the Hare Lake gold occurrence, Tyrrell Township .......... 326
14.10a. Na2O cumulative frequency distribution plot for all Archean extrusive metavolcanic rocks from the Cobalt area ....................... 327
14.10b. Na2O frequency distribution histogram for calc-alkaline samples .... 327
14.10c. Na2O frequency distribution histogram for tholeiitic samples .......... 327
14.11. AFM plot .......................................................................................... 328
14.12. Total alkali versus silica plot .............................................................. 328
14.13a. SiO2 frequency distribution histogram for calc-alkaline samples ....... 329
14.13b. SiO2 frequency distribution histogram for tholeiitic samples .......... 329
14.14 Alkali plot of Archean volcanic extrusive rocks from the Cobalt area ... 330
14.15a. Barium frequency distribution histogram for all Archean extrusive metavolcanic rocks from the Cobalt area .............................. 331
14.15b. Log barium frequency distribution histogram for all Archean extrusive metavolcanic rocks from the Cobalt area .............................. 331

15. SUDBURY RESIDENT GEOLOGIST'S DISTRICT—1992

Introduction .......................................................................................... 335
Mining Activity .................................................................................. 336
Introduction ...................................................................................... 336
PHOTOS
15.1. Nodular anorthosite, Shakespeare–Dunlop mafic intrusion, Shibananing Township, Manitou Stone (Canada) Incorporated .................................................................344
15.2. Intraformational corrugation within calcareous siltstone, Rhodes Township, Bharti Laamanen Mining Incorporated .................................................................347

16. FIELD SERVICES SECTION, SOUTHERN ONTARIO
Introduction ..................................................................................................................359

17. ALGONQUIN RESIDENT GEOLOGIST’S DISTRICT — 1992
Introduction ..................................................................................................................361
Mining Activity .............................................................................................................361
Cal Graphite Corporation .............................................................................................361
Stone Quarries ..............................................................................................................361
Other Quarries .............................................................................................................361
Advanced Exploration and Development ....................................................................361
Exploration Activity ..................................................................................................362
Industrial Minerals ......................................................................................................362
Building Stone ..........................................................................................................362
Quartz .........................................................................................................................366
Graphite .......................................................................................................................366
Precious and Platinum Group Metals and Base Metals ..................................................366

Resident Geologist’s Staff Activities ...........................................................................366
Property Examinations .................................................................................................367
Mica and Feldspar, Stisted Township ........................................................................367
Wickern Deposit, Ryerson Township ........................................................................367
Southwood Road Dimension Stone, Wood Township ..................................................367
Cormack Deposit, Monck Township ..........................................................................367
King Deposit, Baxter Township ..................................................................................367
Bardsville Deposit, Monck Township .........................................................................367
Pacific Granistone, Burton Township ..........................................................................368
Jeffery Quarry, Ryerson Township .............................................................................368
Rock Lake Granite Quarry, Proudfoot Township .........................................................368
Research by Resident Office Staff ...............................................................................368
Building Stone Evaluation of the District of Muskoka and Parts of Haliburton, Simcoe and Victoria Counties ...............................................................368
Northern Ontario Development Agreement ................................................................369
Future Work ..................................................................................................................369
Distribution of Mercury and Associated Elements in Rocks in the Huntsville Area .........................................................................................................................369
Recommendations for Exploration .............................................................................369
Ontario Geological Survey Activity ............................................................................369
Research by Other Agencies .......................................................................................370
Selected Publications Received ....................................................................................370
References ....................................................................................................................370

TABLES
17.1. Mining activity 1992 .........................................................................................363
17.2. Exploration activity during 1992 .......................................................................364
17.3. Summary of claims recorded and assessment work credit ................................365

FIGURES
17.1. Mining activity during 1992 ..............................................................................362
17.2. Exploration activity during 1992 .......................................................................364

18. SOUTHEASTERN RESIDENT GEOLOGIST’S DISTRICT—1992
Introduction ..................................................................................................................371
Mining Activity .............................................................................................................371
Timminco Ltd. .............................................................................................................371
Unimin Canada Ltd. .....................................................................................................371
TABLES

18.1. Mining activity in 1992 ................................................................. 373
18.2. Exploration activity ................................................................. 379
18.3. Summary of claims recorded and assessment work credits in 1992 380
18.4. Summary of Tweed Drill Core Library holdings .......................... 388
18.5. Summary of Bancroft Drill Core Library holdings ......................... 390
18.6. Ontario Geological Survey maps and reports relating to the 390
      Southeastern District, released in 1992

xx
FIGURES
18.1. Operating mines and mills, in 1992 ...........................................372
18.2. Active exploration sites in 1992 .................................................378

19. SOUTHWESTERN RESIDENT GEOLOGIST'S DISTRICT—1992
Introduction ..................................................................................................393
Mining Activities ...........................................................................................393
Gypsum...................................................................................................393
Salt 393
   Rock Salt .......................................................................................396
   Fine Salt .......................................................................................396
   Chemical Salt ................................................................................396
Building Stone ..........................................................................................397
   Dolostone .......................................................................................397
   Sandstone ......................................................................................398
Shale398
Cement Limestone ......................................................................................399
Limestone and Dolomite for Lime, Chemical, Metallurgical and
   Pulverized Stone Products.......................................................................399
Resident Geologist's Staff Activities ..............................................................400
Ontario Geological Survey Activities .............................................................401
Research by Other Agencies ..........................................................................402
Selected Publications Received ......................................................................402
Reference.......................................................................................................402

FIGURE
19.1. Southwestern Resident Geologist's District................................394

20. PETROLEUM RESOURCES CENTRE, MINISTRY OF
   NATURAL RESOURCES—1992
Introduction ..................................................................................................403
Oil and Gas Production .................................................................................403
Exploration and Development Activity ..........................................................403
Staff Activities .............................................................................................405
Drill Sample Storage ......................................................................................406
Recommendations for Exploration .................................................................406
Research by Other Agencies ..........................................................................406
References ...................................................................................................406

TABLE
20.1. Successful exploratory wells in southwestern Ontario, 1992 ......404

FIGURE
20.1. Location of successful exploratory wells in southwestern
   Ontario in 1992 ..................................................................................404
1. Field Services Section, Northwestern Ontario: Introduction

K.G. Fenwick
Manager, Field Services Section (Northwest), Ontario Geological Survey—Information Services Branch

The Field Services Section, northwestern Ontario, of the Mines and Minerals Division is made up of 6 Resident Geologists' districts and covers 4 Mining Divisions: the Thunder Bay, Red Lake, Patricia and Kenora mining divisions. This area is approximately 700 by 700 km in size.

The goal of the Field Services Section is to stimulate and monitor exploration, development and production of the mineral resources in northwestern Ontario. This is done through the 6 Resident Geologists' programs which cover the Red Lake, Sioux Lookout, Kenora, Thunder Bay, Beardmore—Geraldton and Schreiber—Hemlo Resident Geologists' districts; the Canada—Ontario Northern Ontario Development Agreement (NODA) which funded the Northwestern Ontario Industrial Minerals project and the Manitouwadge Mineral Occurrence Inventory project; the 1990–91 Employment Equity Fund which provided funding for a native lecturer to give prospecting classes to the far north First Nation reserves and a Park Geologist to work with MNR Park planners describing geological features within the park system; and the Drill Core Library program which comprises 2 libraries — one in Kenora and the other in Thunder Bay.

The Resident Geologists' programs provide a professional consultative service and advice both in the office and in the field. These services are made available to prospectors, exploration companies and the public on matters related to the geology, the mineral deposits and the exploration and mining activities conducted in northwestern Ontario. In 1992, over 9000 office and phone consultations were provided to their clientele. The Mines and Minerals Division staff made over 280 field visits to exploration and mining sites. The Resident Geologists' general duties also included the provision of technical information and recommendations to other government agencies (i.e., Ontario Ministry of Natural Resources, Ontario Ministry of The Environment, Ontario Ministry of Labour) on land-use matters.

Basic prospecting courses were conducted in Red Lake, Marathon, Manitouwadge, Ignace and Thunder Bay. Prospectors' workshops were held in Fort Frances and Beardmore. Posters depicting the exploration and mining activities in the 6 Resident Geologists' districts, the Manitouwadge Mineral Occurrence Inventory project and the Industrial Minerals in northwestern Ontario were put on display at the 2 Mines and Minerals Symposia in Toronto and Thunder Bay. A corporate poster, depicting the exploration and mining activities in northwestern Ontario, was presented at the Institute on Lake Superior Geology Annual Meeting in Hurley, Wisconsin, at the 1992 State of Minnesota Mineral Activities Symposium in Chisholm, Minnesota, and at the Northeastern Ontario Mines and Minerals Symposium in Timmins.

Reports were either started or continued on both research into and field visits to the mineral occurrences in the Fort Hope—Miminiska Lake area, the Sturgeon Lake area, the Onaman—Tashota area and the central Uchi metavolcanic belt. Satellite summertime field offices were maintained in Beardmore, Geraldton and Marathon.

The staff of the Thunder Bay Drill Core Library collected 27601 m of diamond-drill core from 20 prospects in the Thunder Bay Mining Division during 1992. The staff from the Kenora Drill Core Library collected, from November 25, 1991, to December 31, 1992, 9801.6 m of drill core. Much of the drill core in this library is from recent gold exploration.

There were over 300 active exploration programs in the region in 1992. Over 50% of these active exploration programs were funded by the Ontario Prospectors Assistance Program (OPAP). Of these, 4 were in the advanced-exploration stage.
In 1992, 23 exploration projects in northwestern Ontario were designated under the Ontario Mineral Incentive Program (OMIP) for an approximate total of $1.9 million. One hundred and sixty-four projects were approved under the Ontario Prospectors Assistance Program for an approximate total of $1.6 million.

It has been another excellent year for production of gold in northwestern Ontario. The combined production from the 7 operations — the Golden Giant, the David Bell, the Williams, the Golden Patricia, the Campbell Red Lake, the Arthur W. White and the Dona Lake mines — was over 1.6 million ounces of gold. This amount represents two-thirds of Ontario's — and one-third of the nation's — gold production.

Three base metal mines — the Winston Lake, the Geco and the Shebandowan — were in production during the year. Operations at the Shebandowan Mine, owned by Inco Limited, were suspended on May 15, 1992.

Two granite dimension-stone quarries were in production. Active mining at 10 amethyst deposits, northeast of Thunder Bay, continued on a seasonal basis. Other industrial minerals produced in the area include white quartz, peat moss, soapstone and crushed granitic material.
2. Kenora Resident Geologist’s District — 1992

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INTRODUCTION

Dimension stone, crushed stone, high-purity quartz and peat were the commodities produced in the Kenora Resident Geologist’s District in 1992.

Palin Granite Canada Inc. commenced production of Pine Green granitic dimension stone at its quarry northeast of Kenora. Production of crushed granitic rock, for landscaping and precast purposes, also commenced at a quarry near the Cygnet Lake Road northwest of Kenora. Major production of high-purity quartz continued at the Crystal Quarries Ltd. quartz quarry, south of Vermilion Bay. A granite quarry continued to produce dimension stone west of Vermilion Bay, operated by Nelson Granite Ltd. In November, Barwick Peat Ltd. started operations of a peat moss plant at Barwick.

Two small-scale gold mining projects continued at Flambeau Lake south of Dryden, and at the Olive Mine west of Mine Centre. Western Troy Capital Resources Inc. commenced an advanced exploration program consisting of a 500-ton bulk sampling project, at the recently discovered Wagg gold prospect in Menary Township. For the third year in a row, no advanced exploration was conducted on the 3 underground development gold projects that had been undertaken by the following companies: Nuinsco Resources Ltd. at Cameron Lake; Boise Cascade Canada Ltd. at the Scramble Mine near Kenora; and Consolidated Professor Mines Ltd. at the Duport gold project on Shoal Lake.

Consolidated Professor’s Duport gold project at Shoal Lake has been designated under the Federal Environmental Assessment Act since 1989. This designation has generated apprehension throughout the Ontario mining industry due to the implications it may have for other mineral development projects. An unfortunate consequence is that no junior or major mining companies conducted exploration programs anywhere in the Lake of the Woods–Shoal Lake watershed during 1992. However, Kenora Prospectors and Miners Ltd. has proposed an advanced exploration project for its Cedar Island–Mikado mines gold property on Bag Bay of Shoal Lake in Glass Township. The project will involve the development of a decline ramp to determine continuity of the mineralized zone, and the removal of a 50 000 tonne bulk sample (Daily Miner and News, November 23, 1992). Previous exploration of the property outlined preliminary reserves of 1 234 069 tonnes grading 9.62 g/t Au (Canadian Mines Handbook, 1992–1993, p.210).

The Kakagi–Rowan–Pipestone lakes area, which had been the focus of intense gold exploration since 1983, was inactive in 1992 with the exception of 2 small prospecting programs conducted in the Dogpaw Lake area. The Fort Frances area was also inactive, following 5 years of gold and base metal exploration. The Upper and Lower Manitou lakes area was relatively inactive, except for some small prospecting programs at Upper Manitou Lake.

It is encouraging that staking and exploration activity have been directed toward other greenstone belt areas in the district, due to the recent discoveries of several significant gold and base metal properties. During 1992, 3124 claim units were recorded (Table 2.1), mainly in the Mine Centre, Menary Township, Stormy Lake and Bruin–Wildrice lakes areas (Figure 2.1). This is a significant increase from 1991 when only 1678 claims were recorded. The number of active claim units in the district also increased from 8293 in 1991 to 10 139 in 1992.

The number of exploration projects (Table 2.2, see Figure 2.1) in the Kenora Resident Geologist’s District increased slightly to 47 projects in 1992, from the 44 projects that were active the previous year (Blackburn, Hailstone et al. 1992). Compared with statistics from 1991, dollar value for 1992 assessment work credits increased for diamond drilling by approximately $65 721; for geological surveys by $102 476; and for geophysical surveys by $39 390 (see Table 2.1). Total dollar value for assessment credits increased from $987 196 in 1991 to $1 034 766 in 1992.

Four major mining companies (Homestake Canada Ltd., Inco Exploration and Technical Services Inc., Noranda Exploration Company Ltd. and Teck Exploration Ltd.) were active in the district. Teck and Inco continued mineral exploration programs, and Homestake and Noranda commenced new programs. Four junior mining companies (Champion Bear Resources Ltd., Marbank Minerals Inc., Nipigon Gold Resources Ltd. and Western Troy Capital Resources Inc.) continued exploration programs from previous years, and 3 junior mining companies conducted new programs (Ansil Resources Ltd., Athlone Resources Ltd. and Jaydeemar Explorations Ltd.). Western Troy Capital Resources Inc. commenced an advanced exploration program.

Thirty-four mineral exploration projects (72% of the total number of projects in the Kenora Resident Geologist’s District) were conducted by prospectors compared to 18
Figure 2.1. Kenora Resident Geologist's District: claim-staking, exploration activity (keyed to Table 2.2), advanced exploration and small-scale mining (keyed to text).
Table 2.1. Summary of claims recorded and assessment work credit

<table>
<thead>
<tr>
<th>Year</th>
<th>Claim Units Recorded</th>
<th>Claim Units Cancelled</th>
<th>Claim Units Active</th>
<th>Diamond Drilling</th>
<th>Geophysical Surveys</th>
<th>Geological Surveys</th>
<th>Total</th>
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<td>1278</td>
<td>10139</td>
<td>$65,7218</td>
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<td>3370</td>
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<td>2639</td>
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<td>1677</td>
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<td>940</td>
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<td>29,496</td>
<td>18,049</td>
<td>3070</td>
<td>52,134</td>
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Assessment work credits are reported in workdays up to 1990 and in dollar values following this date.

Table 2.2. Exploration activity during 1992 in the Kenora Resident Geologist’s District.

<table>
<thead>
<tr>
<th>Abbreviations</th>
<th>Diamond Drilling</th>
<th>Mag</th>
<th>Magnetometer Survey</th>
<th>Electromagnetic Survey</th>
<th>Prospecting</th>
<th>Prospecting Survey</th>
<th>Prospecting Survey</th>
<th>Induced Polarization Survey</th>
<th>Stripping</th>
<th>Stripping Survey</th>
<th>Trenching</th>
<th>Trenching Survey</th>
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<td>DD</td>
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</tr>
<tr>
<td>GC</td>
<td>Geochemical</td>
<td>SA</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>GL</td>
<td>Geological</td>
<td>Tr</td>
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<td></td>
</tr>
<tr>
<td>IP</td>
<td>Induced Polarization</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tbody>
</table>

No. On Figure | Individual or Company | Area/Township | Activity |
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<th></th>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Ansil Resources Ltd.</td>
<td>Bad Vermilion Lake area</td>
<td>DD</td>
</tr>
<tr>
<td>2</td>
<td>Athlone Resources Ltd.</td>
<td>Sandbeach Lake area</td>
<td>DD, EM, Mag</td>
</tr>
<tr>
<td>3</td>
<td>Barton, B.</td>
<td>Hyndman Township</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Barton, B.</td>
<td>Garnet Bay and Line Lake areas</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Bolan, J.</td>
<td>Sandbeach Lake area</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Champion Bear Resources Ltd.</td>
<td>Laval Township</td>
<td>DD, IP, Mag</td>
</tr>
<tr>
<td>7</td>
<td>Champion Bear Resources Ltd.</td>
<td>Paterson and Trewline lakes areas</td>
<td>DD</td>
</tr>
<tr>
<td>8</td>
<td>Champion Bear Resources Ltd.</td>
<td>Revell Township</td>
<td>SA, Prosp, Mag, EM</td>
</tr>
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<td>9</td>
<td>Chute, M.</td>
<td>Code Township</td>
<td>ST r, Tr, Prosp, SA, GL</td>
</tr>
<tr>
<td>10</td>
<td>Chute, M.</td>
<td>Dogpaw Lake area</td>
<td>ST r, Tr, Prosp, SA, GL</td>
</tr>
<tr>
<td>11</td>
<td>Cousineau, J.E.</td>
<td>Little Turtle Lake area</td>
<td>SA, ST r, Tr</td>
</tr>
<tr>
<td>12</td>
<td>Cousineau, R., Cousineau, L. and Desjardins, K.</td>
<td>Bennett Lake area</td>
<td>Prosp, SA, ST r, Tr</td>
</tr>
<tr>
<td>13</td>
<td>Etherington, R.</td>
<td>Gundy and Haycock townships</td>
<td>Prosp, SA, ST r</td>
</tr>
<tr>
<td>14</td>
<td>Fairservice, R.</td>
<td>Docker, Bridges and Tustin townships</td>
<td>Prosp</td>
</tr>
<tr>
<td>15</td>
<td>Ferreira, W.</td>
<td>Rex Lake area</td>
<td>Prosp, SA</td>
</tr>
<tr>
<td>16</td>
<td>Glatz, A. and Kozowy, A.</td>
<td>Kawashagemuk Lake area</td>
<td>ST r, Tr, SA, GC</td>
</tr>
<tr>
<td>17</td>
<td>Gliddon, D. and Middaugh, R.</td>
<td>Bennett Township</td>
<td>GL, Tr, SA, EM,</td>
</tr>
<tr>
<td>18</td>
<td>Holmstead, W.</td>
<td>Phillips Township</td>
<td>SA</td>
</tr>
<tr>
<td>19</td>
<td>Homestake Canada Ltd.</td>
<td>Bluff Point Lake area</td>
<td>ST r, SA, EM, Mag, GC, GL</td>
</tr>
<tr>
<td>20</td>
<td>Inco Exploration and Technical Services Inc.</td>
<td>Bad Vermilion Lake area</td>
<td>DD, GL, EM, Mag</td>
</tr>
<tr>
<td>21</td>
<td>Jaydeemar Explorations Ltd.</td>
<td>Cedar Lake area</td>
<td>GC, SA, Prosp</td>
</tr>
<tr>
<td>22</td>
<td>Kuehnbaum, R.</td>
<td>Yellow Girl Bay and Manross Township</td>
<td>GL, GC, Mag, EM</td>
</tr>
<tr>
<td>23</td>
<td>MacEachern, D.</td>
<td>Bennett Lake area</td>
<td>Prosp</td>
</tr>
<tr>
<td>24</td>
<td>Marbank Minerals Inc.</td>
<td>Dogpaw Lake area</td>
<td>Tr, SA</td>
</tr>
<tr>
<td>25</td>
<td>Nastiuk, P.</td>
<td>Little Turtle Lake area</td>
<td>Prosp, Tr</td>
</tr>
</tbody>
</table>

J.R. PARKER et al.
Gold was the target in 26 exploration programs, and 12 exploration projects were directed at base metals, while 6 projects were directed at both gold and base metals. No exploration was conducted for dimension stone this year, although there were 5 active projects in 1991. However, there were 3 exploration projects for soapstone and 1 for silica, fluorite and tungsten in the district in 1992. The Kenora Resident Geologist’s office initiated a compilation study of volcanogenic massive sulphide deposits in the Kenora District, and studies were conducted of 30 mineral properties and other potential mineral areas. A technical summary was made of properties available for option, joint-venture or sale in the Kenora Resident Geologist’s District. The office continued to acquire exploration diamond-drill core from the Kenora, Red Lake and Patricia mining divisions, and construction began of outdoor drill core storage facilities in Kenora, Red Lake and Sioux Lookout. Data of existing abandoned mines was compiled under contract into a database called the Abandoned Mines Inventory System. Staff of the Resident Geologist’s office also monitored exploration activity; prepared computerized digital assessment file index maps; provided geoscience information and professional advice to mineral explorationists; conducted an introductory prospecting course; conducted 2 base metal information sessions for advanced prospectors; and presented field trips, talks and displays for geologists, prospectors and the general public.

**MINING AND QUARRYING ACTIVITY**

There was no major precious or base metal mine production in the Kenora Resident Geologist’s District in 1992.

**Dimension Stone**

Production of Pine Green granitic dimension stone commenced in April at a new quarry operated by Palin Granite Canada Inc. (a division of Palin Granit Oy, Finland), in the Forgotten Lake area, 65 km north-northeast of Kenora. Approximately 500 m$^3$ of stone were extracted and about half of that was shipped for export (G. Zebruck, Palin Granite Canada Inc., personal communication, 1992). Palin Granite received a $600,000 grant from the Northern Heritage Fund Corporation (NOHFC) to assist in the development and operation of the quarry (The Northern Miner, October 5, 1992, p.17). Palin Granite Canada Inc. also diamond drilled 5 holes at its quarry to test the depth of yellow staining, due to weathering, in the granite (G. Zebruck, Palin Granite Canada Inc., personal communication, 1992).
Decorative Aggregate Stone

Production of crushed, red granitic rock commenced at a quarry operated by J.A. Minor and Sons, near the Cygnet Lake Road in the Swan Lake area, 45 km northwest of Kenora. Approximately 10,000 tons of rock were crushed into 4 sizes and stockpiled. A portion of the crushed material was shipped and sold for landscaping stone and architectural precast purposes (J.A. Minor, personal communication, 1992). The project received $60,500 from NOHFC to conduct a feasibility study relating to commercial development of the red granite. The funding was provided under the Resource Diversification Program of NORFUND (Daily Miner and News, December 3, 1992, p.6).

High-Purity Quartz

Crystal Quarries Ltd. continued to supply Dow Corning with pure quartz for use in the manufacture of silicone sealants, from its white quartz vein located 29 km south of Vermilion Bay. In 1992, 19,500 tons of quartz were quarried, crushed and shipped to smelters in East Selkirk, Man. and Montreal, Que. A relatively small amount of the crushed quartz was shipped to the United States for architectural precast purposes (T. Hansen, Crystal Quarries Ltd., personal communication, 1992).

Small-Scale Mining

A. Kozowy (Prospector, Dryden) continued to produce a gold concentrate from a small mill at Flambeau Lake, about 13 km southwest of Dryden on Highway 502 (see Figure 2.1, location A). Mr. Kozowy commenced small-scale mining in 1988 and has subsequently mined out the gold-bearing quartz veins at his Flambeau Lake prospect. Gold-bearing quartz vein material is presently extracted from the Brockman prospect (see Figure 2.1, location B), on the north shore of Brown Lake about 47 km southeast of Dryden on the Sandy Point Road, and transported to the mill at Flambeau Lake. A small open-cut has been established near an old shaft at the Brockman site (A. Kozowy, Prospector, personal communication, 1992).

E. Ludwig of Nighthawk Drilling, Porcupine, Ont. continued to produce gold concentrate from a small mill at the Olive Mine, 9.5 km west of Mine Centre (see Figure 2.1, location C). Mill feed consisted of gold-bearing quartz vein material retrieved from the second (138 feet) level of the mine during 1991 (Blackburn, Hailstone et al. 1992), combined with material extracted from a small open-cut established in 1992 (E. Ludwig, Nighthawk Drilling, personal communication, 1992).

Peat

Barwick Peat Ltd. began harvesting peat moss from the Barnhart muskeg deposit, 9 km north-northeast of Emo, after restoring the old Arctic Peat Moss Products plant at Barwick which had been closed since 1986. The planned production for 1993 is 200,000 bales of peat for horticultural purposes and for soaking up oil spills. The majority of peat will be shipped to markets in the United States and southern Ontario. The plant at Barwick can produce 600,000 bales at full capacity (The Times-News, November 16, 1992; Fort Frances Times, December 16, 1992).

ADVANCED EXPLORATION AND DEVELOPMENT

Western Troy Capital Resources Inc., Menary Township

Western Troy Capital Resources Inc. commenced test milling of a 500-ton bulk sample at the Wagg gold prospect in Menary Township (see "Property Examinations" section of this report), 37 km north of Emo (see Figure 2.1, location D). As of October, 90 tons of gold-bearing quartz vein material had been processed yielding 60 ounces of gold (The Northern Miner, October 5, 1992, p.10) and a sulphide concentrate. The majority of material was excavated from an open cut established on the ‘A’ vein, 1 of 6 gold-bearing quartz veins discovered in 1991. The test mill consists of an 8-by-10-inch jaw crusher; a 10-by-12-inch rolls crusher; a 3-by-3-foot ball mill; a classifier; a slurry pump; and a recovery sluice box.

Consolidated Professor Mines Ltd., Shoal Lake

The Duport gold project at Shoal Lake, owned by Consolidated Professor Mines Ltd., remained inactive in 1992. Proven and drill-indicated reserves at the Duport property stood at 2 million tons averaging 0.35 ounces Au per ton (Blackburn, Hailstone et al. 1992). The project is presently being reviewed under the Federal Environmental Assessment Act.

During 1992, Consolidated Professor Mines Ltd. completed a preliminary environmental report for the Duport project which proposed a revised mining plan and relocation of the treatment plant to a mainland site, outside the Shoal Lake watershed. The company also made the decision to seek a new designation of the project under the Environmental Protection Act and the Ontario Water Resources Act (Consolidated Professor Mines Ltd., News Letter, August 20, 1992).

EXPLORATION ACTIVITIES

Gold and Base Metals

Exploration for metallic minerals was conducted in 4 greenstone belt areas: the Lake of the Woods area, the Manitou-Wabigoon-Eagle lakes area, the Bruin-Wildrice lakes area and the Umfreville-Treelined lakes area. Exploration activity was also conducted in the Mine Centre area, the Menary Township area, the Bluffpoint Lake area, the Dogpaw Lake area and at Cedar Lake.

LAKE OF THE WOODS AREA

All mineral exploration activities at Lake of the Woods were conducted by prospectors who concentrated their efforts in
the east and southeast portions of the lake. There was no active mineral exploration at Shoal Lake.

R. Kuehnbaum sought volcanogenic massive sulphides using geological mapping, magnetic and electromagnetic ground geophysical surveys and limited B-horizon soil geochemical sampling over geophysical anomalies, on a small group of claims north of Yellow Girl Bay on Lake of the Woods. This area was previously explored for base metals by Hudson Bay Exploration and Development Co. Ltd. (R. Kuehnbaum, Prospector, personal communication, 1992).

G. Pogson continued trenching and stripping at the Lavender Lake copper occurrence which he discovered last year in Le May Township, about 450 m west of the Witch Bay Road (Blackburn, Hailstone et al. 1992). G. Pogson also continued trenching and sampling at his Peninsula and Pipeline gold occurrences at Black Sturgeon Lake, Haycock Township and around the Witch Bay and Stella gold prospects in Code Township (G. Pogson, Prospector, personal communication, 1992).

M. Trudzik conducted stripping, channel sampling and geological mapping on 3 mining claims at the Gull Island gold prospect in the southeastern part of Lake of the Woods. The prospect has been explored for gold since 1897. The best assays obtained from channel samples taken by M. Trudzik across a silicified and fractured quartz-feldspar porphyry were: 29.67 g/t Au across 0.46 m; 4.97 g/t Au across 1.4 m; and 2.18 g/t Au across 0.98 m.

B. Perry continued exploration work at his Echo Bay gold prospect on the northeast shore of Echo Bay on the northwestern part of Lake of the Woods. B. Perry conducted mechanical stripping that exposed a system of east-trending quartz veinlets adjacent to the east-northeast-trending main adit vein (B. Perry, Prospector, personal communication, 1992).

Other work done in the Lake of the Woods area include:


- Prospecting, manual stripping and sampling for gold conducted by R. Etherington north of Gundy Creek in Gundy Township and in the southeastern corner of Haycock Township (R. Etherington, Prospector, personal communication, 1992).

- Sampling in old trenches by W. Holmstead at the Wright gold occurrence on the north shore of Young Bay, on the west shore of Kakagi Lake in Phillips Township (W. Holmstead, Prospector, personal communication, 1992).

- Prospecting and sampling for gold conducted by R. Onysko in Kirkup, McMeekin and Le May townships (R. Onysko, Prospector, personal communication, 1992).

- Prospecting and sampling for gold and base metals in Code and Haycock townships by M. Perrault (M. Perrault, Prospector, personal communication, 1992).

**MANITOU–WABIGOON–EAGLE LAKES AREA**

Teck Exploration Ltd. continued exploration for gold and zinc at its Thunder Lake prospect in Zealand Township, about 16 km east of Dryden. Since 1989, exploration has been concentrated on a unit of quartz-feldspar porphyry originally mapped as arkose (Blackburn, Hailstone et al. 1992; Satterly 1943a, 1943b). Gold and zinc mineralization is associated with sericitized and silicified zones within the porphyry (see "Property Examinations" section of this report). Teck diamond drilled 19 holes totalling 6861 m at the prospect during 1992 (B. Miller, Teck Exploration Ltd., personal communication, 1992).

Champion Bear Resources Ltd. commenced exploration work on 2 gold showings at the Beartrack Lake gold occurrence in Laval Township. The company conducted magnetic and induced polarization ground geophysical surveys, and diamond drilled 11 holes totalling about 1220 m (H. Petak, Independent Exploration Services Ltd., personal communication, 1992; Canadian Mines Handbook, 1992–1993, p.91). The occurrence consists of several silicified, sericitized shear zones in dioritic and metavolcanic rocks containing pyrite, sphalerite, galena, arsenopyrite and magnetite with minor tourmaline and scheelite (Berger 1987). Grab samples taken by B. Berger from the No. 2 showing assayed as high as 0.92 ounces Au per ton, 0.17 ounces Ag per ton, 2860 ppm Zn and 1000 ppm As.

Champion Bear Resources Ltd. also commenced exploration work for copper, nickel and gold on its claims in Revell Township, east of Dryden. The claims encompass a few known copper-nickel occurrences and the Lady Marion gold prospect situated along the north contact of the Revell Batholith. The company conducted prospecting, sampling and magnetic and electromagnetic ground geophysical surveys (H. Petak, Independent Exploration Services Ltd., personal communication, 1992).

Other work conducted in the Manitou–Wabigoon–Eagle lakes area include:

- Manual stripping, sampling and prospecting by B. Barton at Eldorado Creek, at the S.500 gold prospect and at the Barton gold occurrence, all situated near Higbee and McKinstry lakes, 4.8 km southwest of Eagle Lake. Barton also conducted stripping, sampling and prospecting at the Old and Pidgeon gold occurrences in Hyndman Township. Barton obtained an assay of 0.10 ounces Au per ton across 2 feet at the Pidgeon occurrence, and 2.2 ounces Au per ton across 4 feet at the S.500 prospect at Higbee Lake (B. Barton, Prospector, personal communication, 1992).
Prospecting and sampling by J. Owen at the Baden Powell gold mine at South Twin Island on Eagle Lake (J. Owen, Prospector, personal communication, 1992).

Prospecting and sampling by F. Plomp at his zinc-copper-gold occurrence in Aubrey Township (see “Property Examinations” section of this report).

Stripping and trenching conducted by J. Redden at the Sakoose gold mine in the Tabor Lake area. Stripping, trenching, sampling and magnetic and electromagnetic ground geophysical surveys conducted by J. Redden and W. McAteer on Redden’s gold property northeast of Upper Manitou Lake in the Boyer Lake area (J. Redden, W. McAteer, Prospectors, personal communication, 1992).

Stripping, trenching and sampling by M. Woitowicz in the vicinity of the McEdna and Victory gold prospects, northwest of Goldrock, at Upper Manitou Lake. Trenching and sampling by Woitowicz at a gold occurrence located on a small island, southwest of Frenchman Island, on Upper Manitou Lake (M. Woitowicz, Prospector, personal communication, 1992).

Noranda conducted magnetic and electromagnetic ground geophysical surveys, rock sampling, soil geochemical surveys, geological mapping, stripping and trenching on portions of its claim group (R. Felix, W. Reid, Noranda Exploration Company Ltd., personal communication, 1992).

**UMFREVILLE-TREELINED LAKES AREA**

Champion Bear Resources Ltd. continued its exploration program in the Separation Lake greenstone belt, which began in 1988. The company’s claim holdings encompass the majority of the greenstone belt and extend about 45 km from Umfreville Lake in the west to Helder Lake in the east. The geology of the Separation Lake area and of Champion Bear’s property and occurrences has been described by Blackburn, Hailstone et al. (1992) and Blackburn, Beakhouse and Young (1992).

Champion Bear Resources Ltd. diamond drilled 54 holes totalling 5856 m during the early part of 1992. Drilling was concentrated on several base metal and gold targets located on grids C, H, I and J at Separation Lake near the English River road; on the Extension grid, One Man Lake grid and grid D located east of Selwyn Lake; and grids A and B on the English River.

The majority of diamond-drill holes intersected anomalous zinc, copper, lead and silver in felsic tuff, banded iron formation, massive sulphide zones and sulphide-bearing chert. Some results of the diamond drilling, submitted for assessment credits, can be seen in Table 2.3.

The only other exploration in the Umfreville-Treelined lakes area was prospecting and sampling for base metals by W. Ferreira at Bug Lake, 21 km north-northwest of Separation Lake (W. Ferreira, Prospector, personal communication, 1992).

**MINE CENTRE AREA**

Staking activity and exploration in the Mine Centre area was concentrated in the areas of Bad Vermilion Lake, Little Turtle Lake, Bennett Lake, Hepburn Lake and Sandbeach Lake as well as Bennett Township. About 1020 claim units were staked in 1992, primarily in the Sandbeach, Bennett and Hepburn lakes areas east of Mine Centre (see Figure 2.1).

The majority of staking commenced after the discovery of a new copper-nickel-cobalt occurrence on the Grey Trout Road in the Sandbeach Lake area. A grab sample taken from the occurrence analyzed 14 620 ppm Cu, 1780 ppm Ni, 18 ppm Cr, 722 ppm Co and 46 ppb Pd (Blackburn, Hailstone et al. 1992). The occurrence was staked by J. Bolen and A. McCormick who subsequently optioned their claims to Athlone Resources Ltd. Athlone conducted magnetic and electromagnetic ground geophysical surveys and diamond drilled 5 holes totalling 1500 feet. Anomalous base metal values were intersected in 2 of the holes, but no significant intersections were encountered (Canada Stockwatch, Sep-
Table 2.3. Results of some of the Champion Bear Resources Ltd.’s diamond drilling in the Separation Lake greenstone belt in 1992.

<table>
<thead>
<tr>
<th>DD Hole</th>
<th>Grid</th>
<th>Rock</th>
<th>Assay (ppm)</th>
<th>Width (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB-120</td>
<td>Extension</td>
<td>massive sulphides and chert</td>
<td>9688 Zn, 272 Cu</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3819 Zn, 465 Cu</td>
<td>14</td>
</tr>
<tr>
<td>CB-116</td>
<td>Extension</td>
<td>banded and brecciated sulphide-bearing chert</td>
<td>6308 Zn, 724 Cu</td>
<td>3.9</td>
</tr>
<tr>
<td>CB-115</td>
<td>Extension</td>
<td>sulphide-bearing chert</td>
<td>4112 Zn, 418 Cu</td>
<td>23.7</td>
</tr>
<tr>
<td>CB-121</td>
<td>Extension</td>
<td>sulphide bands and fractures in granitic pegmatite</td>
<td>9959 Zn, 69 Cu, 10.8 Ag, 10 949 Pb</td>
<td>1.5</td>
</tr>
<tr>
<td>CB-35</td>
<td>A</td>
<td>sulphide-bearing chert</td>
<td>2330 Zn, 346 Cu</td>
<td>22</td>
</tr>
<tr>
<td>CB-33</td>
<td>B</td>
<td>sulphide-bearing chert</td>
<td>2111 Zn</td>
<td>16</td>
</tr>
<tr>
<td>CB-42</td>
<td>H</td>
<td>banded iron formation</td>
<td>2266 Zn, 620 Cu</td>
<td>25</td>
</tr>
</tbody>
</table>

D. Gliddon and R. Middaugh conducted geological mapping, trenching, channel sampling, and magnetic and electromagnetic ground geophysical surveys, and diamond drilled 2 holes totalling 500 feet on a gold occurrence in Bennett Township. The occurrence is the “rediscovery” of an old gold property that was originally worked in 1895 (D. Gliddon, Prospector, personal communication, 1992).

Other work in the Mine Centre area included the following:

- Prospecting for base metals in the Bennett Lake area by D. MacEachern (D. MacEachern, Prospector, personal communication, 1992).
- Prospecting and trenching for gold south of the Olive Mine, in the Little Turtle Lake area by P. Nastiuk (P. Nastiuk, Prospector, personal communication, 1992).
- Sampling, stripping and trenching for gold by J. Cousineau on 4 claims in the Little Turtle Lake area.
- Sampling, stripping and trenching for gold by R. Cousineau, L. Cousineau and K. Desjardins in the Bennett Lake area. A grab sample taken by R. Cousineau from this property assayed 0.48 ounces Au per ton. L. and R. Cousineau also conducted stripping and trenching for base metals on a group of claims north of Glenorchy, in the Bennett Lake area (R. Cousineau, Prospector, personal communication, 1992).
- Prospecting, sampling, trenching and stripping conducted by B. Ross near the Stellar gold prospect on the northwest shore of Bad Vermilion Lake (B. Ross, Prospector, personal communication, 1992).

MENARY TOWNSHIP AREA

Approximately 820 claim units were staked in and around Menary Township during 1992 (see Figure 2.1), after Western Troy Capital Resources Inc. discovered a new gold occurrence in the northeast corner of Menary Township (see “Property Examinations” section of this report). The majority of staking was concentrated along the contact between...
granitic rocks of the Sabaskong Batholith and mafic metavolcanic rocks of the Off-Burdiit lakes greenstone belt.

Western Troy Capital conducted prospecting, sampling and trenching, and discovered 7 additional new gold occurrences in its claim group during 1992 (The Northern Miner, October 5, 1992, p.10). A small amount of diamond drilling was also conducted at the Wagg gold prospect prior to a 500-ton bulk sampling program (E. Ludwig, Nighthawk Drilling, personal communication, 1992).

BLUFFPOINT LAKE AREA

Homestake Canada Ltd. commenced exploration for gold at Bluffpoint Lake, 26 km southwest of Lower Manitou Lake, after optioning about 50 claim units from D. Sande. The company conducted stripping, rock sampling, geological mapping, and electromagnetic ground geophysical surveys and humus sampling. D. Sande had conducted some prospecting on the property prior to optioning it to Homestake. (D. Sande, Prospector, personal communication, 1992). The property straddles the contact between granitic rocks of the Lawrence Lake Batholith and metavolcanic rocks.

Prospecting, sampling, trenching and stripping were conducted by B. Ross at a gold-copper occurrence at Sullivan Lake, located immediately west of Bluffpoint Lake (B. Ross, Prospector, personal communication, 1992). Grab samples taken from this occurrence by B. Ross have assayed as high as 7.2% Cu with anomalous gold and zinc. The mineralization occurs within silicified, mafic metavolcanic flows containing pyrite and chalcopyrite.

DOGPAW LAKE AREA

Marbank Minerals Inc. continued exploration work, which it began in 1990, on a gold occurrence east of the north end of Cedartree Lake in the Dogpaw Lake area. The company trenched and sampled a carbonatized, silicified zone hosting quartz stringers and 5 to 10% disseminated sulphides. Samples taken from the zone analyzed as high as 826 ppb Au. Analysis of 2 samples taken from a gold occurrence on the east shore of Cedartree Lake produced values of 74 850 and 50 850 ppb Au.

Prospecting, manual stripping, trenching, geological mapping and sampling was conducted for base metals and gold by M. Chute, south of Stephen Lake, in the Dogpaw Lake area. Very pyritic, coarse felsic pyroclastic rocks were investigated during the project (M. Chute, Prospector, personal communication, 1992).

CEDAR LAKE AREA

Jaydeemar Explorations Ltd. staked 4 claim units on a gold-copper occurrence located at the southwest end of Cedar Lake, 32 km north-northwest of Vermilion Bay. The company conducted soil sampling, rock sampling and prospecting on the property which is dominantly underlain by granitoid rocks (J. Ladouceur, Jaydeemar Explorations Ltd., personal communication, 1992).

Industrial Minerals

SOAPSTONE

P. Thorgrimson conducted prospecting, stripping, trenching and sampling to assess soapstone potential at the Eagle Lake soapstone quarry, in the Garnet Bay area southwest of Dryden, and at Labyrinth Bay in the Shoal Lake area southwest of Kenora. Trenching and sampling were also conducted at a soapstone occurrence near Coste Island in the Astron Bay area of Lake of the Woods (P. Thorgrimson, Prospector, personal communication, 1992).

SILICA-FLUORITE-TUNGSTEN

A. Glatz and A. Kozowy commenced stripping, trenching, sampling and a limited soil geochemical survey at a silica-fluorite-tungsten occurrence they discovered last year in the Kawashegamuk Lake area, southeast of Dryden (A. Glatz, Prospector, personal communication, 1992). The occurrence consists of large, barren, white quartz veins in a "greisen" alteration zone hosted by granitic rocks of the Revell Batholith (see "Property Examinations" section of this report).

ONTARIO GOVERNMENT INCENTIVE PROGRAMS

In 1992, 5 exploration projects in the Kenora Resident Geologist's District were designated under the Ontario Mineral Incentives Program for a total of $550 275. Twenty-four exploration projects were funded from the Ontario Prospectors Assistance Program for a total of $234 119. Palin Granite Canada Inc. and J.A. Minor and Sons received funding from the Northern Heritage Fund Corporation under the Resource Diversification Program of NORFUND.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The Resident Geologist's office was staffed by J.R. Parker, Acting Resident Geologist; D.G. Laderoute, Acting Staff Geologist (contract); C.E. Blackburn, Project Geologist, Geoscience Branch, Precambrian Geoscience Section; C.C. Storey, Drill Core Library Geologist; C.B. Ravnaas, Assistant Drill Core Library Geologist; and M.J. Guderyan, Secretary. Contract staff during 1992 included the following people: M.E. Perrault, who carried out geological data compilation; A.J. Raoul, who assisted at the Kenora Drill Core Library; J. Balka who worked as a geological field assistant; and R. Kurtz who digitized assessment file index maps under the Unemployment Insurance Job Creation Program.

In February, the position of Staff Geologist was contracted to D.G. Laderoute to replace M.R. Hailstone, who was seconded in 1991 to operate a satellite Resident Geologist office in the Elliot Lake Initiatives area.

In May, C.E. Blackburn began a special assignment with the Ontario Geological Survey—Geoscience Branch, Precambrian Geoscience Section, to map the Separation Lake area north of Kenora. As a result, J.R. Parker (Staff Geologist, Red
Lake Resident Geologist’s office) was seconded to a developmental assignment as the Acting Kenora Resident Geologist in July.

In 1992, the exploration properties and mineral occurrences listed in Table 2.4 were examined in the field by staff of the Kenora Resident Geologist’s office. Companies or individuals conducting exploration at these properties are indicated in brackets. Property locations are indicated on Figure 2.2.

During 1992, 693 consultations were handled in the office of the Resident Geologist and a further 462 consultations were handled by telephone. The Kenora Drill Core Library received 226 visitors and handled 305 telephone requests for information.

Office staff contributed to 2 Mines and Minerals Division geoscience symposia — the first in Thunder Bay in April and the second in Toronto in December — by presenting 2 poster displays, 1 emphasizing exploration activity and the other emphasizing base metal potential in the Kenora Resident Geologist’s District. C.E. Blackburn also presented a talk entitled, “Mineral Exploration Activities in the Kenora Resident Geologist’s District”, at the symposium held in Thunder Bay.

During 1992, geological data compilation consisted of preparing digital index maps and accompanying data sheets for the assessment files in the Kenora office. A data compilation and entry of existing abandoned mines information into a database called the Abandoned Mines Inventory System was conducted under contract by M.E. Perrault as part of the Abandoned Mines Hazards Abatement Program.

A.J. Raoul, Geological Consultant, operated the Ear Falls Dimension Stone Project from the Kenora Resident Geologist’s office from October to December. This project was funded by the Unemployment Insurance Job Creation Program and the Ear Falls Economic Development Office. The project employed 5 individuals and was designed to identify potentially economic dimension stone sites in the Ear Falls area.

The Kenora Drill Core Library, serving the combined Kenora, Red Lake and Patricia mining divisions, had stored 89,881.8 m of completely catalogued diamond drill core by the end of 1992; 9,801.6 m of diamond drill core was collected from 9 sites during the year. For drill core collection sites, see Figure 2.2. A new warehouse and fenced compound was also constructed at the core library. Staff of the Drill Core Library prepared mini-displays that advertise the facilities and services provided by the Kenora Drill Core Library, and placed the displays in the Kenora, Red Lake and Sioux Lookout Resident Geologist offices.

Off-site, outdoor drill core storage sites began to be built in Kenora, Red Lake and Sioux Lookout late in the year, funded through the jobsOntario Capital Fund.

A reference library of geoscience information was established at the Northern Development office in Fort Frances in March.

A booklet was compiled and published this year entitled “Technical summary of properties available for option, joint-venture or sale in the Kenora Resident Geologist’s District”. It contains summaries of various gold, base metal, dimension stone and industrial mineral properties held by prospectors in the Kenora District. Copies are available from the Kenora Resident Geologist’s office.

D.G. Laderoute, assisted by Resident Geologist’s office staff, presented an eighteen-hour prospecting course in Ignace during April, which was conducted 2 evenings per week over a three-week period. Twenty people attended the course and 11 people attended a follow-up field trip. J.R. Parker and D.G. Laderoute presented 2, one-evening base metal information sessions to 8 prospectors in Fort Frances and 6 prospectors in Dryden during October.

Field trips and talks were provided for the Lake of the Woods Historical Society, for the Dryden High School Conservation Course and for students at Beaver Brae High School in Kenora and the Sabaskong First Nation School. C.E. Blackburn and D.G. Laderoute, assisting E. Nabigon (Native Lecturer, Red Lake Resident Geologist’s office), presented a talk on the mining sequence to the First Nations community of Northwest Angle Reserve (I.R. 33B) during March. A field trip was also given to a delegation of Chinese geologists from the Hubei Provincial Bureau of Geology and Mineral Resources of Jiangxi Province, China. Displays were provided in Kenora for the Ontario Mining Association’s Mining Week and in Keewatin for the Careers Northwest regional career fair.

Office staff attended the annual meeting of the Prospectors and Developers Association of Canada in Toronto; a Canadian Institute of Mining, Metallurgy and Petroleum seminar entitled, “Contemporary Approaches to Exploration for Metallic Mineral Deposits” in Thunder Bay; and an AutoCAD exhibition in Winnipeg, Manitoba.

**ACKNOWLEDGMENTS**

Various members of the geological staff contributed to the preparation of the sections that follow.

J.R. Parker conducted the field work and wrote the examination descriptions for the following properties: the Wagg gold prospect, the Kawashagemak Lake silica-fluorite-tungsten occurrence, the Thunder Lake gold-zinc prospect and the Lobstick Bay gold-fluorite prospect.

D.G. Laderoute conducted the field work and wrote the examination descriptions for the following properties: the Plomp zinc-copper-gold occurrence, the Hupchuk copper occurrence, the Mironsky copper-zinc prospect and the Pocket Pond zinc-copper prospect. Laderoute also wrote the section
Table 2.4. Property and other visits, Kenora Resident Geologist's District.

1. Bad Vermilion Lake intrusion, Bad Vermilion Lake area: high-Al anorthosite
2. Benson occurrence, Jaffray Township: Cu, Au
3. Brockman prospect (A. Kozowy), Tabor Lake area: Au
4. Chute property (M. Chute), Code Township: Cu, Zn, Au
5. Evenlode prospect, Ewart Township: Mo, Au, Cu
6. Flambeau Lake prospect (A. Kozowy), Van Horne Township: Au
7. Game Lake prospect, Bridges Township: Zn
8. Grey Trout Road occurrence (Athlone Resources Inc.), Sandbeach Lake area: Cu, Ni
9. Gundy Creek showing (B. Etherington), Gundy Township: Au
10. Haycock Township (M. Perrault): Au
11. Hupchuk occurrence, Halkirk Township: Cu
13. Docker Township (Noranda Exploration Co. Ltd.): Cu, Zn
14. Lavender Lake occurrence (G. Pogson), Code and Le May townships: Cu, Ni
15. Lobstick Bay area: Cu, Zn
16. Lobstick Bay prospect, Lobstick Bay area: Au, F
17. Maybrun Mine, Atikwa Lake area: Cu, Au
18. McKenzie–Gray prospect (Nipigon Gold Resource Ltd.), Bad Vermilion Lake area: Au
19. Mironsky prospect, Halkirk Township: Cu, Zn
20. Olive Mine (Nighthawk Drilling Ltd.), Little Turtle Lake area: Au
21. Pine Green Quarry (Palin Granite Canada Inc.), Forgotten Lake area: granite dimension stone
22. Ploom occurrence (F. Ploom), Aubrey Township: Cu, Zn, Au
23. Pocket Pond prospect, Halkirk Township: Zn, Cu
24. Eagle Lake quartz quarry (Crystal Quarries Ltd.), Line Lake area: silica
25. Rice Bay area, Watten Township: Cu, Zn
26. Stormy Lake, Kawashegamuk Lake area: Cu, Zn
27. Strawberry Island, Bigstone Bay area: Cu, Ni, Co
28. Thunder Lake prospect (Teck Exploration Ltd.), Zealand Township: Au, Zn
29. Wagg prospect (Western Troy Capital Resources Inc.), Menary Township: Au
30. Willard–Kimber lakes, MacNicol, Tustin, Bridges and Docker townships: Cu, Zn

"Volcanogenic Massive Sulphide Compilation Study"; prepared the figure (Figure 2.4); and did the computer-assisted drawings (Figures 2.3, 2.5 and 2.6).

Both Parker and Laderoute contributed to the sections on "Recommendations for Exploration" and "Mineral Deposits not being Mined in the Kenora Resident Geologist's District" (Table 2.5). C.C. Storey wrote the section "Drill Core Storage Program". M.J. Guderyan organized and typed the manuscript and tables. C.B. Ravnaas compiled and plotted claim-staking information for Figure 2.1.

Information on past work included in this report is taken from assessment files of the Kenora Resident Geologist’s office, unless otherwise indicated.

PROPERTY EXAMINATIONS

Wagg Gold Prospect

The Wagg gold prospect is situated in the northeast corner of Menary Township (NTS 52 C/13NW), 37 km north of Emo. The prospect was discovered by Western Troy Capital Resources Inc. in 1991 and is located on mining claim 1079876, which is part of a group of 182 contiguous claim units held by Western Troy Capital. The prospect is accessible from the 404 road, 5 km east of its intersection with Highway 71, about 110 km south of the intersection between highways 71 and 17.

Western Troy Capital’s claim group encompasses ground previously explored by Hudson Bay Exploration and Development Co. Ltd. and Agassiz Resources Ltd. In 1973, Hudson Bay Exploration and Development diamond drilled 2 holes totalling 509 feet southeast of the Wagg Prospect, while exploring for base metals. The holes intersected sections of disseminated sulphides, including sphalerite and chalcopyrite, in intermediate to felsic metavolcanic rocks. Between 1983 and 1985, Agassiz Resources Ltd. conducted stripping, geological mapping, lithogeochemical sampling and various ground geophysical surveys in the northeast corner of Menary Township. The company assessed chert-tuff horizons hosting copper-zinc mineralization, and conducted some work on a nearby gold occurrence.
Quaternary mapping and a reconnaissance till sampling program conducted by the Ontario Geological Survey between 1986 and 1988 (Bajc 1988, 1991) detected gold grains in till about 2 km south of the Wagg prospect.

Western Troy Capital staked an original group of 30 contiguous claims in northeast Menary Township in 1989. The company conducted stripping, sampling, geological mapping and magnetic, electromagnetic and induced polarization ground geophysical surveys. The Wagg gold prospect was subsequently discovered and stripped, sampled and mapped in detail in 1991. Western Troy Capital established a small gold mill on its property and commenced a 500-ton bulk sampling program at the Wagg prospect in 1992.

The Wagg prospect is situated within the Off-Burditt lakes greenstone belt and is underlain by medium- to fine-grained, mafic pillowed flows and massive coarse-grained flows. The mafic metavolcanic rocks contain narrow units of chert and tuffaceous interflow metasediments, and minor intermediate to felsic metavolcanic rocks. The metavolcanic rocks are intruded by numerous granitic, dioritic and pegmatitic dikes; small, felsic, porphyritic plugs; and diabase dikes. The Wagg prospect is about 400 m east of the contact between
the metavolcanic rocks and granitic rocks of the Sabaskong Batholith (Blackburn 1975, 1976).

The Wagg prospect consists of 6 north-northeast-trending, vertically dipping, subparallel quartz veins that are 10 to 20 m apart, and are designated ‘A’ to ‘F’ from southeast to northwest. The veins are contorted and range in width from 0.3 to 2 m, with strike lengths ranging from 11 to 46 m. The veins consist of fine- to medium-grained, massive, sugary, recrystallized and annealed white quartz that is coloured brown and red by iron staining. The veins contain disseminated, fine to coarse visible gold and up to 3% disseminated pyrite and pyrrhotite with chalcopyrite and hematite. Western Troy Capital also identified small amounts of bornite, covellite, molybdenite and native copper in the quartz veins. The ‘A’ vein resembles a crack-seal vein and contains discontinuous layers and wisps of chloritic wall rock that are parallel to the vein-wall rock contacts. Western Troy Capital has interpreted the 6 veins to have originally been part of a single vein that was folded and dislocated into 6 separate sections (Western Troy Capital Resources Inc., Press Release, December 10, 1991).

Host rocks are fine- to medium-grained, massive mafic flows and fine-grained, variolitic and hyaloclastic pillows flows that are metamorphosed to upper greenschist facies. The rocks contain abundant biotite and epidote. The dominant structural fabric is a northeast-trending foliation. Wall rock alteration is minimal and consists of chloritization in sheared rock immediately adjacent to the quartz veins. Wall rocks may also contain up to 2% disseminated pyrite, pyrrhotite and chalcopyrite. Western Troy Capital reported that a silicified, quartz-stringer alteration zone occurs in pyritic, sheared wall rocks adjacent to the ‘B’ and ‘D’ veins. This alteration extends outwards, for about 0.5 m, from either side of the veins.

Representative 10 kg composite samples taken by Western Troy Capital from the ‘A’, ‘B’, ‘D’, ‘E’ and ‘F’ veins gave average assays ranging from 0.85 to 2.045 ounces Au per ton. A grab sample taken from the ‘A’ vein assayed 11.96 ounces Au per ton. Numerous other grab samples from the veins gave respectable gold assays.

Several other gold occurrences have recently been discovered on Western Troy Capital’s claims. Samples from these occurrences are reported to assay as high as 2.99 ounces Au per ton (The Northern Miner, October 5, 1992, p.10).

Kawashegamuk Lake Silica-Fluorite-Tungsten Occurrence

The Kawashegamuk Lake silica-fluorite-tungsten occurrence is situated in the Kawashegamuk Lake area (NTS 52 F/8NW), about 52 km southeast of Dryden. The occurrence is located at the south end of Kawashegamuk Lake, a few hundred metres inland from the northeast shore of the lake. The occurrence was discovered in 1991 by A. Glatz, A. Kozowy and T. Grouette (Prospectors, Dryden) and is located on mining claim units 1144881 and 1144882, which are part of a large, contiguous group of claim blocks equivalent to approximately 125 claim units. The occurrence is accessible from an old Canadian Pacific Forest Products road, 5 km southeast of its intersection with the Sandy Point road, 14 km south of its intersection with Highway 17 at Borups Corners. Recently constructed bulldozer trails extend east from the Canadian Pacific Forest Products road to several large stripped areas at the occurrence.

The area in the vicinity of the Kawashegamuk Lake occurrence has been explored for gold since 1897. In 1952, Canadian Nickel Co. Ltd. conducted a ground magnetic geophysical survey over a small group of claims at the south end of Kawashegamuk Lake, along the northeast shore. In 1965, A. Sanderson, prospecting for Dome Exploration (Canada) Ltd., discovered molybdenite in quartz veins hosted by granitic rocks at Oldberg Lake, 1.2 km north-northwest of the Kawashegamuk Lake occurrence. Dome Exploration conducted trenching, a soil geochemical survey and diamond drilled 3 holes totalling 1710 feet. The drilling intersected numerous quartz veins and stringers containing molybdenite, pyrite, pyrrhotite, chalcopyrite and a few specks of native silver within wide “greisen alteration” zones in granitic rocks. According to diamond-drill logs, the altered rock was dominantly composed of quartz and muscovite containing abundant disseminated pyrite and minor fluorite.

The Kawashegamuk Lake silica-fluorite-tungsten occurrence is situated at the northwest-trending contact between granitic rocks of the Revell Batholith and mafic metavolcanic flows of the Kawashegamuk Lake Group (Kresz et al. 1982b; Kresz 1987). The granitic and metavolcanic rocks are intimately intercalated along the contact, and include associated hybrid rocks which resulted from the assimilation of metavolcanic rocks by the batholith. The metavolcanic rocks are also wedged between the batholith and several small plugs of hornblende and hornblende-quartz diorite (Kresz et al. 1982b). Orientation of quartz veins and foliation along the contact zone is generally 300/90.

The occurrence consists of 5 recently stripped areas and includes the Dome Exploration molybdenite occurrence at Oldberg Lake. The stripped areas are situated along a northwest-trending altered zone with a strike length of 4 km and an average width of 400 m. The altered zone resembles a greisen and is the result of extensive pneumatolytic and hydrothermal activity associated with late-stage cooling of the Revell Batholith. Stripping has exposed numerous large northwest- and east-trending quartz veins within the altered zone, which range in width from 1 to 25 m and have considerable strike lengths.

Veins are commonly hosted by granitic rocks of the Revell Batholith, and by mafic metavolcanic rocks at the southeast end of the occurrence. The veins commonly consist of barren, bull white, massive quartz that may contain variable amounts of disseminated pyrite and sericite with some scheelite, fluorite, molybdenite and bright green mica.
The granitic host rocks are commonly altered to quartz-muscovite schist containing between 1 and 40% disseminated, purple fluorite and 1 to 5% fine-grained, disseminated pyrite. Increased concentrations of fluorite correspond with an increase in alteration intensity and with a high concentration of yellowish to yellow-green mica. The yellowish mica may be gilbertite, a fluorspar-rich variety commonly found in greisens (Whitten and Brooks 1972). The mafic metavolcanic host rocks are altered to quartz-sercite-chlorite schist containing up to 20% disseminated fluorite, abundant disseminated scheelite and variable amounts of pyrite, bright green mica, molybdinite and possibly corundum.

The Kawashegamuk Lake occurrence was originally assessed for its gold potential, but widespread sampling has detected only very low to trace amounts of gold (A. Glatz, Prospector, personal communication, 1992). The occurrence may have some fluorite potential. Two samples taken by P. Hinz (Industrial Minerals Geologist, Thunder Bay Resident Geologist’s office) from one of the “high-grade” fluorite zones analyzed 3.69% F and 140 ppm W; and 1.98% F, 45.4 ppm Ag and 270 ppm W, respectively (Chemex Labs Ltd., Mississauga, Ontario). Other samples taken by P. Hinz from various locations analyzed between 0.11 and 2.6% F (Chemex Labs Ltd., Mississauga, Ontario).

The Kawashegamuk Lake occurrence has considerable potential for high-purity quartz as a source for silica. Numerous barren, bull white quartz veins are accessible by road, and appear to be large enough for quarry operations.

**Thunder Lake Gold-Zinc Prospect**

The Thunder Lake gold-zinc prospect is situated in lots 5 to 9, concessions III and IV, Zealand Township (NTS 52 F/15SE), east of Thunder Lake, about 16 km due east of Dryden. The prospect was discovered by Teck Exploration Ltd., which subsequently staked claims in the area and acquired several patented lots in 1989. The property is accessible from the M.N.R.—Dryden Tree Nursery road which traverses east from Highway 17 for about 2 km, and then turns north for 2.4 km to an area where the road intersects a portion of Teck’s exploration grid. Teck’s property is also crossed by Highway 17, the Trans—Canada Pipeline, a major Ontario Hydro line, the East Thunder Lake road and a concession road that branches west from the Dryden Tree Nursery road.

The area encompassed by Teck’s holdings was previously explored for base metals, iron and gold by G.L. Pidgeon, C.C. Huston and Associates, Algoma Steel Corp. Ltd., Canadian Nickel Co. Ltd. and Jalna Resources Ltd.

In 1956, G.L. Pidgeon discovered a sulphide zone in lot 6, concession IV, Zealand Township. The occurrence consists of pyrrhotite and minor sphalerite at a contact between greywacke and arkose. G.L. Pidgeon trenched the occurrence and diamond drilled 1 hole. A grab sample from the sulphide zone assayed 1% Zn (Satterly 1943a, 1943b; Shklanka 1969). In 1957, C.C. Huston and Associates conducted a magnetic ground geophysical survey and diamond drilled 2 holes totalling 1504 feet to assess an iron occurrence. Between 1966 and 1968, Algoma Steel Corp. Ltd. conducted geological mapping and a magnetic ground geophysical survey, and diamond drilled 5 holes totalling 997 feet while exploring for iron. In 1971, Canadian Nickel Co. Ltd. conducted a magnetic ground geophysical survey on Thunder Lake, and diamond drilled 2 holes totalling 471.5 feet. The drill holes intersected sections of disseminated pyrite, pyrrhotite, chalcopyrite and sphalerite in garnetiferous metasediments. Jalna Resources Ltd. conducted extensive sampling, prospecting and reconnaissance geological mapping over a portion of the area in 1983. Jalna’s survey work detected anomalous gold mineralization, assaying up to 245 ppb Au, in metasedimentary rocks in lot 5, concession IV of Zealand Township.

During 1988, the Geological Survey of Canada conducted a regional lake sediment and water geochemical reconnaissance survey over all of NTS 52 F, as part of a COMDA-funded project (Hornbrook and Friske 1989). The survey detected an anomalous value of 94 ppb Au in lake sediments at Thunder Lake. This information, in conjunction with a reinterpretation of the geology east of Thunder Lake and anomalous gold values detected in metasedimentary rocks, prompted Teck Exploration Ltd. to acquire ground in the area.

Between 1989 and 1992, Teck conducted magnetic, electromagnetic and induced polarization ground geophysical surveys, stripping, channel sampling, geological mapping and approximately 9144 m of diamond drilling on the property.

The Thunder Lake prospect is situated 2.4 km north of the Wabigoon Fault within the Thunder Lake sediments of the Warclub—Minnitaki Group or Warclub assemblage (Blackburn, Johns et al. 1991; OGS 1992). The Thunder Lake sediments are a sequence of metasedimentary rocks consisting dominantly of intercalated greywacke, arkose and iron formation (Satterly 1943a, 1943b).

Geologists with Teck recognized that the “arkose” mapped by Satterly (1943a, 1943b) is actually felsic, quartzfeldspar porphyry intercalated with intermediate to felsic lapilli tuff and minor tuff breccia (B. Miller, Teck Exploration Ltd., personal communication, 1992). The porphyry is variably strained but resembles a crystal tuff, with layering containing quartz and feldspar crystal shards that vary in abundance from layer to layer. Some layers may only contain feldspar or quartz crystals. The porphyry is also massive with abundant euhedral quartz and feldspar phenocrysts, which may indicate that part of the porphyry is intrusive. The intermediate to felsic lapilli tuff and tuff breccia are commonly monolithic but may also be heterolithic. The pyroclastic rocks contain clasts of quartz-feldspar porphyry, fine granular quartz, chert or rhyolite and minor mafic and mudstone clasts. The felsic clasts are generally highly strained and may be difficult to identify in outcrop.

The felsic metavolcanic rocks are intercalated with narrow units of greywacke containing garnet and andalusite porphyroblasts. The metasediments also contain “calc-silicate” pods and lenses consisting of actinolite-tremolite with some tourmaline and chlorite.
The metavolcanic and metasedimentary rocks are highly strained with a well-defined foliation (S1) trending 084°-105°/85°-88°. There are at least 3 possible deformation episodes that can be recognized in the rocks, all indicating dextral movement. The early S1 schistosity is Z-drag-folded about an S2 cleavage, with quartz veins parallel to S1 folded and boudinaged as well. S2 is represented by renewed dextral movement which resulted in lateral displacement of quartz veins along S1, where S1 is unfolded. Late tension-fracture-hosted quartz and quartz-tourmaline veins trend 236°-315°/80°N and intersect all foliations.

Gold, silver, and zinc mineralization occurs within sheared, silicified, sericitized and pyritic quartz-feldspar porphyry that commonly contains narrow seams and layers of sphalerite and galena. The sheared porphyry contains abundant white sericite; up to 10% fine-grained, disseminated pyrite; variable, but minor amounts of biotite; and minor green mica.

**Lobstick Bay Gold-Fluorite Prospect**

The Lobstick Bay gold-fluorite prospect is in the Lobstick Bay area (NTS 52 F/5NW) about 13 km northeast of Sioux Narrows. The prospect consists of 4 showings encompassed by a group of 26 contiguous mining claims held by R.J. Fairservice (Prospector, Kenora). The claim group is situated along the north shore of Lobstick Bay of Lake of the Woods, and is accessible from the Maybrun Mine road about 4 km east of its intersection with Highway 71, 40 km south of its intersection with Highway 17. The Maybrun Mine road intersects an exploration grid established on the property, crossing the baseline and crosslines.

In 1945, J. Thrasher discovered gold and fluorite mineralization in altered, pyritic, felsic metavolcanic rocks at several locations along the north shore of Lobstick Bay. Samples taken by J. Thrasher and R. Thomson (Resident Geologist, Kenora District) assayed between 0.08 and 0.25 ounces Au per ton. In 1963, C. Karas trench and sampled a few of the showings. D.V. Reade diamond drilled 6 holes totalling 208.8 m on the property in 1964. The diamond drilling was reported to have intersected 3 to 10% disseminated fluorite across apparent widths ranging between 3.66 and 39.93 m.

The occurrences were staked by R.J. Fairservice in 1983 and optioned to Esso Resources Canada Ltd. The company conducted trenching, stripping, channel sampling, geological mapping and magnetic and electromagnetic ground geophysical surveys. The best assay obtained from Esso’s channel sampling was 0.043 ounces Au per ton across 2.6 m at the Main showing.

The property was optioned to BP Resources Canada Ltd. in 1984. Between 1984 and 1987, the company conducted soil geochemical sampling, lithogeochemical channel sampling, geological mapping, and magnetic, electromagnetic and induced polarization ground geophysical surveys, and diamond drilled 12 holes totalling 2430 m. The best assay obtained from a channel sample was 2.1 g/t Au across 2.6 m in the vicinity of the Main showing. The best drill intersection was 1.41 g/t Au across 12 m in silicified, sericitized, pyritic alteration zones containing fluorite and tourmaline. A sample taken by BP Resources from a lamprophyre dike (in drill core) within the alteration zone analyzed 3515 ppb Au. Drill holes also intersected wide intervals of sericite-quartz schist containing up to 15% disseminated pyrite, up to 5% tourmaline and between 0.5 and 5% disseminated, purple fluorite and minor galena.

The property was optioned to Noranda Exploration Company Ltd. which conducted soil and lithogeochemical sampling on the property in 1989.

Phelps Dodge Corp. of Canada Ltd. conducted limited humus and lithogeochemical sampling and geological mapping, and diamond drilled 5 holes totalling 700 m in 1990 and 1991. Drill holes intersected significant alteration, but only trace values of gold.

The Lobstick Bay prospect is underlain by intermediate to felsic, fine to coarse, monolithic pyroclastic rocks and quartz-feldspar porphyry of the Berry River formation which is part of the Warclub-Minnitaki Group metasediments, also referred to as the Warclub assemblage, of the Lake of the Woods greenstone belt (Blackburn, Johns et al. 1991; Johns et al. 1984; OGS 1992). The quartz-feldspar porphyry consists of extrusive and intrusive phases, and was interpreted by Johns et al. (1984) to be a combination of a subvolcanic intrusion and extrusive volcanic rocks associated with a felsic volcanic dome. The metavolcanic rocks are south-facing and are underlain and overlain by wackes of the Warclub-Minnitaki Group (Johns et al. 1984).

The metavolcanic rocks are intruded by lamprophyre, gabbroic and diabase dikes, a granodioritic plug and monzodioritic to syenitic rocks of the Kishquabik Lake stock. The contact between the stock and the metavolcanic rocks is 1.6 km northeast of the Lobstick Bay prospect.

The prospect is also 2.5 km due north of the intersection between the northwest-trending Pipestone-Cameron fault and the east-northeast-trending Wabigoon fault.

Gold-fluorite mineralization is localized within the North Shear, a strong deformation zone striking 090° to 100°. This zone is approximately 50 to 100 m wide and has been traced by mapping and diamond drilling for a strike length of 5 km. Rocks within the North Shear are highly strained and characterized by a well defined foliation, Z-drag folding, boudinage and elongated clasts in pyroclastic rocks. Numerous biotite-carbonate lamprophyre dikes occur throughout the shear and are commonly dislocated and boudinaged. A variable amount of quartz veining also occurs throughout the North Shear. Movement along the North Shear is interpreted to have a dextral horizontal component indicated by right-hand sense.
of displacement of lamprophyre dikes in the vicinity of the shear. The North Shear is flanked to the south by a parallel deformation zone that has not been reported to host gold. Phelps Dodge interpreted these deformation zones to be splays off the larger Pipestone–Cameron and Wabigoon faults, south of the prospect.

BP Resources reported that alteration within the North Shear consists dominantly of sericitization (white to yellowish-green sericite) and silification accompanied by 2 to 10% fine-grained, disseminated pyrite; 0.5 to 5% disseminated, purple fluorite; green to dark brown or black tourmaline; and a bright green mica. Other minerals identified by BP Resources within the altered rocks are garnet, chlorite, amphibole, minor biotite, calcite, pyrophyllite and andalusite. Diamond drilling conducted by BP Resources intersected gold mineralization in massive, silicified alteration zones and brecciated, silicified zones consisting of "fragments" of silicified material within a quartz-sericite-pyrite matrix.

J.R. Parker visited the Creek, Fairservice and Old showings on the western part of the exploration grid. Diamond drilling conducted by Phelps Dodge tested the North Shear in the vicinity of these showings. The rocks at all 3 showings consist of very hard, strongly foliated, pyritic, sericitized and variably silicified lapilli tuff and/or quartz-feldspar porphyry. Clasts within the lapilli tuff are dominantly composed of granular, fine-grained quartz. Fluorite is commonly disseminated throughout the rocks, but also occurs in narrow, discontinuous streaks. Sampling conducted at the Creek, Fairservice and Old showings by Phelps Dodge detected gold values up to 70 ppb Au. Whole rock analyses indicate that the altered rocks are strongly sodium-depleted.

The Main showing, near the north shore of Lobstick Bay, is on the eastern part of the exploration grid. Striping and sampling by Esso Resources Canada Ltd., and diamond drilling by BP Resources, tested the North Shear in the vicinity of this showing. The Main showing consists of variably silicified quartz-sericite schist, including a zone of intense quartz veining where the veins have been boudinaged and folded. Abundant pyrite is disseminated throughout the host rocks, but also occurs in 1 to 5 cm wide bands that are parallel to foliation and contain between 10 and 50% pyrite. Esso Resources noted that fluorite is randomly disseminated throughout the zone, but also occurs in late fracture-fillings and quartz veinlets parallel and oblique to the foliation. Esso also identified a 1 m wide fluorite-pyrite zone — where fluorite content is greater than 0.5% — oriented parallel to foliation and exposed over a strike length of 5 m. Two other alteration zones, located northwest and southeast of the Main showing, were stripped, sampled and mapped by Esso Resources.

Plomp Zinc-Copper-Gold Occurrence

The Plomp zinc-copper-gold occurrence is located in lots 16 and 17, concession IV (north half) and lots 16 and 17, concession V (south half), Aubrey Township (NTS 52 F/14SE), approximately 20 km west of Dryden. The original discovery of gold was made in 1991 on a patented claim — part of a contiguous group of 2 patented and 8 active mining claims — owned by F. Plomp (Prospector, Dryden); this gold showing is described in detail in Blackburn, Hailstone et al. (1992). Subsequently, F. Plomp focussed on the area’s potential to host volcanicogenic massive sulphide (VMS) mineralization. There is no recorded history of exploration for either gold or VMS mineralization in the area. The property can be visited by means of a timber-hauling road, which traverses east from the Minnitaki Road 6 km south of its junction with Highway 17 at Minnitaki.

The property is underlain by greywackes and argillites of the Thunder Lake sediments of the Warclub–Minnitaki Group, also referred to as the Warclub assemblage (Blackburn, Johns et al. 1991; OGS 1992), which are interbedded with a series of sheared and sericitized quartz-feldspar-phyric felsic metavolcanic units ranging from tuff to tuff breccia. The abundance of these metavolcanics increases to the north until they predominate. This sequence is, in turn, intruded by mafic dikes or sills up to 1 m wide. Rocks in the area are metamorphosed to amphibolite facies, as indicated by the common occurrence of sillimanite and andalusite porphyroblasts in the metasediments. This metamorphism is presumably an effect of the nearby Ghost Lake Stock (Breaks 1989). The general orientation of the stratigraphy is 080/90.

Significant base metal mineralization occurs in 2 areas:

- Area 1 is approximately 1200 m southeast of the original gold occurrence within intimately interbedded biotite- and garnet-bearing clastic metasediments, and quartz- and feldspar-phyric felsic metavolcanics ranging from tuff to tuff breccia. The metavolcanic rocks locally contain abundant garnet, a dark green, fibrous amphibole exhibiting the “bow-tie” structure of anthophyllite, 10% disseminated pyrite and trace chalcopyrite. This mineral assemblage in the felsic metavolcanic rocks may represent a zone of hydrothermal alteration. However, insufficient exposure makes it difficult to determine the extent or significance of the alteration. Three grab samples of the altered rock, taken by F. Plomp, analyzed 229 ppm Cu, 349 ppm Cu and 354 ppm Cu; a discordant quartz vein here also yielded 64 ppm Ag (F. Plomp, Prospector, personal communication, 1992).

- Area 2 is approximately 480 m north of the original gold occurrence, wholly within weakly to moderately sheared quartz- and feldspar-phyric felsic metavolcanics ranging from tuff to quartz-feldspar crystal tuff. Mineralization consists of up to 10% disseminated and aggregate pyrite, minor sphalerite and trace chalcopyrite as infillings along fractures and shear planes in the metavolcanics. The metavolcanic rocks are moderately sericitized, generally biotitic and contain minor amounts of a fibrous mafic mineral which is either actinolite or anthophyllite. This mineralization has been detected in 2 exposures, 335 m apart, that are aligned in the sense of the regional stratigraphic direction (080°); there is, how-
ever, no bedrock exposure between them. Values of up to 7500 ppm Zn have been obtained from grab samples taken at the western exposure, where mineralized metavolcanics are exposed over a 2 m width; while up to 2700 ppm Zn, 667 ppm Cu and 4.1 g/t Au have been obtained from grab samples taken at the eastern exposure, where sheared and mineralized felsic metavolcanics are exposed over a 5 m width (F. Plomp, Prospector, personal communication, 1992). Visible gold has been observed by D.G. Laderoute at the eastern exposure.

About midway between the 2 areas described above, grab samples taken from an outcrop of sheared, felsic metavolcanic rocks analyzed up to 3459 ppm Ba (F. Plomp, Prospector, personal communication, 1992) and may indicate some hydrothermal alteration.

Hupchuk Copper Occurrence

The Hupchuk copper occurrence is located in lot 12, concession IV, Halkirk Township (NTS 52 C/11NE), approximately 27 km east-northeast of Fort Frances (Figure 2.3). The original discovery of copper here was made by M. Hupchuk in 1966. The easiest access to the occurrence is by means of the Canadian National Railway train tracks, which cross beneath an overpass on Highway 11 situated 34 km east of Fort Frances. The train tracks can be followed on foot west for approximately 400 m to a rock cut; the occurrence is exposed in a series of 4 pits, the first of which is located about 75 m north of the rock cut. The other 3 are spaced about 25 m apart along a northerly trend. This occurrence was open for staking at the time of writing.

The earliest known work in the vicinity of the occurrence was by Canadian National Railways prior to 1963. This company excavated several small pits to explore “sulphide mineralization” (Harris 1974a). In 1963, the area encompassing the occurrence was part of a larger group of claims explored under option by Phelps Dodge Corp. of Canada Ltd. This company mapped the area and diamond drilled 2 holes; the option was subsequently dropped. In 1966, Noranda Mines Ltd. diamond drilled 2 more holes in the general vicinity of the occurrence before terminating its option agreement. Later the same year, M. Hupchuk discovered copper mineralization on an outcrop ridge 500 m northwest of the Highway 11 overpass over the Canadian National Railway’s tracks. North 60 Explorers Ltd. subsequently carried out an induced polarization ground geophysical survey; 3 anomalies detected during this survey were each tested with a diamond-drill hole. According to Harris (1974a), one hole (H-1) intersected “disseminated pyrrhotite and chalcopyrite”, but no assays were reported. In 1968, M. Hupchuk and G. Armstrong diamond drilled 4 more holes totalling 1970 feet; no assays are reported from these holes.

The rocks in the vicinity of the occurrence are part of a narrow metavolcanic belt, approximately 800 m wide, that separates the felsic gneissic rocks of the Rice Bay Dome to the northwest from the Grassy Portage Bay mafic sill to the southeast (see Figure 2.3; Harris 1974b). The rocks are comprised of mafic metavolcanics ranging from pillowed and amygdaloidal flows to magnetite-bearing lapilli tuff; Harris (1974a) interpreted the flows to stratigraphically overlie the pyroclastics. The metavolcanic rocks are intruded by a small, 700 m long by 40 m wide arcuate unit of hornblende gabbro, located at the occurrence, that may be an outlier of the Grassy Portage Bay mafic sill, situated 400 m southeast of the occurrence. This same sequence of metavolcanic rocks also hosts the Red gut Bay copper occurrence (Harris 1974b), which is located 3.2 km northeast of the Hupchuk occurrence (see Figure 2.3).

Mineralization in the northernmost of the 4 trenches consists of stringers of chalcopyrite and pyrrhotite associated with strongly silicified zones in the mafic metavolcanics. A grab sample of this material taken by D.G. Laderoute analyzed 16700 ppm Cu, 1022 ppm Ni and 265 ppm Zn (Temiskaming Testing Laboratories, Ontario Geological Survey, Cobalt). Harris (1974a) reported that a chip sample taken from the trench assayed 0.48% Cu over a 10-foot width. Similar mineralization, as well as disseminated sulphides, are reported from the other 3 smaller trenches, which were excavated south from the northern trench; these are, however, now slumped in. The overall minimum length of the zone is 100 m. This mineralized zone is noteworthy, because it is concentrated along a contact between mafic pyroclastic rocks and overlying mafic flows (Harris 1974b). This type of environment — copper-rich, stringer sulphide mineralization hosted in submarine mafic metavolcanics — is strikingly similar to the Maybrun copper-gold mine, located 32 km east of Sioux Narrows (Davies 1973). The character of mineralization at the 2 locations is remarkably similar as well. Harris (1974a) assumed that the small, arcuate gabbro body at the occurrence was the source of the copper mineralization. As a result, a volcanogenic model has yet to be tested here.

Mironsky Copper-Zinc Prospect

The Mironsky copper-zinc prospect is located in lot 9, concession III, Halkirk Township (NTS 52 C/11NE), 29 km east-northeast of Fort Frances (see Figure 2.3). Copper mineralization was originally discovered in 1963 by M. Hupchuk (Prospector, Fort Frances) when Highway 11 was being constructed. Access to the property is by means of Highway 11, which actually traverses the mineralized zone. This prospect was open for staking at the time of writing.

Following its discovery, the prospect and surrounding area were staked by A. Mironsky of Thunder Bay. This ground, and the Hupchuk copper occurrence to the northwest, were optioned to Phelps Dodge Corp. of Canada Ltd. in 1963. This company conducted geological mapping, and magnetic and Ronka electromagnetic ground geophysical surveys over both properties, and targeted 8 diamond-drill holes totalling 3030 feet on the Mironsky prospect itself. Based on this drilling, a reserve figure of 300 000 tons grading 0.8% Cu to a vertical depth of 300 feet was reported by Harris (1974a). In spite of this, Phelps Dodge dropped its option late in 1963. M. Hupchuk conducted periodic work on the ground until 1978 when G. Armstrong and Belacoma...
Mines Ltd. jointly carried out a four-hole diamond-drilling program. The best diamond-drill intersection was 1.5% Cu across 25 feet; taken together with the Phelps Dodge drilling, the updated minimum dimensions of the mineralized zone were reported by Belacoma to be 800 feet long by 26 feet wide to a vertical depth of 300 feet, with a grade of between 1.0% Cu and 1.5% Cu.

The Mironsky prospect occurs in a thin belt of metavolcanic and metasedimentary rocks that separates the Grass Portage Bay mafic sill to the northwest from the Bears Passage felsic stock to the southeast (see Figure 2.3; Harris 1974b). The general strike of the rocks comprising this belt is 225/70NW. The prospect itself occurs wholly within a lenticular unit of quartz-biotite or quartz-feldspar-biotite schist, which was termed “quartzite” by Phelps Dodge but may be a recrystallized felsic tuff. The schist contains 60 to 85% granular, recrystallized quartz, up to 25% feldspar and up to 15% biotite. The schist weathers buff brown with gossan “burns” and contains narrow sericitized sections. The schist is enclosed within highly strained amphibolitic mafic metavolcanics, which are intruded by minor, irregular bodies of gabbro that may be outliers of the Grass Portage Bay mafic sill. The metamorphic grade is lower amphibolite facies, as indicated by the abundance of porphyroblastic amphibole in the mafic metavolcanics.

The mineralized zone is exposed in a trench 100 m south of Highway 11, and in a rock cut on the north side of the highway. The quartz-biotite schist exposed in the trench is highly strained and S-drag folded. Mineralization consists of up to 5% disseminated and aggregate chalcopyrite with minor pyrrhotite and pyrite, hosted wholly within the quartz-biotite schist. The sulphides also occur in narrow seams that are less than 2 cm thick. Harris (1974a) also recognized minor molybdenite. A sample of this material, taken by D.G. Laderoute, analyzed 8310 ppm Cu, 235 ppm Zn and 0.015 ounces Au per ton (Temiskaming Testing Laboratories, Ontario Geological Survey, Cobalt). Although no sphalerite is otherwise reported, a diamond-drill hole (55–1) of Phelps
Dodge intersected 1.37% Zn and 0.45% Cu over a 7-foot drilled width in the quartz-biotite schist. It is noteworthy that the mineralized drill intersection and the surrounding rocks are further described as containing garnet, chlorite and sericite. These same minerals were reported by Phelps Dodge to occur in the enclosing mafic metavolcanics, and may reflect hydrothermal alteration related to the mineralizing event. As in the case of the Hupchuk copper occurrence, the gabbros of the Grassy Portage Bay mafic sill have been proposed as the source of the mineralization (Harris 1974a); a volcanogenic model for the genesis of the copper-zinc mineralization at the Mironsky prospect has not been tested.

The mineralized quartz-biotite schist unit at the Mironsky prospect may have been part of a continuous unit of intermediate to felsic metavolcanic rocks that appear to have been boudinaged into several discontinuous lenses that extend along the southern contact of the Grassy Portage Bay mafic sill (see Figure 2.3). These other lenses are located southwest of the Mironsky prospect and should be prospected for copper-zinc mineralization.

**Pocket Pond Zinc-Copper Prospect**

The Pocket Pond zinc-copper prospect is located in lot 12, concession V, Halkirk Township (NTS 52 C/11NE), 27 km east-northeast of Fort Frances (see Figure 2.3). Zinc mineralization was first discovered here by G. Armstrong (Prospector, Fort Frances) during trenching in 1971. Access to the prospect is by means of a short road traversing east from Highway 502 to a gravel pit; the intersection of this road and Highway 502 is located 2 km north of the junction between Highway 502 and Highway 11. Several trails, suitable only for foot or ATV travel, traverse generally east from the gravel pit to the mineralized zones. This prospect was open for staking at the time of writing.

The earliest recorded work in the area was by Noranda Mines Ltd., which conducted ground geophysical surveys and diamond drilled 6 holes totalling 1368 feet in 1966. In 1971, M. Hupchuk discovered zinc and copper mineralization during a trenching program; subsequently, in association with Border Cities Ready Mix Cement Ltd., G. Armstrong conducted geological mapping, magnetic and electromagnetic ground geophysical surveys, striping, trenching, lithogeochemical sampling and diamond drilling of 16 holes totalling 1580 m during the period 1972 to 1983. Between 1983 and 1985, Corporation Falconbridge Copper carried out further geological mapping, magnetic and electromagnetic ground geophysical surveys, striping, trenching and diamond drilling of 7 holes totalling 427 m. In 1987, G. Armstrong drilled 1 hole to a depth of 245 m. During the period 1987 to 1988, Minnova Inc. diamond drilled 4 holes totalling 1263 m, and conducted down-hole pulse electromagnetic geophysical surveys in 3 drill holes. In 1990, R. Pitkanen conducted stripping and sampling in the vicinity of the prospect.

The Pocket Pond prospect occurs in a southeast striking sequence of mafic to intermediate and ultramafic metavolcanic rocks consisting predominantly of pillowed flows with interbedded clastic and chemical metasediments, located on the east flank of the Rice Bay Dome (see Figure 2.3). Harris (1974a, 1974b) recognized hornblende gabbro that intrudes this sequence, but D.G. Laderoute and J.R. Parker have reinterpreted this unit, at least where it occurs in the immediate vicinity of the prospect, to be amphibolite, pillowd, mafic metavolcanic flows, based on the occurrence of relict pillow selvages and the porphyroblastic nature of the amphibole grains. All units have been moderately to strongly deformed, with the major axis of deformation approximately parallel to the stratigraphy at 100°. Deformation has resulted in the elongation of pillows in the less competent mafic metavolcanics, while the more competent siliceous metasediments have accommodated the strain by shearing and Z Drag folding. A metamorphic grade of lower amphibolite facies occurs in these rocks, as indicated by the widespread development of medium- to coarse-grained hornblende in the metavolcanics and the general recrystallization of chert to saccharoidal quartz. This metamorphic grade is somewhat lower than that in the Rice Bay area immediately to the west. At Rice Bay, the metamorphic grade is middle to upper amphibolite facies, as indicated by more complete recrystallization of all rock types, development of gneissosity and a general lack of brittle deformation.

Mineralization occurs in 2 distinct zones:

- The Main zone, which strikes at approximately 110°, is the larger and from an economic standpoint, the more interesting of the two. It is exposed in a series of 4 large and several much smaller pits over a strike length of approximately 400 m. Width of the zone ranges from approximately 2 to 5 m. Mineralization is concentrated in siliceous metasediments composed of intimately interbedded chert and black argillite. Three distinct types of mineralization were recognized: 1) pyrite occurring as disseminated grains and locally frambooidal aggregates associated with the argillite in the zone; 2) podiform lenses of sulphides occurring locally, either composed dominantly of sphalerite with minor bands of pyrite and trace aggregates of chalcopyrite, or pyrite with minor amounts of sphalerite and chalcopyrite; and 3) in 1 pit, pyrite occurring as disseminated grains and minor veinlets in a rock consisting mostly of a pale grey or grey-green fibrous mineral that may be tremolite.

Many exposed portions of the mineralized zone are encrusted with a powdery grey-white substance, which may be a hydrous zinc oxide or iron sulphate mineral.

The actual distribution and abundance of the massive sulphides is unclear, given the extensive excavation conducted on the zone. Only small pieces of this material were found in the waste rock piles by D.G. Laderoute and J.R. Parker. The mineralization has been described in various assessment files and by Poulsen (1984). Diamond-drill intersections have been reported assaying up to 2.43% Zn over a 10.3-foot drilled width (King 1973) and 1.73% Zn and 0.09% Cu over a 10 m drilled width (Poulsen 1984).
It was also noted by D.G. Laderoute and J.R. Parker that the metasediments hosting the mineralization are moderately to intensely sheared and locally strongly sericitized. This fact, combined with the similarity between the hanging wall and footwall lithologies—both are amphibolitized pillowed mafic metavolcanics—and the apparent silicification and induration of the wall rock on either side of the zone, suggests that the zinc-copper-iron sulphide mineralization was originally deposited in distal sediments that formed an interflow horizon in a sequence of pillowed mafic flows. This entire sequence was subsequently deformed, causing the more competent metasediments to shear. Hydrothermal fluids may have circulated through the resulting conduit, altering the zone and the adjacent wall rock and remobilizing the sulphides. In the case of the zinc and copper sulphides, these were then redeposited, possibly in fold hinge zones, as massive lenses. The implication is that the Pocket Pond prospect serves as evidence that exhalative base metal mineralizing processes occurred in the general area.

The Skarn zone occurs about 100 m north of the northwestern end of the Main zone. It comprises laminated chert (now saccharoidal quartz)-magnetite iron formation, and a closely associated zone comprising locally massive, coarse-grained subhedral to euhedral garnet and interstitial quartz and epidote. This is interpreted to be a strongly "skarnified" calc-silicate rock, such as impure marble, that is interbedded with, or is immediately in contact with, the iron formation. Minor pyrite and pyrrhotite occur in both the iron formation and the skarn material, but no copper or zinc sulphide minerals were observed. This zone, which is exposed in 3 stripped and trenched areas over approximately 100 m of strike length, is at least 3 m wide.
VOlCANOGENIC MASSIVE SULPHIDE COMPILATION STUDY

Introduction

A study of the volcanogenic massive sulphide (VMS) potential of the Kenora Resident Geologist's District was undertaken by D.G. Laderoute due to the recent interest in volcanogenic copper-zinc-lead deposits. The purpose of the study is to provide the mining and exploration community with a means of guiding its initial exploration efforts, without the necessity of having to duplicate earlier work. The study consisted of: field documentation of VMS occurrences; a comprehensive review of pertinent literature; and reconnaissance field evaluation of several areas selected as a result of that review. The following sections provide a brief description of areas that are considered by the staff of the Kenora Resident Geologist's office to have significant potential to host VMS-type base metal mineralization (Figure 2.4). Most of these areas were open for staking at the time of writing.

Rice Bay Area

The Rice Bay area of Rainy Lake is located approximately 27 km northeast of Fort Frances, in the northern portion of Watten Township and the western portion of Hallirk Township (NTS 52 C/11NE) (see Figure 2.4). Access is easiest by boat; a public boat launch is located on the south shore of Rocky Islet Bay, 20 km northeast of Fort Frances on Highway 11. Most of the Rice Bay area was open for staking at the time of writing.

The Rice Bay area is underlain by supracrustal rocks of the southwestern portion of the Wabigoon Subprovince. These include a sequence of metavolcanic and metasedimentary rocks and intercalated mafic and felsic subvolcanic intrusives, which have been folded into a complex structural feature known as the Rice Bay Dome (see Figure 2.3). This sequence is intruded by an igneous complex ranging from mafic to felsic in composition, known as the Rocky Islet Bay Intrusive Complex. All of the above rocks are in turn intruded by granitic dikes and sills, and late diabase and lamprophyre dikes. The metamorphic grade is amphibolite facies (Beakhouse 1984).

It should be noted that, based on the field work of D.G. Laderoute, Kidd Creek Mines Ltd. and others (Poulsen 1984; Beakhouse 1984; Blackburn, Johns et al. 1991), felsic metavolcanic rocks are much more abundant in the Rice Bay Dome and surrounding area than was previously determined (Harris 1974a, 1974b).

Several features in the Rice Bay area suggest that it has significant VMS potential:

• As noted above, rocks composing the northern portion of the Rice Bay Dome, thought previously to be metasediments, are actually felsic metavolcanic rocks (see Figure 2.3). Furthermore, based on geochemical data reported by Kidd Creek Mines Ltd., the rocks are Type FIIIb felsic metavolcanics that are suggested by Lesher et al. (1986) to have high potential to host VMS deposits. In summary, the rocks exhibit relatively flat rare earth element (REE) patterns with pronounced negative europium anomalies, low zirconium-yttrium ratios, high abundances of high field strength elements and a low abundance of scandium. Lesher et al. (1986) interpreted magmas with these distinctive geochemical signatures to represent those that form the volcanic rocks which host massive sulphide deposits, after being modified by processes in high-level magma chambers.

• There are several candidates for subvolcanic (high-level) intrusions in the Rice Bay area, which may have acted as heat sources for VMS-forming hydrothermal systems. These include: 1) the Grassy Portage Bay mafic sill; 2) a granodiorite body, of unknown extent, exposed on the south shore of Upper Rice Bay; and 3) a quartz-feldspar porphyry intrusion, also of unknown extent, exposed in the vicinity of the junction of highways 11 and 502 (see Figure 2.3).

• There is widespread hydrothermal alteration in the Rice Bay metavolcanic rocks, involving sodium depletion and magnesium enrichment, which is a characteristic alteration pattern found in the footwall rocks of many VMS deposits (Lydon 1988). This is evident not only in the geochemical data reported by Kidd Creek Mines Ltd., but also in the local development of minerals such as chlorite, anthophyllite, staurolite and garnet in the vicinity of Upper Rice Bay (see Figure 2.3). The occurrence of these minerals in felsic metavolcanics indicates that the rocks have undergone hydrothermal alteration.

• There is significant copper-zinc mineralization in siliceous chemical and fine-grained clastic metasediments on the margins of the Rice Bay Dome, at the Pocket Pond zinc-copper prospect (see "Property Examinations" section of this report) and the McTavish copper-zinc occurrence (see Figure 2.3). For example, values of up to 1.73% Zn and 0.09% Cu over 10 m (Poulsen 1984); and 2.43% Zn over 10.3 feet (King 1973) have been reported from diamond drilling at Pocket Pond. Several examples of significant copper-zinc mineralization hosted in metavolcanic rocks occur in the surrounding area, at the Mironsky copper-zinc prospect, the Hupchuk copper occurrence (see "Property Examinations" section of this report) and the Redgut Bay copper prospect (see Figure 2.3; Poulsen 1984).

Previous exploration for VMS mineralization in the Rice Bay area was conducted by Kidd Creek Mines Ltd., and subsequently by Falconbridge Ltd. in the late 1980s. Two holes were diamond drilled by Kidd Creek during this program. (Note that the drill core from these holes is stored at the Kenora Drill Core Library.) Hole RB-3 (see Figure 2.3) was targeted on coincident horizontal loop electromagnetic and magnetic ground geophysical anomalies located immediately north of the zone of sodium depletion, where it occurs on the north shore of Upper Rice Bay. This hole intersected a 6 m wide siliceous chemical metasedimentary horizon
containing abundant pyrrhotite and minor chalcopyrite, which analyzed 500 ppm Cu over 2.5 m. A 6 m wide chlorite-quartz-garnet zone containing 10% disseminated magnetite and minor pyrrhotite, which was intersected further down this hole, analyzed 719 ppm Zn. No other holes were targeted on this horizon, which remains open in all directions. Furthermore, several electromagnetic anomalies detected in the vicinity of Rice Bay (see Figure 2.3) during regional airborne magnetic and electromagnetic geophysical surveys (OGS 1980a) remain untested.

Stormy Lake Area

The Stormy Lake area (NTS 52 F/8NW,SW) is located approximately 57 km southeast of Dryden (see Figure 2.4). The area is accessible by boat, by means of Snake Bay of Stormy Lake. Snake Bay is accessible from the Snake Bay Road, which intersects Highway 17, 13 km south of Dinorwic. A public boat launch is located at the west end of Snake Bay on this road, 30 km south of its intersection with Highway 17.

The Stormy Lake area is entirely underlain by supracrustal rocks of the Manitou-Stormy lakes greenstone belt, which are described in detail by Kresz et al. (1982a, 1982b) and Kresz (1987) (Figure 2.5). In summary, north-northeast-facing felsic metavolcanic rocks of the Wapageisi group, situated in the west and central parts of Stormy Lake, consist of proximal coarse tuff, lapilli tuff and tuff breccia which are gradational to the east into more distal, finer grained tuff and lapilli tuff. These metavolcanic rocks are overlain by metasedimentary rocks of the Stormy Lake group which consist of coarse polymictic and volcanic-clast-bearing conglomerates, quartzofeldspathic sandstones and thin intercalated felsic and mafic flows. This facies is transitional eastward into distal turbidites that are intercalated with abundant iron formation (Blackburn et al. 1982). The metamorphic grade at Stormy Lake is greenschist facies; there appears to be little structural complexity in the rocks.

The following features suggest that the Stormy Lake area has significant VMS potential:
• The metavolcanic rocks are intermediate to felsic pyroclastics, that is, dacitic to rhydacitic in composition, with rhyodicitic to rhyolitic fragments. The distribution of fragment size suggests that the area in the general vicinity of the narrows connecting Snake Bay and Stormy Lake is a proximal volcanic environment. Furthermore, the nearby contact with the overlying metasediments of the Stormy Lake group (see Figure 2.5) suggests that this area was originally a sea-floor environment in which VMS deposits are commonly thought to form (Lydon 1988).

• The metavolcanics exhibit extensive hydrothermal alteration, including widespread chloritization in the proximal volcanic environment mentioned above, and the development of chloritoid within this chloritized zone (see Figure 2.5). This alteration pattern is found in the footwall rocks of some VMS deposits (Lydon 1988). It should be noted that rhyolitic fine tuff or flows north of this chloritized zone, and immediately south of the Stormy Lake group metasediments, are strongly sericitized and exhibit little chloritization. However, the significance of this abrupt change in both lithology and associated alteration has not been determined.

• Regional airborne geophysical surveys (OGS 1980b) have detected several weak to moderately strong, middle to high frequency airborne electromagnetic anomalies beneath Stormy Lake which have not been tested by exploration. These are limited strike-length anomalies that generally occur north of the felsic tuff breccia on the south shore of Stormy Lake, and east of the chlorite-chloritoid alteration on the west shore of Stormy Lake (see Figure 2.5). Longer, stronger anomalies are parallel to the approximate contact between the metavolcanics and the metasediments to the north, and may represent interfloox graphitic and/or pyritic metasediments or other formational units.

• A subvolcanic quartz-feldspar-biotite porphyry intrusion of unknown extent occurs approximately 2 km west of the Stormy Lake-Snake Bay narrows (see Figure 2.5; Kresz et al. 1982a, 1982b). This intrusion may be coeval with the surrounding felsic metavolcanic rocks in the area, and may have been a heat source for ore-forming hydrothermal systems.

• Reconnaissance sampling for gold by Jalna Resources Ltd. detected anomalous base metal mineralization, such as 228 ppm Zn and 221 ppm Cu, in "chlorite schist", approximately 400 m south of Stormy Lake (see Figure 2.5).

• According to the Kenora assessment files, there has been little exploration in the area and virtually none for VMS mineralization.

Phinney–Dash Lakes Area

The Phinney–Dash lakes area (NTS 52 F/4SE) is located 60 km north-northwest of Fort Frances (see Figure 2.4). Access to the area is easiest by air; alternatively, a canoe or small boat would allow access to much of the area by means of a combination of water travel, portages and overland traverses. Ground access is quite limited: a small logging road which traverses east and south from the Tri-lake road, about 20 km east of its junction with Highway 71, terminates at a point about 3 km northwest of Phinney Lake. The Phinney–Dash lakes area was open for staking at the time of writing.

The Phinney–Dash lakes area is underlain by supracrustal rocks of the western Wabigoon Subprovince which are described in detail by Edwards (1980a, 1980b, 1981, 1983). In summary, these comprise a sequence of mafic and lesser felsic metavolcanic rocks and complexly interbedded elastic and chemical metasedimentary rocks, which are folded into a broad, northeast-trending anticline (Edwards 1983). The Phinney–Dash lakes complex—a synvolcanic quartz-feldspar porphyry intrusion and related extrusive and exhalative rocks—occupies the axial zone of the northeastern portion of this anticline. Metamorphic grade in the area is greenschist facies (Figure 2.6).

The following features suggest that the Phinney–Dash lakes area has significant VMS potential:

• According to Edwards (1980a, 1983), the Phinney–Dash lakes complex includes felsic pyroclastics and minor flows. Based on a small amount of available geochemical data (Edwards 1985), these rocks exhibit some of the geochemical signatures of potentially VMS-productive Type III felsic metavolcanics, as described by Lesher et al. (1986). The geochemical signatures include relatively flat REE patterns and negative europium anomalies. The felsic metavolcanic rocks are interbedded with and overlain by volcaniclastic conglomerate which includes pyrite clasts, and abundant iron-rich chemical metasediments dominantly composed of pyritic chert and ferroan carbonate. The felsic metavolcanic rocks are immediately underlain and locally intruded by a substantial body of rhyodacitic quartz-feldspar porphyry (see Figure 2.6). This entire assemblage is interpreted by Edwards (1983) to be a submarine felsic volcanic complex intruded by a subvolcanic quartz-feldspar porphyry stock which is coeval with the surrounding felsic metavolcanic rocks. This interpretation is further supported by the fact that the geochemical signature of the porphyry stock shows a tendency for europium enrichment (Edwards 1985) that corresponds with the pronounced europium depletion in the felsic metavolcanic rocks. This geological environment is an excellent candidate for the occurrence of volcanogenic massive sulphides given the presence not only of favourable host rocks, but also an intrusive heat source (the quartz-feldspar porphyry stock) that may have driven ore-forming hydrothermal systems.
At the west and central parts of the [Schistose] lake, overlying the Katimiagamak basalt formation is altered felsic tuff of variable thickness, generally less than 100 m, overlain by fragmented dark grey pyritic chert and ferroan carbonate up to 100 m thick. Chloritoid and ferroan carbonate occurs in the tuff, in the matrix of the chert unit, and in some of the underlying basalt formation.

Hodder and Edwards (1980) also describe altered felsic pyroclastic debris rock which has "been almost completely replaced by ferroan carbonate, sericite, chlorioid and quartz but exhibits relict porphyritic texture". Hodder and Edwards (1980) attribute this alteration to the action of iron-rich hydrothermal fluids that circulated through the rocks during and after active volcanism. Such hydrothermal activity is fundamental to the formation of VMS deposits (Lydon 1988).

• There has been little recorded exploration for VMS mineralization in the area. The most notable was by Freeport Canadian Exploration Co. between 1971 and 1972, which diamond drilled 5 holes on electromagnetic ground geophysical anomalies situated southwest and east-southeast of Phinney Lake (see Figure 2.6). This diamond drilling intersected felsic pyroclastic rocks containing sections of up to 50% pyrite, and lesser amounts of pyritic chert, that analyzed up to 1800 ppm Cu and 2500 ppm Zn. In 1984, during a gold exploration program, Loydex Resources Inc. discovered, at the south-west end of Phinney Lake, a mineralized zone described as, "weathered sulphides across a distance of twenty-five feet. The gossanized material contains 5% to 10% pyrite, 3% to 5% pyrrhotite, 1% chalcopyrite and 1% sphalerite in a silicified rhyolite" (see Figure 2.6)

Outer Bay–Lake of the Woods

The Outer Bay area of Lake of the Woods (NTS 52 E/7NE) is located approximately 50 km southwest of Kenora (see Figure 2.4). Access is easiest by boat, since numerous public boat launches are located around Lake of the Woods. This area was open for staking at the time of writing.
The Outer Bay area is predominantly underlain by intermediate to felsic metavolcanic rocks of the Mason Lake formation which is part of a mixed intermediate to felsic metavolcanic sequence known as the Monument Bay group (Blackburn, Johns et al. 1991). The Mason Lake formation is a 1000 to 2000 m thick, south-facing sequence of plagioclase- and quartz-phryic, mainly heterolithic, pyroclastic rocks ranging from tuff to tuff breccia (Morrice 1989) which are interpreted by Blackburn, Johns et al. (1991) to have been deposited in a shallow submarine to subaerial volcanic environment. The metavolcanic rocks are intruded by numerous small quartz- and quartz-feldspar porphyry intrusions (Morrice and MacMaster 1989). The felsic metavolcanic rocks are underlain by a lower mafic sequence of mafic to ultramafic, tholeiitic to komatiitic metavolcanic flows located immediately north of the area of interest.

Morrice (1989) recognized that monolithic to heterolithic felsic quartz-feldspar porphyry pyroclastic rocks, situated northwest of Outer Bay, locally contain 5 to 10 mm diameter clasts of pyrite and pyrrhotite which may represent reworked exhalative sulphides. Morrice (1989) also suggested that the transition from mono- to heterolithic pyroclastics may be related to some reworking of the brecciated carapace of a felsic dome, and concluded that the area “is a classic geological environment for base metal deposition”. No base metal exploration has ever been conducted in this area.

**Zigzag Island—Lake of the Woods**

Zigzag Island (NTS 52 E/10NE) is located 20 km west-southwest of Kenora (see Figure 2.4). It is most easily accessed by boat, by means of a public boat launch at Clearwater Bay. This area was open for staking at the time of writing.

Zigzag Island and the surrounding area is underlain by mafic to felsic metavolcanic rocks which are part of a mixed intermediate to felsic metavolcanic sequence known as the Clearwater Bay group (Ayer et al. 1991; Blackburn, Johns et al. 1991). The metavolcanic rocks consist of calc-alkalic mafic flows and felsic pyroclastics; the latter include some ignimbrites. These metavolcanics are overlain by distal metasediments — turbiditic conglomerates and wackes — which occur mainly on the northern portion of Corkscrew Island, east of Zigzag Island (Ayer et al. 1991).

The Zigzag Island formation is a synclinally folded sequence of felsic pyroclastics and flows about 50 km long and 0.1 to 1 km thick, that is part of the Clearwater Bay group. The rocks of this formation exhibit geochemical signatures similar to the potentially VMS-productive Type IIIb felsic metavolcanics described by Lesher et al. (1986) (Ayer et al. 1991). As described previously, these distinctive geochemical features include relatively flat REE patterns and pronounced negative europium anomalies that are interpreted by Lesher et al. (1986) to be representative of magmas — modified by processes in high-level magma chambers — that form volcanic rocks known to host massive sulphide deposits. The Zigzag Island formation is the only assemblage in the Lake of the Woods greenstone belt known to exhibit such a distinctive geochemical signature.

Ayer et al. (1991) also indicate that the Zigzag Island formation contains significant amounts of pyroclastic material consisting of ignimbrites erupted in a subaerial or shallow subaqueous volcanic environment, which is thought to be unfavourable for the formation of VMS deposits. However, Scott (1991) indicates that evidence “is mounting that not all massive sulphides may have formed in deep water.” Scott (1991) describes the VMS deposits at Flin Flon (Manitoba), Sturgeon Lake (Ontario), Rosebery (Western Tasmania) and Mount Chalmers, Australia as having felsic volcanic footwall assemblages representative of shallow water or even subaerial depositional environments.

The VMS potential of the area is enhanced by results of diamond drilling conducted by Kerr Addison Ltd. in 1971 on Corkscrew Island, 1.5 km southeast of Zigzag Island. The diamond drilling intersected 0.54% Zn and 0.05% Cu across a drilled width of 11 m, including a smaller section which assayed 1.0% Zn and 0.2% Cu across 3.1 m. The sulphides occur within this intersection as “threads” and stringers in interbedded sericitized rhyolite and greywacke. Several other diamond-drill holes in the vicinity of this intersection also returned anomalous values of 0.01 to 1% combined copper-zinc over generally narrow widths of less than 1 m.

**MINERAL DEPOSITS NOT BEING MINED IN THE KENORA RESIDENT GEOLOGIST’S DISTRICT**

A compilation of mineral deposits not being mined in the Kenora Resident Geologist’s District was completed this year. Forty-one deposits with published tonnage-grade estimates and/or significant dimensions and grade are identified and listed in Table 2.5. Twenty-seven of the deposits are gold properties, 10 are base metal properties and the remaining 4 deposits consist of iron, uranium, lithium and titanium properties.

Tonnage-grade estimates were compiled from the Canadian Mines Handbook, The Northern Miner, annual reports of mining companies, assessment files in the Kenora Resident Geologist’s office, and various government geoscience publications. Tonnage-grade data for gold deposits reported in Open File Report 5332 entitled, Feasibility of small-scale gold mining in northwestern Ontario (Neilson and Bray 1981) were not used in this compilation because the majority of tonnage-grade calculations in the report are speculative and based on sparse background information.

The gold deposits with the largest tonnage-grade estimates are the Duport Mine and the combined Cedar Island (Cornucopia)—Mikado mines at Shoal Lake southwest of Kenora; and the Cameron Lake prospect in the Rowan Lake area. The Duport and Cameron Lake properties are advanced exploration projects with underground declines, that have been idle since 1989.
<table>
<thead>
<tr>
<th>Deposit Name (NTS)</th>
<th>Commodity</th>
<th>Tonnage–Grade Estimates and/or Dimensions</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad Vermilion Lake–Seine Bay prospect</td>
<td>Fe, Ti, V</td>
<td>1 270 000 tons of 15% TiO₂ and 45% Fe; there is potential for 177 800 tons of titanium sponge.</td>
<td>NM 08/15/85 p.3 (Beaver Energy Resources)</td>
</tr>
<tr>
<td>Bending Lake prospect</td>
<td>Fe</td>
<td>Open pit reserves sufficient to maintain plant output of 2 million tons for 20 years. Main zone is 1500 m long by 300 m wide. (Grade of iron is unstated.)</td>
<td>MDIR, K0133</td>
</tr>
<tr>
<td>Big Master (Kenwest) Mine</td>
<td>Au</td>
<td>Proven and probable: 123 000 tons of 0.30 ounces Au per ton; Indicated: 600 000 tons of 0.22 ounces Au per ton.</td>
<td>CMH, 1988–89, p.92 (Canamerica Precious Metals Inc.)</td>
</tr>
<tr>
<td>Bonanza Mine</td>
<td>Au</td>
<td>5000 tons of 0.25 ounces Au per ton across an average width of 1 foot.</td>
<td>Van Horne Gold Expl. Inc., AFKRG</td>
</tr>
<tr>
<td>Canadian Arrow (Dogpaw Lake) prospect</td>
<td>Au</td>
<td>Indicated: 96 650 tons of 0.43 ounces Au per ton.</td>
<td>CMH, 1992–93, p.81 (Canadian Arrow Mines Ltd.)</td>
</tr>
<tr>
<td>Canamerica E Zone</td>
<td>Au</td>
<td>Indicated and inferred: reserves range from 143 685 tonnes of 0.167 ounces Au per tonne to 529 650 tonnes of 0.103 ounces Au per tonne. Indicated and inferred: reserves range from 163 800 tonnes of 0.194 ounces Au per tonne to 455 000 tonnes of 0.117 ounces Au per tonne.</td>
<td>Cochrane Oil and Gas Ltd., AFKRG</td>
</tr>
<tr>
<td>Cameron Lake prospect</td>
<td>Au</td>
<td>Proven, possible, probable: 3 150 000 tons of 0.168 ounces Au per ton.</td>
<td>CMH, 1992–93, p.264 (Nuinsco Resources Ltd.)</td>
</tr>
<tr>
<td>Central prospect</td>
<td>Cu, Ni</td>
<td>2 200 000 tons of 0.65% Cu and 0.45% Ni.</td>
<td>NM 05/28/53 (Quebec Nickel Corp.)</td>
</tr>
<tr>
<td>Duport Mine</td>
<td>Au</td>
<td>Total geological reserves: 2 000 000 tons of 0.35 ounces Au per ton; Proven and probable: 944 000 tons of 0.39 ounces Au per ton.</td>
<td>CMH, 1992–93, p.109 (Consolidated Professor Mines Ltd.)</td>
</tr>
</tbody>
</table>

**Table 2.5.** Mineral deposits not being mined in the Kenora Resident Geologist's District.
<table>
<thead>
<tr>
<th>Deposit Name (NTS)</th>
<th>Commodity</th>
<th>Tonnage-Grade Estimates and/or Dimensions</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earngey–Lindburg occurrence (52 E/9NW)</td>
<td>Au</td>
<td>50 m long by 5 m wide quartz vein assaying 1.42 ounces Au per ton across 7.5 feet and 0.37 ounces Au per ton across 9.7 feet.</td>
<td>OFR 5695, p.86</td>
</tr>
<tr>
<td>Electrum Lake occurrence Arsenic zone (52 E/11NE)</td>
<td>Au</td>
<td>97.5 m long by 1.76 m wide by 39.6 m deep (minimum) zone averaging 0.36 ounces Au per ton.</td>
<td>OFR 5695, p.98</td>
</tr>
<tr>
<td>Electrum prospect A–C zones (Contact zone) (52 E/11NE)</td>
<td>Au, Cu</td>
<td>A zone—30 m long by 1.5 m wide by 45 m deep averaging 0.34 ounces Au per ton and 0.14% Cu. B zone—45 m long by 0.9 m wide by 61 m deep averaging 0.27 ounces Au per ton and 1% Cu. C zone—45 m long by 1.5 m wide by 30 m deep averaging 0.32 ounces Au per ton and 0.94% Cu. 15 000 tons of 0.24 ounces Au per ton estimated in the C zone.</td>
<td>OFR 5695, p.101</td>
</tr>
<tr>
<td>Electrum prospect–P zone (Electrum Fault zone or Porphyry zone) (52 E/11NE)</td>
<td>Au</td>
<td>30.5 m long by 3.4 m wide by 30.5 m deep averaging 0.40 ounces Au per ton.</td>
<td>OFR 5695, p.106</td>
</tr>
<tr>
<td>Electrum prospect–W zone (Fault zone or West zone) (52 E/11NE)</td>
<td>Au</td>
<td>61 m long by 2.1 m wide by 19.8 m deep averaging 0.23 ounces Au per ton. 100 000 tons of 0.33 ounces Au per ton in the P and W zones combined.</td>
<td>OFR 5695, p.108</td>
</tr>
<tr>
<td>Errington prospect (52 F/6SW)</td>
<td>Au</td>
<td>24 000 tons of 0.73 ounces Au per ton in a zone 450 feet long by 32 inches wide by 240 feet deep.</td>
<td>MDC 16, p.16</td>
</tr>
<tr>
<td>Evenlode prospect (Eco occurrence)</td>
<td>Mo, Au</td>
<td>126 000 tons of 0.68% MoS₂ and 0.015 ounces Au per ton. Indicated: 200 000 tons of 0.53% MoS₂; Inferred: 550 000 tons estimated to a depth of 800 feet.</td>
<td>OFR 5695, p.114; NM 11/11/65 (Evenlode Mines. Ltd.)</td>
</tr>
<tr>
<td>Flambeau Lake prospect (52 F/10NW)</td>
<td>Au</td>
<td>Diamond drilling partially outlined a zone with potential for 572 000 tonnes (gold grade unstated).</td>
<td>International Platinum Corp., AFKRG</td>
</tr>
<tr>
<td>Flint Lake prospect (52 F/5SW)</td>
<td>Au</td>
<td>60 000 tons of 0.30 ounces Au per ton.</td>
<td>Sherritt Gordon Mines Ltd., AFKRG</td>
</tr>
<tr>
<td>Foley Mine (52 C/10NE)</td>
<td>Au</td>
<td>440 000 tons of 0.45 ounces Au per ton in several quartz vein systems.</td>
<td>NM 09/25/80 (Seaforth Mines Ltd.); OFR 5539, p.194</td>
</tr>
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<tr>
<td>Deposit Name (NTS)</td>
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<td>Tonnage–Grade Estimates and/or Dimensions</td>
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</tr>
<tr>
<td>Gaffney prospect (52 F/7SW)</td>
<td>Au</td>
<td>300 000 tons of 0.15 ounces Au per ton.</td>
<td>CMH, 1990–91, p. 393</td>
</tr>
<tr>
<td>Golden Star Mine (52 C/10NE)</td>
<td>Au</td>
<td>10 000 tons of 0.45 ounces Au per ton. 20 000 tons of 0.42 ounces Au per ton and 35 000 tons of 0.15 ounces Au per ton in tailings dump.</td>
<td>OFR 5512, p. 44</td>
</tr>
<tr>
<td>High Lake prospect (52 E/11NE)</td>
<td>Cu, Mo, Au</td>
<td>2000 feet long by 250 feet wide zone containing assay values of 0.10 to 1.35% Cu and 0.01 to 0.05 ounces Au per ton.</td>
<td>GR 41, p. 46</td>
</tr>
<tr>
<td>Kenbridge prospect (52 F/5NE)</td>
<td>Ni, Cu</td>
<td>3 271 390 tons of 1.06% Ni and 0.54% Cu</td>
<td>GR 111, p. 44</td>
</tr>
<tr>
<td>Mavis Lake (Lun–Echo) prospect (52 F/15SE)</td>
<td>Li, Ta</td>
<td>500 000 tons of 1% Li2.</td>
<td>OFR 5718, p. 151</td>
</tr>
<tr>
<td>Maybrun Mine (52 F/5NE)</td>
<td>Cu, Au</td>
<td>2 824 825 tons of 1.18% Cu and 0.08 ounces Au per ton including 1 508 454 tons of 1.48% Cu and 0.11 ounces Au per ton.</td>
<td>GR 111, p. 36</td>
</tr>
<tr>
<td>Mironsky prospect (52 C/11NE)</td>
<td>Cu</td>
<td>800 feet long by 26 feet wide zone to a minimum depth of 300 feet averaging 1 to 1.5% Cu. 300 000 tons of 0.8% Cu (estimated).</td>
<td>Belacoma Mines Ltd., AFKRG; GR 115, p. 59</td>
</tr>
<tr>
<td>New Campbell Island Mines (Richard Lake) prospect (52 L/13SW)</td>
<td>U</td>
<td>650 000 tons of 0.10% U3O8 in a zone 700 feet long by 10 feet wide and 1000 feet deep.</td>
<td>GR 130, p. 46</td>
</tr>
<tr>
<td>Norpax (Reynar Lake) prospect (52 L/6NE)</td>
<td>Ni, Cu</td>
<td>1 010 000 tons of 1.2% Ni and 0.5% Cu.</td>
<td>CMH, 1963, p. 215</td>
</tr>
<tr>
<td>Northrock (South Grassy) prospect–Beaver Pond zone (52 C/11NE)</td>
<td>Cu</td>
<td>1 020 458 tons of 1.17% Cu over a strike length of 400 m including 265 230 tons of 2.08% Cu over a length of 300 m (all estimates valid to a vertical depth of 91 m).</td>
<td>OFR 55512, p. 50</td>
</tr>
<tr>
<td>Olive (Preston) Mine (52 C/15SE)</td>
<td>Au</td>
<td>12 500 tons of 0.34 ounces Au per ton in 2 mineralized shoots and 1100 tons of broken ore averaging 0.31 ounces Au per ton in the second level stope.</td>
<td>NM 05/18/87, p.6</td>
</tr>
<tr>
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<td>NM 06/29/87, p.21</td>
</tr>
<tr>
<td>Deposit Name (NTS)</td>
<td>Commodity</td>
<td>Tonnage–Grade Estimates and/or Dimensions</td>
<td>References</td>
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<tr>
<td>Purdex prospect (A–D zones) (52 E/11NE)</td>
<td>Au</td>
<td>76 500 tons of 0.308 ounces Au per ton (combined indicated tonnage in 4 zones). 241 000 tons at 0.226 ounces Au per ton in the P, A, B and C zones.</td>
<td>OFR 5695, p.273</td>
</tr>
<tr>
<td>Redgut Bay prospect (52 C/11NE)</td>
<td>Cu</td>
<td>1000 m long zone with diamond drill intersections such as 0.31% Cu over 17 m, 0.3% Cu over 6 m, 1.04% Cu over 4 m and 0.83% Cu over 1.5 m.</td>
<td>CMH, 1992–93, p.106 (Consolidated Jalna Resources Ltd.) OFR 5512, p.71</td>
</tr>
<tr>
<td>Regina Mine (52 E/8NE)</td>
<td>Au</td>
<td>4000 tons of 0.43 ounces Au per ton. 30 000 tons at 0.106 ounces Au per ton in tailings.</td>
<td>Lodi Metals Inc. AFKRG; NM 07/25/88, p.7 (Sweeney Gold Corp.)</td>
</tr>
<tr>
<td>Scramble (Homestake) Mine (52 E/16SW)</td>
<td>Au</td>
<td>1200 to 1500 feet long by 12 feet wide zone averaging 0.15 ounces Au per ton.</td>
<td>NM 07/25/88 (Madeleine Mines Ltd.)</td>
</tr>
<tr>
<td>Tabor Lake Mine (52 F/9SW)</td>
<td>Au</td>
<td>13 300 tons of 0.34 ounces Au per ton.</td>
<td>Sulpetro Minerals Ltd., AFKRG</td>
</tr>
<tr>
<td>Vanlas prospect (Kidd zone) (52 F/10NW)</td>
<td>Au</td>
<td>100 000 tons of 0.20 ounces Au per ton.</td>
<td>Power Expl. Inc. annual report, 1988</td>
</tr>
<tr>
<td>Victor Island prospect (52 F/5SE)</td>
<td>Au</td>
<td>Drill indicated reserves: 300 000 tons at 0.12 ounces Au per ton to a depth of 700 feet.</td>
<td>MP 128, p.16</td>
</tr>
<tr>
<td>Virginia prospect (52 F/5NE)</td>
<td>Au</td>
<td>100-foot wide zone averaging 0.10 ounces Au per ton.</td>
<td>GR 111, p.40</td>
</tr>
<tr>
<td>Wind Bay prospect (52 C/10SW)</td>
<td>Zn,Cu</td>
<td>1300 m long by 50 m wide zone hosts several 10 m wide mineralized lenses. Typical diamond drill hole intersections assayed 1.5% Zn, 0.2% Cu across 7 m, and 1.1% Zn, 0.09% Cu across 8.6 m.</td>
<td>OFR 5512, p.89</td>
</tr>
<tr>
<td>Witch Bay occurrence (52 E/9SE)</td>
<td>Au</td>
<td>8.2 g/t Au to 29.5 g/t Au across 30 to 36 cm for a length of 240 m.</td>
<td>OFR 5695, p.370</td>
</tr>
</tbody>
</table>
The majority of gold deposits consist of relatively small tonnages with variable average grades, and may have potential for small-scale mining. One property that stands out is the Earngey–Lindburg (Thrasher–Bigstone property) occurrence where gold assays over an ounce per ton have been reported over significant widths (see Table 2.5; Davies and Smith 1988). This occurrence is located on patented mining claims situated near the Storm Bay Road southeast of Kenora (Davies and Smith 1988).

Base metal deposits dominantly consist of copper or nickel-copper properties, hosted by mafic to ultramafic intrusive rocks, that have modest tonnages with relatively low grades. A few of these properties may also have exploration potential. Three deposits that are interesting for their nickel-copper values are the Kenbridge, Central and Norpax prospects at Empire, Werner and Almo lakes, respectively (see Table 2.5). The Kenbridge prospect is located northeast of Empire Lake about 68 km southwest of Dryden. Nickel-copper mineralization occurs within a lens-shaped zone hosted by an amphibolite-norite intrusive breccia bounded by shear zones (Blackburn et al. 1989). The Central and Norpax nickel-copper prospects are situated in the Werner–Rex lakes area about 84 km north-northwest of Kenora. These deposits are hosted by discontinuous peridotite bodies that occur at intervals along a major east-trending fault zone known as the Werner–Rex lakes lineament (Blackburn et al. 1988). This lineament also hosts the past-producing Gordon Lake copper-nickel-platinum-palladium mine and the Werner Lake cobalt mine (Blackburn et al. 1988).

Tonnage-grade estimates at the Northrock copper prospect in Halkirk and Watten townships, east of Fort Frances, are reported as 1 020 458 tons of 1.17% Cu over a strike length of 400 m in the Beaver Pond zone or 265 230 tons grading 2.08% Cu over a strike length of 300 m (see Table 2.5; Poulsen 1984). Mineralized zones at the Northrock prospect are situated at the base of the Grassly Portage Bay mafic sill along the contact between the sill and underlying mafic to ultramafic metavolcanic flows. An interesting feature at the Northrock prospect is the East zone which has been tested by 2 diamond drill holes. Poulsen (1984) reported that one hole intersected "0.425% Cu and 0.044% MoS2 across 20 m of core: the same intersection, diluted to a greater width yielded 0.223% Cu across 70 m. The vertical and lateral extent of this zone has not been tested;" therefore, the East zone requires further exploration.

Exploration at other base metal properties in Watten and Halkirk townships — such as the Redgut Bay, Mironsky and Wind Bay prospects — has delineated mineralized zones with variable copper and zinc values (see Table 2.5) in favourable geological environments for volcanogenic massive sulphides. A few of these properties, such as the Mironsky copper-zinc prospect (see "Property Examinations" section of this report), require further exploration.

### DRILL CORE STORAGE PROGRAM

The Kenora Drill Core Library serves 3 of the 6 Resident Geologist's districts in northwestern Ontario: Kenora, Red Lake and Patricia (Sioux Lookout). The drill core stored at the library consists of: drill core from entire diamond drill holes from both exploration and mine development drilling; drill core from incomplete holes recovered from old diamond drill sites; short samples of drill core submitted for credit under the old Mining Act (RSO 1980); and drill core submitted for credit under the new Mining Act proclaimed in June 1991. A total of 9801.6 m of drill core from 95 diamond drill holes was added to the collection between November 25, 1991 and December 31, 1992. The current contents of the library consist of: 65 740.7 m of fully catalogued drill core stored inside the building; 24 141.1 m of catalogued drill core on pallets in secure outside storage; and 6462.5 m of drill core collected but not yet catalogued; for a total of 96 344.3 m of drill core from all 3 districts. Drill core in outdoor storage consists of: excess drill core from several drilling projects that was collected in its entirety; drill core removed from indoor storage when core in better condition became available; and surplus drill core left over after some holes were reduced. All of this drill core is available for examination on request.

In addition to its primary function as a drill core storage facility, the core library is a depository for rock samples and equipment from the Kenora Resident Geologist's office. Rock saws and polishers at the core library are available for cutting and polishing rock samples. Lab facilities and a variety of microscopes are available for use in mineral and rock identification. The core library also offers support facilities for Ontario Geological Survey field crews working in the Kenora District.

There were 226 visitors (161 industry, 65 government) and 305 telephone inquiries during the year. A total of 49 workdays were spent by exploration industry personnel examining and sampling drill core, examining mineral and rock sample suites and other materials; as well, 50 workdays were spent using other parts of the facility such as rock saws and polishers, microscopes and the drill core library files. The use of the core library increased from 1991 in both the number of users and the workdays spent in the facility. Major and junior mining company employees who examined drill core at the facility showed a continuing interest in base metals. Many local prospectors and other interested individuals still expressed an interest in gold.

A major new initiative in the core library system is the development of off-site, outdoor drill core storage. For many years some drill core has been stored outside in Kenora, Red Lake and Sioux Lookout in locations with limited storage space. In November of 1992, site preparation for dedicated outdoor storage sites began in Kenora, Red Lake and Sioux Lookout, funded by the jobsOntario Capital Fund. The sites will consist of fenced gravelled yards where drill core can be

32
Table 2.6. Drill core collection sites, Kenora Resident Geologist’s District.

1. Athlone Resources Ltd., Grey Trout Road property (base metals, 4 holes)
2. Champion Bear Resources Ltd., Separation Lake properties (gold, base metals, 28 holes)
3. Consolidated Jalna Resources Ltd., Purdex prospect (gold, 4 holes)
4. Homestake Exploration Ltd., Olive Mine (gold, 10 holes)
5. Mill City Gold Inc.—Rio Algom Exploration Inc., Game Lake prospect (base metals, 3 holes)
6. Palin Granite Canada Inc., Pine Green Quarry (granite, 4 holes)
7. Phelps Dodge Corp. of Canada Ltd., Lobstick Bay prospect (gold, 5 holes)
8. Rio Algom Exploration Inc., Kakagi Lake property (gold, 10 holes)
9. Royal Crest Resources Ltd., Bennett Lake property (gold, 3 holes)

stored on specially designed covered steel pallets, regular wooden pallets or in core racks. The first stage of construction was completed at the end of 1992, and the sites will be in use as soon as the fencing is completed. Drill core that would have been left in the bush or transferred to existing outdoor storage in Kenora will now be stored at these sites. The off-site facilities will increase the capacity of the core library system. In addition, the sites will provide a secure place to store drill core in the District where it was drilled. Mining companies and individuals will be able to bring core to the Red Lake and Sioux Lookout sites and continue to have access to the drill core without travelling to Kenora.

The Kenora Drill Core Library holds 51,181.3 m of fully catalogued core from 645 diamond-drill holes in the Kenora Resident Geologist’s District. Between November 25, 1991 and December 31, 1992, 8209.6 m of core from 71 diamond-drill holes were added to the collection (Table 2.6). For the locations of drill core collection sites in the Kenora District, see Figure 2.2. Gold remained the major exploration target in the Kenora District, and 5 of the 9 properties where drill core was collected, were diamond drilled for gold; 3 were diamond drilled for base metals or combined base metals and gold; and 1 was diamond drilled for building stone (see Table 2.6).

The drill core collected in 1992 from diamond-drill projects in the Kenora District (see Table 2.6; Figure 2.2) include:

- Athlone Resources Ltd. which conducted a diamond-drill program in 1992 on the Grey Trout Road copper-nickel-cobalt occurrence northeast of Mine Centre. The occurrence was discovered in 1991 during construction of the Grey Trout Road.

- Consolidated Jalna Resources Ltd. which explored the Purdex gold prospect north of High Lake in Ewart Township in 1988 and 1989. The drill core collected from this work is representative of the type of mineralization found at the prospect. Several other companies have diamond drilled properties in the High Lake area, and drill core from these sites is also included in the core library collection.

- Homestake Exploration Ltd. which conducted diamond drilling at the Olive gold mine near Mine Centre in 1984. This property has recently been operated by E. Ludwig (Nighthawk Drilling) as a small-scale gold mining project.

- Phelps Dodge Corp. of Canada Ltd. which conducted a five-hole diamond-drill program on its Lobstick Bay gold-fluorite prospect east of Sioux Narrows in 1991 (see “Property Examinations” section of this report). This area has been explored for gold and base metals for several years.

- Royal Crest Resources Ltd. which diamond drilled its Bennett Lake gold property in the west part of Bennett Township, east of Mine Centre, in 1988. The property includes the Independence gold prospect and the Red Cedar gold occurrence. Three of the 5 holes were collected to give representative coverage of the mineralization. The target was gold, but traces of copper-zinc mineralization were also detected in drill core.

- Rio Algom Exploration Inc. diamond drilled several gold occurrences in the Kakagi Lake area between 1990 and 1991. All of this core is now part of the core library collection. Most of the diamond drilling was conducted through the ice of Kakagi Lake; therefore, the drill core provides a record of mineralized alteration zones that are obscured by water and overburden.

- Mill City Gold Inc. and Rio Algom Exploration Inc. which conducted diamond drilling at the Game Lake zinc prospect in Bridges Township, 60 km east of Kenora along Highway 17. Diamond drilling was carried out there in 1987, 1988 and 1990. Representative drill core from the 1988 drilling was collected. This area is part of a narrow, moderate to highly metamorphosed greenstone belt that is currently being explored for base metals by Noranda Exploration Company Ltd.

- Champion Bear Resources Ltd. which diamond drilled 54 holes totalling 5856 m on its Separation Lake properties in the Umfreville—Treelined lakes area. The drilling was the continuation of an exploration program for base
metals and gold which commenced in 1988. The drill core, from 28 diamond-drill holes that were collected, contains numerous wide intersections of anomalous zinc and copper mineralization.

- Palin Granite Canada Inc. which continued diamond drilling at its Pine Green granite quarry north of Kenora. This was the only industrial mineral drilling project in the district this year. Drilling granite deposits is a fairly recent development in building stone exploration (Blackburn, Hailstone et al. 1992).

**RECOMMENDATIONS FOR EXPLORATION**

Since 1989, several gold and base metal exploration programs in the Kenora District have been directed toward porphyritic, felsic metavolcanic rocks interbedded with metasediments of the Warclub–Minnitaki Group (Blackburn, Johns et al. 1991; Blackburn, Hailstone et al. 1992).

Metasediments and metavolcanic rocks of the Warclub–Minnitaki Group, or Warclub assemblage, extend continuously for about 250 km from the Minnitaki Lake area, south of Sioux Lookout, to the extreme southwest corner of Lake of the Woods (Ayer et al. 1991; Blackburn, Johns et al. 1991; OGS 1992). The metasediments are situated north of the Wabigoon fault in the Sioux Lookout–Dryden–Vermilion Bay area, and north of the Pipestone–Cameron fault at Lake of the Woods.

Porphyritic, synvolcanic felsic intrusions and associated intermediate to felsic, quartz-feldspar-phyric metavolcanic rocks are interbedded with the metasedimentary rocks of the Warclub–Minnitaki Group at Lake of the Woods (Johns 1987). The most extensive unit is the Berry River formation at Lobstick Bay which is interpreted by Johns et al. (1984) to be a felsic volcanic complex comprising central to distal and redeposited volcanic facies (Blackburn, Johns et al. 1991). Gold-fluorite-pyrite mineralization accompanied by sericitization, silicification and strong sodium depletion is associated with these rocks at the Lobstick Bay prospect (see “Property Examinations” section of this report). Synvolcanic quartz and quartz-feldspar porphyry intrusions within the Warclub–Minnitaki Group are also located at Witch Bay, Bath Island, Pewabic Island and French Portage all on Lake of the Woods. Some of these porphyries are associated with gold and base metal mineralization.

Quartz-feldspar-phyric metavolcanic rocks, formerly mapped as metasediments of the Warclub–Minnitaki Group (Satterly 1943a, 1943b; Breaks and Kuehner 1984), have recently been recognized at the Plomp zinc-copper-gold occurrence north of Eagle Lake and at the Thunder Lake gold-zinc prospect east of Dryden (see “Property Examinations” section of this report). Gold-zinc mineralization is associated with quartz-feldspar crystal tuff and some intrusive quartz-feldspar porphyry at these locations. There is evidence of hydrothermal alteration that may be related to volcanogenic massive sulphides at the Plomp occurrence.

Gold is associated with several quartz-feldspar porphyry intrusions within metasediments of the Warclub–Minnitaki Group at Minnitaki Lake, south of Sioux Lookout. Sulphide mineralization of possible volcanogenic origin is also related to felsic pyroclastic rocks intercalated with metasediments, immediately south of Minnitaki Lake.

The Warclub–Minnitaki Group metasediments are interpreted by Blackburn, Johns et al. (1991) to represent either fore- or back-arc basin accumulations of sediments in volcanic island arc environments that developed between 2713 and 2695 million years ago. The quartz-feldspar-phyric felsic metavolcanics and related synvolcanic intrusions distributed throughout the Warclub–Minnitaki Group probably represent centres of felsic volcanism within these basin assemblages that may be good targets for volcanogenic massive sulphide mineralization and gold.

Large areas within the Warclub–Minnitaki Group remain unexplored for gold and base metals and may host unrecognized quartz-feldspar-phyric felsic metavolcanic rocks and associated intrusions. These are:

- The Populus Lake area, 32 km southwest of Eagle Lake, where an intrusion of “quartz-feldspar augen-orthogneiss” was mapped by Davies and Watowich (1955, 1958). The intrusion may be a metamorphosed and highly strained quartz-feldspar porphyry. Davies and Watowich (1958) noted that deformed portions of the intrusion “resemble the quartz-feldspar-biotite sediment that it has intruded” and suggested that some of the Warclub–Minnitaki Group metasediments in the area are prochloric in origin. These observations may indicate that the intrusion is synvolcanic. The majority of the metasediments in the Populus Lake area have been mapped as quartz-feldspar mica schist, arkose and arkosic greywacke and greywacke, and derived feldspar-biotite gneiss with units of magnetic iron formation. The metasediments are also intruded by gabbro, quartz-felspassporphyry and a variety of granodioritic rocks (Davies and Watowich 1955, 1958). This area was open for staking at the time of writing.

- The majority of the Eagle River area, about 26 km west of Dryden, is mapped as highly metamorphosed and variably migmatized metasediments of the Warclub–Minnitaki Group (Breaks and Kuehner 1984). However, quartz-feldspar-phyric metavolcanic rocks associated with zinc-copper-gold mineralization have been identified at the Plomp occurrence in the Eagle River area (see “Property Examinations” section of this report). Further exploration in this area may result in more discoveries of felsic metavolcanic rocks and associated mineralization. The majority of the area was open for staking at the time of writing.

Rocks of the Warclub–Minnitaki Group have long been considered to be dominantly composed of variably metamorphosed metasediments with low gold and/or base metal potential. However, the recent discovery of gold and base
metal mineralization associated with previously unrecognized felsic, porphyritic, metavolcanic rocks and intrusions within the group, suggests that a re-evaluation of the mineral potential of the Warclub–Minnitaki Group is necessary. Therefore, exploration for gold and volcanogenic massive sulphides in the areas described above and elsewhere within the Warclub–Minnitaki Group is recommended.

Several areas have been recommended for base metal exploration in the “Volcanogenic Massive Sulphide Compilation Study” section of this report (see Figure 2.4). In summary, these are:

- The Rice Bay area (see Figures 2.3 and 2.4), where rocks previously mapped as metasediments are actually felsic metavolcanic rocks, at least some of which may be VMS-productive Type IIIB felsic metavolcanics (Lesher et al. 1986). These rocks also exhibit evidence of hydrothermal alteration which resulted in sodium depletion and magnesium enrichment. There are several occurrences of significant copper-zinc mineralization in the area, and several untested airborne electromagnetic geophysical anomalies (OGS 1980a). There has only been limited base metal exploration in the Rice Bay area which was open for staking at the time of writing. Two interesting mineralized zones in the Rice Bay area — both of which were also open for staking at the time of writing — are the Mironsky copper-zinc occurrence and the Hupchuk copper occurrence (see Figure 2.3; see “Property Examinations” section of this report).

Diamond drilling by Phelps Dodge Corp. of Canada Ltd. and Belacoma Mines Ltd. at the Mironsky prospect intersected copper-zinc mineralization in quartz-biotite schist which may actually be recrystallized felsic metavolcanic rocks. The mineralized zone at the prospect is reported to be a minimum of 800 feet long by 26 feet wide, extending to a vertical depth of 300 feet, with a grade of 1 to 1.5% Cu. One of the drill holes also intersected 1.37% Zn and 0.45% Cu across 7 feet. Garnet, chlorite and sericite were identified in the rocks at the prospect and may reflect hydrothermal alteration related to the mineralizing event. A volcanogenic model for the genesis of the copper-zinc mineralization at the Mironsky prospect has not been tested. The mineralized quartz-biotite schist unit may also have been part of a continuous unit of intermediate to felsic metavolcanic rocks that appear to have been boudinaged into several discontinuous lenses along the southern contact of the Grassy Portage Bay mafic sill (see Figure 2.3). Other lenses are located southwest of the Mironsky prospect, and should be prospected for copper-zinc mineralization.

The other mineralized zone is the Hupchuk copper occurrence (see Figure 2.3), where up to 0.48% Cu over a 10-foot width is reported from chip sampling across a zone with a minimum strike length of 100 m (Harris 1974a). The geological environment and character of mineralization here — copper-rich, stringer sulphide mineralization hosted in submarine mafic metavolcanics — is strikingly similar to the Maybrun copper-gold mine, located 32 km east of Sioux Narrows (Davies 1973). A volcanogenic model for the genesis of the sulphide mineralization at this occurrence has yet to be tested.

- The Stormy Lake area (see Figures 2.4 and 2.5), where proximal, felsic metavolcanic pyroclastics and flows are intruded by a subvolcanic quartz-feldspar-biotite porphyry intrusion. The metavolcanic rocks locally exhibit hydrothermal alteration which has resulted in the formation of chlorite and chloritoid. A number of untested airborne electromagnetic geophysical anomalies occur in this area (OGS 1980b). Note that there is no recorded base metal exploration at Stormy Lake.

- The Phinney–Dash lakes area (see Figures 2.4 and 2.6), where felsic metavolcanic rocks overlie a subvolcanic quartz-feldspar porphyry intrusion. The metavolcanic rocks exhibit some of the distinctive geochemical signatures of potentially VMS-productive Type III felsic metavolcanics (Lesher et al. 1986). These metavolcanics also exhibit locally intense hydrothermal alteration, which has resulted in the formation of ferroan carbonate, sericite and chloritoid. Anomalous copper-zinc mineralization is known to occur at 2 locations southwest of Phinney Lake, but there has been no follow-up exploration in the area. Most of the Phinney–Dash lakes area was open for staking at the time of writing.

Exploration for volcanogenic massive sulphides is also recommended at Outer Bay and Zigzag Island on Lake of the Woods (see Figure 2.4). These areas exhibit geological and geochemical features which suggest that they have significant potential to host VMS mineralization. The areas were open for staking at the time of writing.

The compilation of mineral deposits not being mined in the Kenora District (see Table 2.5) identifies some small-tonnage gold properties that may be suitable for small-scale mining. Several base metal properties with significant tonnage-grade estimates and/or dimensions also have exploration potential.

**ONTARIO GEOLOGICAL SURVEY–GEOSCIENCE BRANCH ACTIVITIES**

There were 4 Ontario Geological Survey–Geoscience Branch projects in the Kenora District this year. For the locations of these projects, see Figure 2.2.

A) C.E. Blackburn, Precambrian Geoscience Section, conducted 1:15 840 scale mapping in the western half of the Separation Lake area.

B) G.P. Beakhouse, Precambrian Geoscience Section, conducted 1:50 000 scale mapping of migmatitic and granitoid rocks in the Umfreville Lake and Separation Lake areas.
Table 2.7. Maps and reports pertaining to the Kenora Resident Geologist’s District issued by the Ontario Geological Survey, 1992.

**Special Volumes**


**Maps**

- Map 2576 Tectonic assemblages of Ontario, west-central sheet.

**Miscellaneous Papers**


C) T.F. Morris, Sedimentary and Environmental Geoscience Section, conducted surficial geology studies consisting of 1:50 000 scale mapping and deposit examination in the Umfreville Lake area.

D) V.K. Gupta, Precambrian Geoscience Section, conducted gravity transects across the eastern part of the Separation Lake area.

Maps and reports pertaining to the Kenora District that were issued by the Ontario Geological Survey in 1992 are listed in Table 2.7.

**RESEARCH BY OTHER AGENCIES**

**University Theses**

Geoscience theses relating to the Kenora Resident Geologist’s District believed to be in progress or completed during 1992, are as follows.

**MSc AND MA THESES**

G. Clark continued a study of the gold-mining history in the Lake of the Woods area toward an MA degree (University of Manitoba, Winnipeg, Manitoba).

J. Debeer completed a study of the volcanology of the Mine Centre volcanic belt (University of Minnesota, Duluth, Minnesota, USA).

**PhD THESIS**

J.A. Ayer continued a study of the petrogenesis of volcanic and plutonic suites of the Lake of the Woods greenstone belt, and a comparison with those of other belts in the western Wabigoon Subprovince (University of Ottawa, Ottawa, Ontario).

**Other Research**

The Geological Survey of Canada conducted magnetic, VLF-electromagnetic and gamma-ray radiometric airborne geophysical surveys from the Manitoba–Ontario provincial boundary east to longitude 95°W. This was part of a larger airborne geophysical survey that was flown in Manitoba (K. Ford, Geological Survey of Canada, personal communication, 1992). The following NTS areas were surveyed: 52 E/11NE, 14SE, 14NE and 52 L/3SE, 3NE, 6SE.

**SELECTED PUBLICATIONS RECEIVED DURING 1992**


**REFERENCES**


— 1980b. Airborne electromagnetic and total intensity magnetic survey, Manitou–Stormy lakes area, District of Kenora; Ontario Geological Survey, Maps 80 467a-b, 80 468, 80 474 and 80 475, scale 1:20000.


Satterly, J. 1943b. Dryden–Wabigoon area; Ontario Department of Mines, Map 50e, scale 1:63 360.

Scott, S.D. 1991. Volcanogenic massive Cu-Zn-Pb-Ag-Au sulphide ores with emphasis on Canadian Precambrian deposits; in Twelfth Ore Deposits Workshop, Department of Geology, University of Toronto, Toronto, Ontario.


3. Red Lake Resident Geologist’s District — 1992

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INTRODUCTION

The current year continued the downward trend in exploration activity of the last several years. Assessment work reported declined from last year as did the number of claims staked. Table 3.1 summarizes exploration statistics on an annual basis for the past 20 years. All figures for 1991 and 1992 are converted from dollar value to “man days” to allow a direct comparison of year to year statistics. The conversion factor is based on a twenty-two-dollar man day using current dollar value.

Throughout the district, 11 companies explored for minerals. Much of the exploration was directed towards base metals in the vicinity of the past-producer South Bay Mine Cu-Zn deposit and the on-strike stratigraphy of the mine, situated 75 km east of Red Lake. Minnova Inc., Noranda Exploration Ltd., BHP Minerals Canada Ltd. and Rio Algom Exploration Inc. hold ground in the area south and west of the South Bay Mine and all companies were active to varying degrees on their properties. Placer Dome Inc. was the most active company seeking gold mineralization in the Red Lake greenstone belt and at McInnes Lake. After 4 years of exploration in the Dixie Lake area, Teck Corporation dropped its optioned properties, but some of these were subsequently acquired by Noranda.

A summary of exploration activities reported in the district is listed in Table 3.2. Exploration projects listed in the table are keyed to Figures 3.1a and 3.1b.

For the Red Lake district, 3 Ontario Mineral Incentive Programs (OMIP) with a value of $212,363 and 10 Ontario Prospectors Assistance Program (OPAP) grants with a value of $100,000 were designated to companies and individuals engaged in mineral exploration.

MINING ACTIVITIES

Placer Dome Inc. — Campbell Mine

Gold production at Campbell Mine was 298,875 ounces from 507,978 tons milled for 1992. This represents a 14% increase over the previous year when 260,582 ounces of gold were produced. The mine is milling 1400 tons of ore per day with an average mill grade of 0.626 ounces Au per ton. Gold recovery from ore milled is 94%.

Underground development work at the mine included 5334 m of drifting and 1372 m of raising. Ore definition drilling amounted to 19,200 m and exploration drilling of 29,565 m was completed. Exploration emphasis was directed towards mineralization in and beneath the lower levels of the mine workings.

In April, the work force was reduced by 99 employees. The current employment compliment at the mine is 384 people. Proven and probable ore reserves at the mine are 5,017,000 tons with an average grade of 0.58 ounces Au per ton. T. Mann is the General Manager of the mine and T. Stubens is Chief Mine Geologist.

Dickenson Mines Ltd. — Arthur W. White Mine

Gold production at the Arthur W. White Mine was 75,052 ounces from 322,649 tons of ore milled in 1992. This compares to 74,605 ounces of gold produced in the previous year. The daily milling rate is 821 tons and gold recovery of milled ore is about 80%. The mill grade is 0.27 ounces Au per ton.

Underground drilling at the mine amounted to 24,437 m including 12,967 m of ore definition drilling and 11,470 m of exploration drilling. Exploration drilling included the PML zone between the 26th and 28th levels and the D zone hanging wall on the 6th level. Minor drilling on the 34th level tested the depth potential of the ESC and PML zones.

Underground development consisted of 831 m of drifting, 1144 m of ramping and 684 m of raising.

The mine has work force of 280 employees.
Table 3.1. Summary of claims recorded and assessment work credit.

<table>
<thead>
<tr>
<th>Year</th>
<th>Claims Active</th>
<th>Diamond Drilling (Man day, $ value)</th>
<th>Geophysical Surveys (Man day, $ value)</th>
<th>Geological Surveys (Man day, $ value)</th>
<th>Total Man Days (S value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>7038</td>
<td>30 340 (667 486)</td>
<td>24 037 (528 825)</td>
<td>0</td>
<td>61 380 (1 350 363)</td>
</tr>
<tr>
<td>1991</td>
<td>8106</td>
<td>18 398.8 (558 8)</td>
<td>46 796.8 (255 74)</td>
<td>1871 (225 74)</td>
<td>71 591.46 (225 74)</td>
</tr>
<tr>
<td>1990</td>
<td>9844</td>
<td>12 994 (518 0)</td>
<td>91 499 (225 74)</td>
<td>7540 (225 74)</td>
<td>151 384 (225 74)</td>
</tr>
<tr>
<td>1989</td>
<td>11 228</td>
<td>78 538 (488 9)</td>
<td>39 914 (225 74)</td>
<td>8510 (225 74)</td>
<td>132 620 (225 74)</td>
</tr>
<tr>
<td>1988</td>
<td>10 935</td>
<td>215 300 (629 49)</td>
<td>42 666 (225 74)</td>
<td>457 500 (225 74)</td>
<td>261 741 (225 74)</td>
</tr>
<tr>
<td>1987</td>
<td>11 017</td>
<td>81 854 (391 6)</td>
<td>138 443 (225 74)</td>
<td>23 440 (225 74)</td>
<td>189 633 (225 74)</td>
</tr>
<tr>
<td>1986</td>
<td>10 427</td>
<td>22 035 (521 6)</td>
<td>63 60 (225 74)</td>
<td>53 207 (225 74)</td>
<td>118 775 (225 74)</td>
</tr>
<tr>
<td>1985</td>
<td>81 662</td>
<td>39 914 (225 74)</td>
<td>12 495 (225 74)</td>
<td>128 664 (225 74)</td>
<td>107 430 (225 74)</td>
</tr>
<tr>
<td>1984</td>
<td>7799</td>
<td>23 967 (21 108)</td>
<td>79 662 (67 87)</td>
<td>159 633 (81 85)</td>
<td>71 975 (118 775)</td>
</tr>
<tr>
<td>1983</td>
<td>5180</td>
<td>28 771 (13 720)</td>
<td>60 000 (21 108)</td>
<td>118 775 (53 207)</td>
<td>8 182 (107 430)</td>
</tr>
<tr>
<td>1982</td>
<td>3992</td>
<td>23 967 (13 720)</td>
<td>79 662 (21 108)</td>
<td>118 775 (53 207)</td>
<td>67 87 (118 775)</td>
</tr>
<tr>
<td>1981</td>
<td>4301</td>
<td>32 882 (11 15)</td>
<td>12 495 (21 108)</td>
<td>128 664 (53 207)</td>
<td>87 1 (118 775)</td>
</tr>
<tr>
<td>1980</td>
<td>4332</td>
<td>32 882 (11 15)</td>
<td>78 538 (21 108)</td>
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<td>71 975 (118 775)</td>
</tr>
<tr>
<td>1979</td>
<td>5588</td>
<td>32 882 (11 15)</td>
<td>78 538 (21 108)</td>
<td>128 664 (53 207)</td>
<td>67 87 (118 775)</td>
</tr>
<tr>
<td>1978</td>
<td>47362</td>
<td>32 882 (11 15)</td>
<td>78 538 (21 108)</td>
<td>128 664 (53 207)</td>
<td>71 975 (118 775)</td>
</tr>
<tr>
<td>1977</td>
<td>4261</td>
<td>32 882 (11 15)</td>
<td>78 538 (21 108)</td>
<td>128 664 (53 207)</td>
<td>67 87 (118 775)</td>
</tr>
<tr>
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<td>71 975 (118 775)</td>
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<td>1975</td>
<td>34261</td>
<td>32 882 (11 15)</td>
<td>78 538 (21 108)</td>
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<td>67 87 (118 775)</td>
</tr>
<tr>
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<td>5588</td>
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<td>78 538 (21 108)</td>
<td>128 664 (53 207)</td>
<td>71 975 (118 775)</td>
</tr>
<tr>
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<td>5284</td>
<td>32 882 (11 15)</td>
<td>78 538 (21 108)</td>
<td>128 664 (53 207)</td>
<td>67 87 (118 775)</td>
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<tr>
<td>1972</td>
<td>588</td>
<td>32 882 (11 15)</td>
<td>78 538 (21 108)</td>
<td>128 664 (53 207)</td>
<td>71 975 (118 775)</td>
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</tbody>
</table>

Table 3.2. Exploration activity in the Red Lake Resident Geologist’s District.

<table>
<thead>
<tr>
<th>Abbreviations</th>
<th>Explorations</th>
</tr>
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<tbody>
<tr>
<td>AEM</td>
<td>Airborne electromagnetic survey</td>
</tr>
<tr>
<td>AM</td>
<td>Airborne magnetic survey</td>
</tr>
<tr>
<td>ARA</td>
<td>Airborne radiometric survey</td>
</tr>
<tr>
<td>Au</td>
<td>Gold</td>
</tr>
<tr>
<td>BM</td>
<td>Base Metals</td>
</tr>
<tr>
<td>DD</td>
<td>Drilling diamond</td>
</tr>
<tr>
<td>DHH</td>
<td>Diamond drill-hole(s)</td>
</tr>
<tr>
<td>GC</td>
<td>Geochemical survey</td>
</tr>
<tr>
<td>GEM</td>
<td>Ground Electromagnetic survey</td>
</tr>
<tr>
<td>GL</td>
<td>Geological survey</td>
</tr>
<tr>
<td>GM</td>
<td>Ground magnetic survey</td>
</tr>
<tr>
<td>GRA</td>
<td>Ground radiometric survey</td>
</tr>
<tr>
<td>HLEM</td>
<td>Horizontal loop electromagnetic survey</td>
</tr>
<tr>
<td>IP</td>
<td>Induced polarization survey</td>
</tr>
<tr>
<td>PEM</td>
<td>Pulse electromagnetic survey</td>
</tr>
<tr>
<td>RES</td>
<td>Resistivity survey</td>
</tr>
<tr>
<td>SP</td>
<td>Self potential survey</td>
</tr>
<tr>
<td>Str</td>
<td>Stripping</td>
</tr>
<tr>
<td>Tr</td>
<td>Trenching</td>
</tr>
<tr>
<td>UG</td>
<td>Underground development</td>
</tr>
<tr>
<td>VLEM</td>
<td>Vertical loop electromagnetic survey</td>
</tr>
<tr>
<td>VLF-EM</td>
<td>Very low frequency electromagnetic survey</td>
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</table>

<table>
<thead>
<tr>
<th>No</th>
<th>Company/Individual (Occurrence Name or Property)</th>
<th>Township/Area (Commodity)</th>
<th>Exploration Activity</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Akiko-Lori Gold Resources Ltd. (Springpole Lake property)</td>
<td>Casummit Lake map sheet (Au)</td>
<td>DDH(9)-2 085m</td>
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<td>2</td>
<td>Asarco Exploration Co. of Canada Ltd.</td>
<td>Goodall, Skinner and Earngey tps., Karas Lake, Slate Lake, Avis Lake, Hailstone Lake, Jubilee Lake, Little Shabumeni Lake and Uchi Lake map sheets (Au, BM)</td>
<td>GL, GEM, GM, line cutting</td>
</tr>
<tr>
<td>3</td>
<td>BHP Minerals Canada Ltd. (Fly Lake property)</td>
<td>Mitchell and Bowerman tps. (BM)</td>
<td>GM, HLEM, gravity, PEM surveys</td>
</tr>
<tr>
<td>No</td>
<td>Company/Individual (Occurrence Name) or Property</td>
<td>Township/Area (Commodity)</td>
<td>Exploration Activity</td>
</tr>
<tr>
<td>----</td>
<td>-------------------------------------------------</td>
<td>---------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>4</td>
<td>Breakwater Resources Ltd. (Fly Lake property)</td>
<td>Mitchell Tp. (BM)</td>
<td>GM, GEM</td>
</tr>
<tr>
<td>5</td>
<td>Buhlmann, E.</td>
<td>Stull Lake map sheet (Au)</td>
<td>Lithogeochemical sampling</td>
</tr>
<tr>
<td>6</td>
<td>English, P., Hermiston, W.</td>
<td>Dedee Lake map sheet (Au, BM)</td>
<td>Str, Tr, prospecting</td>
</tr>
<tr>
<td>7</td>
<td>Frank, R.</td>
<td>Skinner Tp. (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>8</td>
<td>Greenstar Resources Ltd.</td>
<td>Shabumuni Lake map sheet (Au)</td>
<td>DDH(4)-368m</td>
</tr>
<tr>
<td>9</td>
<td>Hawke, D., Campbell, G. (Hawke–Campbell properties)</td>
<td>Mitchell Tp., Karas Lake, South of Otter Lake map sheets (BM)</td>
<td>GL, sampling</td>
</tr>
<tr>
<td>10</td>
<td>Hodgson, R. (Swain Lake property)</td>
<td>Shabumeni Lake map sheet (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>11</td>
<td>Luxor Explorations Ltd.</td>
<td>McDonough Tp. (Au)</td>
<td>DDH(2)-550m</td>
</tr>
<tr>
<td>12</td>
<td>Maciejewski, T.</td>
<td>Ball Tp. (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>13</td>
<td>McNerney, Wm.</td>
<td>Skinner Tp. (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>14</td>
<td>Minnova Inc. (Fly Lake property)</td>
<td>Mitchell and Bowerman tps. (BM)</td>
<td>DDH(9)-5120m, PEM, GL, sampling</td>
</tr>
<tr>
<td>15</td>
<td>Noranda Exploration Company Ltd. (Snake Falls area – Dixie 3) (Dixie Lake area)</td>
<td>South of Otter Lake and Gerry Lake map sheets (BM)</td>
<td>DDH(9)-2005m, geophysical surveys</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dixie Lake map sheet (BM)</td>
<td>AEM, AM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zionz Lake and Gull Lake map sheets (Au, BM)</td>
<td>GL</td>
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<tr>
<td></td>
<td></td>
<td>South of Otter Lake map sheet (BM)</td>
<td>Prospecting, geophysical survey</td>
</tr>
<tr>
<td></td>
<td>(Horseshoe Island property)</td>
<td>Casummit Lake map sheet (Au)</td>
<td>DDH(2)-403 m, Tr</td>
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<tr>
<td></td>
<td>(BP Resources)</td>
<td>Karas Lake map sheet (BM)</td>
<td>DDH(2)-907 m</td>
</tr>
<tr>
<td>16</td>
<td>Placer Dome Inc. (Gullrock Lake property)</td>
<td>Bateman Tp. (Au)</td>
<td>DDH(5)-1126 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Willans Tp. (Au)</td>
<td>GL, lithogeochemical sampling and limited soil sampling</td>
</tr>
<tr>
<td></td>
<td>(Martin Bay property)</td>
<td>Fairlie and Todd tps. (Au)</td>
<td>GL, GM, VLF-EM, lithogeochemical sampling and limited soil sampling</td>
</tr>
<tr>
<td></td>
<td>(McInnes Lake property)</td>
<td>McInnes Lake map sheet (Au)</td>
<td>Prospecting, lithogeochemical sampling and soil sampling</td>
</tr>
<tr>
<td></td>
<td>(Sobel Lake property)</td>
<td>Otter Lake and South of Otter Lake map sheets (Au)</td>
<td>GL, lithogeochemical sampling</td>
</tr>
<tr>
<td>17</td>
<td>Rio Algom Exploration Inc.</td>
<td>Bowerman and Mitchell tps. (BM)</td>
<td>GL, linecutting</td>
</tr>
<tr>
<td>18</td>
<td>Rivard, O. (East Bay property) (Heath property)</td>
<td>Bateman Tp. (Au)</td>
<td>DDH(1)-53m extended hole</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Todd Tp. (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>19</td>
<td>Rosenthal, L. &amp; A.</td>
<td>Fredart Lake area (Au)</td>
<td>Prospecting and trenching</td>
</tr>
<tr>
<td>20</td>
<td>Smith, D.</td>
<td>Shabumeni Lake map sheet (Au)</td>
<td>GL, sampling, line cutting</td>
</tr>
<tr>
<td>21</td>
<td>Smith, D., English, P.</td>
<td>Bateman Tp. (Au)</td>
<td>Str, sampling</td>
</tr>
<tr>
<td>22</td>
<td>Soltermann, R. (Wolf Bay property)</td>
<td>Todd Tp. (Au)</td>
<td>VLF-EM, linecutting</td>
</tr>
<tr>
<td>23</td>
<td>Spirit Lake Explorations Limited</td>
<td>North Spirit Lake area (Au, BM)</td>
<td>GL, prospecting, sampling</td>
</tr>
<tr>
<td>24</td>
<td>Strilchuk, G.</td>
<td>Skinner Tp. (Au)</td>
<td>Prospecting</td>
</tr>
</tbody>
</table>
EXPLANATION

• Exploration Activity 1992 (keyed to Table 3.2)
  + Claim Staking 1992
  — District Boundary

Figure 3.1a. Red Lake Resident Geologist's District, north part.
EXPLANATION

* Exploration Activity 1992 (keyed to Table 3.2)

• Producing Mines, 1992

1. Placer Dome Inc.—Campbell Mine
2. Dickenson Mines Ltd.—Arthur W. White Mine

+ Claim Staking, 1992

Figure 3.1b. Red Lake Resident Geologist's District, south part.
Ore reserves in the proven and probable category are 3,119,083 tons at a grade of 0.32 ounces Au per ton. The mineral inventory, including proven, probable and possible ore reserves is 5,042,635 tons with an average grade of 0.31 ounces Au per ton.

B. Eyres served as Mine Manager for most of the year. The position is presently held by J. McCombe. J. Rogers is Chief Mine Geologist.

### ADVANCED EXPLORATION AND DEVELOPMENT

Both the Cochenour–Willans Mine in Dome Township and the McFinley Red Lake Mines Ltd.'s property were inactive and remain on a care and maintenance status.

#### Table 3.3. Red Lake gold production April 2, 1930 to December 31, 1992.

<table>
<thead>
<tr>
<th>Mine</th>
<th>Years of Production</th>
<th>Ore Milled Short Tons</th>
<th>Troy Ounces</th>
<th>Kilo-grams</th>
<th>Ounces Per Ton</th>
<th>Grams Per Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Howey</td>
<td>1930–1941; 1957 (1)</td>
<td>4,630,779(2)</td>
<td>421,592</td>
<td>13,113</td>
<td>0.091(2)</td>
<td>3.35</td>
</tr>
<tr>
<td>McKenzie Red Lake</td>
<td>1935–1966</td>
<td>2,353,833</td>
<td>651,156</td>
<td>20,253</td>
<td>0.277</td>
<td>9.50</td>
</tr>
<tr>
<td>Red Summit</td>
<td>1935–1936</td>
<td>591</td>
<td>277</td>
<td>8.6</td>
<td>0.469</td>
<td>16.08</td>
</tr>
<tr>
<td>Red Lake Gold Shore</td>
<td>1936–1938</td>
<td>86,333</td>
<td>21,100</td>
<td>656</td>
<td>0.244</td>
<td>8.37</td>
</tr>
<tr>
<td>Gold Eagle</td>
<td>1937–1941</td>
<td>180,095</td>
<td>40,204</td>
<td>1,250</td>
<td>0.223</td>
<td>7.65</td>
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<tr>
<td>Madsen</td>
<td>1938–1976</td>
<td>8,371,631</td>
<td>2,416,609</td>
<td>75,165</td>
<td>0.289</td>
<td>9.91</td>
</tr>
<tr>
<td>Hasaga</td>
<td>1938–1952</td>
<td>1,515,282</td>
<td>218,213</td>
<td>6787</td>
<td>0.144</td>
<td>4.94</td>
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<tr>
<td>Cochenour–Willans(3)</td>
<td>1939–1971</td>
<td>2,311,165</td>
<td>1,244,279</td>
<td>38,701</td>
<td>0.538</td>
<td>18.45</td>
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<tr>
<td>McMarmac</td>
<td>1940–1948</td>
<td>152,978</td>
<td>45,246</td>
<td>1,407</td>
<td>0.296</td>
<td>10.15</td>
</tr>
<tr>
<td>A.W. White (Dickenson)(4)</td>
<td>1948–Present</td>
<td>7,321,669</td>
<td>2,931,041</td>
<td>91,165</td>
<td>0.400</td>
<td>13.73</td>
</tr>
<tr>
<td>Starratt Olsen</td>
<td>1948–1956</td>
<td>907,813</td>
<td>163,990</td>
<td>5,100</td>
<td>0.181</td>
<td>6.20</td>
</tr>
<tr>
<td>Campbell</td>
<td>1949–Present</td>
<td>12,973,654</td>
<td>7,769,066</td>
<td>241,644</td>
<td>0.599</td>
<td>20.54</td>
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<tr>
<td>H.G. Young</td>
<td>1960–1963</td>
<td>288,179</td>
<td>55,244</td>
<td>1,718</td>
<td>0.192</td>
<td>6.58</td>
</tr>
<tr>
<td>Mount Jamie</td>
<td>1976</td>
<td>552</td>
<td>265</td>
<td>8.2</td>
<td>0.480</td>
<td>16.46</td>
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<tr>
<td>Buffalo</td>
<td>1980–1982</td>
<td>31,986</td>
<td>1,656</td>
<td>52</td>
<td>0.052</td>
<td>1.78</td>
</tr>
<tr>
<td>Abino</td>
<td>1985–1986</td>
<td>2,733</td>
<td>1,397</td>
<td>44</td>
<td>0.51</td>
<td>17.49</td>
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<tr>
<td>Lake Rowan</td>
<td>1986–1988</td>
<td>13,023</td>
<td>1,298</td>
<td>40</td>
<td>0.10</td>
<td>3.42</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>41,142,296</td>
<td>15,982,633</td>
<td>497,111.8</td>
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<td></td>
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</table>

Notes:
1. Continuous production 1930 to 1941; includes 268 ounces recovered from clean up in 1957.
2. From 1930 to 1941, the ore mined at Howey, before sorting, totalled 5,158,376 tons.
3. The average production from run-of-mine ore was therefore 0.0817 ounces Au per ton (2.80 g/t).
4. Includes production from Annco and Wilmar properties.
5. From 1970, includes production from Robin Red Lake.
EXPLORATION ACTIVITY

Akiko-Lori Gold Resources Ltd. and Gold Canyon Resources Inc. completed a nine-hole drill program on the Springpole property. Drilling targeted the Portage Zone where Gold Fields Canadian Mining Ltd. previously outlined 27 million tons grading 0.035 ounces Au per ton. Reported intersections are shown in Table 3.4.

Asarco Exploration Co. of Canada Ltd. acquired 17 claim groups consisting of 110 claim units in the Birch-Confederation-Uchi lakes area to cover geophysical anomalies identified on the 1991 Ontario Geological Survey airborne geophysical survey. Ground geophysical and geological surveys were completed on all properties by the company.

BHP Minerals Canada Ltd. conducted geophysical surveys on its Fly Lake property in Mitchell and Bowerman Townships.

Luxor Exploration Inc. drilled 2 holes totalling 548 m on its Slate Bay property in McDonough Township. The drilling intersected 76 m of an epidote-garnet skarn.

Minnova Inc. holds 435 claim units in several claim groups in the Confederation Lake area. Reconnaissance geological surveys and 9 diamond drill holes with a combined length of 5120 m were completed on the properties; downhole pulse EM surveys were done in select drill holes.

Noranda Exploration Co. Ltd. explored for base metal mineralization in the South of Otter Lake and Gerry Lake areas. Noranda's exploration program included linecutting, geological and geophysical surveys and diamond drilling of 9 holes totalling 2005 m on their Selco Joint Venture properties. These properties are described in more detail in the section on Property Examinations.

Table 3.4. Results of drill hole intersections on the Springpole property.

<table>
<thead>
<tr>
<th>Hole</th>
<th>Interval (ft)</th>
<th>Au (ounces per ton)/(ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S–92–02</td>
<td>370.5–390.0</td>
<td>0.140/19.5</td>
</tr>
<tr>
<td>S–92–03</td>
<td>313.9–324.4</td>
<td>0.160/10.5</td>
</tr>
<tr>
<td></td>
<td>444.8–463.5</td>
<td>0.100/18.7</td>
</tr>
<tr>
<td>S–92–04</td>
<td>406.0–411.0</td>
<td>0.291/5.0</td>
</tr>
<tr>
<td></td>
<td>406.0–426.0</td>
<td>0.120/20.0</td>
</tr>
<tr>
<td></td>
<td>615.0–672.0</td>
<td>0.173/57.0</td>
</tr>
<tr>
<td></td>
<td>625.0–662.0</td>
<td>0.214/37.0</td>
</tr>
<tr>
<td></td>
<td>641.7–662.0</td>
<td>0.282/20.3</td>
</tr>
</tbody>
</table>

Note: Information from Vancouver Stockwatch, March 9, 1992.

In the Dixie Lake area, properties previously explored by Teck Corporation were explored by Noranda using airborne geophysical surveys late in the year.

In the Birch Lake area, Noranda drilled 2 holes to a combined depth of 403 m on its Horseshoe Island property and did reconnaissance exploration around Zionz and Durkin lakes.

Placer Dome Inc. conducted geological exploration on 5 properties in the district. On its 48 claim East Bay property in Bateman Township, the company completed 1126 m of diamond drilling in 5 holes. The Martin Bay property, located in Fairlie and Todd townships consists of 105 claims and was explored using magnetic and electromagnetic surveys, geological mapping and lithogeochemical and soil sampling surveys. Work was confined to the southern part of the property.

Placer Dome's 157 claim Sobel Lake property is located approximately 30 km east of the town of Red Lake. Lithogeochemical and geological surveys were completed over 42 claims of the east part of the property.

The Gullrock Lake property includes 32 claims on the east side of Gullrock Lake, Willans Township, 20 km east of Red Lake. Work on this property included geological mapping, lithogeochemical sampling and limited soil sampling.

Placer Dome Inc. holds a 162 claim group in the McInnes Lake greenstone belt located 130 km north of Red Lake. Limited prospecting, lithogeochemical and soil sampling was done on this property.

Spirit Lake Explorations Limited holds 44 patented claims in the south central part of North Spirit Lake, 180 km north of Red Lake. Geological mapping, prospecting and sampling of old trenches and pits for both gold and base metals were completed by the company.

A number of local prospectors, funded by the Ontario Prospectors Assistance Program (OPAP), were active in the district; most of these were concentrated in the Red Lake greenstone belt, a few explored in the Birch–Confederation–Uchi lakes area and one explored for gold mineralization at Stull Lake, 400 km north of Red Lake.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The Resident Geologist's office was staffed by B. Atkinson, Resident Geologist, J. Parker, Staff Geologist and L. Kosloski, Secretary.

During the first quarter of 1992, J. Parker completed a provincial prospecting manual entitled "Discover Prospecting". G.H. Brown was contracted as Staff Geologist during this period.
RED LAKE—1992

In July, J. Parker was seconded to the Kenora office as Resident Geologist; the Red Lake Staff Geologist position was contracted to C. Lormand.

Other contract staff employed during the year were C. Sundstrom, Secretary, while L. Kosloski compiled Geological Data Inventory Folios (GDIFs); results of that work are described under a separate section. M. Reid, was employed as Computer Assistant, and L. Kowalchuk, office assistant, was funded under a Section 25 work program. R. Comber served as a summer field assistant. E. Nabigon was funded through the Ontario Human Resources Secretariat’s Employment Equity Fund and the Ministry of Northern Development and Mines as Lecturer to Native Reserves.

G.H. Brown instructed a prospecting course in Red Lake, and E. Nabigon gave prospecting courses to 6 native reserves. Reserves included Northwest Angle First Nation #33B, Cat Lake First Nation, Summer Beaver First Nation, Long Lake #58 First Nation, Ginoogaming First Nation, and Rocky Bay First Nation. A prospecting course was also given at the Community Resource Center in Red Lake by E. Nabigon. J. Parker presented an information session on volcanogenic massive sulphide deposits to local prospectors.

Office staff completed 11 property visits (Figure 3.2) and led 7 geological tours of the Red Lake geology.

B. Atkinson commenced quarter-mile scale re-mapping of Dome Township, and with R. Comber spent 1 week at Zionz and Jackpine lakes examining geology and mineral occurrences. Results of that work are summarized below.

ACKNOWLEDGMENTS

L. Kosloski typed the manuscript, compiled information and drafted several of the map figures. K.G. Fenwick, Manager, Ontario Geological Survey—Information Services Branch, edited the text.

Information on past work included in this report is taken from assessment files of the Red Lake Resident Geologist’s Office unless otherwise indicated.

RECONNAISSANCE OF THE ZIONZ LAKE—JACKPINE LAKE AREA

Introduction

The Zionz Lake—Jackpine Lake area is located 140 km east-northeast of Red Lake and 115 km west of Pickle Lake. The area encompasses the eastern reach of the Birch—Confederation—Uchi lakes greenstone belt and was the subject of geological investigations by the first author during the 1992 field season.

Zionz Lake is one of a chain of lakes forming the Cat River waterway. Jackpine Lake is accessible by canoe from Zionz Lake via the Cat River and Kapikik Lake. Two portages of 800 m and 120 m in length on the Cat River must be crossed between Zionz and Kapikik lakes enroute to Jackpine Lake. Access to the area is by float equipped aircraft. A winter road from Cat Lake passes through the area and connects to the town of Ear Falls via Birch Lake and the South Bay Mine road.

Previous Work

In 1969, Fort Reliance Minerals Ltd. completed geological mapping, trenching and sampling on a block of 26 claims on the east side of Zionz Lake.

The area was covered by reconnaissance geological mapping during Operation Pickle Lake at a scale of 1 inch to 2 miles (Sage et al. 1973).

Quaternary Geology

Ice direction as indicated by glacial striae was from the northeast. A swarm of prominent eskers trend southwesterly through the area, one of these passes through Zionz Lake and is exposed as several small spectacular boulder armoured islands in the main body of the lake. Subsequent lake ice modification of the boulder islands has resulted in the piling up of large glacial boulders around the perimeters of the islands, leaving a concave interior.

Geology

The Zionz Lake—Jackpine Lake area is located in the western Uchi Subprovince, the general geology is depicted in Figure 3.3. The metavolcanic rocks underlying Zionz Lake are assigned to the Confederation assemblage (OGS 1992).

The south and west parts of Zionz Lake is underlain mainly by amphibolitized mafic metavolcanic rocks and related intrusive rocks. Due to an overall high strain state, few primary structures are preserved in the mafic rocks. A thin unit of heterolithic intermediate tuff breccia outcrops in the south part of the lake. East-trending stratigraphy in the southwest part of the lake swings northerly along the east side of Zionz Lake, parallel to enclosing batholithic contacts. No stratigraphic facing directions are recognized in the area.

The north part of the lake is underlain by amphibolite-biotite paragneiss. Felsic to intermediate plutonic rocks underlie the east part of the lake. Pegmatite dikes associated with the felsic intrusive rocks consist of quartz, plagioclase, orthoclase and biotite, often with well-developed graphic intergrowth of quartz and orthoclase.

The Jackpine Lake area is underlain by a thin circular band of amphibolitized mafic metavolcanic flows and greywacke metasediments detached from the main body of the Zionz Lake greenstone by granitic rocks. A domal mass of weakly to moderately foliated biotite tonalite intrudes the Jackpine Lake greenstone and has caused the circular disposition of the greenstone. Biotite granodiorite outcrops along the south shore of Jackpine Lake and as small reefs in the
EXPLANATION

- Property Examinations, 1992
- OGS Field Party Locations, 1992 (keyed to text)
  - OFR 5835, area of coverage
- Geological Data inventory Folios in preparation, area of coverage
- Diamond Drill Core Collection Site

Figure 3.2. Property examinations, Red Lake Resident Geologist's District.
north central part of the lake. The central intrusion has resulted in spectacular folding of the greenstone between Jackpine Lake and the elongate arcuate lake to the east. Granodiorite dikes intruding the greenstone predate the main deformational event.

No primary features were observed in the greenstone; foliations mimic the circular structure of the Jackpine Lake intrusion.

MINERAL OCCURRENCES

Fort Reliance Minerals Ltd.

The Fort Reliance Minerals Ltd. occurrence is located on the southeast side of Zionz Lake. Three bedrock trenches have been blasted on a 10 m wide pyrrhotite-bearing zone of biotite + muscovite + quartz schist. The northern most trench is located 200 m east of Zionz Lake and measures 30 m by 1 m by 0.5 m deep. Trenched bedrock carries up to 1% pyrrhotite mineralization smeared along schist planes. The central trench is 20 m long, 1 m wide and 1 m deep and has a more amphibolitized mafic component compared to the north trench. Silicification and garnetization is noted in this trench. Pyrrhotite and pyrite occur as disseminations and massive pods in schistose metasediments. The third, most southern trench is located on the east slope of a bedrock ridge approximately 365 m southwest of the northern trench. It measures 7 m long by 1 m by 0.5 m deep and exposes schistose metasedimentary rocks with very rare pyrite and pyrrhotite mineralization. Granitic dikes up to 50 m wide invade the metasedimentary rocks in the vicinity of the trenches, but these appear unrelated to mineralization.

Sampling by Fort Reliance Minerals Ltd. on the property returned analysis of 0.005 to 0.009% Ni and 0.01 to 0.04% Cu. Chalcopyrite mineralization was reported by the company.

Thirteen samples from the trenches collected by the first author all assayed less than 34 ppb Au. Analysis of these samples resulted in values between 83 and 205 ppm Cu and 61 to 305 ppm Zn (Temiskaming Testing Laboratories).

Only very rare pyrite mineralization was observed at Jackpine Lake. Samples collected from Jackpine Lake gave the results shown in Table 3.5.
CONIFER LAKE STOCK

The Conifer Lake stock is located 50 km south of Red Lake and 50 km west of Ear Falls. It can be reached by float plane from either Conifer or Sumach lakes. The Conifer logging road crosses Conifer Creek, 3 km south of Sumach Lake; the creek can be navigated by canoe to Sumach Lake, but this requires 2 portages.

Previous Work

Initial investigations of the Conifer Lake stock were made by Ontario Hydro. Davies (1964) did a geological reconnaissance of the stock. Panagapko (1976) completed a geological, chemical and petrological study of the stock. Geological mapping of the area (Breaks et al. 1975) was completed at a scale of 1:63 360.

Figure 3.4. Geology of the Conifer Lake stock, modified from Panagapko (1976).

Table 3.5. Results of analyses of select samples from the Jackpine Lake area.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Au (ounces per ton)</th>
<th>Ag (ounces per ton)</th>
<th>Cu (ppm)</th>
<th>Zn (ppm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>92-BTA-67</td>
<td>Nil</td>
<td>Nil</td>
<td>28</td>
<td>54</td>
<td>granodiorite gneiss</td>
</tr>
<tr>
<td>92-BTA-68</td>
<td>Nil</td>
<td>Nil</td>
<td>97</td>
<td>14</td>
<td>amphibolite</td>
</tr>
<tr>
<td>92-BTA-72</td>
<td>0.004</td>
<td>Nil</td>
<td>34</td>
<td>22</td>
<td>gabbro</td>
</tr>
</tbody>
</table>

CONIFER LAKE

SUMACH LAKE

scale

200 m
Geology

The Conifer Lake stock is a 1200 m diameter circular intrusive body located in the English River Subprovince. It intrudes, and is cored by, peraluminous granite (Breaks 1991). The geology of the stock, modified from Panagapko (1976), is shown in Figure 3.4.

The main mass of the Conifer Lake stock consists of ultramafic rocks including coarse-grained black pyroxenite and finer grained varieties of similar composition. Mineralogically, the pyroxenite includes both rusty weathering orthopyroxene and black clinopyroxene with submetallic lustre, as well as abundant interstitial biotite. Occasional irregular xenoliths up to 30 cm diameter and discontinuous veinlets of medium- to coarse-grained plagioclase + quartz + biotite are noted in the ultramafic rocks.

A 0.5 m wide north trending dike of coarse-grained plagioclase + quartz + biotite + rare fluorite outcrops on the prominent ridge face overlooking Sumach Lake.

The core of the stock consists of pink quartz-rich granite with xenocrystic aggregates of garnet and quartz up to 1 cm in diameter. The core granite is almost completely devoid of mafic minerals.

Structure

The circular structure of the Conifer Lake stock is readily evident in aerial photographs and by its magnetic signature. Foliations in outcrops describe circular patterns around the stock and dip 30° to 55° toward the interior, suggesting a funnel-like morphology (Panagapko 1976).

Mineralization

Minor amounts of pyrrhotite mineralization occur as fine-grained irregular crystals within the ultramafic rocks. Geochemical analysis of 6 characteristic samples of ultramafic rocks from the Conifer Lake stock gave the following results (Panagapko 1976): 360 to 1640 ppm Cr; 75 to 370 ppm Ni; 65 to 410 ppm Cu.

The petrography of the Conifer Lake stock is summarized from Panagapko (1976). The mean mineralogical composition of 12 ultramafic rocks from the Conifer Lake stock consists of 349 k hornblende, 1296 biotite, 896 orthopyroxene, 2296 clinopyroxene, 1396 olivine, 796 plagioclase, 396 opaque minerals and 16 epidote. Individual specimens contain up to 2596 olivine, 4596 clinopyroxene, 2596 orthopyroxene, 6596 hornblende and 2096 biotite. The plagioclase is andesine, ranging in composition from An3 to An50. Opaque minerals include both magnetite and pyrrhotite as small anhedral grains. The pyroxenes are hypersthene and augite and these show some alteration to hornblende.

Granitic rocks consist of albitic plagioclase, potassium feldspar, quartz and biotite with accessory cordierite, sillimanite and zircon.

Whole rock analyses of select specimens, keyed to Figure 3.4, gave the results shown in Table 3.6.

Table 3.6. Chemical analyses of selected rocks from the Conifer Lake stock (data from Panagapko 1976).

<table>
<thead>
<tr>
<th>Sample (keyed to Figure 3.4)</th>
<th>A</th>
<th>B</th>
<th>Ultramafic Rocks</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiO₂ (%)</td>
<td>47.7</td>
<td>46.4</td>
<td>49.4</td>
<td>45.9</td>
<td>49.6</td>
<td></td>
<td>45.0</td>
<td>71.7</td>
<td>71.0</td>
<td>71.0</td>
</tr>
<tr>
<td>Al₂O₃</td>
<td>7.19</td>
<td>6.98</td>
<td>5.87</td>
<td>5.61</td>
<td>7.57</td>
<td></td>
<td>14.1</td>
<td>15.8</td>
<td>16.6</td>
<td>16.3</td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>3.21</td>
<td>3.62</td>
<td>2.90</td>
<td>2.60</td>
<td>3.07</td>
<td></td>
<td>3.86</td>
<td>0.15</td>
<td>0.39</td>
<td>0.41</td>
</tr>
<tr>
<td>FeO</td>
<td>8.45</td>
<td>6.91</td>
<td>9.17</td>
<td>9.02</td>
<td>5.54</td>
<td></td>
<td>8.95</td>
<td>0.29</td>
<td>0.44</td>
<td>0.29</td>
</tr>
<tr>
<td>MgO</td>
<td>16.3</td>
<td>18.3</td>
<td>18.3</td>
<td>20.0</td>
<td>13.4</td>
<td></td>
<td>9.94</td>
<td>0.05</td>
<td>0.05</td>
<td>0.01</td>
</tr>
<tr>
<td>CaO</td>
<td>11.2</td>
<td>10.2</td>
<td>7.81</td>
<td>10.5</td>
<td>14.8</td>
<td></td>
<td>11.3</td>
<td>0.74</td>
<td>0.71</td>
<td>0.61</td>
</tr>
<tr>
<td>Na₂O</td>
<td>2.27</td>
<td>2.27</td>
<td>1.88</td>
<td>2.15</td>
<td>2.94</td>
<td></td>
<td>2.66</td>
<td>5.29</td>
<td>6.04</td>
<td>6.21</td>
</tr>
<tr>
<td>K₂O</td>
<td>0.55</td>
<td>1.66</td>
<td>0.98</td>
<td>1.17</td>
<td>0.74</td>
<td></td>
<td>0.84</td>
<td>5.54</td>
<td>2.93</td>
<td>3.24</td>
</tr>
<tr>
<td>TiO₂</td>
<td>0.65</td>
<td>0.52</td>
<td>0.43</td>
<td>0.51</td>
<td>0.56</td>
<td></td>
<td>1.59</td>
<td>0.02</td>
<td>0.04</td>
<td>0.03</td>
</tr>
<tr>
<td>P₂O₅</td>
<td>0.07</td>
<td>0.10</td>
<td>0.06</td>
<td>0.07</td>
<td>0.14</td>
<td></td>
<td>0.35</td>
<td>0.11</td>
<td>0.19</td>
<td>0.21</td>
</tr>
<tr>
<td>MnO</td>
<td>0.19</td>
<td>0.18</td>
<td>0.22</td>
<td>0.20</td>
<td>0.16</td>
<td></td>
<td>0.17</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>CO₂</td>
<td>0.10</td>
<td>0.08</td>
<td>0.10</td>
<td>0.15</td>
<td>0.25</td>
<td></td>
<td>0.09</td>
<td>0.09</td>
<td>0.10</td>
<td>0.08</td>
</tr>
<tr>
<td>H₂O⁺</td>
<td>0.07</td>
<td>0.48</td>
<td>0.56</td>
<td>0.43</td>
<td>0.14</td>
<td></td>
<td>0.51</td>
<td>0.03</td>
<td>0.32</td>
<td>0.09</td>
</tr>
<tr>
<td>H₂O⁻</td>
<td>0.58</td>
<td>0.62</td>
<td>0.54</td>
<td>0.52</td>
<td>0.45</td>
<td></td>
<td>0.40</td>
<td>0.22</td>
<td>0.34</td>
<td>0.32</td>
</tr>
<tr>
<td>S</td>
<td>0.03</td>
<td>0.02</td>
<td>0.02</td>
<td>0.06</td>
<td>0.13</td>
<td></td>
<td>0.02</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>TOTAL</td>
<td>98.6</td>
<td>98.3</td>
<td>98.2</td>
<td>98.9</td>
<td>99.4</td>
<td></td>
<td>99.8</td>
<td>100.0</td>
<td>99.2</td>
<td>98.8</td>
</tr>
</tbody>
</table>
PROPERTY EXAMINATIONS
Gold Occurrences and Prospects

The regional geology of the Red Lake greenstone belt is depicted in Figure 3.5. Two gold occurrences, the Intelisano property and the Wolf Bay property, are both found in the lower mafic sequence (Pirie 1981) of the Red Lake greenstone belt and are described below.

Intelisano Property, Bateman Township

Originally part of the Beatrice Red Lake Gold Mines Ltd. claim group, the Intelisano property is located on the east shore of East Bay of Red Lake. Access to the property is by the Nungesser Road from Highway 125. A trail leads to the property 1 km east of the Nungesser Road. The property includes patented claims KRL 252 to 255 inclusively.

No previous work is reported on the property, but some pits and trenches have been excavated. Recent work by J. Intelisano includes power stripping and sampling.

GEOLOGY

The property is underlain by pillowed to massive mafic metavolcanic rocks of the lower mafic sequence as defined by Pirie (1981). The mafic rocks are intruded by quartz phryic felsic dikes that trend northeasterly parallel with the regional stratigraphy. The dikes attain widths up to several metres and exhibit sericitic alteration and moderate- to well-developed foliation. The mafic rocks show varying degrees of carbonate alteration. An iron carbonate vein hosted by mafic rocks outcrops on the shoreline of East Bay on claim KRL 252. Occasional small white to grey quartz veins invade the mafic rocks, but these are of very limited extent.

MINERALIZATION

Values up to 8.30 ounces Ag per ton and 0.09 ounces Au per ton are reported (J. Intelisano, personal communication, 1991). The gold assay was obtained from a sample located 150 m south of the north boundary line of claim KRL 252, the silver values were obtained 90 m south of No. 4 post of claim KRL 254.

Three samples collected by the author from a recently stripped area on claim KRL 254 gave the results shown in Table 3.7.

Figure 3.5. General geology of the Red Lake greenstone belt with property locations described in text: (A) Intelisano property, Bateman Township and (B) Wolf Bay property, Todd Township.
**Table 3.7.** Results of analyses of selected samples from the Intelisano property, Bateman Township.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Description</th>
<th>Au (ppb)</th>
<th>Ag (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>92-BTA-17</td>
<td>mafic metavolcanic rock</td>
<td>6</td>
<td>&lt;2</td>
</tr>
<tr>
<td>92-BTA-18</td>
<td>sericitized felsic dike</td>
<td>7</td>
<td>&lt;2</td>
</tr>
<tr>
<td>92-BTA-19</td>
<td>quartz vein material</td>
<td>9</td>
<td>&lt;2</td>
</tr>
</tbody>
</table>

**Table 3.8.** Results of analyses from selected samples from the Wolf Bay property, Todd Township.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Description</th>
<th>Au (ounces per ton)</th>
<th>Ag (ounces per ton)</th>
<th>As (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>92-BTA-89</td>
<td>pyrrhotite-bearing mafic flow</td>
<td>0.172</td>
<td>1.27</td>
<td></td>
</tr>
<tr>
<td>92-BTA-90</td>
<td>silicified, biotitic mafic flow</td>
<td>0.028</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>92-BTA-91</td>
<td>arsenopyrite-bearing mafic flow</td>
<td>0.023</td>
<td>0.12</td>
<td>641</td>
</tr>
<tr>
<td>92-BTA-92</td>
<td>arsenopyrite-bearing mafic flow</td>
<td>0.009</td>
<td>trace</td>
<td>11760</td>
</tr>
</tbody>
</table>

**Table 3.9.** Sample 91-BTA-11.

<table>
<thead>
<tr>
<th>SiO₂(wt%)</th>
<th>Al₂O₃</th>
<th>Fe₂O₃</th>
<th>FeO</th>
<th>MgO</th>
<th>CaO</th>
<th>Na₂O</th>
<th>K₂O</th>
<th>TiO₂</th>
<th>P₂O₅</th>
<th>MnO</th>
<th>LOI</th>
<th>Au(ppb)</th>
<th>Ag(ppm)</th>
<th>As (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>77.16</td>
<td>12.60</td>
<td>1.23</td>
<td>0.74</td>
<td>0.15</td>
<td>0.33</td>
<td>3.52</td>
<td>3.78</td>
<td>0.55</td>
<td>0.01</td>
<td>0.02</td>
<td>0.90</td>
<td>&lt;2</td>
<td>&lt;2</td>
<td>&lt;10</td>
</tr>
</tbody>
</table>

**PREVIOUS WORK**

1945  Perma Gold Mines Limited completed stripping, trenching, prospecting and sampling on the property.

1953  The 12 original claims covering the property were surveyed and found to be oversized. Additional assessment work requirements were not filed and the claims lapsed. The ground was subsequently restaked by various individuals before R. Soltermann acquired the property.

1977–1983  R. Soltermann completed 12 diamond drill holes totalling more than 685 m.

1984–1988  R. Soltermann did sampling assays, power stripping and VLF-EM surveys.

1989–1990  BHP-Utah Mines Ltd. did magnetic surveys and drilled 5 holes totalling 900 m.


**GEOLOGY**

The Wolf Bay property is located in the Red Lake greenstone belt of the western Uchi Subprovince. The property lies within the lower mafic sequence of mainly metavolcanic rocks as defined by Pirie (1981) (see Figure 3.5), and is assigned to the Balmer assemblage (Stott and Corfu 1991).

From north to south across Wolf Peninsula, property geology includes a 40 m wide chert-ironstone conglomeratic unit in contact with a 200 m thick sequence of quartz crystal tuff. The crystal tuff unit is in contact with pillowed to massive mafic flows that are biotitized and garnetized with sulphide mineralization. Sulphide minerals include pyrite, pyrrhotite, arsenopyrite, chalcopyrite, sphalerite and galena.

All rock types are moderately to strongly foliated in an OS00 direction, and dip steeply to vertically. The Killala Baird batholith of granodiorite composition outcrops on the south shore of Wolf Peninsula.

Sulphide mineralization occurs with the mafic flows and is accompanied by biotite alteration, garnetization and silicification. The mineralized zones have had extensive trenching and bear some resemblance to Madsen ore mineralization in Baird Township. The highest reported gold values are associated with arsenopyrite mineralization.

The chert-ironstone conglomerate unit carries considerable pyrrhotite mineralization and is extensively rust stained along its entire strike length.

Several rock samples were collected from the trenched zones on claim KRL 903834. Analyses are shown in Table 3.8.
From the limited sampling, gold appears to have a greater affinity for pyrrhotite rather than arsenopyrite on the Wolf Bay property.

Whole rock analysis of a sample of quartz crystal tuff, collected 100 m east of claim KRL 368771 gave the results shown in Table 3.9.

BASE METAL PROSPECTS

Dixie 3, 17, 18, 19 Prospects

The Dixie 3, 17, 18 and 19 prospects are 4 claim groups originally acquired by Selco Mining Corp. to cover electromagnetically responsive volcanic stratigraphy on strike with the South Bay Mine massive sulphide deposit. Claim boundaries of the Dixie prospects are shown in Figure 3.6.

All 4 Dixie prospects are located in an area of subdued topographic relief with an extensive coverage of glacial overburden. Hence, outcrop is scarce and much of the geology of the prospects is derived from diamond drill core and geophysics.

The Dixie 3 prospect was not visited by the authors, but is included in the following description for sake of comparison.

LOCATION AND ACCESS

The Dixie 3 prospect is located 22 km north of Ear Falls situated west of Whitefish Falls between the South Bay Mine road and the Snake Falls road. The centre of the original claim group is approximately 8 km northeast of Bruce Lake. Access to the prospect is by boat from Bruce Lake at Highway 105 and up Ten Mile Creek. Alternatively, a winter drill trail branching off the Snake Falls road at about kilometre 14 leads to the prospect.

The Dixie 17, 18 and 19 prospects are located approximately 27 km north of Ear Falls and 44 km southeast of Red Lake. These 3 prospects form a large block of contiguous claims as shown in Figure 3.6. Access to the southern part of the claim group is afforded by travelling east along the Snake Falls road which intersects Hwy 105 south of Red Lake. A series of logging roads branch off the Snake Falls road and lead into the individual properties.

PREVIOUS WORK

The regional geology containing the Dixie prospects has been mapped by Breaks et al. (1976) and Thurston and Paktunc (1985).

The Dixie 3 property was the subject of a BSc research topic by R. Saxby (1977). On the Dixie 3 occurrence, Selco Mining Corp. began an intensive exploration program in 1976, following a regional airborne geophysical survey in the area. Ground geophysical surveys and follow up diamond drilling by Selco and its successor BP Resources Canada Ltd. outlined a small deposit of copper and zinc mineralization. Follow-up drilling by BP Resources failed to locate more mineralization.

Noranda Exploration Co. Ltd. subsequently optioned the property and did additional geophysical surveys and diamond drilling in 1991 and 1992.

The Dixie 17, 18 and 19 prospects were explored by Selco at the same time it carried out work on the Dixie 3 prospect. This work included extensive geophysical surveys and diamond drilling of 7 holes in 1977 and 2 more holes in 1979 on the Dixie 17 property. The drill campaign intersected Cu and Zn massive sulphide mineralization.

On the Dixie 18 property, Selco drilled 20 holes in 1977 and delineated massive sulphide mineralization. The area of exploration interest was referred to as the Main Sulphide Zone. More geophysical surveys including downhole pulse EM were followed by diamond drilling in 1979 with the discovery of additional massive sulphide mineralization. By 1981, the claims lapsed, but the ground was restaked by Selco and limited additional drilling was completed. In all, a total of 30 holes were drilled on the Dixie 18 property by the company.

On the Dixie 19 property, Selco drilled 13 holes with a combined length of 2485 m in an effort to locate the strike extension of mineralization delineated on the Dixie 17 and 18 prospects.

Noranda Exploration participated in a joint venture partnership to further explore all 4 Dixie properties. Between 1989 to 1992, Noranda drilled 7 holes to explore for additional base metal mineralization.

GEOLOGY

The regional geology of the Dixie prospects is depicted in Figure 3.7. The stratigraphy hosting the Dixie prospects is the westward continuation of that hosting the South Bay Mine massive sulphide deposit located 45 km to the northeast. The regional geology is east-trending and is intruded and bifurcated by several large felsic intrusions, the most voluminous is the Bruce Lake pluton which outcrops to the south of the Dixie prospects. An elongate mass of felsic intrusive rocks outcrops at Big Falls and extends northeast to Fredart Lake. This intrusion splits the belt of metavolcanic rocks hosting the Dixie prospects into a northern and southern section. The Dixie 3 prospect lies in the southern section, while the Dixie 17, 18 and 19 prospects lie in the northern section. The northern section is inferred to be of Cycle III age (Thurston and Paktunc 1985) and is assigned to the Confederation assemblage (Stott and Corfu 1991). It consists of pillowed and massive mafic flows with interbedded felsic flows, tuffs and both clastic and chemical metasediments. Spherulitic flows are noted on the Dixie 18 property.

The age of the southern section of the belt hosting the Dixie 3 prospect is unknown. Felsic metavolcanic rocks are the dominant lithology. Bedded to massive felsic tuff, lapillistone and tuff breccia debris flow rocks are overlain by fine-grained felsic tuff and pillowed mafic flows. Graded bedding in the felsic tuff is north facing while pillows in the mafic flows are south facing (Thurston and Paktunc 1985). A large oblate body of gabbro crops out west of the Dixie 3 prospect.
Figure 3.6. Claim location map of the Dixie 3, 17, 18 and 19 base metal prospects.

Figure 3.7. General geology of the Dixie 3, 17, 18 and 19 base metal prospects.
On the Dixie 17 prospect, diamond drilling intersected altered felsic tuffs intruded by dikes of pegmatitic granite and gabbro. Alteration includes chlorite, biotite and anthophyllite.

On the Dixie 18 prospect, the Main Sulphide Zone is hosted by mafic flows with minor felsic to intermediate tuffs. An 8 m thick unit of marble and intersections of graphic argillite, quartz feldspar porphyry and feldspar porphyry dikes, rhyodacite, spherulitic dacite and intermediate tuffs and pyroclastic breccias are reported in diamond drill logs. Alteration includes chlorite + biotite + anthophyllite + cordierite + garnet. Quartz, carbonate and epidote veining is occasionally present. A thin unit of chert magnetite iron formation occurs to the north of the Main Sulphide Zone. Drill hole geology is shown in Figure 3.8.

The Dixie 19 prospect is underlain by a narrow belt of felsic to intermediate pyroclastic rocks bound to the north and south by metagabbro and intruded by granitic dikes. Diamond drilling intersected felsic to intermediate tuffs and flows, quartz feldspar porphyries and interbedded clastic metasediments. Biotite and actinolite with some zones of coarse-grained anthophyllite + chlorite + talc + sericite characterize the alteration of the Dixie 19 prospect.

The following description of the Dixie 3 prospect is summarized from Saxby (1977). From south to north the Dixie 3 prospect geology, as derived by Selco Mining Corp. diamond drilling includes 45 m of quartz feldspar porphyry, 24 m of felsic flows and tuffs, with minor interbedded greywacke metasediments, 45 m of alternating thinly bedded mafic and felsic green and grey metasediments, 7 m of mafic flows, 30 m of felsic metavolcanic rocks and metasediments hosting the mineralized zone and coarse felsic pyroclastic rocks and 15 m of intermediate tuff. Alteration of the rocks is best developed adjacent to the mineralized zone and includes silicification, chloritization and biotitization. Staurolite and andalusite porphyroblasts occur in metasediments below the mineralized zone with tremolite, chlorite and cummingtonite occurring within the mineralized zone.

MINERALIZATION

The Dixie 3 prospect mineralization is hosted by felsic metavolcanic and metasedimentary rocks. Sulphides include pyrrhotite, sphalerite, pyrite, chalcopyrite and minor galena. Magnetite constitutes up to 10% of the opaque minerals. Sphalerite and pyrrhotite occur in massive form whereas pyrite occurs as porphyroblasts within the massive mineral-
The GDIFs were completed in the Birch–Confederation–Uchi lakes greenstone belt, which is an historic gold camp that has seen renewed exploration activity in the last decade. The GDIFs cover the NTS areas of 52N/02, 52N/07, 52N/08 and 52N/09. These NTS areas include Brownstone Lake, Casummit Lake, Keigat Lake, Little Bear Lake and Knott Township, Little Shabumeni Lake, Narrow Lake, Okanase Lake, Satterly Lake, Seagrave Lake, Shabu Lake, Shabumeni Lake, and Uchi Lake and Earngey Township, which have been the scene of intensive gold exploration. The GDIF coverage corresponds with a larger area that was encompassed by airborne geophysical surveys contracted by the Ontario Geological Survey in 1991 (OGS 1991b).

**DIAMOND DRILL CORE STORAGE PROGRAM**

Diamond drill core from various exploration programs completed in the Red Lake District is archived in the Kenora Drill Core Library. The core library serves as a repository for drill core submitted from Red Lake, Kenora and Sioux Lookout districts. Drill core stored at the library consists of core obtained from both exploration and mine development drilling, core recovered from old diamond drill sites, core specimens submitted for credit under the former Mining Act (Revised Statutes of Ontario 1980, and earlier statues), drill core submitted for assessment credit under the current Mining Act (RSO 1990), and core donations from other sources.

The Kenora drill core library holds 17 355.7 m of core from 210 drill holes in the Red Lake District. Core added to the collection from Red Lake during the present year consists of 12 drill holes with a combined length of 1196.7 m. Additional core remains in temporary storage in Red Lake and is not yet catalogued.

A new initiative in the core library program is the development of an off-site core storage. Funded by jobsOntario Capital, an outdoor fenced core storage compound, under construction 6 km south of Red Lake, will provide secure storage for diamond drill core from the district. The most geologically significant and important core will continue to be archived inside the Kenora drill core library.

In 1992, core in the Red Lake District was obtained from base metal stratigraphic drilling in the area southwest of the South Bay Mine and from gold exploration at Mink Lake. A drill program completed by Gold Fields Canadian Mining Ltd. in 1987 to 1988 at Mink Lake encountered felsic metavolcanic rocks with considerable shearing and alteration. Gold values are low in most of the core excepting one 1.5 m intersection that assayed 1.03 ounces Au per ton. Core from 3 holes characterizing the geology and mineralization of the Mink Lake drill program was collected. Other accessions to the library include core from 3 holes drilled in 1969 by Copper Lode Mines Ltd. in Belanger Township, 1 hole from Noranda's 1992 South of Otter Lake drilling and 5 holes drilled by Selco Mining Corp. Ltd. in 1976, also in the South of Otter Lake area.

A list of catalogued Red Lake diamond drill core archived in the Kenora drill core library is presented in Table 3.11.
Table 3.11  Summary of core from the Red Lake Resident Geologist’s District in the Kenora drill core library.

<table>
<thead>
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<th>Area</th>
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<th>Company</th>
<th>Holes</th>
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<td>52N/04SE</td>
<td>Eldor Resources Ltd.</td>
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<td></td>
<td>52N/04SW</td>
<td>Golden Exploration and Development Co.</td>
<td>5</td>
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<tr>
<td></td>
<td>52N/04SE</td>
<td>Granges Exploration Ltd.</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>52N/04SW</td>
<td>Gunnar Gold Inc.</td>
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</tr>
<tr>
<td>Bateman Township</td>
<td>52N/04NE</td>
<td>Penway Explorers Ltd.</td>
<td>9</td>
</tr>
<tr>
<td>Belanger Township</td>
<td>52N/15NW</td>
<td>Copper Lode Mines Ltd.</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>52N/15NW</td>
<td>Copper Lode Mines Ltd.</td>
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</tr>
<tr>
<td>Bruce Lake</td>
<td>52K/14SW</td>
<td>Griffith Mine</td>
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<tr>
<td>Bucket Lake</td>
<td>53C/10SW</td>
<td>Rockspan Resources Ltd.</td>
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</tr>
<tr>
<td>Casummit Lake</td>
<td>52N/08NW</td>
<td>Gold Fields Canadian Mining Ltd.</td>
<td>*3</td>
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<td>Dent Township</td>
<td>52N/02SE</td>
<td>Selco Mining Corp. Ltd.</td>
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<tr>
<td></td>
<td></td>
<td>Sherritt Gordon Mines Ltd.</td>
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<td></td>
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<td>Silverside Resources</td>
<td>3</td>
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<tr>
<td>Dome Township</td>
<td>52N/04SW</td>
<td>Interquest Resources Ltd.</td>
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<td></td>
<td>Sherritt Gordon Mines Ltd.</td>
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<td>Fairlie Township</td>
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<td>Minex Ltd.</td>
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<td></td>
<td></td>
<td>Minex Ltd. (Altura Mines)</td>
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<td></td>
<td>Selco Mining Corp. Ltd.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sherritt Gordon Mines Ltd.</td>
<td>1</td>
</tr>
<tr>
<td>Gerry Lake</td>
<td>52K/14NE</td>
<td>Noranda Exploration Co. Ltd.</td>
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<tr>
<td>Grist Lake</td>
<td>53C/04NW</td>
<td>Cominco Ltd.</td>
<td>3</td>
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<tr>
<td>Heyson Township</td>
<td>52N/04SW</td>
<td>Laverty Red Lake Mines Ltd.</td>
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<td>Selco Mining Corp. Ltd.</td>
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<td></td>
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<td>Teck Corporation</td>
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<td>Black Cliff Mines Ltd.</td>
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<td>53G/05SW</td>
<td>Eldor Resources Ltd.</td>
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<td>Seagrave Lake</td>
<td>52N/08SE</td>
<td>BP Resources Canada Ltd.</td>
<td>4</td>
</tr>
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<td>52N/07SW</td>
<td>Flint Rock Mines Ltd.</td>
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<td>Shabumeni Lake</td>
<td>52N/07SE</td>
<td>Falconbridge Ltd.</td>
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<td></td>
<td>Marilyn Resources Ltd.</td>
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<tr>
<td>Slate Lake</td>
<td>52K/15E</td>
<td>Noranda Exploration Co. Ltd.</td>
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<td>South of Otter Lake</td>
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<td>Dixie Joint Venture (Selco)</td>
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<td></td>
<td>Lightval Mines Ltd.</td>
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<td>Selco Mining Corp. Ltd.</td>
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<td></td>
<td></td>
<td>Selco Mining Corp. Ltd.</td>
<td>*5</td>
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<td>Todd Township</td>
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<td>Soltermann, R.</td>
<td>3</td>
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</table>

* indicates core added in 1992

Note: Assessment credit drill core samples submitted under the Mining Act (Revised Statutes of Ontario 1980 and previous statues) is not included in this table.
RECOMMENDATIONS FOR EXPLORATION

ZIONZ LAKE

Electromagnetic conductors identified on the Ontario Geological Survey airborne geophysical survey in the southwest bay of Zionz Lake occur adjacent to intermediate fragmental rocks outcropping on shoreline exposures. These conductors merit investigation as possible sulphide bodies with economic potential, however, because the conductors underlie the lake, diamond drilling is the only way to evaluate them. A drill program in the area could utilize the Cat Lake winter road for access to Zionz Lake.

Base Metals

The felsic volcanic stratigraphy between South Bay Mine and Heyson Township merits attention for base metal mineralization. Although this area has previously been recommended, it bears re-mention as a possible source for volcanogenic massive sulphide mineralization. Muir (1991) notes the occurrence of garnet and possibly cordierite and sillimanite in outcrops along Highway 105 in the vicinity of the Bug River, 13 km south of Red Lake; this mineral assemblage may have base metal implications.

Red Lake–Birch–Confederation–Uchi Greenstone Belts

Regional geochemical till sampling (Sharpe 1992) has pinpointed a number of localities with gold grains in till. These merit follow-up as potential new gold sources.

The 1991 Ontario Geological Survey airborne geophysical survey (OGS 1991a) reveals the presence of a major fold structure north of Blondin Lake in the Birch–Uchi lakes greenstone belt. At Blondin Lake, the greenstone belt is thin and constricted by granitoid rocks, but may present a structural trap for gold mineralization. Beakhouse (1991) notes gold mineralization in the area is related to structures developed during late infolding of the greenstone belt.

Northern Greenstone Belts

In the Berens River Subprovince, Stone (1991) notes possibilities for copper-nickel mineralization at Hornby Lake greenstone belt and Cherrington Lake greenstone belt. Uranium and rare metals occur along the Bear Head fault zone in the vicinity of the Favourable Lake greenstone belt.

Building Stone

A Section 25 work program conducted by the Ear Falls Economic Development Office has identified a number of potential sites for building stone. A considerable variety of colours and textures of granitoid rocks are reported and merit follow-up as possible quarry sites (Raoul 1992).

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

D. Stone, Precambrian Geoscience Section, Ontario Geological Survey–Geoscience Branch, completed the fourth year of an on-going 1:50 000 scale mapping program of the Berens River Subprovince. Mapping during the 1992 field season was completed on Little Trout, Henfrey, Pringle, Nechigona, Sampson, Margot, Shabumeni, Mamakwash, Madden, Ollen and Hewitt lakes map sheets.

T.L. Muir, of the same section, completed 1:15 480 and 1:50 000 scale geological mapping of the Dixie Lake area, Uchi Subprovince.

RESEARCH BY OTHER AGENCIES

D.R. Sharpe, Geological Survey of Canada, continued a second year of regional till geochemical sampling of the Red Lake–Woman Lake area. Over 400 glacial till samples have been collected for multi-element analysis. Initial results of that work are presented as an open file report (Sharpe 1992). M. Lange, University of Münster, Germany, commenced geological investigations of the Frame Lake pluton, Berens River Subprovince, located 150 km north of Red Lake.

C. Tarnocai began a mineralogical study of alteration in the Campbell Mine as an MSc research topic at the University of Ottawa.

D.C. Kamineni, Atomic Energy of Canada Ltd., Pinawa, Man., examined granitoid rocks around the Red Lake greenstone belt.

A. Raoul, Ear Falls Economic Development Office, Ear Falls, Ont., examined intrusive rocks in the Ear Falls area to assess their building stone potential.


Ontario Geological Survey

Open File Reports


Geological Survey of Canada

Open File 2583 Sharpe, D.R. Drift Composition of Till and Sand Samples from the Red Lake/Woman Lake Area, District of Red Lake, Northern Ontario; 120p.
REFERENCES


D.A. Janes¹, G.W. Seim² and C.C. Storey³

¹Resident Geologist, Sioux Lookout, Field Services Section, Ontario Geological Survey—Information Services Branch
²Staff Geologist, Sioux Lookout, Field Services Section, Ontario Geological Survey—Information Services Branch
³Drill Core Library Geologist, Kenora, Field Services Section, Ontario Geological Survey—Information Services Branch

INTRODUCTION

In 1992, the number of exploration projects in the Sioux Lookout Resident Geologist’s District was down 10% from 1991 and down 49% from 1987. Prospectors and mineral-exploration companies conducted 28 exploration programs in the district during the year. The programs conducted by the companies were, for the most part, focussed on locating base-metal deposits while the prospectors continued to focus on locating gold deposits. Programs in the Sioux Lookout District’s portion of the Wabigoon greenstone belt accounted for 68% of the total programs in the district. Exploration programs in the Central Uchi greenstone belt accounted for 25% of the total. The 2 exploration projects in the northern greenstone belts accounted for the remaining 7%. Figures 4.1a and 4.1b show the site locations for the 28 exploration programs worked in 1992. Table 4.1, which is keyed to Figures 4.1a and 4.1b, provides more detailed information on the exploration programs.

There were no advanced exploration programs active in the district in 1992. The Goldlund Mine property was released by Noranda Exploration Company Ltd. and subsequently acquired by Locke Rich Minerals Ltd. of Houston, Texas. Locke Rich is studying the feasibility of re-opening the mine. KWG Resources Inc. started negotiations to acquire the Thierry Mine property from Etruscan Enterprises Ltd., but upon completing due diligence did not complete the acquisition. Odyssey Capital Corp., a private company, acquired an interest in the Pickle Crow Mine and Central Patricia Mine properties (excluding environmentally sensitive claims) from Noramco Mining Corporation.

MINING ACTIVITY

Two gold mines were in production within the Sioux Lookout resident geologist’s district in 1992. Figure 4.2 gives the locations of the active mines.

The Golden Patricia Mine (Lac Minerals Ltd.) is located approximately 70 km west-southwest of Pickle Lake and recovers gold from a quartz-vein system. The mine is accessed by 2 declines approximately 1 km apart. During 1992, a one-compartment shaft with manway to 330 m was commissioned. Access to the mine site is by a winter road and by air to a private strip at the site. The mine employed 183 workers at the end of 1992.

The mill uses conventional grinding, gravity separation and cyanidation followed by zinc precipitation to recover gold. During 1992 the mill operated at 370 tonnes per day with an average head grade of 19.4 g/t Au. During the year, 135 000 tonnes were milled to produce 81 000 troy ounces of gold (J. Brisco, Lac Minerals Ltd., personal communication, 1993).

The Dona Lake Mine (Placer Dome Inc.) is located approximately 12 km southeast of the town of Pickle Lake and recovers gold from a highly deformed sulphide-replaced iron formation. The mine is a 550 tonnes per day underground operation accessed by a 362 m shaft with a planned ultimate depth of 485 m. The mill uses semi-autogenous grinding followed by flotation and cyanidation. Gold is recovered in a carbon-in-pulp circuit followed by electrowinning. The mine recovered 46 004 ounces of gold from 204 524 tonnes milled (D. Drake, Placer Dome Inc., personal communication, 1993).

Noranda Inc. and Minnova Inc. continued the rehabilitation of the mine sites in the south Sturgeon Lake base-metal camp. The Mattabi Mill is still on care and maintenance and could be started up on short notice.

At the Sioux Lookout Resident Geologist’s Office, activities during the year were concentrated on mineral deposit studies in the Central Uchi greenstone belt and in the Sturgeon Lake gold-mining area. Time was also spent building a computer-based database for mineral exploration and office files were studied for the Abandoned Mine Hazard Information System database.

The Ontario Geological Survey—Geoscience Branch, had no field parties in the district during 1992.

EXPLORATION ACTIVITY

The level of exploration activity in the Sioux Lookout Resident Geologist’s District in 1992 was less than it was in 1991. The decrease in the level of activity, however, was smaller than it was between 1990 and 1991. There were 28 exploration programs carried out by prospectors and mineral-exploration companies in the Sioux Lookout Resident Geologist’s District in 1992. The programs conducted by the companies were, for the most part, focussed on locating base-metal deposits while the prospectors continued to focus on locating gold deposits. The Sioux Lookout District’s portion of the Wabigoon Subprovince experienced the majority of the
Figure 4.1a. Sioux Lookout Resident Geologist's District, exploration activity, 1992.

Figure 4.1b. Sioux Lookout Resident Geologist's District, exploration activity, 1992.
<table>
<thead>
<tr>
<th>No. on Figs. 4.1a, 4.1b</th>
<th>Company or Individual</th>
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<tr>
<td>1</td>
<td>Asarco Expl. Co. of Canada Ltd.</td>
<td>10 ddh—2021.9 m, surface and borehole PEM surveys in Evans Lake and Conant Tp. areas.</td>
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<td>E. Bazinet</td>
<td>2 ddh in the Duffell Lake area.</td>
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<td>A. Benderite</td>
<td>Stripping and sampling in the Dunne Lake area.</td>
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<td>A. Best</td>
<td>Stripping and sampling in the Fourbay Lake area.</td>
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<td>BHP Minerals Canada Ltd.</td>
<td>17 ddh—1828.8 m, prospecting, geological mapping, soil sampling and IP Survey in the McVicar Lake area.</td>
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<td>BHP Minerals Canada Ltd.</td>
<td>Line cutting, geological mapping, prospecting and lithogeochemical sampling in the Six Mile Lake and Quest Lake areas.</td>
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<td>7</td>
<td>Champion Bear Resources Ltd.</td>
<td>Line cutting, magnetometer and VLF—EM surveys, geological mapping, stripping and sampling and diamond drilling in the Keikewabik Lake area.</td>
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<td>8</td>
<td>G. Gorzynski and E. Ewen</td>
<td>Prospecting in Conant Tp. and Armit Lake areas.</td>
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<td>Granges Inc.</td>
<td>Geological mapping and a limited IP survey in the Evans Lake area.</td>
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<td>W. Hollingsworth</td>
<td>4 ddh in Beckington Lake area.</td>
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<td>Homestake Canada Ltd.</td>
<td>1 ddh—174 m in the Tarp Lake area.</td>
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<td>JRJ Exploration Ltd.</td>
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<td>C. Kuryliw</td>
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<td>14</td>
<td>Lac Minerals Ltd.</td>
<td>Trenching and sampling in the Kawashe Lake area.</td>
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<td>Major General Resources Ltd.</td>
<td>ddh—1600 m in the Drum Lake area.</td>
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<td>M.V. Maki</td>
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<td>Protom EM—57 moving loop, HLEM and magnetometer surveys, geological mapping, prospecting and soil sampling in the Six Mile Lake and Penass Lake areas.</td>
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</tr>
<tr>
<td>26</td>
<td>A.M. Sanderson</td>
<td>Prospecting and soil sampling in the Wapamisk Creek area.</td>
</tr>
<tr>
<td>27</td>
<td>Teck Exploration Ltd.</td>
<td>9 ddh—1029 m, trenching, IP, magnetometer and VLF—EM surveys in Drayton Tp.</td>
</tr>
<tr>
<td>28</td>
<td>T. Twomey and B. Smith</td>
<td>Line cutting and geophysical surveys in Beckington Lake area.</td>
</tr>
</tbody>
</table>
EXPLANATION

- Producing Mines, 1992
  1. Lac Minerals Ltd., Golden Patricia Mine ..........Au, Ag
  2. Placer Dome Inc., Dona Lake Mine .................Au, Ag

- Mills
  1. Camreco Inc.
  2. Mattabi Mines Ltd.

- Producing Quarries
  1. C.N.R. Watcomb Quarry

+ Property Visits (keyed to Table 4.3)

▲ Diamond Drill Core Collection Sites (keyed to Text)

■ District Boundary

Figure 4.2. Sioux Lookout Resident Geologist's District, producing mines, 1992.
Table 4.2. Summary of claims recorded and assessment work credit.

<table>
<thead>
<tr>
<th>Year</th>
<th>Claim Units Recorded</th>
<th>Claim Units Cancelled</th>
<th>Claim Units Active</th>
<th>Physical Work $</th>
<th>Geotechnical Surveys $</th>
<th>Total $</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991*</td>
<td>1967</td>
<td>3482</td>
<td>11 502</td>
<td>306 896</td>
<td>60 129</td>
<td>449 360</td>
</tr>
<tr>
<td>1992</td>
<td>1655</td>
<td>1417</td>
<td>11 743</td>
<td>1 557 864</td>
<td>355 342</td>
<td>1 963 404</td>
</tr>
</tbody>
</table>

*Revised totals from June 1, 1991 to year end 1991.

exploration activity in the district. A summary of claims recorded and assessment work credit is presented in Table 4.2.

Northern Greenstone Belt

At Opapimiskan Lake, the partners in the Musselwhite property (Placer Dome Inc., TVX Gold Inc. and International Corona Corporation) completed 12 diamond-drill holes totalling 2055 m. The diamond drilling was aimed at testing areas away from the known gold deposits for gold mineralization. The partners also removed stores of fuel on the property in order to minimize environmental concerns (T. Lewis, Placer Dome Inc., written communication, 1992).

A.M. Sanderson of Red Lake prospected and did some soil sampling at the east end of Horseshoe Lake. Mr. Sanderson is following up anomalous gold values in soils about an iron formation horizon (A.M. Sanderson, Prospector, personal communication, 1992).

Central Uchi Greenstone Belt

In the Lang Lake–McVicar Lake area, Noranda Exploration Company Ltd. and BHP Minerals Canada Ltd. were active on separate properties. Noranda Exploration Company Ltd. completed an exploration program on their Saddle Lake property that included geological mapping and prospecting, HLEM and magnetometer surveys and the drilling of 2 diamond-drill holes totalling 231.5 m. The program was aimed at locating further volcanogenic massive sulphide mineralization on the property, but obtained no results of economic significance (J. Sullivan, Noranda Exploration Company, Ltd., written communication, 1992).

BHP Minerals Canada Ltd. continued to explore their McVicar Lake property for gold mineralization. Their completed exploration programs included geological mapping and prospecting, soil sampling, an IP survey and 17 diamond-drill holes totalling 1828.8 m. They also plan to conduct further IP survey work and diamond drilling in 1993 (R. Bonner, BHP Minerals Canada Ltd., personal communication, 1992).

Northeast of Pickle Lake near the Metcalfe gold occurrence, Homestake Canada Ltd. completed an exploration program started in 1991 with the drilling of a 174 m diamond-drill hole (File #52O/09SE–0092, assessment files, Resident Geologist’s office, Sioux Lookout).

Wabigoon Subprovince

SAVANT LAKE AREA

In 1992, Asarco Exploration Co. of Canada Ltd. drilled 10 diamond-drill holes and did borehole and surface PEM surveys on its property in the Evans Lake area and Conant Township. Eight drill holes totalling 1761.9 m tested the COT–1 airborne electromagnetic anomaly. Significant Cu and Zn values were intersected in 2 holes. Two drill holes tested other airborne electromagnetic anomalies on the property. Values up to 2% Cu were intersected northwest of Willow Lake (R.S. Gray, Asarco Exploration Company of Canada Ltd., personal communication, 1992).

Granges Inc. did geological mapping and a limited IP survey on claims in the Evans Lake area in the search for volcanogenic massive sulphides.

R. Ramsay continued work on his Kashawegama Lake property in the Armit Lake area. He did geological mapping, overburden stripping and sampling. Along the south shore of Kashawegama Lake in the central part of the property a unit of reddish quartz-sericite schist was found to be consistently mineralized. It commonly yielded gold values in the range of 200 ppb Au (G.M. Hogg Consulting Geologist, written communication, 1992).
G. Gorzynski and E. Ewen prospected in the Savant Lake–Marchington Road areas and in the Kashaweogama Lake–Armit Lake areas. Two claim groups were staked, 1 in each area. On the claim group in the Armit Lake area, a new sulphide showing hosted in an ultramafic (dunite) sill assayed 0.65% Ni across 6.5 m. The new showing was named the DC Creek occurrence (G. Gorzynski and E. Ewen, written and personal communications, 1992).

BHP Minerals Canada Ltd. conducted prospecting, geochemical and mapping programs for base metals in the Six Mile and Quest lakes areas near Sturgeon Lake. They were following up on mapping conducted by the Ontario Geological Survey in 1991, which suggested base-metal potential in the area.

Champion Bear Resources Ltd. acquired the Swimit Lake property from the owners, the Wasik family of Dauphin, Manitoba. Champion Bear Resources Ltd. optioned surrounding claims from local prospectors and conducted geophysical and geological surveys over the property, which is probably the earliest gold prospect in the Minnitaki Lake area. A long quartz-vein system was stripped and examined. A drill program was under way at the end of 1992.

W. Hollinsworth, a prospector from Savant Lake, drilled potential extensions of the quartz-vein system of the Davidson–Carr prospect, Northeast Arm of Sturgeon Lake. This was an Ontario Prospectors Assistance Program (OPAP) supported program.

Mr. T. Toomey and Mr. B. Smith cut lines and conducted geophysical surveys on the Powell prospect and surrounding areas on the Northeast Arm of Sturgeon Lake. This was an OPAP supported program.

Mr. C. Kuryliw continued a detailed study of mineralization in the King Bay area of Sturgeon Lake. He conducted geophysical and geological surveys in the Fourbay Lake area.

### RESIDENT GEOLOGIST’S STAFF ACTIVITIES

Classified staff in the Resident Geologist’s office include D.A. Janes, Resident Geologist; G.W. Seim, Staff Geologist and M.O. Roy, Geological Secretary. Contract staff during the year included M. Perrault, Acting Staff Geologist; P. Toth, Geological Assistant; H.T. Waller and A. MacTavish, CAD Technicians; C. Bowen and P. Newton, Data Researchers; and N. Macpherson, Temporary Geological Secretary.

During the year, D.A. Janes continued evaluations of mineral occurrences and properties with potential for small-scale gold mining in the Wabigoon Subprovince. He served as a member on the Ministry of Northern Development and Mines’ Information Technology and Real Time Imaging committees. Much of the summer field season was spent in the Sturgeon Lake area, examining and mapping gold-bearing quartz-vein deposits. A small project on satellite-based geographical positioning systems (GPS) was done concurrently with the mapping program. The technology appears useful in areas where maps are unavailable or inaccurate, or where large blowdown areas exist.

From January to March, 1992, G.W. Seim was seconded to the Incentives Office in Sudbury. Upon his return to Sioux Lookout, he organized a Mining Sequence Display presentation at the Queen Elizabeth District High School Career Day, and a weekend Geophysical Prospecting Course in Savant Lake. Over the summer, the Staff Geologist guided 2 field trips in the south Sturgeon Lake area, conducted property examinations and continued a structural study of gold occurrence.

### Table 4.3. List of property examinations during 1992.

| 1. | Ouillette Lake occurrence (between Ouillette Lake and Mine Lake) |
| 2. | Armstrong–Best (King Bay area) |
| 3. | United States prospect/occurrence (Shores King Bay property) |
| 4. | MacRead property (King Bay area) |
| 5. | Triangle occurrence (Sturgeon Lake) |
| 6. | McGee Lake occurrence (Hut Zone) |
| 7. | Black Vein occurrence (Rickaby Mine) |
| 8. | Northern Lights (Northeast Arm of Sturgeon Lake) |
| 9. | Iron Duke (East Bay of Sturgeon Lake) |
| 10. | Shrew Island (Northeast Arm of Sturgeon Lake) |
| 11. | Davidson–Carr (Northeast Arm of Sturgeon Lake) |
| 12. | Powell occurrence (Campbell property) |
| 13. | Hadley occurrence (Highway North of Savant Lake) |
| 14. | McGee Lake (East Bay) |
| 15. | Sturgeon Narrows gold occurrence |
| 16. | Martin occurrence (Couture Lake properties) |
| 17. | Belanger Lake occurrence (Fraser Lake) |
| 18. | Belmore Bay No. 2 showing |
| 19. | McEdwards Lake |
| 20. | Schmidt major occurrence (Swimit Lake) |
| 21. | Cobb Bay occurrence |
| 22. | Wright–Hargreaves |
| 23. | Darkwater Mine |
| 24. | Mattabi Mine site |
| 25. | Keevil occurrence (Chalcopyrite occurrence on Pike Lake Intrusion) |
| 26. | Rainbow Quarry |
| 27. | Pickle Crow Mine site |
The area situated 76 km east of Sioux Lookout, comprises an area of 2700 km² within the Wabigoon Subprovince of the Precambrian Shield.

The bedrock in the area is Precambrian in age. The stratigraphic succession has been subdivided into four assemblages on the basis of lithology and geographic distribution. These assemblages comprise several volcanic cycles. Each of these cycles consists of a lower unit of mafic metavolcanics and an upper unit of intermediate to felsic, generally fragmental metavolcanics. A change in chemistry, an hiatus in volcanism, or a period of sedimentation demarcate cycle and assemblage boundaries. Two major episodes of clastic sedimentation have occurred in the area. Interbedded sulphidic and graphitic ironstone and mudstone are associated with intermediate to felsic metavolcanics. Interbedded chert and silicate-quartz-magnetite ironstone are found associated with clastic metasedimentary sequences.

Subvolcanic gabbroic and ultramafic intrusions occur dominantly in lower mafic metavolcanics, but extensively intrude felsic to intermediate fragmental and clastic metasediments. Epizonal felsic intrusions in the southern part of the area are interpreted to be of subvolcanic origin.

Batholithic granitic complexes composed predominantly of tonalite and granodiorite define the southern, eastern, and northeastern boundaries of the volcano-sedimentary belt. Syn- and late-tectonic plutons of granodiorite and tonalite intrude into the volcano-sedimentary belt. Syenite-monzonite granodiorite plutons emplaced within the mafic metavolcanic-metasedimentary succession marginal to the Eastern Granitic Batholith Complex may be anatexis in origin. Late- to post-tectonic quartz-monzonite stocks and alkalic intrusive complexes were emplaced marginal to and within the confines of the volcano-sedimentary belt.

The metavolcanics, metasediments, mafic and ultramafic intrusions, and felsic epizonal intrusions were metamorphosed to the greenschist to lower almandine-amphibolite facies rank of metamorphism.

The major structures consist of two synclinal folds trending east and northeast respectively. The Sturgeon Narrows Cataclastic Zone transects the volcano-sedimentary belt, and is almost 50 km long.

In 1991, the Ontario Geological Survey published Special Volume 4, Part 1, Geology of Ontario. The authors reviewed the geology of Ontario from historical and recent perspectives. Based on this review, a sea floor growth–oceanic plate subduction model was adopted for the genesis of the greenstone-granitoid terrains of the earliest Precambrian in Ontario.

In the Sturgeon Lake area, the 4 assemblages recognized by Trowell (1983) are retained in most part. The Vista Lake metasediments have been defined as a separate sedimentary assemblage. These assemblages are now interpreted to be tectonic in the sense that they have been moved to their present location by the forces of plate motion and accreted to protocontinental nuclei represented now by gneiss-granitoid belts. Figure 4.3 shows the tectonic assemblages presently recognized in the Sturgeon Lake belt. This is a first pass at a complex problem and changes due to further studies are probable.

Figure 4.4 shows the locations of 3 property visits done in the Sturgeon Lake area during 1992.

The Douglas Mining Company Prospect (Belmore Bay of Sturgeon Lake)

Between 1906 and 1908, Douglas Mining Company acquired and explored 2 vein systems on Belmore Bay of Sturgeon Lake. During the same period, the Belmore Bay Mining Company explored the area and acquired claims. Belmore Bay Mining Co. sank a shaft near Mud Lake and erected a three-stamp mill which ran for a short time (Moore 1911).
The Douglas Mining Company worked on several properties in Belmore Bay. Two of these properties were visited by the Sioux Lookout Resident Geologist during the summer of 1992. Located on claim FM 205, frequently referred to as P.7, is the Belmore Bay No. 2 occurrence. The Ruby property is located on the upper half of claim SV 399, also referred to as TB6, located north of the Belmore Bay No. 2 occurrence. Moore (1911, p. 151) describes the Ruby property as follows:

On what is called the Ruby property owned by the Douglas Mining Company there is a shaft said to be 30 feet deep on a mass of quartz stringers about 4 feet wide, in dark greenstones varying in composition from diabase to diorite. North of the shaft 100 feet and on the same vein is a pit about 22 feet deep where the vein varies in width from 3 inches to 2 feet. The veins run in a general northeast direction with the strike of the rock and with a dip 60 degrees northwest.

The gangue here is quartz of good quality and calcite. It contains pyrite and chalcopyrite, and specimens of free gold were seen in calcite and quartz.

To the south of Belmore Bay No. 2 occurrence is located the Salkeld group of gold-bearing quartz veins, presently owned by A. Best of Savant Lake. The discovery date of this property is unknown, but Coniagas Mines Ltd. examined and drilled the property in January, 1936. Drilling carried out during the summer of 1955 by Mr. Anderson gave excellent results (File #521/02SE–0077, assessment files, Resident Geologist's Office, Sioux Lookout). Falconbridge Limited did mapping and sampling on the property in 1986 which is reported in the above-mentioned file.

LOCATION AND ACCESS

The Douglas Mining Company’s Belmore Bay No. 2 occurrence is located on patented claim FM 205. The claim is accessed from the northeast corner of Belmore Bay of Sturgeon Lake where a cut trail leads east approximately 800 m to the north end of the vein system on FM 205. There are large areas of blown down trees around Belmore Bay but the trail is passable. Float equipped air craft can land on the bay in summer. The closest public boat access to the lake is from tourist camps near Horizone Bay of Sturgeon Lake.

EXPLORATION HISTORY

The only record of exploration of this property is a description of the property in Moore (1911, p. 151):

Since the year 1906 the region around Belmore Bay has attracted considerable attention, as there are many veins within about three miles of the lake. The Douglas Mining Company have camps on the east shore of the bay and have sunk a couple of shafts (Fig. 15). On claim P.7 there is a shaft said to be 22 feet deep on a vein varying in width from 3 inches to 2 feet. A test-pit near by shows stringers running through the schist. On the same claim and 98 paces distant from the 22-foot shaft there is another one 73 feet deep on the same vein. The rock from the bottom of the shaft consists of gray to white quartz scattered through schist and mineralized with chalcopyrite and pyrite.

A. Best acquired the property in 1989 and cut a trail to the trenches and shaft area. The author examined the property in the summer of 1992 with a view to evaluating the potential for small deposit gold mining in the area. Because of the lack of recent air photos, a global positioning system (GPS) was used to locate quartz vein segments.

GEOLOGY

The area is underlain by rocks of the Squaw Lake cycle of the Northeast Arm Assemblage (Trowell 1983). The rocks exposed in the area of the Belmore Bay No. 2 occurrence would correspond to the F2 formation. Trowell defines the F2 formation as a mafic metavolcanic sequence containing massive to pillowed flows and thin layers of hyaloclastic pillow breccia.

As presenty defined in the Geology of Ontario (Blackburn et al. 1991) the rocks are included in the Handy Lake Assemblage, a mixed group of basaltic flows and calc-alkaline pyroclastic rocks. In the trenched areas, the exposed rocks are mainly massive to foliated dark green metabasalts with few, if any, intrusive rocks other than narrow quartz veins. Trenches have been excavated to a depth of 1 to 2 m over a strike length of 300 m.

Few pillow structures are obvious, and the rocks have a schistosity which varies from north to 330° and dip steeply west. The trenches, which vary from 1 to 2 m in width, expose...
narrow (25 to 50 cm) rusty, white, quartz veins which trend 20° and have variable steep dips. Figure 4.5 shows the location and layout of the trenches. The veins pinch out and the workers had excavated cross trenches to locate en échelon vein extensions, usually located within 3 to 10 m. The offsets appear to be to the east of the strike of the first vein.

Two shafts were located on the vein structure. The shaft reported by Moore (1911) to be 22 feet deep is largely fallen in and the vein is not exposed. The second pit to the south, reported to be 73 feet deep, is lined by logs and has samples of quartz from the shaft on site. The grey to white quartz with pyrite and chalcopyrite mentioned in Moore (1911), was sampled and returned 1.356 ounces Au per ton (DAJ92–30), the best assay obtained in the examination. From the assays obtained (Table 4.4) the area around this shaft and the vein extensions to the south gave the best results on the property. The trenches north of the shaft area gave assays in the 0.002 to 0.03 ounces Au per ton range.

From this, it would seem that vein extensions to the south should be sought. The Salkeld occurrence, from assessment work reports quoted previously, appears to have some of the characteristics of the present property and merits re-examination.
Table 4.4. Assay results from the Belmore Bay No. 2 occurrence.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Type</th>
<th>oz. per ton Au</th>
<th>oz. per ton Ag</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAJ92-30</td>
<td>grab</td>
<td>1.356</td>
<td>0.4</td>
<td>spoil heap, 73 ft. shaft</td>
</tr>
<tr>
<td>92-31</td>
<td>chip</td>
<td>0.199</td>
<td>trace</td>
<td>trench 30 m south shaft</td>
</tr>
<tr>
<td>92-32</td>
<td>grab</td>
<td>0.301</td>
<td>trace</td>
<td>south end of occurrence</td>
</tr>
<tr>
<td>92-35</td>
<td>chip</td>
<td>0.002</td>
<td>nil</td>
<td>3 northern pits composite</td>
</tr>
<tr>
<td>92-36</td>
<td>grab</td>
<td>0.004</td>
<td>nil</td>
<td>character sample of above</td>
</tr>
<tr>
<td>92-37</td>
<td>grab</td>
<td>0.031</td>
<td>nil</td>
<td>67 m from north end</td>
</tr>
<tr>
<td>92-38</td>
<td>grab</td>
<td>0.025</td>
<td>nil</td>
<td>84 m from north end</td>
</tr>
<tr>
<td>92-39</td>
<td>grab</td>
<td>0.007</td>
<td>nil</td>
<td>spoil heap, 73 ft. shaft</td>
</tr>
</tbody>
</table>

**Armstrong–Best Prospect, King Bay of Sturgeon Lake**

**LOCATION AND ACCESS**

This property is located at the west end of King Bay near the north shore of the lake (see Figure 4.4). The Six Mile Lake forestry road joins Highway 599 approximately 1 km south of the bridge on the Sturgeon River rapids. Approximately 11 km south on the Six Mile Lake road a cleared but rough trail runs northeast to the Armstrong–Best prospect. Alternatively, summer access to the property can be had from the west end of King Bay by either boat or float equipped aircraft.

**INTRODUCTION**

In 1982, G. Armstrong and A. Best drilled a new gold prospect 200 m north of the shoreline of King Bay. This new prospect is located 200 m south of the MacRead prospect described in Janes et al. (1992). The first holes drilled by Armstrong and Best set in motion a small staking rush in the area. The initial drilling was done on a geophysical anomaly in an area covered by 5 to 7 m of granular overburden. In order to evaluate the geology of the prospect, Armstrong and Best power stripped an area 30 m by 60 m.

The property was optioned to Steep Rock Resources Inc. In turn, Falconbridge Ltd., Hudson Bay Exploration and Almaden Resources Corporation examined all or part of the property. In 1990, the property was returned to Armstrong and Best. In 1991 and 1992, A. Best attempted to pump out the pit which is prone to flooding. In 1992, an area to the east of the original pit was stripped and washed. This revealed an extension of the blue-quartz vein system found in the original pit.

The most recent mapping in the area is by D.J. Robinson (1992). He mapped the Six Mile Lake area which includes the west end of King Bay. The history of the deposit is summarized in the above mentioned report.
George Armstrong and Alan Best acquired the property in the late 1970's in the vicinity of a surface Au showing immediately north of King Bay. In 1949, C.J. Ryan completed 10 diamond drill holes on the property totaling 809.8 m (table 6) and intersected up to 0.06 to 0.08 ounce Au per ton over widths of up to 0.85 m. A small gold deposit has subsequently been outlined consisting of visible gold contained within blue-grey quartz veins hosted by chloritized and carbonatized pillowed and massive mafic flows of the Six Mile cycle. Several diamond drilling campaigns have tested the deposit and surrounding area, including: Armstrong and Best (14 holes, 1451 m); Steep Rock Resources Inc. (1982, 20 of 45 holes, 6136 m); Hudson Bay Exploration and Development (1984, 4 holes, 971 m); Falconbridge Nickel Limited (1986, 5 holes, 956 m) and Almaden Resources Corp. (1987, 11 holes, 863 m). The property is underlain by south facing, east trending, steeply dipping, chloritized, locally sheared and carbonatized massive and pillowed mafic flows, with thin intercalated lenses of felsic tuff and wacke. Feldspar porphyry dikes have been intersected in diamond drilling and a feldspar porphyry stock outcrops along the south shore of King Bay.

George Armstrong and Alan Best intersected the following results in five of ten diamond drill holes completed (opt, ounces per ton):

<table>
<thead>
<tr>
<th>Drill hole</th>
<th>Au (opt)</th>
<th>From (m)</th>
<th>To (m)</th>
<th>Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>153</td>
<td>3.85</td>
<td>41.9</td>
<td>44.9</td>
<td>3.05</td>
</tr>
<tr>
<td>155</td>
<td>1.93</td>
<td>98.3</td>
<td>99.8</td>
<td>1.52</td>
</tr>
<tr>
<td>157</td>
<td>1.03</td>
<td>41.1</td>
<td>47.2</td>
<td>6.10</td>
</tr>
<tr>
<td>158</td>
<td>0.89</td>
<td>35.1</td>
<td>42.7</td>
<td>7.62</td>
</tr>
<tr>
<td>159</td>
<td>0.22</td>
<td>47.2</td>
<td>58.0</td>
<td>10.8</td>
</tr>
</tbody>
</table>

The mineralized zones are hosted within blue-black quartz veins containing 2 to 5%, pyrite, pyrrhotite, chalcopyrite and visible gold and a gangue mineral assemblage of ankerite, calcite and talc schist. Steep Rock Resources Inc. optioned the property in 1983 and completed VLF-EM16 and magnetometer surveys at a 50 m spacing over the property. The magnetic survey confirmed an east trending sequence and also indicated the presence of a sulfide-rich interflow horizon within the deposit stratigraphy. Subsequent diamond drilling confirmed the presence of an alteration zone enveloping the vein structure. Initial diamond drilling from north to south included the following results: KB-3, 0.127 ounce Au per ton across 3.81 m; KB-4, 1.34 ounce Au per ton across 9.05 m and KB-5, 0.864 ounce Au per ton across 4.66 m. These three diamond drill holes tested the occurrence over a strike length of 50 m and to a depth of 50 m.

Hudson Bay Exploration and Development (HBED) reported that the stratigraphic section of the deposit consists principally of massive and pillowed mafic flows, with very minor QFP, chert, tuff and wacke. HBED also indicated that the gold zone was hosted within westeringly plunging, narrow (0.20 to 1.50 m) and irregular blue quartz veins coincident with a marker horizon of sulfide facies iron formation. HBED completed four diamond drill holes over 200 m strike length to test the structure at 125 to 150 m depth, from south to north. Diamond drill holes KB-46 intersected 0.73 ounce Au per ton across 0.37 m and 0.98 ounce Au per ton across 0.43 m and diamond drill hole KB-50 intersected 0.64 ounce Au per ton across 0.24 m.

Falconbridge Nickel Limited reported that no significant intercepts were encountered from 5 diamond drill holes on the property. Twenty-seven overburden rotasonic drill holes were also completed in three fences south of the deposit in King Bay.

DEPOSIT GEOLOGY

The new section is located immediately to the east of the original pit. The area newly stripped and washed down is 2 to 3 m higher than the base of the older pit and should not flood. Figure 4.6 details the quartz veins and other features exposed. The 3 sampled locations shown on Figure 4.6 were assayed at the Temiskaming Testing Laboratory.

There are at least 3 veins exposed in the pit. Two of them are the normal blue quartz veins similar to those found immediately to the west in the older flooded pit. The veins contain minor pyrite and trace chalcopyrite with rare fine visible gold. The gold tenor is in the 0.1 to 0.3 ounces Au per ton. The third vein resembles the veins in the MacRead prospect 200 m north of the pit. This vein contains considerably higher sulphide content, at times between 20 to 40 percent. The sulphides are pyrite, galena and sphalerite with trace chalcopyrite. This vein is considerably more irregular than the blue quartz veins. The vein broadens and swings north at the western limit of the pit. This is associated with strong north-trending shears. The host rock is massive metabasalt which has minor carbonate replacement in sheared areas.

A very interesting feature is the shear folding of this vein from a west to a northerly strike. This is similar to folding of the main vein on the MacRead prospect 200 m north. This suggests that one or more north-trending late shears cut the volcanic pile at the west end of King Bay and are responsible for the emplacement of several of the known quartz-sulphide veins.

Mr. A. Best recently resampled the northern vein on the newly stripped area. The vein was fractured by low velocity blasting and 8 samples ranging from 1 to 5 kg taken systematically. Fire assays in the Bell-White Analytical Laboratories Ltd. returned 4 assays in the 0.1 to 0.39 ounces Au per ton range. The other 4 samples ranged between 2.85 to 16.05 ounces Au per ton (G. Armstrong, written communication, 1992).

J RJ Cobb Bay Property, Sturgeon Lake

In the summer of 1989, J RJ Exploration Ltd. examined and worked on what is now known as the J RJ Cobb Bay gold property on Cobb Bay of Sturgeon Lake. Previously, the area was known as the Cobb Bay copper occurrence. There are no records of previous exploration for gold on this property in the Sioux Lookout Resident Geologist’s assessment files.

LOCATION AND ACCESS

Figure 4.4 shows the general location of the occurrence. The property can be reached by boat from Sturgeon Lake. The
best access is from Cobb Bay Camp road, off Highway 599. The Cobb Bay Camp road is signed and the right fork leads to a boat launch and parking area. Directly south of the boat launch is a narrow bay. At the south end of the bay on the west side, a marked trail leads to the northernmost trenches of the area stripped by JRJ Exploration Ltd.

REGIONAL GEOLOGY

The most recent mapping of the area is by Trowell (1974). In this report, the following description of the Cobb Bay copper occurrence is included:

The Cobb Bay copper occurrence is located approximately 1/2 mile north of the northeastern tip of Cobb Lake. Two trenches (6 feet by 4 feet), approximately 700 feet apart, have been dug on this occurrence. The northernmost trench is in a sheared and carbonatized intermediate metavolcanic outcrop, which has a red-brown weathering surface; only minor pyrite mineralization was observed. The southern trench is in an outcrop of a silicified, intrusive(?)/porphyritic rock; it is highly sheared (northeast trend) and carbonatized and minor pyrite and chalcopyrite mineralization was observed.

Ontario Geological Survey Map 2268 - Granite Bay of Sturgeon Lake covers the occurrence. In 1991, the area immediately to the east of Cobb Bay was mapped by the Ontario Geological Survey. Robinson (1992) discussed the geology and stratigraphy of the area, and placed it within the Six Mile Lake Cycle. The Six Mile Lake Cycle is a unit of felsic pyroclastic rocks, cut by dikes to plugs of metagabbro and feldspar porphyry. In the recently published *Geology of Ontario* (Thurston et al. 1991), the area is defined as falling within the Handy Lake assemblage, a mixed unit of felsic and mafic metavolcanic rocks.

SITE GEOLOGY

The JRJ Cobb Bay property was initially visited in the summer of 1990 and in the fall of 1992 when additional stripping had been done. The A-zone, which is the northernmost trench, was mapped and sampled in some detail. Figure 4.7 was done from a visit in September 1992.

The trenching exposes a 120 m intrusive contact between a 3 to 7 m wide north-trending quartz porphyry dike and sheared ferrocarbonate altered massive metabasalt. The brown alteration surrounds the porphyry dike in a halo 1 to 3 m wide. Contacts of the halo with uncarbonated metabasalt are relatively sharp. Commonly the altered portions of the metabasalt has thin (3 to 6 mm), quartz veining with a strike
of 220° to 240°. Two minor faults offset the dike on the north end of the outcrop. The sampling done in 1992 was to confirm good assays in gold found on the south end of the trenching in 1990 (Table 4.5).

Unfortunately, the sampling did not confirm the 1990 results. One tentative conclusion is that gold is relatively enriched in the altered mafic metavolcanics when compared to the quartz veining.

The Schmidt Occurrence

The Schmidt occurrence, which contains the Schmidt shaft, is located approximately 1.5 km west of the north end of Swimit Lake and approximately 3 km east of the southern tip of Pickerel Arm of Minnitaki Lake (Figure 4.8). Claim map plan G–2087 (Keikewabik Lake) covers the area of the occurrence.

The property consists of 12 unpatented claims and 2 patented claims. The 2 patented claims were bought recently by Champion Bear Resources Ltd.

The unpatented claims are held by a group consisting of A. Glatz, A. Kozowy, J. Langelaar and one other. These claims are optioned to Champion Bear Resources Ltd.

HISTORY

The property is known locally as the Schmidt occurrence and is one of the oldest gold prospects near Minnitaki Lake. The original shaft dates back to 1898 and was sunk on a high-grade quartz vein.

In 1950, Central Manitoba Mines Ltd. drilled 3 holes on the property. The best result was 1.12 ounces Au per ton over a narrow width (A. Glatz, Prospector, personal communication, 1992). In a survey of mining activity in the Sioux Lookout area, the Schmidt occurrence was described by Chisholm (1951):

The Schmidt showing (19) is located 3 miles east of the extreme southwest end of Pickerel arm of Minnitaki Lake, on the northern part of claim H.W. 636. A quartz vein from 3 to 5 feet wide has been traced by a series of trenches for a distance of 350 feet in a northeasterly direction from an old shaft located at the edge of a swamp. The present work done by Central Manitoba Mines consists of resampling the old surface pits and testing the westerly extension of the vein beneath the swamp by drilling.

Company officials report that high values in gold over narrow widths have been obtained from the northeasterly extension of the vein. What appears to be the continuation of the vein to the southwest was reported to have been intersected in one hole beneath the swamp.

The vein, where exposed, consists of a series of parallel quartz stringers in chlorite schist. A quartz porphyry dike is exposed adjacent to the shaft. The quartz is mineralized with scattered patches of galena, chalcocyprite, and pyrite, comprising less than 1 per cent of the vein material. The gold is reported to occur in the native state as fine submicroscopic particles and to have a high silver content.

What appear to be a series of subsidiary fractures to the main vein are exposed in trenches on the east side of the swamp, to the southwest of the shaft, for a distance of about 600 feet. Erratic values in gold are reported in these trenches.

Very little activity is reported on the claims from 1951 to 1981. With the surge of exploration due to flow-through financing, other properties in the area had considerable exploration done on them. The key claims were patented and no agreements were made. L. Chorlton conducted a structural study of the Echo Township–Sandybeach Lake area between 1987 and 1989 (Chorlton 1991). This was carried out in conjunction with 1:15 840 scale mapping programs carried...
Table 4.5. Assays of samples from A-zone, JRJ Cobb Bay occurrence.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Gold (oz/ton)</th>
<th>Type</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>GWS90-140</td>
<td>0.127</td>
<td>chip</td>
<td>Fe-carb., 2-3 % pyrite, 2 m</td>
</tr>
<tr>
<td>-143</td>
<td>0.147</td>
<td>grab</td>
<td>Fe-carb., 2-3 % pyrite</td>
</tr>
<tr>
<td>-146</td>
<td>0.377</td>
<td>grab</td>
<td>weak Fe-carb., qtz. st., 1% py</td>
</tr>
<tr>
<td>GWS92-14A</td>
<td>0.037</td>
<td>grab</td>
<td>carb. mafic, qtz. vein 5% pyrite</td>
</tr>
<tr>
<td>-15</td>
<td>0.031</td>
<td>grab</td>
<td>carb. mafic, 3-5% pyrite</td>
</tr>
<tr>
<td>-18</td>
<td>0.029</td>
<td>grab</td>
<td>site 4, weak carb. 5% pyite</td>
</tr>
<tr>
<td>-19</td>
<td>0.007</td>
<td>grab</td>
<td>qtz. vein with pyrite</td>
</tr>
<tr>
<td>-20</td>
<td>0.031</td>
<td>grab</td>
<td>qtz. vein, &lt; 1% pyrite</td>
</tr>
<tr>
<td>-21</td>
<td>0.048</td>
<td>grab</td>
<td>Fe-carb mafic, 1% pyrite</td>
</tr>
<tr>
<td>-22</td>
<td>0.004</td>
<td>grab</td>
<td>Fe-carb mafic, 1% pyrite</td>
</tr>
<tr>
<td>-23</td>
<td>0.021</td>
<td>grab</td>
<td>Fe-carb mafic, 1% pyrite</td>
</tr>
<tr>
<td>-24</td>
<td>trace</td>
<td></td>
<td>site 3, 5 cm qtz. vein</td>
</tr>
<tr>
<td>-25</td>
<td>0.017</td>
<td>grab</td>
<td>carb. mafic, 1-2% pyrite</td>
</tr>
<tr>
<td>-26</td>
<td>0.019</td>
<td>grab</td>
<td>strong carb., &lt; 1% pyrite</td>
</tr>
</tbody>
</table>

Figure 4.8. Location map for the Schmidt occurrence.
out by Berger and assistants between 1987 and 1989 (Berger et al. 1987, 1988; Berger 1988, 1989). As part of this study, L. Chorlton (1991) briefly examined the Schmidt showing. Her report on the occurrence is as follows:

The Schmidt Occurrence ... is hosted by metabasalt and felsite displaying intense iron carbonatization, and abundant veins in phyllonitic schists with subvertical lineations and local steeply plunging folds of the strong foliation. Ankeritized wall rock and numerous quartz and ankerite veins contain abundant sphalerite, galena, and pyrite. Grab samples of sulphide-bearing quartz vein taken by the author yielded 0.82 and 0.39 ounce Au/ton, and carbonized felsite yielded 3.57 ounces Au/ton. The metabasalt is brecciated and calcified beside the ankeritized zone. Though not examined in detail, the tectonic fabrics in this occurrence resemble those of the Alto-Gardnar and Midas shear zone segments.

In 1991, A. Glatz put together a group that staked 12 claims surrounding the 2 patented claims. After discussions, the Glatz group optioned their claims to Champion Bear Resources, who had purchased the 2 patents from the owners.

ACCESS

In 1987, Canadian Forest Products Ltd. extended a logging road network in the area north of the Highway 17 near Basket Lake. This allowed vehicles into the area around Swimit Lake for the first time. Access is by the Basket Lake road, approximately 35 km east of Dinorwic, on Highway 17. At the Camp 19 intersection, a rough but driveable hauling road leads north to within 1 km of the Schmidt shaft. A short trail to the shaft can be used by all-terrain vehicles.

Alternately, the site can be reached from the south end of Pickerel Arm of Minnitaki Lake where a 3 km trail leads to the Schmidt shaft.

GEOLOGY

The only published map to deal with the Swimit Lake area in any detail is by M.E. Hurst (1932). This map was produced at 1:95 050 scale (1 inch to 1.5 miles).

Trowell et al. (1983) mapped the Flying Loon Lake area, covering the area from the south end of Sturgeon Lake to Amik Lake which is located south of Minnitaki Lake near 92°W. The area between McAree Township and Amik Lake is not covered by recent mapping.

Hurst (1932) mapped the contacts between the granite and greenstone terrane and established the contact between the greenstones and the Minnitaki sediments to the north. The area has considerable drift cover and many of the lower areas are covered with peat-sedge bogs or black spruce swamps.

Hurst (1932) visited the Schmidt shaft on what was then called the Schmidt-Wallbridge group and reported on the situation as follows:

This property consists of two patented claims, H.W. 635 and 636, located about two miles east of the head of Pickerel arm of Minnitaki lake. These claims are held by Mrs. C. Schmidt of New York and by interests associated with W. H. Wallbridge, of Toronto.

Some years ago an inclined shaft was sunk to a depth of 29 feet on a quartz vein occupying a fracture zone in greenschist. This vein strikes N25°E and dips to the north. About 20 feet northeast of the shaft the vein is exposed for a width of 8 feet. It could not be traced farther along the strike on account of the overburden. The quartz on the dump is mineralized with sphalerite, pyrite, chalcopyrite, and galena. It also contains some carbonate. Several patches and tongues of quartz porphyry were observed in the vicinity of the workings. Coarse feldspar basalt porphyry outcrops to the east of the shaft. Gold is said to be present in the portions of the vein containing sulphides. Considerable surface work has been done on the showings since the property was examined.

The current exploration program was done for Champion Bear Resources Ltd. during the summer of 1992. Independent Exploration Services Ltd. conducted a stripping, mapping and sampling program. Initially, a 65 m section of vein to the south of the shaft was stripped and sampled. Based on the results, the stripped area was extended to 600 m and parallel zones were cleared and examined.

GEOLOGY OF THE SHAFT AREA

There are few exposures of bedrock in the area of the shaft. Figure 4.9 shows the general geology of the stripped zone as of late August 1992. Early work was concentrated on the area around the shaft shown outlined in Figure 4.9. A detail of this area is given in Figure 4.10. The author wishes to thank L. Chastko and H. Petak of Independent Exploration Ltd. for their aid and courtesy during visits to the property. A. Glatz very kindly guided the author to the site through a maze of unmarked bush roads.

The sequence of metabasalt exposed in the stripped areas between lines 46N and 48N consist of a layer of plagioclase glomeroporphyritic metabasalt, at least 20m thick, between 2 layers of slightly feldspar-porphyreritic metabasalt. The western contact of the glomeroporphyritic unit is open folded or crenulated with a 0.5 to 1 m amplitude. At the contact, there is a 1 m band of egg-shaped feldspar glomerocrysts oriented with their long axes normal to bedding. This is taken as a top indicator since feldspar megacrystals tend to be found near the top of mafic flows or sills. The orientation and elongation of the glomerocrysts is problematic. There is no fanning to suggest cleavage orientation due to folding. A possible explanation would be compression parallel to bedding, in this case roughly north-south. This compressional event has been proposed as a possible explanation for the genesis of the vein system by consultant A. Pryslak who examined the property for Champion Bear Resources Ltd. (A. Pryslak, personal communication, 1992). The author wishes to thank Mr. Pryslak for permission to use his working maps of the prospect.

Two varieties of felsic dikes cut the metabasalts in the stripped area. The first and probably the oldest type are dikes of felspar porphyry. They are grey to white in colour and somewhat foliated. These dikes have no obvious preferred
Figure 4.9. General geology of the Swimit Lake gold prospect (Schmidt occurrence).
CHAMPION BEAR RESOURCES LTD.
SWIMIT LAKE GOLD PROSPECT
MAIN ZONE
GEOLOGY AND SAMPLE LOCATIONS

Quartz vein
Quartz vein (inferred in area of overburden)
Zone of shearing and alteration surrounding the quartz vein system
Sample location
opt Au Ounce Gold per ton
Shear zone
Shaft
Pit

Figure 4.10. Detailed geology of the main zone, Swimit Lake gold prospect (Schmidt occurrence).
Table 4.6. Assay results from the Schmidt occurrence, shaft area.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Type</th>
<th>oz. Au per ton</th>
<th>oz. Ag per ton</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAJ92-41</td>
<td>grab</td>
<td>13.594</td>
<td>4.74</td>
<td>shaft</td>
</tr>
<tr>
<td>92-42</td>
<td>grab</td>
<td>1.121</td>
<td>0.43</td>
<td>L 50+00N 0+55E</td>
</tr>
<tr>
<td>92-43</td>
<td>grab</td>
<td>0.713</td>
<td>0.27</td>
<td>L 50+05N 0+50E</td>
</tr>
<tr>
<td>92-44</td>
<td>grab</td>
<td>0.261</td>
<td>0.93</td>
<td>L 51+00N 0+75E</td>
</tr>
</tbody>
</table>

orientation but appear to be concentrated in the stripped area. The dikes vary from 3 to 25 m in width and pinch and swell in outcrop. The second type of dike is fine grained to aphanitic quartz porphyry. These dikes are pale red in colour and could be taken for aplites. They appear to cut the quartz veins or possibly fill-in fractures in the vein.

The quartz veins are white to grey in colour and contain heavy sulphide mineralization in some areas, especially surrounding the old shaft. Samples collected from this area contain up to 10 per cent sulphides, consisting of pyrite, chalcopyrite, galena and sphalerite in decreasing order of abundance. A number of assayed samples from this area have given results greater than 10 ounces Au per ton. Sample DAJ92-41 returned 13.594 ounces Au per ton and 4.74 ounces Ag per ton (Table 4.6).

The quartz veins frequently have a sinusoidal form which pinch out to form an elongate "s". The veins are aligned with a major shear zone which cuts through the property at 20°. A minor shearing direction trending approximately 240° may be responsible for the sinusoidal shape of the vein segments. The veins vary considerably in width and in some areas around the shaft the wall rock may carry gold values.

Champion Bear Resources Ltd. have initiated a drill program on the property which will start in December of 1992.

**Wright-Hargreaves Property, Minnitaki Lake**

**INTRODUCTION**

In 1989, K. Bernier of Sioux Lookout staked a block of claims to cover the Wright-Hargreaves gold prospect. He received grants from the Ontario Prospector Assistance Program in 1989-1990 and 1990-1991. Mr. Bernier used the funds from the grants to complete geophysical surveys and trenching programs on the block of claims. He re-excavated the original trenches and traced the alteration associated with the gold mineralization for more than 1.5 km, by geophysical interpretation and prospecting. In 1991, following site visits, Teck Explorations Limited optioned the block of claims from Mr. Bernier. Teck acquired additional geophysical surveys and geological mapping. In 1992, Teck completed several trenches and a nine-hole 1029 m diamond-drilling program. The Wright-Hargreaves property was returned to K. Bernier in the fall of 1992. The Sioux Lookout Resident Geologist and the Staff Geologist have visited the Wright-Hargreaves property several times since January 1990, following the exploration progress.

**LOCATION AND ACCESS**

The Wright-Hargreaves property is located about 12 km south of Sioux Lookout on the north shore of East Bay of Minnitaki Lake. Figure 4.11 gives the location of the prospect.

The property may be accessed by boat from Sioux Lookout or by a network of bush roads and a tractor trail leading south from Highway 642 at Alcona.

**EXPLORATION HISTORY**

The discovery date of the Wright-Hargreaves occurrence is unknown.

In 1948, an unknown party dug a number of trenches across the occurrence and completed 4 short X-ray drill holes (Johnston 1972).

In 1950, R.J. McCombe initiated the staking of 31 claims to cover the occurrence and strike extensions. Wright-Hargreaves Mines Limited optioned the claims from Mr. McCombe.

In 1951, Wright-Hargreaves Mines Limited completed a geological survey on the property and took more than 225 samples for gold assay. The highest assay result was $7.00 gold per ton ($35.00 U.S. per ounce) over a narrow width (assessment file 52J/04SW-0016-A1, Resident Geologist's Office, Sioux Lookout).

In 1989, K. Bernier restaked the ground.

The recent history is detailed in the "Introduction" above.

**GEOLOGY**

The Wright-Hargreaves occurrence lies at the sheared contact between mafic metavolcanics to the north and metasediments to the south. The mafic metavolcanics are lava flows interlayered with feldspar porphyritic crystal tuff.
The metasediments are interlayered metagreywacke and meta-argillite beds. Some of the meta-argillite beds are graphitic.

The mafic metavolcanics north of the Wright-Hargreaves occurrence are massive to strongly foliated basalts. The foliation north of the original working strikes 50° and dips north. Geological mapping by Teck Explorations Limited indicates the foliation roughly parallels the sheared contact between the basalts and the sediments.

The sheared contact between the mafic metavolcanics and the sediments can be traced for several kilometres. An east-trending (75°) gold-bearing zone extends from the original workings along the sheared contact for more than 1.8 km. The gold-bearing zone averages 5 m in width and dips steeply north. The zone, as exposed in trenches, is contained within a strongly silicified and iron-carbonate altered metavolcanic rocks. Up to 5% pyrite occurs in the altered metavolcanic rocks as disseminated euhedral crystals and as flat circular smears on shear surfaces. The colour of the altered metavolcanics is generally tan, but locally is blue-grey. The blue-grey colour may be due to traces of disseminated molybdenite as assays of the blue-grey material have returned up to 0.05% Mo. Considerable quartz veining is present near the north boundary of the gold-bearing zone. The quartz veins are sulphide-poor compared to the altered rock. Shearing within the gold-bearing zone is more intense towards the south boundary with the sediments than it is at the north boundary. The south boundary of the gold-bearing zone is not exposed in the trenches.

The diamond drilling of the gold-bearing zone suggests the altered metavolcanic rock was originally a feldspar porphyritic crystal tuff containing sparse quartz phenocrysts. The north boundary of the gold-bearing zone is gradational across the contact of the feldspar porphyritic crystal tuff with the basaltic lava flows. The south boundary of the gold-bearing zone is sharp and is located at the contact of the feldspar porphyritic crystal tuff with the sediments. The contact is marked by a thin, massive to veined graphite unit which occasionally contains fragments of feldspar porphyritic crystal tuff.

**PROPERTY EXAMINATION**

The Sioux Lookout Resident Geologist and the Staff Geologist examined the Wright-Hargreaves occurrence on several occasions between January 30, 1990 and July 23, 1992. The site visits were at the requests of K. Bernier and later Teck Explorations Limited. The above geological description of the occurrence is a compilation of observations made on the
visits. A total of 24 grab and chip samples were taken during the site visits from both old and new trenches along the gold-bearing zone and from 2 additional areas on the property. Assays results for samples taken from the gold-bearing zone range from a low of 14 ppb up to 0.14 ounces Au per ton (assaying by Ontario Geoscience Laboratories, Toronto and Temiskaming Testing Laboratory, Cobalt). Teck Explorations Limited reported gold assays up to 4.4 g/t Au from grabs and 1.5 g/t Au over 5 m from K. Bernier's trench on the original showing (assessment file 52J/04SW-0025, Resident Geologist's Office, Sioux Lookout). Assay results from the diamond-drill program were not encouraging.

First Loon Lake
"Exhalitive" Horizon

INTRODUCTION

In 1987, Minnova Inc. intersected a thin "exhalitive" horizon in a diamond-drill hole on their First Loon Lake property. The "exhalitive" horizon averaged 10% zinc equivalent over approximately 60 cm. In the winter of 1988-1989, Minnova Inc. conducted a follow-up drilling program in which several holes intersected the "exhalitive" horizon. In the summer of 1989, the Staff Geologist examined the intersections in all the drill holes as well as the complete rock succession intersected in 2 of the drill holes.

LOCATION AND ACCESS

Minnova Inc.'s First Loon Lake property lies about 20 km to the northeast of Pickle Lake. The property starts on the northeast side of the Crowshore Patricia patented claims in McCullaugh Township and extends northeast for several kilometres past First Loon Lake. Access to the property is limited to helicopter, float-equipped aircraft and foot travel. The closest road is the Pickle Crow Mine road which is not passable past the Crowshore Patricia Mine shaft.

PROPERTY EXAMINATION

Minnova drilled the volcano-sedimentary succession hosting the "exhalitive" horizon from the northwest to the southeast. In the following discussion, the terms "above" and "below" are used in respect to the respective location of rock units in the drill holes.

The rock succession hosting the "exhalitive" horizon consists, from the top of the drill holes downwards, of mafic metavolcanic flows, felsic metavolcanic tuffs and tonalite. The mafic metavolcanic flows contain interflow members of black meta-argillite and felsic ash metatuff. Some non-economic sulphides are associated with the interflow members.

The felsic metavolcanics are at least 2090 m thick and consist of quartz crystal ash metatuff, ash metatuff and lapilli metatuff. The "exhalitive" horizon is contained within a quartz crystal ash metatuff bed which is in contact with the mafic metavolcanics at the top of the drill holes. The depth of the "exhalitive" horizon was located about 17 m below the contact with the mafic metavolcanics. In the other drill hole, the "exhalitive" horizon was located about 41 m below the contact.

The "exhalitive" horizon is about 60 cm thick in all of the drill holes. The horizon consist of disseminated to massive pyrite, pyrrhotite, sphalerite, galena, chalcopyrite and possibly tetrachloride set in quartz crystal ash metatuff. The best assay results from the horizon came from the initial intersection. It averaged 10% zinc equivalent. Typically, the horizon averages 5% zinc equivalent. The felsic metavolcanics below the "exhalitive" horizon are predominantly ash metatuff with interlayers of chloritic metasediment and possible iron formation (intervals of chloritic metasediment with magnetite layers). In one of the 2 drill holes examined, the felsic metavolcanics contain a 32 m wide, mafic metavolcanic interlayer. This mafic metavolcanic interlayer is cut by several chlorite-pyrrhotite-chalcopyrite stringer zones.

The felsic metavolcanics as intersected in the drill holes are hydrothermally altered from the mafic metavolcanic contact through to the tonalite contact. Three alteration assemblages were recognized by the Staff Geologist. They are:

1. sericite + silicification
2. chlorite + garnet ± biotite ± magnetite ± pyrrhotite ± chalcopyrite
3. sericite + muscovite + silicification

The sericite and silicification alteration assemblage is found in the felsic metavolcanics above, hosting and immediately below the "exhalitive" horizon. Partial whole-rock geochemistry on the felsic metavolcanics below the "exhalitive" horizon performed by Minnova Inc. suggests intense hydrothermal alteration. Sodium values are below 0.5%. Potassium and iron values are somewhat higher than what is considered normal for felsic metavolcanics. Silica values range from 74 to 76%, which is considered slightly high for calc-alkaline rhyolites. The felsic metavolcanic immediately below the "exhalitive" horizon is also depleted in titanium (O. Steele, Minnova Inc., personal communication, 1989).

The chlorite + garnet ± biotite ± magnetite ± pyrrhotite ± chalcopyrite assemblage is found in the felsic metavolcanics below the "exhalitive" horizon. This assemblage is not exclusive of the sericite and silicification assemblage. It was not determined if 1 assemblage overprinted the other.

The sericite + muscovite + silicification assemblage is found in the felsic volcanics near the contact with the tonalite at the bottom of the drill holes. This assemblage overprints the 2 previous assemblages. The Staff Geologist suggests that this latter assemblage is caused by contact metasomatism from the tonalite. The alteration is accompanied by a growth in grain size which combine to obscure the contact between the tonalite and the felsic volcanic.
The Pickle Crow Project, Albany Area

In 1992, the second year of the Pickle Crow project, the Staff Geologist examined 3 surface gold occurrences north of the Albany shaft on the Pickle Crow patented claims (Figure 4.12). The Pickle Crow project was initiated in 1991 with the purpose of mapping in detail the many surface gold occurrences on the Pickle Crow Gold Mines Ltd. and Central Patricia Gold Mines Ltd. properties near Pickle Lake. The objective of the project is to further investigate the structural controls of gold mineralization of past producers in the area.

In 1991, the Staff Geologist mapped the Sigmoid Vein area at the northeast end of the Pickle Crow property. As a result of this work, the Staff Geologist suggested that the gold occurrences on the Pickle Crow patented claims are associated with a large deformation zone(s) as defined by Colvine et al. (1988).

The 3 surface gold occurrences examined in 1992 were the “D” zone, the “E” zone and an unnamed zone along the north contact of the Albany porphyry. The latter was found by Noramco Explorations Inc. in the late 1980s. The “D” zone area was mapped at a scale of 1:600 and the other 2 areas at a scale of 1:240. The “D” zone had been previously mapped by Noramco Explorations Inc. at a scale of 1:240. Magnetic interference from the iron formation in the Albany shaft area causes compass readings to be unreliable. For this reason, the strike and azimuth determinations for the mapped area are given in general terms.

GENERAL GEOLOGY OF ALBANY SHAFT AREA

Figure 4.13 illustrates the general geology of the Albany shaft area and the areas of detailed mapping. Pye (1976) described in detail the geology of the Albany shaft area. Parts of the following section are based on his observations and conclusions.

The principle lithologies observed in the Albany area are metabasalt, oxide-facies iron formation and quartz-feldspar porphyry.

Metabasalt underlies the greater portion of the Albany shaft area as illustrated in Figure 4.13. The metabasaltic rocks are comprised of massive and pillowed lava flows locally
interlayered with metatuff and oxide-facies iron formation. The lava flows are typically dark green and fine grained.

Just north of the Albany shaft, metatuff and iron-formation beds are a significant part of the rock succession. The metatuff and iron formation beds are highly deformed and locally exhibit boudinage structure. A large-scale fold closure to the north is indicated by "Z"-shaped drag folds. However, the spatial distribution of the iron-formation beds suggests a more complicated, possibly cross-folded, structure. The metatuff and iron-formation beds are cut out by the Albany porphyry (discussed below) about 150 m west of the shaft. The metatuff and iron-formation beds outcrop again 450 m west of the shaft. To the west of the porphyry, the metatuff and iron-formation beds are highly silicified and contact relationships between beds are uncertain.

Several intrusive bodies intrude the volcano-sedimentary succession in the vicinity of the Albany shaft. The oldest intrusive rock in the area is a hornblende diorite or gabbro. Elliptical bodies of hornblende diorite up to 460 m in length and 70 m in width intrude the lava flows to the northwest of the Albany shaft. Hornblende diorite does not outcrop near the gold occurrences examined by the Staff Geologist.

Two large irregular bodies of porphyritic rock, locally known as the Pickle Crow and Albany porphyries, intruded the volcano-sedimentary succession later than the hornblende diorites. The Pickle Crow porphyry is located to the northwest of Albany shaft and is not shown in Figure 4.13. The Pickle Crow porphyry, according to Pye (1976) is a quartz-albite porphyry and it: "consists of phenocrysts of both albite and quartz embedded in a matrix of plagioclase, quartz, sericite, chlorite, and carbonate with subordinate amounts of magnetite and apatite". The Pickle Crow porphyry is highly altered and schistose.

The Albany porphyry intruded the volcano-sedimentary succession near the location of the Albany Shaft. The Albany porphyry according to Pye (1976) is a porphyritic albite granite. The porphyritic albite granite has a similar mineralogy to the quartz-albite porphyry (the Pickle Crow porphyry) but has muscovite phenocrysts. The Albany porphyry has a coarser grained matrix than the Pickle Crow porphyry. The Albany porphyry is highly fractured and altered by iron carbonate. The two porphyries are visibly different in appearance.

East of the Albany porphyry, several biotite-quartzfeldspar porphyry dikes cut across the volcano-sedimentary succession. These dikes are classed as quartz-diorite porphyry. The dikes are more massive than Albany porphyry and the feldspar phenocrysts are andesine instead of albite.
Pye (1976) suggested that the 3 different porphyry types in the Albany shaft area were emplaced at different times during the deformation history. He suggests that the Pickle Crow porphyry is the oldest intrusive body and that the quartz-diorite porphyry dikes are the youngest. This is based on the Pickle Crow porphyry having a stronger deformation fabric and more intense alteration while the dikes are more massive and less altered.

Aplite dikes and biotite lamprophyre dikes are the latest intrusive in the Albany shaft area.

“D” ZONE

The “D” zone outcrops about 200 m north of the Albany shaft. Pye (1976) described the geology of the “D” zone. Figure 4.14 is a compilation of personal observations and previous mapping of the “D” zone and surrounding area.

The “D” zone hosts a set of quartz veins in a shear system which has a known strike length of at least 180 m. The shear system appears to be 2 main shear zones which cross and/or coalesce in the center of the “D” zone and diverge toward each end. One shear zone strikes slightly north of east and the other, east to slightly south of east. The strike parallel schistosity in both dips 60° to 70° north. Typically, the shear zones are 3 to 5 m wide, but range up to 15 m. The sheared rock is highly carbonatized and chloritic.

The quartz veins of the “D” zone exhibit boudinage structure and are highly deformed. They are composed of “sugary” textured white quartz with a little carbonate and subordinate pyrrhotite and chalcopyrite. Tourmaline and sericite are developed along the walls and along ribbon structure in the quartz. Visible gold has been reported in the quartz vein and some chip samples and drill-core intersections have assayed well over 1.0 ounce Au per ton. On the whole, however, the assays have returned non-economic values. The gold distribution in the veining is believed to be very erratic. The Staff Geologist did not submit samples from the “D” zone for assay. Detailed sample plans for the “D” zone are available in the assessment files (Sioux Lookout Resident Geologist’s Office, Sioux Lookout).

Several narrower shear zones were observed in outcrop north and south of the “D” zone. Some of the shear zones strike sub-parallel to the “D” zone shearing while other shear zones strike at sharp angles into the “D” zone. The Staff Geologist did not observe any of the latter shear zones cutting or coalescing with the “D” zone shear zones. However, one of the observed shear zones located about 30 m south of the “D” zone trifurcates to the west. All 3 branches contain quartz veins.

“E” ZONE

The “E” zone is located 170 to 320 m west-northwest of the Albany shaft. The geology of the “E” zone is described by Pye (1976). A trench excavated by Noramco Explorations Inc. exposes the east end of the “E” zone for about 45 m along strike. The geology of the “E” zone trench is shown in Figure 4.15.

The “E” zone is a set of quartz boudins hosted in a 6 to 8 m wide shear zone. The shear zone cuts through metabasaltic pillowed lava flows with an average strike of 75°. The schistosity within the shear zone is parallel to the strike of the zone and dips steeply north to vertical. Pye (1976) indicates that early diamond-drill intersections suggest that the “E” zone has a flat dip to the south.

At the east end of the “E” zone trench, the quartz veins are present as ribbons and sheets in an intensely sheared, strongly carbonatized and chloritic rock. To the west, the quartz veins quickly become thicker and are a mixture of boudins and continuous veins. There may be more than a single age of quartz vein as some veins are semi-continuous while adjacent veins are severely contorted boudins. Most quartz veins in the “E” zone are white and sugary and contain small amounts of carbonate, tourmaline, sericite, pyrrhotite and pyrite. Pye (1976) reported visible gold in the veins.

The Staff Geologist took 7 grab and chip samples from quartz veins exposed in the “E” zone trench. The highest assay result, 0.326 ounces Au per ton (Temiskaming Testing Laboratories), was from a sample of a boudin of rose-weathering quartz at the west end of the trench. Assay results for all the samples taken from the “E” zone are listed in Table 4.7.

ALBANY PORPHYRY — NORTH CONTACT TRENCH

In 1989 and 1990, Noramco Explorations Inc. excavated 3 large trenches to expose the greater portion of the Albany porphyry. In doing so, they discovered, or possibly re-discovered, 2 gold-bearing zones; the first along the north contact of the porphyry intrusive and the second in iron formation south of the porphyry intrusive. In 1992, the Staff Geologist and assistant, P. Toth, mapped (at a scale of 1:240) the trench which exposes the north contact of the Albany porphyry. P. Toth will complete a thesis (Bachelor of Science) at Brock University on the geology of the trench. The North Contact trench measures approximately 300 by 30 m. Figure 4.16 is a generalized geology map of the North Contact trench.

The rock exposed in the North Contact trench can be subdivided into 2 units; one of interlayered metabasalt and iron formation to the north, and the other of quartz-mica-feldspar porphyry to the south. A wide shear zone (up to 30 m) straddles the contact between the 2 units, but is found mostly in the interlayered metabasalt and iron formation unit. Within the shear zone and interweaving along the contact between the 2 units is a zone of quartz veinings. In the metabasalt and iron formation unit, the quartz occurs as single veins carrying minor sulphides. In the porphyry, the quartz occurs both as single veins and as infillings to brecciated porphyry. Invariably, the wall rock to the quartz veins is strongly carbonatized and carries minor sulphides, mainly pyrite. Quartz veins were only seen in the westernmost 180 m of the stripped area.
Figure 4.14. Geology of the “D” Zone area, Pickle Crow property.

Figure 4.15. Geology of the “E” Zone trench, Pickle Crow property, with sample locations.
Table 4.7. Assay results of “E” Zone samples.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Description</th>
<th>ounces Au per ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>GWS-92-008</td>
<td>Grab, sheeted quartz carbonate vein, trace pyrite</td>
<td>0.005</td>
</tr>
<tr>
<td>GWS-92-009</td>
<td>70 cm chip, two white quartz veins and intervening wall rock, traces pyrite</td>
<td>0.023</td>
</tr>
<tr>
<td>GWS-92-010</td>
<td>35 cm chip, white quartz vein</td>
<td>0.114</td>
</tr>
<tr>
<td>GWS-92-011</td>
<td>Grab, white quartz vein, stringer chalcopyrite</td>
<td>0.089</td>
</tr>
<tr>
<td>GWS-92-012</td>
<td>30 cm chip, white quartz vein</td>
<td>0.006</td>
</tr>
<tr>
<td>GWS-92-013</td>
<td>Grab, grey quartz vein, trace pyrite</td>
<td>0.054</td>
</tr>
<tr>
<td>GSW-92-014</td>
<td>Grab, rose weathering quartz, trace pyrite</td>
<td>0.326</td>
</tr>
</tbody>
</table>

The shear zone, straddling the contact between the porphyry unit and the interlayered metabasalt and iron formation unit, trends east-northeast. The metabasalt within the shear zone possesses a strong schistosity and a slaty cleavage both of which dip, for the most part, about 70° north. Locally, the schistosity and slaty cleavage dip steeply south. The iron formation within the shear zone is found mostly within the eastern-most 120 m of the stripped area. The iron formation does not exhibit the schistosity and slaty cleavage of the metabasalts, but rather occurs as isolated pods (boudins) which are, internally, highly folded and faulted. The spatial distribution of the pods of iron formation suggests that there were originally 2 horizons of iron formation interlayered with the metabasalt.

The quartz-mica-feldspar porphyry unit exposed in the North Contact trench is comprised of the porphyritic albite granite body and the quartz-diorite porphyry dikes described by Pye (1976). The Staff Geologist recognized the presence of biotite in the dikes, but made no distinction between the 2 porphyries while mapping. There is doubt as to whether the 2 porphyries are distinct intrusive events. In outcrop, the porphyries appear identical with the exception of the occurrence of biotite phenocrysts rather than muscovite phenocrysts in the dikes. There also appears to be a contact phase to the body of porphyritic albite granite that had darker mica phenocrysts identified as biotite. The Staff Geologist suggests that the quartz-diorite porphyry of Pye (1976) may be a contact phases of the porphyritic albite granite.

The wide shear zone, which straddles the contact between the porphyry unit and the interlayered metabasalt and iron formation unit, affected both quartz-diorite porphyry dikes and the porphyritic albite granite body of the porphyry unit. The rocks of the porphyry unit exhibit a strong east-northeast-trending schistosity and cleavage within the shear zone. Outside the shear zone, the rocks of the porphyry unit exhibit a weak east- to southeast-trending schistosity and cleavage. Locally, the east- to southeast-trending schistosity is much stronger and discrete shear zones are identified. These east- to southeast-trending shear zones refract into the east-northeast-trending wide shear zone straddling the contact between the porphyry unit and the interlayered basalt and iron formation unit.

P. Toth took over 50 grab and chip samples from the North Contact trench for petrographic study and assay. To date, 16 samples have been assayed for gold and silver. All silver values returned nil or trace. The best result, 0.127 ounces Au per ton is from a 1 m chip sample of quartz vein and iron formation. Nine of the remaining sample assayed between 0.121 ounces Au per ton and 0.011 ounces Au per ton. Most of these samples were of quartz-filled brecciated porphyry and/or quartz vein with small amount of pyrite. The remaining 6 samples returned values between 0.005 ounce Au per ton and trace gold.

DISCUSSION

In Janes et al. (1992), the Staff Geologist suggested that the gold occurrences on the Pickle Crow patented claims are associated with a large deformation zone(s). Some observations made during the study of the “D” zone area, the “E” zone and the North Contact trench tend to support the suggestion. For example:

1. The structure hosting the “D” zone is 2 shear zones of apparently the same age which coalesce into a single zone and then separate at the other end of the map area.
2. Also in the “D” zone area are several other sub-parallel shear zones, one of which trifurcates.
3. The main contact east-northeast-trending shear zone and the east-southwest-trending shear zones cutting the Albany porphyry are not definitely of different ages. They may have developed during a single period of deformation and have a large scale C and S fabric relationship. C and S fabric relationships can be observed in the basalt in relatively undeformed basalts outside the main shear zone.
On the other hand, the structure hosting the "D" zone fits into Stott and Brown's (1986) model of conjugate fractures developed at low angles to the principle flattening schistosity. This model states that, in general, only 1 member of a conjugate set develops into a significant shear zone in any 1 locality. However, the "D" zone is the exception to the rule in that both members of the conjugate fracture pair are equally developed as shear zones. The rest of the shear zones observed in the "D" zone area would appear to fit the general rule as structures relating to the second member of a conjugate pair were not observed.

Most of the quartz veins observed in the areas examined thus far on the Pickle Crow project are deformed into well-developed boudinage structures with the boudins themselves being later deformed. Only in the "D" zone and the "E" zone, as developed in underground workings, are sections of the quartz veining continuous over significant lengths (i.e., greater than 30 m). This is in contrast to the main production veins at the Pickle Crow Mine. These production veins, though they pinch and swell and are highly contorted, are continuous over considerable lengths. This difference in the character of the quartz veins, among other factors, has separated the major production veins from those which have not seen significant production.

**DRILL CORE LIBRARY PROGRAM**

The Kenora Drill Core Library serves 3 of the 6 Resident Geologist's districts in northwestern Ontario: Kenora, Red Lake and Patricia (Sioux Lookout). The drill core stored at the library consists of: drill core from entire diamond-drill holes from both exploration and mine development drilling; drill core from incomplete holes recovered from old diamond-drill sites; short samples of drill core submitted for credit under the old Mining Act (RSO 1980); and drill core submitted for credit under the new Mining Act proclaimed in June 1991. A total of 9801.6 m of drill core from 95 diamond-drill holes was added to the collection between November 25, 1991, and December 31, 1992. The current contents of the library consist of: 65 740.7 m of fully catalogued drill core stored inside the building; 24 141.1 m of drill core on pallets in secure outside storage; and 6462.5 m of drill core collected, but not yet catalogued; for a total of 96 344.3 m of drill core from all 3 districts. Drill core in outdoor storage consists of: excess drill core from several drilling projects that were collected in their entirety; drill core removed from indoor storage when core in better condition became available; and surplus drill core left over after some holes were reduced. All of this drill core is available for examination on request.

There were 226 visitors (161 industry, 65 government) and 293 telephone enquiries for the year. A total of 49 work days were spent by industry examining and sampling drill core, rock sample suites and other materials, as well as 50 work days spent using other parts of the facility (sample cutting, rock and mineral identification, file research, etc.). The usage of the core library increased from 1991 in both the number of users and the man days spent in the facility. The users who examined drill core showed a continuing interest in base-metals over gold. Both major and junior mining companies showed an interest in base metals, although many of the local prospectors and other interested people still showed a preference for gold.
A major new initiative in the core library system is the expansion of off-site drill core storage. For many years, some drill core has been stored outside in Kenora, Red Lake and Sioux Lookout in locations with limited space. In November of 1992, site preparation for dedicated outdoor storage sites began in Kenora, Red Lake and Sioux Lookout, funded by the jobsOntario Capital Fund. The sites will consist of fenced gravelled yards where drill core can be stored on specially designed covered steel pallets, regular wooden pallets or in racks. The first stage of construction is scheduled to be completed by the end of November and the sites will be in use as soon as the fencing is completed. These sites will hold drill core that would have been either left in the bush or transferred to the existing outdoor storage in Kenora. They also increase the capacity of the core library system to allow the collection and preservation of larger amounts of drill core. In addition, the sites provide a secure place to store drill core in the District where it was drilled, to enhance the services available to the exploration industry. Exploration and mining companies and individuals will be able to bring core to the Red Lake and Sioux Lookout sites and continue to have access to the drill core without travelling to Kenora.

The library holds 20,712.8 m of core from 231 drill holes in the Sioux Lookout District. Between November 25, 1991 and November 23, 1992, 916.5 m of core from 12 drill holes was added to the collection (Table 4.8). Core was collected from 4 projects this year, all explored for gold.

Argyle Ventures Inc. diamond drilled its Dorothy Lake property 80 km west of Pickle Lake in 1989 and 1990 (see Figure 4.2a, drill core collection site 1). Core from 5 of the 9 holes was collected in 1992. The core intersected a mixed assemblage of mafic to felsic metavolcanics and iron formation. Gold assays are low, but 1 hole has sulphide-rich layers with high copper and zinc values, in 1 sample greater than 1800 ppm copper and 10,000 ppm zinc (assessment files, Resident Geologist’s Office, Sioux Lookout).

Golden Peaks Resources Ltd. diamond drilled its Cat Track property (see Figure 4.2a, drill core collection site 2) on the south side of Savant Lake in Poisson Township in 1990. In 1992, 2 of the 3 holes were collected. The core shows silicified and carbonatized metavolcanics with quartz veins. Gold assays are low.

July Resources Corp. drilled its Kawinogans River property at Pickle Lake in 1989 (see Figure 4.2a, drill core collection site 3). Three of the 6 holes were collected in 1992. The holes intersected strongly altered metavolcanics and quartz veins. Assays up to 0.38 ounces Au per ton (assessment files, Resident Geologist’s Office, Sioux Lookout) were reported.

Noranda Exploration Co. Ltd. drilled its Kam Lake property near Kaminiskag Lake 64 km southwest of Pickle Lake in 1987 (see Figure 4.2a, drill core collection site 4). Core from 2 of the holes was collected in 1992. The drilling intersected mafic to intermediate metavolcanics and metasediments with iron formation. Gold values were low.

**RECOMMENDATIONS FOR EXPLORATION**

**Gold**

Interest in gold deposits in the Echo Township and Sandybeach Lake area (see Figure 4.8), has increased recently with the acquisition of the Goldlund Mine by Locke Rich Minerals Ltd. The new owners are examining the Goldlund property and searching for external sources of mill feed.

Champion Bear Resources Ltd. are encouraged by results of work done on the Schmidt gold occurrence (Swimit Lake) in 1992. This property is approximately 13 km from the Goldlund Mine property, but considerably farther by existing roads.

Chorlton (1991) groups the Schmidt occurrence with the Alto-Gardnar, Midas, Rivers and Glatz occurrences in a spatial domain of gold occurrences located east and southeast of a cluster of granitoid stocks. Chorlton (1991) further indicates that this spatial domain: "is traversed by several discrete, northeasterly striking, steep to moderately dipping shear zones."

A portion of the area between Sandybeach Lake and the Swimit Lake area is not mapped to a scale usable in exploration. For this reason, it is recommended that this area should be thoroughly prospected, bearing in mind the association of known gold mineralization with northeast-trending shear zones.

**BASE METALS**

A very interesting result of the recently published *Geology of Ontario* (Thurston et al. 1991) is the recognition that the Precambrian greenstone belts in Ontario are the product of ocean floor growth and related plate subduction processes. This should lead to a better understanding of the genesis of base-metal deposits as part of the oceanic growth-subduction cycle.

In the Wabigoon Subprovince, it is clear that a considerable portion of the rocks within the subprovince are fragments of volcanic arcs and back arc basins, since the felsic rocks found there are not a significant component of oceanic crust. In these back arc basins, deposits known as the Besshi type containing copper, zinc and minor lead are found associated with basalts and terrogenous rocks, usually sediments. The alteration associated with this type of deposit is chlorite replacement, silicification and the deposition of iron-manganese-bearing chert. Often the rocks are black fine-grained sediments.

The Patara sediments outcrop along Highway 664 near the town of Hudson in the Sioux Lookout District (Johnson 1972). This group includes arkose, slate, greywache, chlorite
Table 4.8. Summary of Sioux Lookout Resident Geologist’s District drill core.

<table>
<thead>
<tr>
<th>Area (Lake)</th>
<th>NTS</th>
<th>Company</th>
<th>Holes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beckington L.</td>
<td>52J/02NE</td>
<td>Coastora Resources Ltd.</td>
<td>2</td>
</tr>
<tr>
<td>Bell L.</td>
<td>52G/15SW</td>
<td>Minnova Inc.</td>
<td>5</td>
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<tr>
<td>Collishaw L.</td>
<td>52P/12NW</td>
<td>July Resources Corp.</td>
<td>3*</td>
</tr>
<tr>
<td>Conant Tp.</td>
<td>52J/07NE</td>
<td>Noranda Exploration Co. Ltd.</td>
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<tr>
<td>Connell Tp.</td>
<td>520/08NE</td>
<td>Gallant Gold Mines Ltd.</td>
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<tr>
<td></td>
<td>520/09SE</td>
<td>Kerr Addison Mines Ltd.</td>
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<tr>
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<td></td>
<td>Silverside Resources Inc.</td>
<td>3</td>
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<tr>
<td>Coucheemoskog L.</td>
<td>520/08SE</td>
<td>Power Exploration Inc.</td>
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<td>Drayton Tp.</td>
<td>52J/04SW</td>
<td>Nahanni Mines Ltd.</td>
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<td>Echo Tp.</td>
<td>52F/16NW</td>
<td>Braeswood Exploration Ltd.</td>
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<tr>
<td></td>
<td></td>
<td>Rio Tinto Canadian Expl.</td>
<td>7</td>
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<td>Fourbay L.</td>
<td>52J/02SW</td>
<td>Riverton Resources Corp.</td>
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<td></td>
<td></td>
<td>Steeprock Resources Ltd.</td>
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<td></td>
<td></td>
<td>(Wahlex Ltd.)</td>
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<tr>
<td>Fry L.</td>
<td>520/03NW</td>
<td>Umex Inc.</td>
<td>12</td>
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<tr>
<td>Johnston Bay</td>
<td>520/03SE</td>
<td>Kerr Addison Mines Ltd.</td>
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<td>Jutten Tp.</td>
<td>52J/07SE</td>
<td>Westmin Resources Ltd.</td>
<td>3</td>
</tr>
<tr>
<td>Kawashe L.</td>
<td>520/06SE</td>
<td>Ateba Mines Ltd.</td>
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</tr>
<tr>
<td>Kecheokagan L.</td>
<td>52B/02NW</td>
<td>Great Plains Dev. Co.</td>
<td>3</td>
</tr>
<tr>
<td>Lomond Tp.</td>
<td>52K/01SW</td>
<td>Nahanni Mines Ltd.</td>
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<td>Meen L.</td>
<td>520/06NW</td>
<td>Argyle Ventures Inc.</td>
<td>5*</td>
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<td>Nemeigusabins L.</td>
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<td>Platinum Exploration Canada Ltd.</td>
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<td>Parnes L.</td>
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<td>Penassi L.</td>
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<td>Pickerel Tp.</td>
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<td>TriOrigin Exploration Ltd.</td>
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</tr>
<tr>
<td>Poisson Tp.</td>
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<td>2*</td>
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<td>Six Mile L.</td>
<td>52G/15NW</td>
<td>Noranda Exploration Co. Ltd.</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Santana Petroleum Corp.</td>
<td>10</td>
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<td>Smock L.</td>
<td>52G/13NE</td>
<td>BHP–Utah Mines Ltd.</td>
<td>3</td>
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<tr>
<td>Squaw L.</td>
<td>52J/02SE</td>
<td>Alotta Resources Ltd.</td>
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<td>MPH Consulting Ltd.</td>
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<td></td>
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<td>Villeneuve Resources Ltd.</td>
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<tr>
<td>Tarp L.</td>
<td>520/09SE</td>
<td>H. J. Hodge Inc.</td>
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<td></td>
<td></td>
<td>Kerr Addison Mines Ltd.</td>
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</tr>
<tr>
<td>Vermilion Tp.</td>
<td>52K/02SW</td>
<td>Smith, D.E. (Acadia Minerals Ventures Ltd. option)</td>
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<td></td>
<td>52K/02SE</td>
<td>Moneta Porcupine Mines Ltd.</td>
<td>6</td>
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<tr>
<td>Whipper L.</td>
<td>52K/01SW</td>
<td>Nahanni Mines Ltd.</td>
<td>1</td>
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<td>Zarn L.</td>
<td>52J/04SE</td>
<td>Goldwinn Resources Ltd.</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kerr Addison Mines Ltd.</td>
<td>2</td>
</tr>
</tbody>
</table>

* indicates core collected in 1992
Note: Assessment credit drill-core samples submitted under the old Mining Act are not included in this table.
schist and tuff with volcanic boulder to pebble conglomerate and chert. In the road outcrops along Highway 664, the Patara basal contact is taken at the contact of a mafic pillow breccia which grades into a mafic sediment. Within the underlying basin, a large barren sulphide deposit, The North Pines Mines Ltd. deposit, was mined previously for sulphur. A number of other deposits of similar nature are known in the area. Small amounts of chalcopyrite are reported from the North Pines and other deposits in the area.

In 1983, Nahanni Mines Ltd. drilled a geophysical anomaly on Hwy. 664 near the upper contact of the Patara group (assessment file 52J/04SW-0019, Resident Geologist’s Office, Sioux Lookout). Multiple conductors containing massive to near massive sulphides were found in 1 drill hole. While these were barren sulphides, conditions suitable for deposition of massive sulphides existed post deposition of the sediments.

Other areas in the Patara group and similar sediments in the Minnitaki Lake and Savant Lake areas appear to have potential for Besshi-type deposits. Sampling for alteration and anomalous base-metal values are potential exploration tools.

SELECTED PUBLICATIONS RECEIVED


REFERENCES


INTRODUCTION

For the fourth consecutive year, exploration activity has declined in the Thunder Bay District. Prospectors, with the help of the Ontario Prospectors Assistance Program, have maintained their level of activity and continue making new discoveries. Major mining companies carried out exploration programs on previously owned properties only, and as a result, no properties were optioned from prospectors this year. The 6 junior mining companies operating in the district did not option any properties this year either. Only 2 projects could be considered at an advanced stage of exploration. The only producing mine, Inco Limited’s Shebandowan Mine, was put on care and maintenance on May 15, 1992.

MINING ACTIVITY

Shebandowan Mine

The Shebandowan Mine, owned by Inco Limited and operated by MacIsaac Exploration Limited, produced nickel-copper concentrates (plus cobalt and precious metals) until May 15, 1992. Inco Limited decided to temporarily close the operation pending an increase in nickel prices, coupled with a depletion of nickel stockpile. The mine was scheduled to reopen October 1992, but this was delayed due to worsening economic factors. The mine is still closed and is being maintained on a stand-by basis.

The mine is located on the southwest part of Lower Shebandowan Lake (lat. 48°36', long. 90°10'), approximately 75 km west-northwest of the city of Thunder Bay.

Amethyst

In 1992, there were 10 amethyst producing properties, 5 of these are tourist attractions and allow people to pick their own amethyst for a fee. The amethyst is also sold as specimens, decorative and lapidary stone, jewellery and giftware, and landscape stone.

The best known and largest operation is that of Thunder Bay Amethyst Mine Panorama. This property is situated in central McTavish Township, approximately 35 km northeast of the city of Thunder Bay. The majority of the properties are located between Thunder Bay and Nipigon.

Amethyst shops are located in the Thunder Bay-Nipigon area along the Highway 11 and Highway 17 corridor. A brochure describing the location of the mines and shops is available at the Thunder Bay Resident Geologist’s office.

Amethyst producing areas are plotted on Figure 5.1.

ADVANCED EXPLORATION ACTIVITY AND DEVELOPMENT

Madeleine Mines Ltd.—Lac des Iles Platinum Group Metals

Madeleine Mines Ltd. is continuing to bring their Lac des Iles property towards an unspecified production date. The Roby Zone has been stripped and mapped, and 1200 m of diamond drilling was carried out on this and other zones. The road to the minesite was upgraded and tailings pond preparation is underway. The company has set up an environmental research lab with the assistance of the University of Guelph, the University of Michigan and the Lakes Research Branch of the National Waters Research Institute, Environment Canada. They are testing metal contamination in a wide variety of flora and fauna from the tailings produced during mill test. They are also investigating vegetation types for use in site and tailings stabilization. The company has received all the necessary permits with the exception of that necessary for effluent discharge. Application for this is at an advanced stage. Published reserves are 22.6 Mt grading 0.19 ounces per ton PGM and 0.02 ounces Au per ton (Canadian Mines Handbook 1992-1993, p.226).

Central Crude Limited—Moss Lake Project

Exploration activity resumed on this property in October after being dormant since December of 1990. Central Crude Limited has optioned the property from joint venture partners Storimin Exploration Limited and Tandem Resources Ltd. Central Crude has an option to earn a 60% interest in the property by spending $6.5 million. The period of inactivity is the result of Central Crude’s inability to secure financing. The seven-hole, 4383 metre diamond-drilling program that took place from October to December was financed by Central Crude issuing 333334 shares on a flow-through
EXPLANATION

- Exploration Activity
- Producing Metal Mine
  - Inco Shebandowan

Advanced Development
- Madeleine Mines Ltd.

Amethyst Producing Areas

District Boundary

Figure 5.1. Thunder Bay Resident Geologist's District.
basis to Hemlo Gold Mines Inc. by way of private placement at 45 cents per share. Upon completion, Hemlo Gold will own a 48.99% interest in Central Crude.

The seven-hole drill program was designed to test the down-dip extension of the Q.E.S. zone at a depth below (a) 350 m. The results are as follows:

<table>
<thead>
<tr>
<th>Hole Number</th>
<th>Interval (feet)</th>
<th>Length (feet)</th>
<th>Gold (oz/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>92-N-247</td>
<td>1504.6-1566.6</td>
<td>62.0</td>
<td>0.095</td>
</tr>
<tr>
<td>Including</td>
<td>1542.0-1561.7</td>
<td>19.7</td>
<td>0.194</td>
</tr>
<tr>
<td>92-N-248</td>
<td>1774.3-1803.2</td>
<td>28.9</td>
<td>0.025</td>
</tr>
<tr>
<td>Including</td>
<td>1795.9-1803.2</td>
<td>7.33</td>
<td>0.063</td>
</tr>
<tr>
<td>92-N-249</td>
<td>1366.5-1405.8</td>
<td>39.3</td>
<td>0.050</td>
</tr>
<tr>
<td>92-N-250</td>
<td>2061.4-2115.2</td>
<td>53.8</td>
<td>0.050</td>
</tr>
<tr>
<td>Including</td>
<td>2071.9-2080.4</td>
<td>8.53</td>
<td>0.161</td>
</tr>
<tr>
<td>92-N-251</td>
<td>1299.2-1316.5</td>
<td>62.3</td>
<td>0.054</td>
</tr>
<tr>
<td>92-N-252</td>
<td>1890.75-1990.80</td>
<td>80.05</td>
<td>0.055</td>
</tr>
<tr>
<td>Including</td>
<td>1916.01-1964.24</td>
<td>48.23</td>
<td>0.074</td>
</tr>
<tr>
<td>92-N-253</td>
<td>1742.13-1788.06</td>
<td>45.93</td>
<td>0.072</td>
</tr>
</tbody>
</table>

(Central Crude Ltd., press releases, December 8, 1992 and January 4, 1993.)

The mineralization on this property, just east of Moss Lake, is mostly covered by Snodgrass Lake (lat. 48°32', long. 90°43') and the inflowing, swampy Wawiag River. The mineralization intersected is consistently altered diorite (mainly chlorite, some albite, epidote and quartz) with 5% disseminated pyrite, and occasional chalcopyrite-bearing quartz veinlets. Published reserves are 82 MT grading 0.031 ounces Au per ton (Canadian Mines Handbook 1992-1993, p.90).

EXPLORATION ACTIVITY

For the fourth year in a row, exploration activity in the Thunder Bay Resident Geologist's District has declined. It also declined in the Thunder Bay Mining Division which includes the Beardmore-Geraldton and Schreiber-Hemlo Resident Geologist's districts. Even though the number of claim units has increased from 28054 to 30964, the amount of assessment work received by the Mining Recorder's office has decreased from $8517516 to $4027098. This figure over-estimates the activity level, as 90.5% of the files submitted were for work done prior to 1992. Normally 50% of submissions are from the current year.

In the Thunder Bay District, the number of properties being explored has decreased from 64 to 51 (Table 5.1). Eight of the properties were explored by major mining companies (11 in 1991, 31 in 1990, 21 in 1989), 6 by junior mining companies (7 in 1991, 17 in 1990, 30 in 1989, 57 in 1988), the remainder by prospectors. The number of diamond-drilling programs has increased to 15, from 13 in 1991. The number of OMIP grants has decreased to 3, from 10 in 1991, 19 in 1990. The number of OPAP grants has increased to 42 from 40 in 1991 and 29 in 1990.

The most sought after commodity is still gold. Gold was the primary target on 29 properties. Seventeen properties were explored for base metals, up substantially from previous years, 2 for platinum, 1 for silver and fluorite and 2 for amethyst. Prospecting for amethyst is more widespread than indicated as it takes place on unstaked land in a competitive environment, and on each of the producing properties.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The office of the Resident Geologist was staffed by M.J. Lavigne Jr., Resident Geologist, and J. Scott, Geologist. Additional staff this year included M. Garland, Regional Mineral Specialist and K. Younger, Exhibition Designer. This office handled over 900 inquiries, conducted 28 property visits, carried out reconnaissance in 3 areas, and organized 12 field trips. Two prospecting courses were given at the core library with a total of 53 students. This office also provided logistical support for 4 Ontario Geological Survey—Geoscience Branch mapping projects.

M. Garland completed a study of amethyst deposits in the Thunder Bay area and submitted a manuscript for review.

Public education received much attention. This included dealing with hundreds of inquiries from teachers, conducting 2 workshops for teachers, visiting classrooms, setting up displays for Mining Week, Cordilleran Roundup and Institute on Lake Superior Geology. This office initiated a public education program which will focus on providing teachers with developed curriculum and student activity kits. Staff from this office have participated on several provincial, inter-provincial and inter-governmental working groups which focus on education, and mining related education.
Table 5.1. Exploration activity in the Thunder Bay Resident Geologist’s District.

<table>
<thead>
<tr>
<th>Company/Individual (Property Name)</th>
<th>Claim Map Sheet (Commodity)</th>
<th>Exploration Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Akiko Gold Resources Ltd.-Gold Giant Minerals Inc.</td>
<td>Moss Township G-676 (Au)</td>
<td>DDH (5), Tr</td>
</tr>
<tr>
<td>3. BHP-Utah Mines Ltd. (Tommyhow Lake)</td>
<td>Kashisibog Lake, Whitebirch Lake G-2663, G-152 (Cu, Zn)</td>
<td>DDH, GL, geophysics</td>
</tr>
<tr>
<td>5. Calvert, D. (Cunniah Lake)</td>
<td>Saganans Lake G-555 (Cu)</td>
<td>GL, Tr, prospecting</td>
</tr>
<tr>
<td>6. Christianson, D.E., Christianson, E. (Beck Creek)</td>
<td>Moss Township G-676 (Au)</td>
<td>DDH (7) – 4383 m</td>
</tr>
<tr>
<td>7. Cominco Ltd.</td>
<td>Tartan Lake G-2706 (base metals)</td>
<td>line cutting, GL, geophysics</td>
</tr>
<tr>
<td>8. D’Aigle, A.P.</td>
<td>Ander Lake G-691 (Cu)</td>
<td>GL</td>
</tr>
<tr>
<td>10. D’Silva, B. &amp; Parker, D. (Frank West property)</td>
<td>Hagey Township G-661 (Cu, Ni)</td>
<td>Prospecting, sampling</td>
</tr>
<tr>
<td>12. Hackl, J.</td>
<td>Hagey Township G-661 (Au, Cu, Ni)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>13. Harty, R., Harty, O.</td>
<td>MacGregor Township G-672 (amy)</td>
<td>Str</td>
</tr>
<tr>
<td>14. Hayne, B.</td>
<td>Wabikon Lake G-773 (Au, Cu)</td>
<td>DDH, prospecting</td>
</tr>
<tr>
<td>15. Hayne, B. (Nelson Road)</td>
<td>MacGregor Township G-672 (Au)</td>
<td>GL, geophysics</td>
</tr>
<tr>
<td>16. INCO Exploration and Technical Services Inc.</td>
<td>Whiddon Lake G-151 (base metals, Au)</td>
<td>GL, geophysics</td>
</tr>
<tr>
<td>17. INCO Exploration and Technical Services Inc.</td>
<td>Finlayson Lake G-528 (base metals)</td>
<td>GL, geophysics</td>
</tr>
<tr>
<td>18. INCO Exploration and Technical Services Inc.</td>
<td>Hagey Township G-661 (base metals)</td>
<td>GEM, GM</td>
</tr>
<tr>
<td>19. INCO Exploration and Technical Services Inc. (Shebandowan mine)</td>
<td>McTavish Township G-675 (amy)</td>
<td>Mechanical</td>
</tr>
<tr>
<td>20. Josephson, A.</td>
<td>Moss Township G-676 (Au)</td>
<td>DDH (1)</td>
</tr>
<tr>
<td>21. Kwiatkowski, R., Kukkee, E.</td>
<td>Moss Township, Tilly Lake G-676, G-562 (Cu, Mo, Au)</td>
<td>DDH (2)</td>
</tr>
<tr>
<td>Company/Individual (Property Name)</td>
<td>Claim Map Sheet (Commodity)</td>
<td>Exploration Activity</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-----------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>22. Madeleine Mines Ltd.</td>
<td>Lac des Iles G-739 (PGM, Cu, Ni)</td>
<td>DDH, GL, Str</td>
</tr>
<tr>
<td>24. Lundmark, H.</td>
<td>Whitefin Lake G-778 (Au)</td>
<td>Str, mapping</td>
</tr>
<tr>
<td>25. Martin, J. &amp; Bumbu, C. (McInnis Lake)</td>
<td>Powell Lake G-549 (Au, Cu)</td>
<td>Tr, assays</td>
</tr>
<tr>
<td>26. McKellar, R.</td>
<td>Hagey Township G-661 (Au)</td>
<td>Prospecting, sampling</td>
</tr>
<tr>
<td>27. Mealey, G.L.</td>
<td>Richardson Lake G-553 (base metals)</td>
<td>Prospecting, geophysics</td>
</tr>
<tr>
<td>50. Myslicki, J., Starr, E. (Cunniah Lake)</td>
<td>Saganagons Lake G-555 (Au)</td>
<td>Prospecting, Tr</td>
</tr>
<tr>
<td>29. Noranda Exploration Company Limited</td>
<td>Little Sturge Lake, Rightangle Lake G-71, G-755 (Cu)</td>
<td>DDH (9) – 2150 m</td>
</tr>
<tr>
<td>30. Noranda Exploration Company Limited (Vanguard)</td>
<td>Kashabowie Lake G-2714 (Cu, Zn)</td>
<td>GEM</td>
</tr>
<tr>
<td>31. Challenger Minerals Inc. (Deatys Creek)</td>
<td>Tilly Lake G-549 (Au)</td>
<td>IP, DDH (3) – 429 m</td>
</tr>
<tr>
<td>32. Piikanen, R., Piikanen, D.</td>
<td>Gorham Township G-660 (Au)</td>
<td>Prospecting, assays</td>
</tr>
<tr>
<td>33. Petrunka, D. (Olcott gold occ.)</td>
<td>McCaul Township G-554 (Au)</td>
<td>Prospecting, mapping</td>
</tr>
<tr>
<td>34. Puumala, M., Purdon, R.</td>
<td>Max Lake G-741 (base metals)</td>
<td>Prospecting, VLF-EM, GM, Tr</td>
</tr>
<tr>
<td>35. Ranta, E. (Ardeen prop.)</td>
<td>Moss Township G-676 (Au)</td>
<td>Prospecting, mapping, Tr</td>
</tr>
<tr>
<td>36. Ranta, E. (Snodgrass Lake)</td>
<td>Moss Township G-676 (Au)</td>
<td>GM, VLF-EM</td>
</tr>
<tr>
<td>37. Redden, J. (Porcupine Mountain Mine)</td>
<td>O’Connor Township G-678 (Ag,F)</td>
<td>Str, sampling</td>
</tr>
<tr>
<td>38. Richmond, W.</td>
<td>Tib Lake G-2660</td>
<td>Prospecting</td>
</tr>
<tr>
<td>40. Schoor, M.</td>
<td>Moss Township G-676 (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>41. Suni, L.</td>
<td>Gorham Township G-660 (base metals)</td>
<td>Str, DDH (1), GL</td>
</tr>
<tr>
<td>42. Teck Corporation</td>
<td>Haines Township G-662 (Au)</td>
<td>GL</td>
</tr>
<tr>
<td>43. Ternowesky, J., Belisle, O.</td>
<td>Burchell Lake G-706 (Au, Zn, Cu)</td>
<td>GL, VLF-EM, GM</td>
</tr>
<tr>
<td>44. Twomey, T.</td>
<td>Duckworth Township G-638 (Au)</td>
<td>Prospecting, sampling, DDH</td>
</tr>
<tr>
<td>45. Wicheruk, M. (Hill Lake occ.)</td>
<td>Hutchison Township G-571 (Au)</td>
<td>DDH (4), Tr, Str</td>
</tr>
<tr>
<td>46. Wing, A. (North gold occ.)</td>
<td>Saganagons Lake G-555 (Au)</td>
<td>DDH (3)</td>
</tr>
<tr>
<td>47. Wing Resources &amp; Wye Resources Inc.</td>
<td>Saganagons Lake G-555 (Au)</td>
<td>Pilot Mill at</td>
</tr>
<tr>
<td>49. Wye Resources Inc. (Beaver Pond gold occ.)</td>
<td>Saganagons Lake G-555 (Au)</td>
<td>DDH (3)</td>
</tr>
</tbody>
</table>
PROPERTY EXAMINATIONS

Fisher Lake Gold Occurrence, Moss Township (Akiko Gold Resources Ltd.)

During the fall of 1991 and 1992, Akiko Gold Resources Ltd. has been exploring 3 claim blocks in Moss Township.

HISTORY

These claims were staked on October 31, 1990, when the land came open for staking. The land was previously owned by the Province of Ontario, which, in turn, purchased it from Belore Mines Ltd. in 1976 under a joint Federal-Provincial program called the Agricultural Rehabilitation and Development Act. Depatenting (and opening for staking) of this land could only proceed after amendments to the Public Lands Act came into effect 4 years ago.

As a result of the staking on October 31, 1990, and as a result of negotiations and agreements with other parties involved in the staking, Gold Fields Canadian Mining Limited acquired 3 claim blocks containing a total of 44 claims.

In October 1991, Gold Fields Canadian Mining Limited optioned the claims to Akiko-Lori Gold Resources, which can earn a 50% interest in the property by spending $500,000 before October 15, 1995. In November 1991, Akiko-Lori Gold Resources Ltd. entered into a joint venture with Omega Gold Corporation. Each company could then earn up to a 25% interest in the property.

In October of 1991, this joint venture carried out prospecting, geological mapping, stripping and channel sampling on targets previously identified by Gold Fields Canadian Mining Limited. This includes the Fisher Lake gold occurrence from which values as high as 16 ounces Au per ton had been obtained by Gold Fields in 1990.

Grab samples from the Fisher Lake gold occurrence taken during the October 1991 program were as high as 42 ounces Au per ton.

In a September 14, 1992, press release, Akiko-Lori Gold Resources Ltd. and Omega Gold Corporation announced that Gold Giant Minerals Inc. have agreed to fund the 1992 diamond-drilling program and earn a 25% interest in the property. Two diamond-drill holes were drilled in early October 1992 to evaluate the Fisher Lake zone. Hole number ML-92-01 did not intercept the zone while hole number ML-92-02 intercepted the zone at a depth of 81 feet and encountered 16 feet grading 0.15 ounces Au per ton.

In a press release on November 4th, 1992, Akiko-Lori Gold Resources Ltd. and Omega Gold Corporation announced their amalgamation, the new company called Akiko Gold Resources Ltd.

LOCATION

The Fisher Lake gold occurrence is situated in the northwest corner of claim TB 1172363, 200 m west of Fisher Lake. The 50 m outcrop that was stripped in 1991, is immediately south of the Ardeen Mine access road. The western end of the outcrop is 8 m from the western boundary of the claim block.

GEOLOGY

The gold mineralization occurs as 2 distinct zones, the first striking at 85° terminates against the second zone which strikes at 43°. Both zones dip to the south at 70° (Figure 5.2). The east-striking zone consists of a shear zone, from 0.3 to 1.2 m in width, containing a quartz vein from 10 to 15 cm in width. The shear zone is silicified and contains ankerite as clots and stringers and 3 to 5% disseminated pyrite. The vein contains up to 20% pyrite and lesser amounts of galena and chalcopyrite. For most of its length, this shear zone separates iron formation to the north from chloritized (intermediate?) volcanics to the south. Where unsheared, this contact trends to the northeast, (the regional strike) and at the eastern end of the outcrop the shear is entirely within volcanic rock and at the west end it is entirely in iron formation, before being terminated against the northeast-trending shear.

The northeast-trending shear is 0.3 to 1.5 m in width, exposed for 15 m and consists of ankerite, chlorite and sericite. This shear contains a quartz vein 10 to 20 cm in width. The vein contains 10% pyrite, with galena and chalcopyrite. Taken over a strike length of 23 m, the east-striking shear has a calculated weighted average grade (uncut) of 0.613 ounces Au per ton over a width of 1.6 m. Three of the 14 channel samples averaged 0.89, 0.12 and 0.11 ounces Au per ton over 3.7 m. The average results from the northeast-trending shear were not as high, the 2 best being 0.36 and 0.64 ounces Au per ton over 0.9 m. All other channel samples on this zone were less than 0.05 ounces Au per ton. A 2.7 m channel sample, in the wall rock southeast of the the confluence of the 2 shear zones averaged 0.27 ounces Au per ton over 2.7 m.

In addition to the Fisher Lake occurrence, Akiko-Lori investigated 6 other new discoveries on their property. On the adjacent Ardeen mine property, M. Fogen has made numerous new discoveries and rediscoveries over the last couple of years. To the immediate south, E. Ranta made the following discovery.

E. Ranta, Moss Lake

Approximately 500 m south of the Fisher Lake discovery, prospector E. Ranta discovered a 0.3 m wide quartz vein exposed for 20 m. The vein contains pyrite, galena and sphalerite. Assays up to 3 ounces Au per ton have been procured. The east-northeast-striking vein was discovered on the south side of a regionally prominent shallow east-striking ravine. This ravine, which most likely represents a shear zone, can be traced easterly towards the the Moss Lake project, and westerly towards the Minolletti trenches. The host rock is fine-grained, feldspathic and intermediate to
Obadinaw Property, Elephant Lake

The Obadinaw property is located just west of the southwest corner of Moss Township at lat. 48°30', long. 90°55'. Access is via Canadian Pacific Forest Products access roads through Moss Township and the Tilly Creek areas. Claim map sheets that cover the area are the Tilly Lake sheet G-562 and the Powell Lake sheet G-549. The property is situated approximately 80 km west of Thunder Bay.

The property consists of 31 contiguous unpatented mining claims held 50% by E. Kukkee and 50% by R. Kwiatkowski. The primary claims are as follows: TB 1108351, TB 1120045-50, TB 1149212-15 and TB 1195677-78. A second group making up the balance of the 31 claims was staked subsequent to the first group.

The general geology of the area has been described by Harris (1970). Quetico-type metasedimentary rocks have been intruded by granodiorites and diorites. Quartz and quartz-epidote vein stockworks are associated with these dioritic intrusions as are zones of intense silica flooding. Chalcopyrite, molybdenite and gold mineralization is associated with the zones of quartz-vein stockworks and silification. Grab samples consistently average 0.34% Cu. An OPAP-financed drill program in the summer of 1992 intersected 6.1 m grading 0.021 ounces Au per ton, 0.28% Cu and 0.08% Mo. A silicified zone located 1.6 km west of the main occurrence yielded grab sample assays of over 1% Cu, 0.045 ounces Au per ton and 0.31% molybdenum.

Copper mineralization is widespread and occurs in silicified breccias, sheared volcanics and in quartz veins. The highest gold and molybdenum values occur in the silicified breccia zones.

Analysis of grab samples yielded gold values as high as 0.893 ounces Au per ton. Copper values in grab samples were as high as 14.4%.

North Gold Showing, Saganaga Lake

In the summer and fall of 1992, A.J. Wing carried out an exploration program on a property near Saganaga Lake in which Wye Resources holds a 60% interest and Curran Bay Resources Ltd. holds a 40% interest. The area of interest is 600 m northwest of the Powell gold occurrence, reported in Harris (1968).

HISTORY

Gold was first reported in the area in 1934 when a vein was discovered by the Powell brothers.

The property was apparently inactive until 1956, when the Consolidated Mining and Smelting Company of Canada...
Limited re-staked the ground, did more trenching and drilled 3 diamond-drill holes.

Mapping for the Ontario Department of Mines in 1965, F.R. Harris included a description of the Powell gold occurrence, and the reporting of 14 quartz veins, 1 of which carried 0.04 ounces Au per ton (Harris 1968). This may have been the occurrence that was later discovered by Curran Bay Resources Ltd. in 1984, east of a small lake locally referred to as the Minnow Pond. Curran Bay called this the West showing.

In 1971, airborne surveys were flown over the area for Dome Exploration, and for Addicks Canadian Properties Inc.

From 1983 to 1987, Curran Bay Resources Ltd. staked claims and carried out an exploration program consisting of line cutting geophysical surveys, geological mapping, outcrop stripping and diamond drilling.

Much of this work was focussed on the Powell gold occurrence, however, prospecting and mapping resulted in the discovery of 3 other gold occurrences, 600 m northwest of the Powell. These were called the West Beaver Pond showing, the East Beaver Pond showing and the North showing. Currently, Wye Resources refers to this area as the "Star Zone."

In February of 1987, Wye Resources entered into an option agreement with Curran Bay Resources Ltd. whereby, Wye could gain a 60% interest in the property by carrying out $400 000 of exploration work by December 1989. In 1987, the work consisted of stripping and trenching the Powell occurrence, stripping and channel sampling the East Beaver Pond showing, and channel sampling the West zone (Minnow Pond showing). Diamond drilling took place in 1988 and 1989 on the Powell occurrence.

In December 1991, Wye Resources carried out a diamond-drill program on the property. Three holes were drilled on the North showing. Hole 91-4 intersected 16.86 m grading 0.085 ounces Au per ton. This included the following intersections: 3.76 m grading 0.20 ounces Au per ton, 2.87 m grading 0.14 ounces Au per ton, and 1.7 m grading 0.11 ounces Au per ton.

The current drill program by A. Wing consisted of three 20.5 m holes on the North showing, which is also referred to as the "Star Zone" by Wye Resources. Hole 92-1 intersected 13.23 m grading 0.054 ounces Au per ton, hole 92-2 intersected 16.31 m grading 0.081 ounces Au per ton, and hole 92-3 intersected 16.76 m grading 0.043 ounces Au per ton. All these holes had shorter higher grade intersections.

**GEOLOGY**

The West Beaver Pond showing, East Beaver Pond showings, North showing and West showing are all hosted by an irregularly shaped gabbroic body. Only a portion of the eastern boundary of the intrusion has been mapped (along which occur the above gold occurrence), where it can be traced for 1 km in a north direction. Albitization and silicification is widespread in the sheared and brecciated portions of the gabbro. Feldspar-porphyry dikes intrude the gabbro.

At the North zone, the mineralization consists of numerous quartz veins striking at 45° and dipping 35° to 45° to the southeast in an area 20 by 40 metres. Brecciated areas have undergone quartz flooding, bleaching (albitization?) and pyritization. The East Beaver Pond zone is only 100 metres to the north. The mineralization is identical. The full extent and the connection between all the gold mineralization within this gabbro body has yet to be determined. The potential for large tonnage, low grade (0.05 ounces Au per ton) mineralization is high.

**THUNDER BAY DRILL CORE LIBRARY**

**Introduction**

The Thunder Bay Drill Core Library is 1 of 7 core libraries across Ontario operated by the Ministry of Northern Development and Mines. Collectively, they promote and support Ontario’s minerals industry by preserving drill core of economic, academic and historical importance.

In 1992, the Thunder Bay Drill Core Library was staffed by P. Sarvas (Drill Core Library Geologist), B. Nelson (Acting Assistant Drill Core Library Geologist) and L. Murray (Receptionist, January to March). Staff activities were supervised by M. Lavigne Jr., the Thunder Bay Resident Geologist.

The Thunder Bay Drill Core Library collects drill core from the Thunder Bay Mining Division, which encompasses 3 Resident Geologist districts: Thunder Bay, Beardmore-Geraldton and Schreiber-Hemlo (see also Figures 5.1, 6.1 and 7.1 this volume).

**Drill Core Inventory**

As of December 1992, there are 139662 m of drill core available for examinations at the Thunder Bay Drill Core Library.

This includes: 47185 m from the Thunder Bay Resident Geologist District; 36918 m from the Beardmore-Geraldton District; and 55559 m from the Schreiber-Hemlo District.

Most of the drill core stored at the Thunder Bay Drill Core Library is from metallic mineral exploration properties. A representation of drill core from industrial-mineral properties, dimension stone and building stone properties, and geotechnical projects is also available.

**Catalogues**

All of Ontario’s core libraries print and distribute a drill core library catalogue. This catalogue is an up-to-date tabular listing of drill core stored at that core library. Information (such as company, location, hole number, year of drilling,
Analysis of Drill Core
The analysis and sectioning of drill core stored at Ontario’s Drill Core Libraries — including geophysical measurement, assaying, whole rock analysis and thin sectioning — is allowed. Terms and conditions apply — please contact your nearest Resident Geologist or Drill Core Library staff for details.

Donation of Drill Core
All drill core libraries in Ontario accept donations of drill core and related materials. According to Ontario Mining Act Regulations 116/91, sections 16(9) and 16(10), relinquishment of drill core may make you eligible for assessment work credit.

If you wish to donate drill core for assessment work credit, certain conditions must be met — please consult the Mining Act (R.S.O., 1990, c. M.14) and Ontario Regulation 116/91.

For more information on donating drill core to Ontario’s drill core libraries, please contact your nearest Resident Geologist or Drill Core Library staff.

Remote Core Storage
In 1992, the Ontario Government announced the jobs Ontario Capital Initiative. Part of this program involved the establishment of remote core-storage at selected sites throughout Ontario. The purpose is to:

- increase the capacity of Ontario’s drill core libraries to store drill core
- provide a more convenient location for explorationists to deliver donated drill core
- provide work for local services and contractors through: construction of fenced-in one- to two-acre gravel pads; construction of steel drill core pallets; and, transportation and storage of drill core from the drill core libraries to the remote core storage sites.

In the Thunder Bay Mining Division, remote core-storage sites will be established near Kakabeka Falls, Beardmore and Marathon. In 1992, gravel pads were laid out at these 3 sites. In 1993, the sites will be fenced in and steel core-pallets will be constructed.

Core Collected in 1992
In 1992, 27601 m of drill core from 140 holes, representing 20 separate mineral exploration properties, was collected, catalogued and stored by Thunder Bay Drill Core Library staff (Table 5.2). The following are brief descriptions of some of these 20 properties.

CAN–FER MINES LTD. AND ALGOMA STEEL CORPORATION LIMITED, CAN–FER PROPERTY, SUNI TOWNSHIP
The large group of leased and patented mining claims is located in western Suni Township and eastern Oboshkegan Township, approximately 55 km north-northwest of Geraldton. From 1958 to 1960, Can–Fer Mines Ltd. (later merged to become Bralorne Resources Limited) conducted an exploration program consisting of geophysical and geological surveys, diamond drilling and bulk sampling. Exploration activity focussed on an iron deposit near the west shore of Jeffries Lake in central Suni Township (Amukun 1980).

The bedrock geology underlying this property consists of Archean intermediate to mafic metavolcanic rocks enveloping a narrow (1 to 2 km wide) east-trending band of felsic to intermediate metavolcanic rocks and iron formation. This band, consisting of metamorphosed pyroclastic rocks, feldspar porphyries, clastic sedimentary rocks, chert, jasper and iron formation, is locally referred to as the Central Onaman Iron Range. The iron formations are composed of: 1) alternating magnetite, hematite, siderite and chert with calcite; and 2) a magnetite-chert-amphibole schist (Amukun 1980).

The extensive drilling by both Can–Fer Mines Ltd. and Algoma Steel Corporation Limited targeted the iron potential of the Central Onaman Iron Range. Most of the drilling took place in 2 locations: just west of Jeffries Lake and approximately 1.5 km north of Indigo Lake. Most holes intersected clastic metasedimentary rocks and iron formation. Alteration is variable in width, distribution and intensity. Altered section variably display garnet, chlorite, sericite, quartz and sulphide mineralization. Disseminated sulphides consist mainly of pyrite and pyrrhotite but minor amounts of chalcopyrite and arsenopyrite are also present (assessment files, Resident Geologist’s office, Beardmore–Geraldton District, Thunder Bay).

Drill core was assayed for iron. Most holes intersected significant iron mineralization (greater than 20% soluble iron) over significant core lengths (greater than 30 m). No analyses other than soluble iron are recorded (assessment files, Resident Geologist’s office, Beardmore–Geraldton District, Thunder Bay).
Table 5.2. Drill core collected by Thunder Bay Drill Core Library staff during 1992.

<table>
<thead>
<tr>
<th>Company/Individual</th>
<th>Property/Location</th>
<th>Year Drilled</th>
<th>Number of holes</th>
<th>Core Stored (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Can–Fer Mines Limited</td>
<td>Pagwachuan Lake/ Laponen Lake</td>
<td>1959</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>6. Wilson, A.</td>
<td>Ashmore Tp.</td>
<td>1991</td>
<td>1</td>
<td>86</td>
</tr>
<tr>
<td>7. Michon, R.</td>
<td>Dello Lake/Cosgrave Lake</td>
<td>1990</td>
<td>2</td>
<td>117</td>
</tr>
<tr>
<td>11. Suni, L.</td>
<td>Gorham Tp.</td>
<td>1992</td>
<td>1</td>
<td>89</td>
</tr>
<tr>
<td>12. Bond Gold Canada Inc.</td>
<td>Hemlo West/Lecours Tp.</td>
<td>1989</td>
<td>5</td>
<td>482</td>
</tr>
<tr>
<td>15. Noranda Mines Ltd. (Geco Division)</td>
<td>Straight Lake/Loken Lake</td>
<td>1983</td>
<td>2</td>
<td>230</td>
</tr>
<tr>
<td>18. Noranda Mines Ltd. (Geco Division)</td>
<td>Deep Drilling Project/ Manitouwadge Lake</td>
<td>1981</td>
<td>7</td>
<td>8850</td>
</tr>
</tbody>
</table>
COLD SPRING GRANITE (CANADA) LTD., COLDWELL, McCOY AND O'NEILL TOWNSHIPS

The 3 properties (the Coldwell Red property, the Angler Black property and the O'Neill Black property) are located on the north shore of Lake Superior in the Marathon area. In 1989, Cold Spring Granite extracted and tested blocks of "granite". Tests included sawing, polishing, thermal finishing and physical property testing. The company also conducted a ground probing radar survey, and completed 44 short, vertical diamond-drill holes (Gerow and Bellinger 1990).

The properties are geologically situated within the Port Coldwell alkali complex. As per the tradition of dimension-stone producers, the rock are referred to as "granite" but are, in fact, different phases of syenite. Cold Spring Granite uses the names "Canadian Red granite" and "Canadian Black granite", referring to 2 differently coloured phases of the alkali syenite (Gerow and Bellinger 1990).

Cold Spring Granite's 44 drill holes tested the fracturing and colour of the syenites at all 3 deposits. All holes intersect medium- to fine-grained, equigranular syenite (assessment files, Resident Geologist's office, Schreiber-Hemlo District, Thunder Bay).

BOND GOLD CANADA INC., HEMLO WEST PROPERTY, LECOURS TOWNSHIP

Six holes, all drilled in 1989, were collected from this property which is located near the western boundary of Lecours Township, approximately 20 km east of Marathon and 20 km west of the Hemlo orebody.

The area is underlain by Archean supracrustal rocks of the Lower Heron Bay Sequence in the Schreiber-Hemlo greenstone belt of the Wawa Subprovince. The property geology is dominated by pillowed to massive mafic metavolcanic flows and metasedimentary rocks along with some pyroclastic felsic metavolcanic rocks and porphyritic granitic to monzonitic intrusives and associated felsic dikes (Muir 1982). Exploration on the property prior to Bond Gold Canada Inc. has revealed a geological environment favourable to gold mineralization (assessment files, Resident Geologist's office, Schreiber-Hemlo District, Thunder Bay).

All holes tested geophysical targets (IP, GM or combined IP-GM anomalies). The only significant assay result came from hole HW89-05 which ran 0.34 ounces Au per ton, 1.12 m from a quartz-feldspar porphyry intrusive in contact with mafic volcanic flow rocks (assessment files, Resident Geologist's office, Schreiber-Hemlo District, Thunder Bay). At the time of this report, the assay results for drill hole HW89-06 were not available.

ALGOMA STEEL CORPORATION LIMITED, GERALDTON PROPERTY, ERRINGTON TOWNSHIP

Nine holes, drilled between 1969 and 1975 by Algoma Steel Corporation, were collected from this property. The drill program was centered on a large island in Kenogamisis Lake (Little Long Lac) which is located approximately 3 km southwest of Geraldton and 1.5 km west of the past-producing Little Long Lac gold mine. Algoma Steel's efforts were concentrated on evaluating the Geraldton iron formation as a potential source of iron ore for its steel plant in Sault Ste. Marie.

The property is underlain by a sedimentary sequence containing greywacke, arkose (feldspar porphyry?) and banded iron-formation. Arkose, which is the host rock of the Little Long Lac gold mine, has been classified as a quartz arkose. The greywacke grades from coarsely bedded quartz wackes to finely laminated slates. Jasperitic oxide-facies banded iron-formation is frequently interbedded with greywacke (assessment files, Resident Geologist's office, Beardmore-Geraldton District, Thunder Bay).

Two prominent structures, the Barton Bay syncline and the Little Long Lac fault, trend in an easterly direction across the ground drilled by Algoma Steel. An interpreted major fold closure within the iron formation dominate a portion of the sediments and occurs just east of the Algoma Steel targets. A large Z-shaped fold on the north limb of the Barton Bay syncline is the structure controlling the ore bodies of the Little Long Lac gold mine (Pye 1951).

VENTEX ENERGY LIMITED, OLCOTT PROPERTY, MCCAUl TOWNSHIP

The majority of the holes collected from this project were from the Ollcott gold showing within mining claims TB 1051900 and TB 1004640 in McCaul Township located approximately 18 km east of Atikokan.

The Ollcott property is underlain by metavolcanic and gabbroic rocks of the Wabigoon Subprovince in the southern half and by the Marmion Lake batholith in the northern half (Schneider and Dutka 1985).

The target intersections consist of distinct alteration zones within a diorite host. These relatively thick alteration zones contain significant chlorite, tourmaline and grey bleached silicified sections along with local quartz-carbonate veinlets and thin veinlets composed of tan sericite and light-green chrome mica. Associated sulphides consist of pyrite and arsenopyrite. The most significant gold values came from the alteration zone intersected in drill hole V-6-88 which assayed 0.127 ounces Au per ton over 28.8 feet (assessment files, Resident Geologist's office, Thunder Bay District, Thunder Bay).
RECOMMENDATIONS FOR EXPLORATION

Amethyst

A small, amethyst vein-system plus some nice purple amethyst float was found in the Greenwich Lake area (lat. 48°48', long. 88°51'). This area meets the basic requirements of amethyst formation which are: 1) close to the Archean/Proterozoic unconformity, 2) fault zones, 3) sources of radioactivity, and 4) excess silica present in the rock systems.

Recent logging in the area east of Greenwich Lake has exposed a small vein system that should be investigated. Blocks of granitic float cut by amethyst veins were found in 2 separate areas and deserve to be followed up.

One float was located a few metres north of a beaver pond located east of the southern end of Greenwich Lake (Location A, Figure 5.3). The float was a boulder of hematized granite cut by amethystine veins. The float was approximately 0.27 m³ in volume; half was removed as a sample.

The other float was located on the north side of a bush road near the junction with a loop road. The float is just west of a small lake (Location B, Figure 5.3). The float consists of a pink medium-grained granitic boulder, 1 face of which is covered by good purple amethyst. Crystal size is in the order of 1 to 1.5 cm high. Nearby, in outcrop, a small amethystine quartz vein cutting pink granitic rocks is exposed near the road edge.

Lead-zinc veins at the Ogema Mine, located 13 km to the east of Greenwich Lake, also contain amethyst as does a vein system exposed near the north end of Furcate Lake (lat. 48°47', long. 88°46').

A new forest access road that connects Highway 527 and Greenwich Lake area should be prospected for amethyst. This is especially true of the area east of the McKenzie River,

![Figure 5.3. Amethyst float location, Greenwich Lake.](image-url)
where major regional faulting in granitic rocks would provide good potential for the development of amethyst-bearing structures such as at the Thunder Bay Amethyst Panorama Mine, only about 13 km to the east.

**Proterozoic Base Metals**

A groundwater study was conducted by Puumala (1992) for the Ontario Ministry of the Environment to assess potential uranium hazards in well-water in the Thunder Bay area. Base metal values ranging up to 4800 ppm Zn and up to 2100 ppm Cu were found in some water systems. The high values were obtained from water samples that came from wells in Proterozoic rocks known to be anomalous in base metals. Puumala’s report can be viewed at the Thunder Bay Resident Geologist’s office.

**CURRENT RESEARCH**

**Ontario Geological Survey**

The Ontario Geological Survey continued geological mapping in the Shebandowan belt west of the city of Thunder Bay. I. Osmani continued work in the western Shebandowan area between Burchell Lake (lat. 48°35', long. 90°38') and Upper Shebandowan Lake (lat. 48°37', long. 90°28'). B. Berger initiated a four-township project by completing mapping in Adrian and Marks townships. Aldina and Sackville townships are scheduled to be mapped in 1993. H. Brown started mapping Oliver and Ware townships completing Oliver Township in 1992; Ware is scheduled to be mapped in 1993.

Open File Maps of these projects are available for viewing at the Thunder Bay Resident Geologist’s office. A preliminary summary of these projects is outlined in *Summary of Field Work and Other Activities 1992* (Osmani et al. 1992; Brown 1992; Berger 1992).

**Lakehead University**

MSc theses currently completed and underway at Lakehead University include:

Current MSc Theses

T. Werner: Paleomagnetism of Quetico Subprovince Rocks

J. Selway: Ultramafic Intrusion in the Quetico Subprovince

J. Xiong: Geochemistry—Coldwell Complex

J. Young: Petrology and Geochemistry of the Gunflint Lapilli Tuff

B. Embeden: Gunflint Formation

B. Kowalski: Fluid Inclusion Studies

Recently Completed (May '92) MSc Theses

B. Seemayer: Variations in Metamorphic Grade in Metapelites in Transects Across the Quetico Subprovince North of Thunder Bay, Ontario.


A. MacTavish: The Geology, Petrology, Geochemistry, Sulphide and Platinum-Group Element Mineralization of the Quetico Intrusions, Northwestern Ontario.

**REFERENCES**


J.K. Mason\(^1\) and G.D. White\(^2\)

\(^1\)Resident Geologist, Thunder Bay, Field Services Section, Ontario Geological Survey—Information Services Branch.

\(^2\)Geologist, Thunder Bay, Field Services Section, Ontario Geological Survey—Information Services Branch.

INTRODUCTION

The Beardmore–Geraldton Resident Geologist’s office operates within the Thunder Bay Mining Division. The Beardmore–Geraldton District is outlined on Figures 6.1 and 6.2 and includes the communities of Beardmore, Jellicoe, Geraldton, Longlac, Nakina, Fort Hope, Lansdowne House, Summer Beaver and Webequie. Approximately 73 exploration programs were undertaken in the Beardmore–Geraldton Resident Geologist’s District by prospectors, junior companies and major companies in 1992.

The Ontario Prospectors Assistance Program (OPAP) funded 59 programs in the Beardmore–Geraldton District totalling $563,579 and representing 14% of the provincial total. The Ontario Mineral Incentive Program fund paid out $289,184 through 6 grants in the district.

Figure 6.1. Beardmore–Geraldton Resident Geologist’s District (south map) exploration activity — 1992 (keyed to Table 6.1).
Exploration programs accounted for 68% of exploration programs in the Beardmore-Geraldton area. Seventy-five percent of the 73 programs conducted by prospectors, junior companies and major companies were for gold. Twenty-one percent of exploration programs were for base metals.

Exploration and development remained suspended on the Brookbank gold deposit, Irwin Township. The Ontario Court of Appeals will decide in early 1993 on ownership of the 1.3 million ton gold deposit grading 0.25 ounce Au per ton (Canadian Mines Handbook 1992-1993, p.267). Metalore Resources Limited launched the appeal after Ontex Resources Ltd. were awarded the property in a 1990 Ontario Supreme Court decision. A potential 1991 option deal between Placer Dome Inc. and Ontex Resources Ltd. failed.

The Castlewood Metals and Exploration Ltd.-Goldbrook Explorations Ltd. Joint Venture undertook a major base metal exploration program in the Onaman River area for volcanogenic massive sulphide (VMS) mineralization. The property consists of 130 claims and is located 48 km northeast of Beardmore, Ontario. Following an integrated exploration program of airborne geophysical surveys, ground geophysics (magnetometer, very low frequency electromagnetic [VLF-EM] and horizontal loop electromagnetic [HLEM]), geologic and alternate mapping and thin sections and lithogeochemical studies, a volcanogenic massive sulphide (VMS) target 1200 m by 90 m was identified for 15 000 m of diamond drilling in 1993.

Challenger Minerals Ltd. entered into an agreement with Giant Gripp Mines Inc. in August, whereby Challenger has the right to earn a 100% interest in the Marshall Lake copper-zinc property by completing 12 000 m of diamond drilling over a 4 year period. The Marshall Lake property is composed of 90 leased and 20 additional mineral claims and is located 68 km northwest of Nakina. "Previous work has outlined geological reserves of 2.2 million tons of 1.2% copper, 4.2% zinc, 2.45 ounces silver per ton and 0.012 ounce gold per ton in the Main Zone..." (Challenger Minerals Ltd., press release, August 17, 1992).

KWG Resources Inc.-Home Fault Mines Limited under property management of Blue Falcon Mines Ltd. conducted a large drill program on the Blue Heron property. The property is located in the Lavoie Lake area 30 km north of Lansdowne House and consists of over 1000 claim units including affiliated company holdings. "A previous exploration program identified a mineralized zone having an average true width of 30.1 feet intermittently drilled to 500 vertical feet and containing a probable 14.6 million tons averaging 0.58% Cu and 0.37% Ni with intermittent anomalous values for gold, platinum, palladium and cobalt" (KWG Resources Inc., press release, April 21, 1992).

Asarco Exploration of Canada Ltd. entered into an agreement with Lac Minerals Ltd. to acquire 95 patented claims and 52 licences of occupation 3 km south of Geraldton. The property includes the former MacLeod-Cockshutt, Mosher-Longlac and Hard Rock gold mines. Past production from the mines during the period 1938–1970 exceeded 2 million ounces of gold.

The Pan-Empire Mill, Summers Township, held by Pan Continental Mining Limited and the Magnet Mine, Errington Township, held by Roxmark Mines Limited-Beaurox Mines Limited remained in a care and maintenance status.

Assessment work and claim summaries for the Thunder Bay Mining Division is given in Table 5.1 of Lavigne et al. (this volume). A summary of exploration programs undertaken in the Beardmore-Geraldton Resident Geologist's District is found in Table 6.1.

Resident Geologist's Staff Activities

Staff of the Beardmore-Geraldton Resident Geologist's District includes: J. Mason, Resident Geologist; G. White, Staff Geologist; C. Komar, Secretary; S. Warren, Secretary and Assessment File Clerk; A. White, Assessment File Clerk.

The Beardmore-Geraldton Resident Geologist's staff provided consultation and geological data to prospectors, mining company geologists, consultants and native groups.
<table>
<thead>
<tr>
<th>Company/Individual (Property Name)</th>
<th>Township/Area (Commodity)</th>
<th>Exploration Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Barino Construction Ltd.</td>
<td>Oakes Township (granite)</td>
<td>Str, Tr, bulk sampling</td>
</tr>
<tr>
<td>2. Beardmore Gold Stake</td>
<td>Legault Township (Au)</td>
<td>Str, Tr</td>
</tr>
<tr>
<td>3. Blue Falcon Mines Ltd.--KWG Resources Inc.--Home Fault Mines Ltd.--SEG Explorations (Blue Heron property)</td>
<td>Lavoie Lake (Cu, Ni, Co, Pt, Pd, Au)</td>
<td>DDH</td>
</tr>
<tr>
<td>4. Brinklow, L., Brinklow, W., Nivens, P.</td>
<td>Olie Lake (Au, graphite, minor Cu, Zn)</td>
<td>Str, Tr, GM, VLF–EM, HLEM</td>
</tr>
<tr>
<td>5. Brinklow, W.</td>
<td>Oakes &amp; Daley townships (Au)</td>
<td>Str, Tr, DDH</td>
</tr>
<tr>
<td>6. Callisto Minerals Inc.</td>
<td>Metcalfe Lake</td>
<td>GC, geophysics</td>
</tr>
<tr>
<td>7. Castlewood Metals and Explorations Ltd.–Goldbrook Explorations Joint Venture (Onaman River property)</td>
<td>Onaman Lake (Cu, Zn, Pb, Mo, Ag, Au, Bi)</td>
<td>GM, VLF–EM, HLEM, GL, GC</td>
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<tr>
<td>8. Cayuga Syndicate (O. Albert occurrence)</td>
<td>Caramat Lake (Cu)</td>
<td>GC, GM</td>
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<tr>
<td>10. F. Checkley and B. Nelson (Sturgeon Bridge occurrence)</td>
<td>Legault Township (Au)</td>
<td>Str, Tr</td>
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<tr>
<td>11. J.G. Clark and A. Eveleigh (Holland–Chellew occurrence)</td>
<td>Muriel Lake (Ag-Pb-Cu-Zn-Au)</td>
<td>Str, GM</td>
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<tr>
<td>12. R. Cote</td>
<td>Conglomerate Lake (Au)</td>
<td>Str, Tr, prospecting</td>
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<td>13. M. and B. Cowan (Crooked Green Creek Mine)</td>
<td>Pifher Township (Au)</td>
<td>DDH</td>
</tr>
<tr>
<td>14. N. Cox</td>
<td>McComber Township (Au)</td>
<td>Str, Tr, prospecting</td>
</tr>
<tr>
<td>15. N. Cox and M. Nelson (Paint Lake property)</td>
<td>Walters Township (Au)</td>
<td>Str, Tr, prospecting</td>
</tr>
<tr>
<td>16. A. Douglas (Shepherd occurrence)</td>
<td>Toronto Lake (Au, Cu, Pb, Zn)</td>
<td>Prospecting, Str, Tr</td>
</tr>
<tr>
<td>17. Founder Resources Inc. (McFarlane prospect)</td>
<td>Long Lake (Au)</td>
<td>Rehabilitation</td>
</tr>
<tr>
<td>18. Founder Resources Inc. (Blackwater Lake property)</td>
<td>Leduc Township (Au, Zn, Ag, Pb, Cu)</td>
<td>Str, Tr, GC, GM, HLEM, VLF–EM</td>
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<td>19. Founder Resources Inc. (Coral Lake property)</td>
<td>Leduc Township (Au, Ag)</td>
<td>VLF–EM, GM, DDH</td>
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<td>20. Founder Resources Inc. (Expansion Lake occurrence)</td>
<td>Leduc Township (Au)</td>
<td>Tr</td>
</tr>
<tr>
<td>21. Freewest Resources Inc. (O’Neil–Bat Lake occurrence)</td>
<td>Elmhirst Township (Au)</td>
<td>Str, Tr, GL, GC, prospecting</td>
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<tr>
<td>Company/Individual (Property Name)</td>
<td>Township/Area (Commodity)</td>
<td>Exploration Activity</td>
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<td>22. Freewest Resources Inc.</td>
<td>Summers Township (Au)</td>
<td>Str</td>
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<td>23. F. Gagnon</td>
<td>O'Sullivan Lake (Au, Ag, Cu)</td>
<td>Str, Tr, DDH, prospecting</td>
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<tr>
<td>24. W. Gagnon</td>
<td>O'Sullivan Lake (Au, Ag, Cu)</td>
<td>DDH</td>
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<td>25. D. Goodman</td>
<td>Summers Township (Au)</td>
<td>Str, Tr, prospecting</td>
</tr>
<tr>
<td>26. F. Goodman</td>
<td>Gripp Lake (Cu)</td>
<td>Tr, prospecting</td>
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<td>27. H.G. Goodman Jr.</td>
<td>Vivian Township (Au)</td>
<td>Prospecting, Str, Tr, GL, GC</td>
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<td>28. H.K. Goodman</td>
<td>Brennan Lake (Au)</td>
<td>Prospecting, Str, Tr</td>
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<tr>
<td>29. H. Greenland (Burrows Lake occurrence)</td>
<td>Burrows Lake (Mo)</td>
<td>Prospecting</td>
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<tr>
<td>30. T. Head</td>
<td>Fernow Township (Au, Cu)</td>
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<td>31. T. Head</td>
<td>Greta Lake (Au)</td>
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</tr>
<tr>
<td>32. H. Hein</td>
<td>Arrell Lake</td>
<td>Str</td>
</tr>
<tr>
<td>33. L. Holt, M. Holt and T. Auger</td>
<td>Leduc Township (Au)</td>
<td>Prospecting, line cutting</td>
</tr>
<tr>
<td>34. Homestake Canada Ltd. (Hol–Lac occurrence)</td>
<td>Ashmore Township (Au)</td>
<td>Str</td>
</tr>
<tr>
<td>35. F. Houghton</td>
<td>Elmhirst Township (Au)</td>
<td>Prospecting, GL</td>
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<td>36. F. Houghton (Foisey occurrence)</td>
<td>Rickaby Township (Au)</td>
<td>Prospecting</td>
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<td>37. Jibey Exploration Ltd.</td>
<td>Durer Lake</td>
<td>GEM, GM</td>
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<td>38. D. Kindla</td>
<td>McComber Township (Au)</td>
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<td>39. Lafontaine Minerals</td>
<td>Summers Township (Au)</td>
<td>Str, Tr, prospecting</td>
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<td>40. P. Lassila (Nordic Lake occurrence)</td>
<td>Irwin Township (Au)</td>
<td>Prospecting, GL, Str, Tr</td>
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<td>41. R. MacAdam</td>
<td>Summers Township (Au)</td>
<td>Str, prospecting</td>
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<td>42. N. Maki and A. Maki (Maki occurrences)</td>
<td>Vincent Township (Au)</td>
<td>Str, Tr</td>
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<td>43. McKinnon Prospecting</td>
<td>Klotz Lake (Au)</td>
<td>GL, geophysics, GC</td>
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<td>44. McKinnon Prospecting</td>
<td>Pagwachuan Lake (Au)</td>
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<td>45. J. McMahon (Colter Lake property)</td>
<td>Colter Township (Au)</td>
<td>Str, Tr, prospecting</td>
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<td>46. J. McMahon (Undersill property)</td>
<td>Summers Township (Au)</td>
<td>Str, Tr</td>
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<tr>
<td>47. R. Mehaffey</td>
<td>Marshall Lake (Cu)</td>
<td>Prospecting</td>
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<td>48. Mercier Limited Inc.</td>
<td>O'Sullivan Lake (Au, Cu, Ni)</td>
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<td>49. R. Michon</td>
<td>Humboldt Bay</td>
<td>Prospecting</td>
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<td>50. G. Milks (Royal Crown occurrence)</td>
<td>Gzowski Township (Zn, Cu, Au)</td>
<td>Str, Tr, prospecting</td>
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<td>51. Milner Consolidated Silver Mines Ltd.</td>
<td>Pagwachuan Lake (Au)</td>
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<tr>
<td>52. Milner Consolidated Silver Mines Ltd.</td>
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<td>DDH</td>
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<td>Company/Individual (Property Name)</td>
<td>Township/Area (Commodity)</td>
<td>Exploration Activity</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
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<td>53. W. Miron</td>
<td>Elmhirst Township (Au, Cu)</td>
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<tr>
<td>54. M. Nelson</td>
<td>Onaman Lake (Cu, Zn, Pb, Ag)</td>
<td>Str</td>
</tr>
<tr>
<td>55. Noranda Exploration Company Ltd. (Larson occurrence)</td>
<td>Rickaby Township (Au)</td>
<td>Prospecting, Str, Tr, GC</td>
</tr>
<tr>
<td>56. Noranda Exploration Company Ltd. (Colpitts Lake property)</td>
<td>Melchett Lake (Au, Cu, Zn)</td>
<td>Prospecting, GL, AEM, AM</td>
</tr>
<tr>
<td>57. Orient Resources Inc. (Kengate–Milestone prospect)</td>
<td>Elmhirst Township (Au)</td>
<td>GL, DDH</td>
</tr>
<tr>
<td>58. S. Parent</td>
<td>Kawitos Lake (Cu, Zn)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>59. J. Parres</td>
<td>Rickaby Township (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>60. C. Pettit</td>
<td>McComber Township (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>61. C. Pettit (Wenzoski occurrence)</td>
<td>Walters Township (Au)</td>
<td>DDH</td>
</tr>
<tr>
<td>62. Phelps Dodge Corp. of Canada Ltd.</td>
<td>Oboshkegan Township (Cu, Zn)</td>
<td>Prospecting, GL, GC, geophysics</td>
</tr>
<tr>
<td>63. Pichette Mining Exploration (Pichette occurrence)</td>
<td>Vincent Township (Au)</td>
<td>Str, Tr</td>
</tr>
<tr>
<td>64. Placer Dome Inc.</td>
<td>Kirby and Fulford townships (Au)</td>
<td>DDH, GL, prospeclting</td>
</tr>
<tr>
<td>65. B. Rainboth</td>
<td>Danford Township (Zn)</td>
<td>GC, prospeclting</td>
</tr>
<tr>
<td>66. J. Savage and L. Savage</td>
<td>Leduc Township (Au)</td>
<td>Str, Tr, prospecclting</td>
</tr>
<tr>
<td>67. A. Skalesky (Kondrat occurrence)</td>
<td>McComber Township (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>68. M. Smith</td>
<td>O'Sullivan Lake (Au)</td>
<td>GL, prospecclting</td>
</tr>
<tr>
<td>69. M. Swereda</td>
<td>Croll Township (Au)</td>
<td>DDH, Str, Tr, GL, prospecclting</td>
</tr>
<tr>
<td>70. M. Swereda</td>
<td>Klotz Lake (Au)</td>
<td>DDH</td>
</tr>
<tr>
<td>71. O. Theriault</td>
<td>Kirby Township (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>72. Trump Reserve Minerals Ltd.</td>
<td>Elbow Lake (Cu, Zn)</td>
<td>DDH</td>
</tr>
<tr>
<td>73. A. Wilson (Hollinger–Wilson occurrence)</td>
<td>Ashmore Township (Cu)</td>
<td>DDH</td>
</tr>
<tr>
<td>74. WNW Prospecting Syndicate (Loudon–McBurnie occurrence)</td>
<td>Fulford Township (Au)</td>
<td>Str, GL, GC</td>
</tr>
</tbody>
</table>

Property visits (Figure 6.3), field trips and mineral information talks were delivered.

Field offices in Beardmore and Geraldton were staffed for the months of May to October on a weekly, part-time basis. The Ministry of Northern Development and Mines office (Northern Development and Transportation Division) in Geraldton serves as the Geraldton field office and the Beardmore Municipal office hosts the Beardmore field office.

The Resident Geologist's Program handled 662 personal consultations and 382 phone inquiries in the Beardmore, Geraldton and Thunder Bay offices. Assessment file inquiries for the Thunder Bay Mining Division totalled 561 inquiries and 130 phone calls.

Twenty-eight property visits were undertaken and 2 field trips were conducted for industry personnel. A prospectors information session was held in Beardmore addressing the following topics: incentives, finance (syndicates), the Mining Act and industrial minerals.
EXPLANATION — PROPERTY VISITS — 1992

1. Bankfield Mine (Beaurox Mines Limited)
2. Big Mac zone (Castlewood Metals and Explorations Ltd.)
3. Blackwater River property (Founder Resources Inc.)
4. Colter Lake property (J. MacMahon, M. Rentz, L. Cox)
5. Fernow Township occurrence (T. Head)
6. Foisey occurrence (F. Houghton)
7. Gzowski Lake property (O. Sanfacon)
8. Headway-Coulee prospect (Castlewood Metals and Explorations Ltd.)
9. Houghton 801 occurrence (Freewest Resources Inc.)
10. Jellicoe Gold Mine (Placer Dome Inc.)
11. Kawitos Lake property (S. Parent)
12. Koch-Daniff occurrence (J. Parres)
13. Larson occurrence (F. Houghton)
14. Leitch Mine (Teck Corporation)
15. Lynx #2 prospect (Castlewood Metals and Explorations Ltd.)
16. MacLeod-Cockshutt Mine (Lac Minerals Ltd.)
17. Missing Link Extension occurrence (M. Nelson)
18. Nordic Lake occurrence (P. Lassila, F. Houghton)
19. O'Neil Creek (Bat Lake) occurrence (A. Douglas)
20. Pichette occurrence (G. Pichette)
21. Rickaby (Kenty-Douglas option) prospect (745714 Ontario Ltd.)
22. Royal Crown occurrence (G. Milks, C. Paul)
23. Savage West occurrence (J. & L. Savage)
24. Sollas Lake property (B. Mehaffey)
25. Swereda-Croll occurrence (M. Swereda)
26. Vivian Township property (H. Goodman Jr.)
27. Wenzoski occurrence (C. Pettit)
28. WNW Resources property (A. Willy)

Figure 6.3. Property visits, Beardmore-Geraldton Resident Geologist's District (south map).
The authors presented an exploration talk and poster display at the Northwestern Ontario Mines and Minerals Symposium in Thunder Bay. A poster was displayed at the provincial Mines and Minerals Symposium in Toronto.

The authors, in conjunction with the Greenstone Economic Development Corporation and the communities of Beardmore, Geraldton, Longlac and Nakina, hosted a booth at the Prospectors and Developers convention in Toronto.

Contributions were made to the Public Education Program through participation and displays in Thunder Bay (Mining Week and teacher professional activity days) and Winnipeg (Kekeenamawky Native Conference). Contributions on fabrication, manufacturing and recycling were made toward teacher’s kits for schools.

A remote diamond-drill core storage site under the Jobs Ontario Creation Program was identified in Beardmore, Ontario. Site preparation by contractor was completed by year-end. Phase 2 including fencing and steel pallet installation will take place in 1993.

Meetings were held in the First Nation reserves of Lansdowne House and Webequie on mineral potential, exploration and native concerns.

The Beardmore–Geraldton Historical Research Project, Open File Report 5823 authored by A. Speed and S. Craig was released.

A draft of an open file report entitled “Mineral Occurrences and Deposits of the Fort Hope Area” has been completed. Publication of the report is scheduled for 1993.

Staff attended the Canadian Mining and Metallurgy Mineral Deposits Symposium, Thunder Bay and Mine Rehabilitation Seminar, Thunder Bay.

**PROPERTY EXAMINATIONS**

**General Geology and Structure**

The geology of the Beardmore–Geraldton area, the east part of the Wabigoon Subprovince, has been divided into 2 belts: 1) the Beardmore–Geraldton Belt; and 2) the Onaman–Tashota metavolcanic belt. The belts are separated by the Paint Lake fault, a major dextral transcurrent fault.

The Beardmore–Geraldton Belt is situated within an east-trending, isoclinally folded, metavolcanic-metasedimentary sequence. Lithologic units have been transposed into a series of alternating slices or interleaves of metavolcanic and metasedimentary rocks within a wrench fault or megashear zone.

The Beardmore–Geraldton Belt has been subdivided lithologically into 1) the Southern metavolcanic subbelt and 2) the Southern metasedimentary subbelt.

The Onaman–Tashota metavolcanic belt is a felsic to mafic, calc-alkalic and tholeiitic metavolcanic sequence bounded to the south by the Paint Lake fault.


Subprovinces located north of the Wabigoon in order from south to north are as follows: 1) English River Subprovince, 2) Uchi Subprovince, 3) Berens River Subprovince and 4) Sachigo Subprovince (Thurston et al. 1991). The Uchi and Sachigo subprovinces are east-trending metavolcanic-metasedimentary belts, with associated granitic terrains.

The Uchi Subprovince and Sachigo Subprovince consist of linear to arcuate groups of mafic to felsic metavolcanic rocks and metasedimentary assemblages underlain by synvolcanic plutons, and intruded by younger felsic intrusions and large batholithic complexes. Age of the volcanic rocks range from 3.02 to 2.71 billion years (Thurston et al. 1991).

**Beardmore–Geraldton Belt**

**NORDIC LAKE OCCURRENCE**

The Nordic Lake occurrence is situated in south-central Irwin Township, 13.5 km northeast of Beardmore and 4 km south of the Brookbank gold deposit. The property is accessible by travelling Highway 11 to the Windigokan Lake Road and north for 4.6 km to a point south of Nordic Lake and at the east end of the claim group. A flagged bulldozer trail leads approximately 1 km west to the main gold occurrence. Under a 1992 Ontario Prospectors Assistant Program (OPAP) grant, property owners Pentti Lassila and Frank Houghton conducted detailed prospecting, mapping, stripping, trenching and sampling along a prominent gold-bearing deformation zone. All activities were centred on a 16-claim unit, TB 1194050.

The earliest recorded exploration work in the area, which included stripping and trenching, was done by Nordic Sturgeon Gold Mines, Limited and the Rayner–Tyson Syndicate in 1935 (Laird 1936). In the vicinity of the present day claims, Laird (1936) reports that "a prospect pit has been sunk on a band of what appears to be a brecciated cherty iron formation. The band at this point is 5 1/2 feet wide and exposed over a length of 60 feet. Both the fragments and matrix are heavily impregnated with very fine pyrite." In 1944, initial work was conducted on the Brookbank gold zone by Noranda Mines Limited 4 km north of the present day property. In 1984, M.F. Cowan completed a detailed geologic mapping and magnetometer survey centred around Nordic Lake and covering the extreme northeast part of the claim block (Cowan 1984). Wescap Energy Corporation conducted a combined airborne magnetic, electromagnetic and VLF-EM survey over most of the southern half of Irwin Township in 1985.
(Pitcher 1985). During the 1987 season, joint venture partner, to Wescape Energy Corporation) Coulson Exploration Inc. completed a geologic mapping program over a large 152-claim block known as the south Brookbank property (Lassila 1987). This again covered the southern part of the township. Extensive stripping and trenching were also initiated during this time, primarily concentrated in the eastern part of the Nordic Lake property (assessment files, Resident Geologist’s office, Beardmore–Geraldton District, Thunder Bay). It should be noted that the Nordic Lake occurrence (NLO) was not found during this or any previous period of exploration activity. Considering its (NLO) proximity to the Brookbank gold zone to the north and the concentrated exploration work conducted throughout Irwin Township, this would seem to demonstrate that numerous mineralized showings with economic potential are yet to be discovered.

Detailed geologic mapping of Irwin Township, as well as adjoining Sandra and Dorothea townships to the west, was completed by W.O. Mackasey of the Ontario Division of Mines in 1967 (Mackasey 1975). The Nordic Lake property lies entirely within mafic metavolcanic rocks of the west-central part of the main Beardmore–Geraldton Belt. More specifically, it is situated just north of the Watson Lake fault primarily within pillowed metavolcanic rocks. A shear horizon or deformation zone ranging from 100 to 150 m wide and striking 255° has been traced for at least 1000 m through the central part of the property. Outcrops and stripped bedrock “windows” of highly sheared pillow metavolcanic rocks define the zone. The deformation zone is abruptly terminated along the northern contact, where large, 1 to 1.5 m, well-formed, south-facing pillows were observed. The southern contact is less well defined due to limited bedrock exposure. Within and along the strike of the deformation zone, areas of prominent chlorite-sericite-carbonate alteration associated with quartz-filled tension fractures were noted. Some areas host stretched and deformed pillows exhibiting highly altered sericitized-silicified centres, which form knots roughly 10 cm in diameter. Crosscutting mafic and feldspar dikes, in addition to marker beds of cherty fine-banded metasedimentary rocks up to 0.5 m wide, were observed at several locations along the deformation zone.

Most of this year’s field work was concentrated at the western end of the deformation zone in an area known as the Glade Trench, which hosts the main Nordic Lake occurrence. The original showing was up to 1.5 m wide by 7.5 m long and has since been stripped for an additional 150 m to the west. This area is characterized by a quartz vein and stringer system hosted in sheared chlorite-sericite-rich mafic metavolcanic rocks, which contain from 2 to 5% very fine disseminated pyrite. It is from this altered pyritic wall rock that the highest gold assay values have been obtained. Further stripping at a point 200 m east along strike of the Glade Trench uncovered a second gold bearing zone (named the Road Vein) of similar size and character. Some ankerite, trace galena and minor purple-coloured fluorite were noted in outcrop at both occurrences.

Grab samples of altered pyritic mafic metavolcanic host rock collected by the property owners and the authors from both the Glade Trench and Road Vein assayed consistently up to 0.25 ounce Au per ton (the highest being 0.267 ounces Au per ton). Samples collected from the quartz vein and stringer horizons assayed up to 0.08 ounces Au per ton (Resident Geologist’s files, Beardmore–Geraldton District, Thunder Bay).

**WENZOSKI OCCURRENCE**

The main Wenzoski occurrence is located in southwest Walters Township approximately 370 m south of Nora Lake. The property consists of 2 contiguous leased claims (TB 302466 and TB 302709) held by D.C. Clark and an adjoining staked claim (TB 815446) held by prospector C. Pettit of Jellicoe. Access to the occurrence is via Highway 11 west from Jellicoe for 16 km and north on an old bush road for 3 km to a point just south of Nora Lake. To date, much of the work has focussed on claim TB 302466 at the main occurrence. During the 1992 season, prospecting, sampling, a detailed ground electromagnetic (EM) and magnetometer survey and 3 short diamond-drill holes totalling 61 m were completed. This was done under an Ontario Prospectors Assistance Program (OPAP) grant by C. Pettit.

Previous work consisted of stripping, trenching and sampling over the original showing by J. Wenzoski from 1963–1967. In 1972, R. Halverson drilled 9 short Winkle holes totalling 93.4 m before transferring the claim to D.C. Clark. The property was subsequently optioned by Conwest Exploration Co. Ltd., and in 1973, a 9 hole diamond-drill program was completed totalling 347.8 m. From 1975–1976, D.C. Clark drilled 6 additional short holes and performed extensive stripping and trenching, all centred on claim TB 302466 over the original occurrence. The property was brought to lease in 1980 and optioned to E & B Canady Limited of Alabama in 1981. Between 1982 and 1983, an extensive stripping program was done by the company, and a 16 ton bulk sample was extracted from the main occurrence. The sample was shipped to the Northern Concentrators Mill in Thunder Bay, where grades averaged from 0.2 to 0.3 ounces Au per ton.

Walters Township, including the Wenzoski occurrence, was geologically mapped in detail by W.O. Mackasey in 1968 (Mackasey 1976). This work indicates the property lies within a narrow band or wedge of mafic metavolcanic rocks located in the west-central part of the main east-trending Beardmore–Geraldton Belt. Thick sequences of metasedimentary rocks are in fault contact with the metavolcanic unit to the north and south. The main gold-bearing horizon ranges from 12 to 30 cm wide and is represented by a crack-seal, ribbon-banded to brecciated stockwork quartz vein system, with minor calcium carbonatization noted. Mackasey (1976) states that "although veining appears to be related to the same fracture system in the metavolcanics, exposure between test pits is not sufficient to determine if the quartz forms one continuous vein or several en échelon veins". The quartz vein unit strikes roughly 80° exhibiting a steep southerly dip and can be traced in old workings for approximately 200 m westward. The metavolcanic host rock in the immediate vicinity of the vein is described as a sheared,
grey- to buff-coloured, carbonate-altered, sericitic-rich unit. Wall rock mineralization consists of 7 to 10% coarse-grained disseminated, euhedral arsenopyrite primarily concentrated along vein boundaries and up to 5% disseminated pyrite throughout. Rare chalcopyrite was also observed in some samples.

It is important to note the existence of a medium- to coarse-grained quartz-feldspar porphyry dike(s) on the property exhibiting blue quartz phenocrysts. The dike, which is observed crosscutting the quartz vein unit in the main pit at a high angle, ranges from 3.0 to 4.5 m wide and can be traced roughly along the general trend of the vein for approximately 300 m (C. Pettit, Prospector, personal communication, 1992). The dike varies from pink to light green in colour and contains up to 1% very fine disseminated pyrite. Samples of the dike collected and analyzed by both the property operator (C. Pettit, Prospector, personal communication, 1992) and the Resident Geologist staff all returned anomalous values in gold ranging from 200 to 1000 ppb. These values combined with the width, extent and unusual character of the porphyry unit (compared to others observed by the authors in the region) make this a primary target for further detailed exploration.

In considering the main quartz vein unit, 1972 drilling by Conwest Exploration Company Limited yielded a 0.3 m (1 foot) section assaying 4.0 ounces Au per ton. Visible gold was also noted in samples from the main pit in 1972 (C. Pettit, Prospector, personal communication, 1992). Grab samples collected by the author during a 1992 visit to the property assayed as high as 0.411 ounces Au per ton from arsenopyrite-rich altered metavolcanic host rock adjacent to the vein (Resident Geologist’s files, Beardmore–Geraldton District, Thunder Bay).

Onaman–Tashota Metavolcanic Belt

O’NEIL CREEK (BAT LAKE) OCCURRENCE

The O’Neil Creek (Bat Lake) occurrence is located in east-central Elmhirst Township, approximately 15 km northwest of the town of Jellicoe. The property is road accessible by travelling 31.5 km northwest on the Kinghorn Road from Highway 11 to the O’Neil Creek Road and continuing southwest for 1.2 km to the occurrence. Detailed prospecting by A. Douglas of Thunder Bay under an Ontario Prospectors Assistance Program grant in 1991 uncovered a mineralized gold-bearing shear zone. The occurrence is located on claim TB 1157085, and in the spring of 1992, the entire property, which consists of 4 additional contiguous claims (TB 1157086, 1187989-90, 1195697) and a separate claim to the west (TB 1187998), was optioned to Freewest Resources Inc. Extensive stripping, trenching, detailed mapping and sampling were initiated by the company in the area of the original discovery (TB 1157085).

The general area surrounding the occurrence has seen limited exploration activity prior to 1980. In 1960, Ambassador Mining Development Ltd. completed a ground magnetometer survey, conducted detailed geologic mapping and diamond drilled 5 short holes (152 m) over a 12-claim block east of Elmhirst Lake (Smith 1960). Although not located, the drill holes lie close to the present day showing. From 1983–1988, the Elmhirst Lake Syndicate controlled a large number of claims in central Elmhirst Township. Detailed ground (VLF-EM, magnetometer and induced polarization [IP]) and airborne geophysical surveys, geologic mapping, extensive stripping and trenching and diamond drilling totalling 287 m in 3 holes were completed (Mayer and Pearson 1988; Goettler 1983; Baker 1984). In 1989, Primrose Gold Resources Inc. conducted an IP survey and drilled 5 holes totalling 759 m (Winter 1989) on a property centred over the southern part of Wilkinson Lake (east-central Elmhirst Township) (assessment files, Resident Geologist’s office, Beardmore–Geraldton District, Thunder Bay). The O’Neil Creek (Bat Lake) occurrence was not uncovered during this sustained period of relatively intense exploration, and the discovery of additional gold-bearing zones in the area is likely.

The property lies within the south-central part of the Onaman–Tashota metavolcanic belt. Detailed mapping of both Elmhirst Township and adjoining Rickaby Township was completed by Mackasey and Wallace of the Ontario Geological Survey in 1972 (Mackasey and Wallace 1978). This work places the O’Neil Creek property in an east-northeasterly striking band of intermediate to felsic metavolcanic rocks that pinches out just west of claim boundary TB 1187998. The metavolcanic rocks are terminated and bounded to the north and south by 2 granodioritic plutons, namely the Elmhirst Lake and Coyle Lake stocks. Most of the rocks in the vicinity of the showing are of pyroclastic origin. Outcrop exposures along what is known as the south (stripped) zone (claim TB 1157083) show the coarse-grained nature of these fragmental rocks. Subangular matrix-supported clasts range up to 10 cm in size and generally average 1 to 3 cm. The fragments show some reaction rim features and more important, contain from 10 to 15% fine-grained disseminations and patches of sulphide mineralization, primarily pyrrhotite with minor pyrite. The matrix contains less than 1% very fine-grained disseminated pyrite and rare chalcopyrite. It is important to highlight this area of the property (i.e., south zone), since although narrow shear zones have been sampled for their gold content, the base metal potential of the larger area is worth considering.

The north zone or main showing, where gold was originally discovered by prospector A. Douglas, is well-exposed in a 20 m long trench and a 10 by 22 m stripped area. Sampling to date has indicated that anomalous gold is associated with a series of quartz veins and stringers in narrow east-trending shear zones. The highest gold content (from samples assayed to date) is associated with the area of most intense shearing, which averages approximately 25 cm wide. The host rock can be described as a dark grey, siliceous, crowded feldspar porphyry tuff, with subhedral feldspars ranging from 1 to 4 mm in size. The shear related quartz stringers (± carbonate)
are associated with chlorite-sericite alteration, and the entire zone generally contains from 1 to 3% fine disseminated pyrite, minor pyrrhotite and rare chalcopyrite. Native copper mineralization was also noted in some samples. Quartz vein ing exposed along strike to the east of the main stripped area ranges up to 0.6 m wide. Siliceous feldspar porphyry dikes were seen also crosscutting the main shear horizon.

Detailed channel sampling across the north zone by Freewest Resources Inc. returned values up to 0.531 ounces Au per ton over narrow widths. The surrounding host rock also exhibits consistent anomalous gold values. Selected grab samples collected by the owner along the main shear horizon assayed as high as 2.114 ounces Au per ton. Limited sampling of the south coarse-grained pyroclastic zone gave values up to 0.09 ounces Au per ton (Resident Geologists' files, Beadmore-Geraldton District, Thunder Bay).

**ONAMAN RIVER PROPERTY**

The Onaman River property is located east of Onaman River and west of Onaman Lake 40 km north of Jellicoe, Ontario. The property is accessible by travelling Highway 11, 8 km east of Jellicoe to the Kinghorn Road and then 62 km north on the Kinghorn Road—Con Lake Road and Mine Road system. The exploration camp is located near the north end of MacDonald Lake. The Onaman River property consists of 130 claims covering 2134 ha held as a joint venture: Goldbrook Explorations Inc. (40%) and Castlewood Metals and Explorations Ltd. (60%). Goldbrook holds a 38% controlling interest in Castlewood. Work completed to date includes: airborne magnetometer and VLF-EM surveys (Dighem V), line cutting (280 km), HLEM survey (65 km), gravity survey (50 km), geologic mapping, prospecting, stripping, petrographic studies and whole rock lithogeochemical studies (Howard 1992; Bowdidge 1992).

Mineral exploration was first recorded on the property in 1916 at the Coulee No. 2 and No. 4 zones, in the northern part of the current claim block. Work in the area during the 1920s was for gold. In the 1930s, the Middleton Vein was discovered consisting of zinc-lead-silver mineralization. From 1949 to 1952, Headvue Mines Limited, Coulee Lead and Zinc Mines Limited, and Carndesson Mines Ltd. diamond drilled 189 holes totalling 49 500 feet. Zinc-lead-silver ± gold prospects are the target in what has now been mapped as the upper part of the mafic-volcanic sequence or in the base of the felsic sequence (Bowdidge 1992). The Headway Main Zone (geologic inventory of 250 000 tons grading 4.4% Zn and ± 1 ounce Ag per ton) and the Coulee No. 5 Zone (geologic inventory of 42 000 tons grading 1.16% Zn, 0.76% Pb, 5.83 ounces Ag per ton and 0.066 ounces Au per ton) were discovered (Bowdidge 1992).

Noranda Exploration conducted airborne and ground geophysical surveys, geologic mapping and diamond drilling in 1973 and 1974. Seventeen holes were drilled totalling 3500 feet. One of the drill holes intersected massive pyrite-pyrrhotite mineralization in what is now termed the "Big Mac" sulphide zone (Bowdidge 1992).

In 1974, N. Cox and D. Thorsteinson, Beadmore prospectors, discovered malachite-rich till immediately south of the Headway—Coulee claims and staked claims to cover the discovery. Lynx—Canada Explorations Ltd., Dejour Mines Ltd. and Canadian Reynolds Metals Ltd. optioned the claims and conducted ground geophysics and diamond drilling (17000 feet). Two subeconomic deposits were found including: 1) the No. 1 zone, estimated to contain 61 500 tons grading 4.19% Cu, 3.23 ounces Ag per ton; and 2) the No. 2 zone, estimated to contain 121 000 tons grading 2.03% Cu, 1.01 ounces Ag per ton and 0.029 ounces Au per ton (Bowdidge 1992).

S. Osterberg, a University of Minnesota-Duluth graduate student, completed a MSc thesis (Osterberg 1985) and journal article (Osterberg et al. 1987) both addressing the VMS alteration on the Headway—Coulee property and sparking Goldbrook's interest. Goldbrook Explorations Inc. acquired its first option in 1987, and Castlewood Metals and Explorations Ltd. was incorporated and financed in 1991. An integrated exploration program began in 1991 (Bowdidge 1992).

The Onaman River property is located in the Onaman—Tashota metavolcanic belt. The property is underlain predominantly by mafic metavolcanic rocks overlain by felsic metavolcanic rocks, which interfinger or grade into conglomerate to the south and west. Two granitic intrusions, the Onaman Lake batholith and the Jackson Lake Stock bound the narrow metavolcanic belt (Thurston 1980).

Mafic metavolcanic rocks are estimated to be 1200 m thick and consist of mafic pillowled magnesium tholeiites. Pillowed iron tholeiitic basalts, although less common, form a distinct 100 m thick unit. Five exhalite metasedimentary rocks, which interfinger and/or grade into conglomerate to the south and west. Two granitic intrusions, the Onaman Lake batholith and the Jackson Lake Stock bound the narrow metavolcanic belt (Thurston 1980).

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Felsic to intermediate metavolcanic rocks consist of lapilli tuff and tuff which are associated with the conglomerate and have been described by Bowdidge (1992).

The thickness of the felsic sequence decreases from about 500 metres in the MacDonald Lake area, which appears to be the centre of felsic volcanism, to less than 50 metres in the northern part of the property, where it apparently pinches out altogether. A study of whole-rock chemical analyses using immobile elements (still in progress), suggests that the felsic volcanics are mainly of tholeiitic affinity.
Figure 6.4. Onaman River property.
In the MacDonald Lake area, recent stripping has exposed vesicular felsic lavas, quartz-feldspar porphyry intrusives and possible coarse agglomerates as well as lapilli tuffs. Only minor volumes of felsic lava and porphyritic intrusive rocks are present in the thinner parts of the sequence to the north-east.

The conglomerates exposed at the south end of the property consist mainly of cobbles of granite and mafic volcanics with a minor amount of arkosic matrix. Clasts of quartz, felsic volcanics and chert-magnetite iron formation are also present. The range and proportion of clast lithologies suggests a source to the south-east, and implies a certain amount of uplift and subaerial erosion following the deposition of the Castlewood Lake and Onaman River volcanics.

Within the sequence of felsic tuffs, there are one or more horizons of conglomerate material, referred to as "diamictite" by Osterberg. These differ from the conglomerate in that the abundance, and particularly the variety of volcanic clasts are greater. The precise mechanism by which these rocks were deposited is not known, but it is clear that they represent influxes of sedimentary material into an area otherwise dominated by volcanism.

It appears that, during the time interval between the deposition of the Onaman River and Conglomerate Lake mafic volcanic sequences, the area of the property was a shallow sea with land to the south-east. Fluvial conglomerates were being deposited into the edge of the sea at the same time as a felsic volcano centred at MacDonald Lake was active, and there was some mixing as well as interfingering of volcanic and sedimentary material.

Castlewood Metals and Explorations Ltd. have mapped VMS hydrothermal alteration over a strike length of 8 km and through a stratigraphic thickness of up to 1 km (Figure 6.4). Felsic metavolcanic rocks exhibit alteration. The only altered mafic rocks are found in the upper part of the mafic sequence in the south (Bowdidge 1992).

Osterberg (1985) described 5 zones of alteration:

1. unaltered rocks: albite + actinolite + chlorite + epidote
2. calcite zone: calcite + quartz + chlorite + epidote ± sericite
3. sericite zone: sericite + quartz ± chlorite ± calcite ± epidote
4. iron chloride zone: iron-chlorite + ankerite ± quartz ± sericite
5. chloritoid zone: chloritoid + iron-chlorite ± ankerite ± sericite
6. kyanite zone: kyanite + quartz ± andalusite

Intense chlorite and chloritoid alteration (greater than 50%; chloritoid zone) increases in the MacDonald Lake area near the "Big Mac" sulphide zone. Black chlorite was noted in a series of anastomosing stringers forming a zone 70 m wide, cutting vesicular, sericitized felsic metavolcanic rocks 75 m east of the "Big Mac" sulphide zone on the footwall side, analogous to the Mobrun Mine and Ansil Mine footwall alteration. The calcite and sericite zones are elevated in CO₂ and depleted in sodium. The iron chloride and chloritoid zones are enriched in iron and magnesium and depleted in sodium. The kyanite zone is depleted in all elements excluding silica, alumina and titanium Bowdidge (1992) postulated the following hydrothermal system:

The alteration system defined on the Onaman River property is consistent with circulation of hydrothermal fluids at an angle through rocks in a shallow-water marine environment. Partial boiling of the fluid at shallow depths would result in the separation of the water into vapour-enriched and vapour-depleted streams, discharging in different areas. Most of the acidic components (principally SO₂) would be partitioned in the vapour phase, which would condense when it was discharged into cold sea water. Recharge of this acidic water would cause intense acid leaching in the immediate recharge area (kyanite zone), and generate acidic fluids throughout the upper part of the hydrothermal system. Acidic fluids are required to cause the breakdown of sericite to give kaolinite or pyrophyllite, which are the source of the "peraluminous" mineralogy. Chloritoid is assumed to be the result of metamorphic reaction between chlorite and either pyrophyllite or kaolinite, while kyanite is assumed to be derived from pyrophyllite or kaolinite in the absence of iron-bearing minerals.

Most mineralization on the property consists of: 1) stratabound zinc-rich mineralization and 2) stratabound or crosscutting copper mineralization.

The Big Mac Zone, a massive sulphide zone, is located in the thickest and most intensely altered part of the felsic metavolcanic rocks. The zone is southeast of MacDonald Lake and is represented by a series of strong EM and magnetic anomalies 15 000 m long by 60 m wide. In 1972, Noranda drill intercepted 25 m of massive pyrite-pyrrhotite at one end of the anomaly.

Goldbrook Explorations Inc. plan to diamond drill up to 1500 m within the MacDonald Lake area. The thickest and most altered part of the felsic sequence has the potential to host VMS mineralization, a part of the Big Mac Zone.

Sachigo Subprovince

BLUE HERON (LANSDOWNE HOUSE) PROJECT

The Blue Heron (Lansdowne House) Project area is located 30 km north of Lansdowne House at Lavoie and Springer lakes (long. 87°36'W and lat. 52°31'N). The property is accessible by float plane from Pickle Lake or Nakina or may be reached by winter road. In January 1992, Blue Falcon Mines Ltd. held a 100% interest in 6 claim blocks in 2 groups totalling 1536 ha. In March, Horne Fault Mines Ltd. and
KWG Resources Inc. entered into option agreements with Blue Falcon Mines Ltd. KWG can earn a 60% interest in 96 claim units by spending $3 million on exploration over 3 years. Twenty diamond-drill holes totalling 3241 m were completed in 1992. Ground magnetometer and VLF-EM and MaxMin electromagnetic surveys were undertaken during 1992.

The first documented mineral occurrence was made by a native trapper who brought a J.E. Rowlandson to Copper Point, Rowlandson Lake. Copper and nickel mineralization was noted in place on a small peninsula. Rowlandson immediately staked the occurrence and conducted sampling, trenching and drilling. The claims were restaked in 1936, and a gold occurrence was discovered that same year. Lansdowne Minerals Ltd. and Winisk River Mines Ltd. were formed to trench and diamond drill the property. Results lead to a staking rush and copper-nickel discoveries in the Bartman Lake, Rowell Lake, Springer Lake and Lavoie Lake areas. Rowlandson’s Syndicate had discovered the major occurrence of this new metavolcanic belt at Springer–Lavoie lakes in 1938. By 1940, $450,000 had been spent on the property.

In the late 1950s, Aberdeen Mines Ltd., Pickle Patricia Mines Ltd. and Temagami Mining Co. Ltd. undertook geophysics and diamond drilling totalling 1386 m in an area north of Lavoie Lake and south of Bartman Lake. In 1957, La Corne Lithium Ltd. completed magnetic and electromagnetic surveys at Rowlandson, Bartman and Lavoie lakes (Novak 1992).

Canadian Nickel Co. Ltd., in 1970, conducted an airborne geophysical survey and staked a large group of claims. Line cutting, HLEM surveys, VLF–EM surveys, magnetic surveys and diamond drilling followed. By 1974, 47 drill holes totalling 5839 m were completed. Three main copper-nickel zones were drill intercepted, but market conditions and metal prices lead to claims being dropped by 1981 (Novak 1992).

Forester Resources Inc. (1983) staked over 600 claims in the Lavoie Lake–Rowlandson Lake area. Airborne geophysics, reconnaissance geologic mapping, trenching, sampling, diamond drilling and additional claim staking followed in 1984 bringing the land position to 1780 claims. Backhoe trenching, IP and diamond drilling continued until 1986. Copper, nickel and gold mineralization were discovered (Novak 1992). Weaco Resources Ltd. conducted line cutting, magnetic surveys, electromagnetic surveys, ground electromagnetic (GEM) surveys and diamond drilling on a small claim group.

Blue Falcon Mines Ltd. undertook claim staking and airborne geophysics (magnetic gradient) in 1991.

The Blue Heron Project is situated in the Sachigo Subprovince, an arculate group of mafic to felsic metavolcanic rocks and metasedimentary assemblages underlain by synvolcanic plutons and intruded by younger felsic intrusions and larger batholithic complexes. The southeastern part of the Sachigo Subprovince consists of mafic metavolcanic rocks, migmatized metasedimentary rocks and metavolcanic gneisses. Felsic plutons (trondhjemite to quartz monzonite) form the large batholiths. Quartz diorite, diorite, gabbro and anorthositic gabbro have intruded the metavolcanic rocks (Novak 1992).

The eastern part of the metavolcanic belt is composed of mafic to intermediate tuffaceous pyroclastic units and pillow metavolcanic rocks striking between 98° and 105° and dipping north at 85°. Mafic intrusive rocks have been interpreted from geophysics at Springer Lake and Lavoie Lake which are present in flow rocks and tuffs containing numerous sulphide lenses. Layered anorthosite is present as a large complex in the Brazeau–Rowell lakes area. A siliceous tuff, mineralized with pyrite and chert was noted in central Rowlandson Lake (Novak 1988).

The property geology is specifically composed of anorthositic gabbro, in places layered, intruding intermediate metavolcanic rocks.

Fifty-three 6 channel INPUT anomalies were noted from the 1984 Questor survey (Novak 1992). Canadian Nickel’s diamond drilling (1970–1974) outlined copper-nickel mineralization within layered anorthositic gabbro, specifically the Bartman–Lavoie lakes layered complex. The potential for chrome, platinum group element (PGE) and gold mineralization is present within this intrusion, as well as 3 additional intrusions, interpreted from airborne geophysics.

Sulphide mineralization was intercepted in 18 of 20 diamond-drill holes completed in zones A (M–12) and C and D (L–11) in 1992, which represent major geophysical anomalies at Lavoie and Springer lakes. The geophysical anomalies extend 3 km in length and merge in a “wishbone”-shaped structure (Novak 1992).

R. Chataway, Project Geologist, KWG Resources Inc. described the C and D zones (Chataway 1992):

The C-D grid is on the west side of Lavoie Lake and is oriented along an east-west base line. Magnetic and VLF–EM survey coverage is complete while MaxMin 11 coverage was more selective.

The C-ZONE, (along BL 36 N), is underlain by a sequence from north to south of gabbro, basalt, mafic sediments/volcanics and felsic sediments/volcanics. Geophysical surveys indicate a wide EM conductor with an associated moderate strength to weak magnetic anomaly.

The 1992 drill campaign included 3 holes (92–C–1, 2 and 3) which intercepted continuous sulphide mineralization across the sections. However, the intersections of economic interest are in the gabbroic lithologies which correspond to the northern part of the geophysical conductor. Centered over the baseline is the C - West Zone which is 85-160 feet wide averaging 0.14% to 0.234% Cu and 0.065% Ni and the C - central Zone (L 126 + 20 W) averaging 0.28% Cu and 0.06% Ni over 122 feet.
Table 6.2. Assay values for the Blue Heron (Lansdowne House) project.

<table>
<thead>
<tr>
<th>Hole No.</th>
<th>Target</th>
<th>Width (m)</th>
<th>Cu (%)</th>
<th>Ni (%)</th>
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<tr>
<td>92A3</td>
<td>A</td>
<td>30.6</td>
<td>0.269</td>
<td>0.198</td>
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<tr>
<td></td>
<td></td>
<td>6.3</td>
<td>0.46</td>
<td>0.54</td>
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<tr>
<td>92A4</td>
<td>A</td>
<td>28.5</td>
<td>0.323</td>
<td>0.172</td>
</tr>
<tr>
<td>92C1</td>
<td>C</td>
<td>45.2</td>
<td>0.269</td>
<td>0.198</td>
</tr>
<tr>
<td>92D2</td>
<td>D</td>
<td>30.6</td>
<td>0.398</td>
<td>0.115</td>
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<tr>
<td></td>
<td></td>
<td>(of which 11.1)</td>
<td>1.05</td>
<td>0.161</td>
</tr>
<tr>
<td>92D3D (North)</td>
<td></td>
<td>21.5</td>
<td>0.387</td>
<td>0.118</td>
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<tr>
<td></td>
<td></td>
<td>94.1</td>
<td>0.204</td>
<td>0.049</td>
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</table>

(KWG Resources Inc., press release, May 25, 1992.)

The mafic and felsic units are cut by numerous copper-rich fractures oriented near-parallel to the core axis. As such, their frequency is not known; it would be necessary to drill north-bearing holes to best document and calculate their economic importance.

The D-Zone is a large area of sulphide (copper-nickel) mineralization which remains open in all directions.

This is based upon recently completed drilling and on previous (Inco) drill information. Seven holes tested a promising section of the geophysical conductor, with some holes being collared in mineralization due to the deep overburden, approximately 70 feet thick, and others stopped in low grade mineralization.

The area is underlain by gabbro and gabbro-diorite lithologies with minor basalts (to the south) and interbands of mafic sediments (?).

Previously known mineralization has been confirmed, as well as the vertical extension of mineralization to below 150 m. Assay results from selected diamond-drill holes are shown in Table 6.2.

Further drilling is recommended in 1993 on zones C and D, located west of Lavoie Lake.

Geological reserves stand at 14.6 million tons averaging 0.58% Cu and 0.37% Ni in the L–11 (zones C, D) and M–12 (zone A) anomalies (Novak 1992).

For further information on copper mineralization the reader is referred to Schnieders et al. (this volume) regarding the Rockbound Lake copper occurrence.

**RECOMMENDATIONS FOR EXPLORATION**

**Base Metals and Gold**

The Toronto–Crescent lakes area is recommended for magmatic copper-nickel-cobalt-platinum-palladium mineralization. Numerous mafic intrusions have been identified from geologic mapping. One anorhostic gabbro sill (Ketchikan Lake to Toronto Lake) was found to be hosting copper-nickel mineralization in the 1960s. Sublayer contacts with mafic metavolcanic rocks and footwall rocks should also be examined as potentially hosting elevated copper mineralization.

Felsic metavolcanic terrains in the Onaman–Tashota metavolcanic belt should be re-examined for volcanicogenic massive sulphides (VMS) including the following areas: Marshall–Toronto lakes, Metcalfe–Oboshkegan lakes, Melchett–Colpitts lakes and Elmhirst–Rickaby–Lapierre townships. Stratigraphy should be carefully mapped with any interflow marker horizons identified, and the rocks should be prospected out for sulphides. Units immediately above and below interflow metasedimentary units may host VMS alteration and mineralization. Tectonic setting with the felsic metavolcanic rocks should be understood, and conjugate fault sets should be explored for and examined. Felsic intrusions should be re-examined to determine if they are subvolcanic (hypabyssal intrusions). Berger (1992) identified the Summit Lake batholith as a subvolcanic intrusion and likely source of magma for the intermediate to felsic metavolcanic rocks in the Toronto–Marshall lakes area.

A re-evaluation of the OGS–Aerodat airborne geophysical survey is recommended for potential VMS targets (OGS 1989).

Exploration in 1992 has included diamond drilling the eastern extensions of the Paint Lake fault in the Wildgoose Lake area for gold deposits. The fault has been intersected in areas of extensive overburden, but little mineralization has been encountered to date. Further detailed prospecting for gold is recommended between Geraldton and the Kinghorn Road on the Paint Lake fault and subsidiary faults and/or lineaments.

Gabbro and porphyry intrusions should be prospected for in fault zone and/or lineament environments. Gold mineralization can be associated with pyrite and/arsenopyrite. Sulphide minerals are disseminated or occur with quartz carbonate veining and/or stockworks within the intrusions or at contacts with metasedimentary and metavolcanic rocks.

Diabase sheets of the Lake Nipigon basin should be prospected for younger mafic to ultramafic intrusions, which postdate Lake Superior Rift volcanism (Nipigon basin failed arm), that may have concentrated nickel sulphide mineralization (Noril’sk model).

**Industrial Minerals**

The Quetico Subprovince should be prospected for graphite. A new graphite occurrence was located by W. Brinklow north of Manitouwadge in 1992 (see Hinz and Lucas, this volume).

The potential for dimension stone exists in younger felsic intrusions in the Beardmore–Geraldton area. Follow up is warranted, but transportation costs may suggest exploration should be focussed south of the CNR main line.

118
Large barren quartz veins can be attractive targets for pure silica (greater than 97% SiO₂). A number of North American silica users are looking at northern Ontario as a potential supplier.

Porphyritic diabase dikes in the Beardmore–Jellicoe area should be reinvestigated as a source for specialty tile material. The stone is unique and would be highly sought after if found as massive, unfractured wide dikes (30 m).

ACKNOWLEDGMENTS

G. White wrote a large section of the report. S. Warren (Secretary) typed the report. K. Fenwick (Manager, Information Services Branch, Northwest Ontario) edited the manuscript. Prospectors and company personnel are thanked for their contribution.

SELECTED PUBLICATIONS RECEIVED


REFERENCES


7. Schreiber–Hemlo Resident Geologist's District—1992

B.R. Schnieders1, M.C. Smyk2 and D.B. McKay3
1Resident Geologist, Thunder Bay, Field Services Section, Ontario Geological Survey—Information Services Branch
2Geologist, Thunder Bay, Field Services Section, Ontario Geological Survey—Information Services Branch
3Manitouwadge Mineral Resource Geologist, Thunder Bay, Field Services Section, Ontario Geological Survey—Information Services Branch

INTRODUCTION

The Schreiber–Hemlo District covers an area from the Nipigon River east to White River, and from the US–Canada border north to Upper Rosyln Lake and Kagiano Lake (Figure 7.1). The area includes the communities of Rossport, Schreiber, Terrace Bay, Marathon, Heron Bay and Manitouwadge, as well as Pic Heron Reserve #50, Pic Mober Reserve #82, Pays Plat Reserve #51 and Lake Helen Reserve #53A. The district is adjacent to the communities of Nipigon and White River. There are presently 5 producing mines in the district, which hosts the Schreiber–Winston Lake, Hemlo and Manitouwadge mining camps. The David Bell Mine of Teck–Corona Operating Corporation, Golden Giant Mine of Hemlo Gold Mines Inc. and Williams Mine of Williams Operating Corporation are the gold mines at Hemlo. The base metals mines include the Noranda Inc., Geco Division mine in Manitouwadge, and the Minnova Inc., Winston Lake Division mine located northwest of Schreiber.

Gold production from the Hemlo camp was again spectacular in 1992. Mining highlights include the production of 1,158,444 ounces of gold from the 3 Hemlo mines. The Hemlo gold mines were among the top gold producers in Canada in 1992, as well as being some of the lowest cost gold producers in the world. The Golden Giant Mine, Hemlo Gold Mines Inc. production cost per ounce was $139.68 in 1992 (B. Kusins, Golden Giant Mine, personal communication, 1993). In 1991 and again in 1992, the Williams Mine was Canada's top gold producer, producing 496,920 ounces of gold in 1992 (J. Gray, personal communication, Williams Mine, 1993). The David Bell Mine was again one of Canada's largest and highest grade-producing gold mines, producing at a grade of 0.47 ounces Au per tonne (P. Desautels, David Bell Mine, personal communication, 1993). In July, Homestake Mining Co. acquired a major stake in the David Bell and Williams mines, after completing a US$400 million merger with International Corona Corp. (The Financial Post, November 28, 1992, p.17).

The Geco Division of Noranda Inc. continued into its thirty-sixth year of continuous base metal production, while the Winston Lake Division of Minnova Inc. continued into its fifth consecutive year of base metal production. Metallgesellschaft AG of Germany, through its 57%-owned Toronto subsidiary, Metall Mining Corp., secured a 50.4% stake in Minnova Inc. (The Financial Post, November 28, 1992, p.17).

Exploration activity in the Schreiber–Hemlo District decreased once again in 1992. The total number of active exploration programs in 1992 was 51, down from the 1991 figure of 59 (Figure 7.2; Tables 7.1, and 7.2). In 1992, there were 26 exploration programs carried out by prospectors and 24 exploration programs carried out by major companies. This leaves just 1 program carried out or joint-ventured by junior mining companies, reflecting one of the problems facing the mining and exploration industry today. In addition, the Noranda Group (including Geco Division, Noranda Inc., Hemlo Gold Mines Inc. and Noranda Exploration Company Ltd.) remained active with 12 exploration programs in the Schreiber–Hemlo District—50% of the exploration programs by major companies. Geco Division (Noranda Inc.) and Noranda Exploration Company Ltd. remained active in the Manitouwadge area, committed to exploring for new and additional reserves. Present reserves at Geco Division give the mine a life expectancy of between 2 and 4 years, depending on economic parameters.

Minnova Inc. conducted a deep diamond-drilling program on its Pick Lake deposit, located 1.5 km southwest of the Winston Lake headframe. Published geologic reserves are listed at 1.6 million t at a grade of 1.1% Cu and 17.7% Zn in the upper and lower zones (The Northern Miner, November 18, 1991, p.3). The narrow high-grade massive sulphide deposit is presently undergoing economic evaluation.

Approximately 1100 inquiries from the exploration and mining sector as well as the general public were dealt with by the Schreiber—Hemlo program at the Thunder Bay office, at the Marathon field office and in the field. This number represents an approximate 10% drop from 1991, again reflecting the present recession in the exploration and mining industry. Program staff conducted 48 property visits and 10 field trips in 1992. The Ontario Prospectors Assistance Program (OPAP) designated $166,925 to 18 applicants working in the Schreiber–Hemlo District. The Ontario Mineral Incentive Program (OMIP) designated $87,793 towards 2 exploration programs. Several new occurrences were discovered by prospectors in 1992 including: 1) the Shuman—Fowler zinc occurrences in the Spruce Bay area of White Lake; 2) soil samples anomalous in zinc in the Fire Mountain—Prairie River area, discovered by J. Courtney and G. Daniels; 3) vein # 5 on the Schreiber—Pyramid property, rediscovered by T. Twomey; and 4) several new amethyst veins in the Quoits Lake–Kabamichigama Lake area, discovered by the Vos family of Nipigon. In addition, R. Reukl and R. Michon, of...
Table 7.1. Exploration activity in the Schreiber-Hemlo Resident Geologist’s District (expressed as percentage of programs).

<table>
<thead>
<tr>
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<tr>
<td>Gold and/or Silver (Au,Ag)</td>
<td>70%</td>
<td>61%</td>
<td>45%</td>
<td>55%</td>
<td>47%</td>
<td>45%</td>
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<tr>
<td>Base Metals (Cu, Zn, Ag)</td>
<td>14%</td>
<td>18%</td>
<td>34%</td>
<td>35%</td>
<td>38%</td>
<td>45%</td>
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<tr>
<td>Platinum Group Elements (PGE, Cu, Ni)</td>
<td>14%</td>
<td>9%</td>
<td>3%</td>
<td>3%</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Industrial Minerals (including dimension stone, amethyst)</td>
<td>2%</td>
<td>12%</td>
<td>18%</td>
<td>7%</td>
<td>10%</td>
<td>6%</td>
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Total Number of Active: 51 60 56 75 59 51

Table 7.2. Exploration activities in the Schreiber-Hemlo Resident Geologist’s District (keyed to Figure 7.2).

Abbreviations

<table>
<thead>
<tr>
<th>Abbreviations</th>
<th>Description</th>
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<tbody>
<tr>
<td>AEM</td>
<td>Airborne Electromagnetic Survey</td>
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<tr>
<td>AM</td>
<td>Airborne Magnetic Survey</td>
</tr>
<tr>
<td>ARA</td>
<td>Airborne Radiometric Survey</td>
</tr>
<tr>
<td>DDH</td>
<td>Diamond Drill Hole(s)</td>
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<tr>
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<td>Ground Electromagnetic Survey</td>
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<td>Ground Geochemical Survey</td>
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<td>GL</td>
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<td>VLEM</td>
<td>Vertical Loop Electromagnetic Survey</td>
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<td>VLF-EM</td>
<td>Very Low Frequency Electromagnetic Survey</td>
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<th>Company/Individual (Property Name)</th>
<th>Claim Map Sheet (Commodity)</th>
<th>Exploration Activity</th>
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<td>1. Acker, W., Otto, R. (McKenna–McCann property)</td>
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<td>2. Bumbu, C. (Jackpine River property)</td>
<td>Blair Lake (base metals, Au)</td>
<td>Prospecting, Tr, sampling</td>
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<td>3. Carroll, D. (Spruce Bay property)</td>
<td>White Lake (North) (Au, base metals)</td>
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<td>5. Daniels, G., Courtney, J. (Fire Mountain property)</td>
<td>Tuuri Tp. (base metals)</td>
<td>Prospecting, soil sampling, sampling</td>
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<td>6. Daniels, G., Courtney, J. (Worthington Creek property)</td>
<td>Priske Tp. (Au)</td>
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<td>8. Ferguson, J., Ferguson, A.</td>
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<td>9. Fowler, B., Shuman, M., Daniels, G. (Wabikoba Creek property)</td>
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<td>12. Hamei, J. R. (Beaver Creek property)</td>
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<td>15. Hemlo Gold Mines Inc. (Moses option) (Onitap option) (Solidor option)</td>
<td>Pic, Lecours tps. (Au)</td>
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124
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<td>21. Michon, R., Reukl, R. (Salamander Point)</td>
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<td>24. Minnova Inc. (Winston Lake)</td>
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<td>DDH</td>
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<td>25. Minnova Inc. (Pic Lake deposit)</td>
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<tr>
<td>27. Nabigon, P.</td>
<td>Cooper, Johns, Hambleton, Shabotik tps.</td>
<td>Prospecting, sampling, Tr</td>
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<td>31. Newmont Exploration Ltd. (Summers Lake East)</td>
<td>Wabikoba Lake</td>
<td>GC, GL</td>
</tr>
<tr>
<td>33. Noranda Exploration Company, Limited (Page Lake property)</td>
<td>Seeley Lake (base metals)</td>
<td>GEM</td>
</tr>
<tr>
<td>34. Noranda Exploration Company, Limited (Spider Lake property)</td>
<td>Tuuri Tp.</td>
<td>(base metals) GL</td>
</tr>
<tr>
<td>35. Noranda Inc. (Geco Division) (Banana Lake property)</td>
<td>Herbert Tp. (Cu, Zn)</td>
<td>Line cutting, GM</td>
</tr>
<tr>
<td>36. Noranda Inc. (Geco Division) (Candy Bar Lake property)</td>
<td>Olie Lake (Cu, Zn)</td>
<td>Line cutting, GL, GC, HLEM</td>
</tr>
<tr>
<td>37. Noranda Inc. (Geco Division) (Lampson property)</td>
<td>Black River (Cu, Zn)</td>
<td>GL, GC, line cutting</td>
</tr>
<tr>
<td>38. Noranda Inc. (Geco Division) (One Otter East property)</td>
<td>Loken Lake, Herbert, Nickle tps. (Cu, Zn)</td>
<td>GC, DDH</td>
</tr>
<tr>
<td>39. Noranda Inc. (Geco Division) (Pinegrove property)</td>
<td>Black River (Cu, Zn)</td>
<td>GL, GC, line cutting, GM, deep GEM</td>
</tr>
<tr>
<td>40. Noront Resources Ltd. (Bremner River property)</td>
<td>White Lake (South) Oskabukuta Lake (Au)</td>
<td>DDH</td>
</tr>
<tr>
<td>42. Saunders, D., Simoneau, P. (Ihnatko–Kusins property)</td>
<td>Wabikoba Lake (Pb, Zn)</td>
<td>Line cutting, GL, GEM, prospecting, sampling</td>
</tr>
<tr>
<td>43. Saunders, D., Simoneau, P. (Summers Lake property)</td>
<td>Wabikoba Lake (Au, Cu, Zn)</td>
<td>Line cutting, GL, GEM, prospecting, sampling, Tr</td>
</tr>
<tr>
<td>44. Turner, A. (Dotted Lake property)</td>
<td>Wabikoba Lake (dimension stone)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>45. Turner, A. (Faries East property)</td>
<td>Ceci Tp. (Cu)</td>
<td>Prospecting, sampling, Tr</td>
</tr>
<tr>
<td>46. Turner, A. (Swill Lake property)</td>
<td>Leslie Tp. (Cu, Zn, Au)</td>
<td>GM, VLF–EM, HLEM, GL, line cutting, Tr, prospecting, sampling, GEM</td>
</tr>
<tr>
<td>47. Turner, A. (Swill Lake property)</td>
<td>Priske Tp. (Au)</td>
<td>Prospecting, sampling, Tr, Str</td>
</tr>
<tr>
<td>48. Twomey, T., Smith, B. (Schreiber–Pyramid–Twomey properties)</td>
<td>Black River (base metals)</td>
<td>Prospecting, Tr, sampling</td>
</tr>
<tr>
<td>49. Vaudrin, R., Donaldson, D. (Lampson Road property)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50. Vos, C. (Kabamichigama Lake property)</td>
<td>Kabamichigama Lake (industrial minerals)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>51. Williams Operating Corporation (Teck Corporation–International Corona Corporation) (Williams Mine)</td>
<td>Bomby Tp. (Au)</td>
<td>DDH</td>
</tr>
</tbody>
</table>
Manitouwadge, while conducting diamond drilling on the
Burnt Rock showing, intersected 2.58% Zn across 9.4 m (31
feet) and 3.41% Zn across 11.8 m (39 feet) in holes 1 and 2,
respectively.

The year was unfortunately marred by the tragic deaths
of prospectors W. Acker and R. Otto during exploration of
their McKenna–McCann property north of Schreiber. A
subsequent Coroner’s Inquest has produced a number of
recommendations concerning improved safety and training
for prospectors and explorationists (The Times-News,
December 11, 1992, p.3).

ACKNOWLEDGMENTS

Technical support and assistance for this report were pro-
vided by S. Warren who prepared assessment file data and
provided typing and word processing support. The
Manitouwadge section was written by D.B. McKay,
Manitouwadge Mineral Resource Geologist. K. Fenwick
reviewed and edited the manuscript.

As always, numerous prospectors, geologists and indi-
viduals from the exploration and mining sector provided
valuable information and discussion throughout 1992, and
many are referred to throughout the text.

All analytical work reported unless otherwise noted was
performed by Temiskaming Testing Laboratory, Ministry of
Northern Development and Mines, Cobalt and Geoscience
Laboratories Section, Ontario Geological Survey, Toronto.

MINING ACTIVITY

Geco Division (Noranda Inc.)

Production from the Geco Division mine, Manitouwadge,
from January 1, 1992 to December 31, 1992, involved
milling 1,329,310 tons (short) of ore at a grade of 1.91% Cu,
2.34% Zn and 1.29 ounces Ag per ton (H. Lockwood, Geco
Division, personal communication, 1993).

The mineral inventory as of January 1, 1993 is listed at
4,300,000 tons (short) at 1.77% Cu, 2.58% Zn and an
estimated 1.24 ounces Ag per ton (H. Lockwood, Geco
Division, personal communication, 1993). The present res-
pves give the Geco Mine a life expectancy until mid-1996
(H. Lockwood, Geco Division, personal communication,

Winston Lake Division
(Minnova Inc.)

The Minnova Inc. Winston Lake Division Mine completed
its fifth full year of production in 1992. Production for the
period of January 1, 1992 to December 31, 1992 was 346,662
tons at a grade of 1.28% Cu, 15.78% Zn, 40.34 g/t Ag and 1.82 g/t Au (R. Sim, Winston Lake Division, per-
sonal communication, 1993).

Reserve estimates as of January 1, 1993, which include
proven, probable, possible and potential ore with a 20%
dilution at 0% grade, are indicated at 1,550,388 t at a grade
of 0.97% Cu, 13.8% Zn, 26.98 g/t Ag and 1.15 g/t Au (R. Sim,
Winston Lake Division, personal communication, 1993).

Hemlo Area Mines

DAVID BELL MINE (TECK-CORONA
OPERATING CORPORATION)

Production from the David Bell Mine from January 1, 1992
to December 31, 1992 consisted of 220,020 feed ounces
(210,121 recoverable ounces) of gold from 468,441 t
milled at a feed grade of 0.470 ounces Au per tonne (P.
Desautels, David Bell Mine, personal communication, 1993).

Mineable and diluted ore reserve estimates as of
December 31, 1992 were 6,318,325 at 0.354 ounces Au per
tonne representing 2,236,182 ounces Au (P. Desautels, David
Bell Mine, personal communication, 1993).

GOLDEN GIANT MINE
(HEMLO GOLD MINES INC.)

Production from the Golden Giant Mine from January 1,
1992 to December 31, 1992 was 451,403 ounces Au from
1,710,930 t milled at a grade of 12.878 g/t (B. Kusins,
Golden Giant Mine, personal communication, 1993). This
includes milling 171,532 t at a grade of 12.2 g/t from the
Quarter claim and 8156 t at a grade of 1.544 g/t from the
Sceptre zone.

Total ore reserves as of December 31, 1992 were 15,720
000 t at a grade of 11.0 g/t (B. Kusins, Golden Giant Mine,
personal communication, 1993). This figure includes ton-
naages from the Golden Giant deposit No.1 of 13,270,289 t at
a grade of 11.06 g/t and 1,810,996 t at a grade of 10.55 g/t
from the Quarter claim.

WILLIAMS MINE
(WILLIAMS OPERATING CORPORATION)

Production from the Williams Mine from January 1, 1992
to December 31, 1992 was 496,920 ounces Au from 2,299,696
t milled at a grade of 0.226 ounces Au per tonne (J. Gray,
Williams Mine, personal communication, 1993).

Total proven, and probable diluted ore reserves for the
Williams Mine as of January 1, 1993 are estimated at
31,888,000 t at a grade of 0.192 ounces Au per tonne
representing 6,117,100 ounces Au (J. Gray, Williams Mine,
personal communication, 1993).

EXPLORATION ACTIVITY

Exploration activity in the Schreiber–Hemlo District de-
clined for the second straight year in 1992. The number of
active exploration programs in 1992 was 51, down from 59
in 1991 (see Figure 7.2 and Table 7.1). The Ontario Prospectors Assistance Program (OPAP) assisted in funding 18 exploration programs. The Noranda Group (Hemlo Gold Mines Inc., Geeco Division, Noranda Exploration Company Ltd.) was again the most active company with 12 exploration programs, accounting for 50% of the active exploration programs by major companies.

For the first time in the last 5 years exploration for base metals equalled that of gold exploration. Base metal exploration has made a steady increase over the past 5 years and in 1992 represented 45% of the total exploration programs, the same contribution as gold exploration. Industrial minerals and platinum group element (+ copper, nickel) exploration accounted for 6% and 4%, respectively, of all active exploration programs (see Table 7.1). Further description of industrial mineral and building stone activity in the Schreiber–Hemlo District is presented by Hinz and Lucas (this volume).

A summary of the claims recorded and assessment work for the Thunder Bay Mining Division is available in Table 5.1, Lavigne et al., this volume.

Gold Exploration

Gold tied with base metals as the most sought-after commodities in the Schreiber–Hemlo District in 1992, and each represented 45% of the exploration programs. In the Hemlo camp, major exploration companies such as Hemlo Gold Mines Inc., Williams Operating Corporation, Newmont Exploration Ltd., Lac Minerals Ltd. and Homestake Canada Ltd. carried out the bulk of the exploration, while junior companies were almost nonexistent.

Hemlo Gold Mines Inc. carried out 1908 m of diamond drilling in 18 holes on the Golden Sceptre property in 1992. Geologic mapping of surface exposures and the North Zone open pit walls combined with relogging of previously drilled core from Golden Sceptre has delineated a zone of extensive feldspathic alteration lying immediately north of the Moose Lake porphyry (B. Kusins, Golden Giant Mine, personal communication, 1992). Hemlo Gold Mines Inc. is currently concentrating on evaluating near-surface gold mineralization located within the feldspathically altered zones on the Golden Sceptre property.

Hemlo Gold Mines Inc. conducted drilling in 1992 on the North Shores gold mine–Worthington Bay property. However, the option was dropped, and the property was returned to Autotrac Ltd. Noranda Exploration Company Limited optioned the North Shores property in 1988, and the property was included in the Hemlo Gold Mines Inc. portfolio in 1989. Original work included humus geochemical surveys, trenching and sampling in 1989. Line cutting, magnetometer, induced polarization (IP) and very low frequency electromagnetic (VLF–EM) geophysical surveys, prospecting, geologic mapping, trenching and diamond drilling of 14 holes, totalling 1615.6 m, were carried out from 1990–1992.

A new gold-mineralized zone known as the Afric Zone was discovered on the North Shores mine property by Noranda Exploration Company Limited. The 25 m wide zone has been followed along strike for approximately 250 m and to a depth of 75 m and is open in all directions (Londry 1992). Additional targets and zones present the potential of developing a low grade (2.0 to 3.0 g/t Au), high tonnage (greater than 10 000 000 t) deposit, or a narrower, higher grade (greater than 10 g/t Au) deposit (Londry 1992). A preliminary reserve of approximately 2 million tonnes of 2.2 g/t Au has been suggested within the Afric zone (Londry 1992). The gold mineralization is associated with pyrite–chlorite haloes around and within quartz veins that fill fractures in high level, intrusive rocks, such as a brecciated and fractured quartz porphyry, feldspar porphyry, syenite, as well as felsic volcanic rocks. The gold mineralization is structurally controlled by 2 prominent (conjuate?) fracture systems: an early set, striking 090° to 110° and a later, crosscutting set striking 040° to 060°. Surface trenching on the No. 3, 4 and 5 zones revealed encouraging results, including 19.9 g/t Au across 5 m, 13.03 g/t Au across 1 m and 7.75 g/t Au across 5 m, respectively. Of these zones, only the No. 3 zone has been drill tested by a single hole (Londry 1992).

A summary of some of the significant results from drilling on the North Shores property (Londry 1992) is presented in Table 7.3.

Williams Operating Corporation conducted approximately 3000 m of diamond drilling on the B-Zone (West) from the 9450 level, with encouraging results (A. Guthrie, Williams Mine, personal communication, 1992). In addition, approximately 5000 m of diamond drilling in 20 holes was carried out on the C-Zone and C-333 Zone from the 9975 level.

Lac Minerals Ltd. continued exploration drilling on its White River prospect in Bomby, Brothers and Laberge townships. Work in 1992 included geologic surveys, soil and humus geochemical surveys and ground IP and magnetometer surveys.

Newmont Exploration Ltd. was active on 4 exploration programs in the Hemlo area. Geologic surveys, soil geochemical surveys and diamond drilling were carried out in 1992.

Homestake Canada Ltd. carried out reconnaissance geologic surveys, geochemical surveys, prospecting, and sampling on its Pic Township and Bomby Township properties.

T. Twomey, prospecting in Priske Township near the Schreiber–Pyramid property made several new gold discoveries in 1991 and 1992. The Twomey iron formation and power line occurrences are described later in this report. T. Twomey also conducted property evaluation for small-scale mining potential on the Harkness–Hays and Schreiber–Pyramid properties.

Prospector C. Bumbu conducted stripping, trenching and sampling on the Jackpine River (Moschuk) occurrence located on the Jackpine River fault system, 25 km northeast of Nipigon. Several new occurrences of copper and gold were
discovered with initial grab sample results indicating values of 0.122 ounces Au per ton and 7.01% Cu (Resident Geologist's files, Resident Geologist’s office, Schreiber–Hemlo District, Thunder Bay).

R. Hamel conducted diamond drilling on the Beaver Creek (Hamel–Doyan or Siville–Ferrier East) property, located in Syine Township approximately 3 km northeast of Jackfish Lake. Drilling intersected a shear zone in a diorite-gabbro unit containing quartz-carbonate stringers and minor chalcopyrite. A sample assayed 0.356 ounces Au per ton across 1.5 m (5 feet) (R. Hamel, Prospector, personal communication, 1992).

**Base Metal Exploration**

Base metal exploration displayed another increase in 1992, accounting for 45% of the total number of exploration programs, equal to that for gold (see Table 7.1). This increase represents a continuation of a five-year trend of resurgence in base metal exploration. This is likely due to similar, nationwide trends that are designed to replace declining reserves. Declining reserves at the Geco Division mine in Manitouwadge have prompted several programs throughout the district in the past few years, for example.

Minnova Inc. continued exploration on its Pick Lake deposit located 1.5 km southwest of the Winston Lake Mine. In 1992, Minnova drilled 4191 m to test for satellite deposits and extensions of the Pick Lake horizon, as well as some definition drilling on the deposit itself. The 1.6 million t deposit, which grades 1.1% Cu and 17.7% Zn (The Northern Miner, November 18, 1991, p.3), is presently undergoing economic evaluation. This thin, high-grade, massive sulphide deposit is considered a high-risk mining target due to the thin, sheet-like nature of the ore and the depth (up to 1000 m) of the deposit (R. Sim, Winston Lake Division, personal communication, 1992).

Minnova Inc., in joint venture with Cumberland Resources Ltd. and Noranda Inc., conducted 3670 m of diamond drilling as well as down-hole geophysical surveys on its Victoria Lake property located 15 km southeast of the Winston Lake Mine. Two of the holes intersected 12 m and 17 m of chert-sulphide exhalite interbedded with mafic flows and sedimentary rocks with anomalous values in zinc (George Cross News Letter, November 19, 1992, p.2). This represents a new, mineralized, target horizon. No drilling is presently planned for 1993.

Minnova Inc. also conducted 1654 m of diamond drilling on the main Winston Lake deposit and horizon, to test for extensions of the ore and satellite deposits.

Geco Division (Noranda Inc.) and Noranda Exploration Company Limited were active in the Manitouwadge synform and surrounding area. A more complete summary of exploration and prospecting in the Manitouwadge area is available in the “Manitouwadge Mineral Resource Geologist Project” section of this report.

J. Courtney and G. Daniels prospecting in the vicinity of their Fire Mountain property located 1 km north of Highway 17 on the west side of the Prairie River, 30 km east of Terrace Bay, sampled soil horizons anomalous in zinc. Sampling of soils returned values of up to 2623 ppm Zn, with 23 of the 61 samples returning greater than 100 ppm Zn. Of these 23 samples, 11 returned values greater than 250 ppm Zn and 4 were greater than 500 ppm Zn (J. Courtney, Prospector, personal communication, 1992). The Regional Lake Sediment and Water Geochemical Survey (Friske et al. 1991b), released by the Geological Survey of Canada in 1991, indicates a large regional zinc anomaly over this area.

R. Reukl and R. Michon of Manitouwadge conducted prospecting, stripping, sampling and diamond drilling on their Nagunagisic zinc-lead-copper occurrence (Burnt Rock showing) in 1992. Diamond drilling intersected 2.58% Zn across 9.4 m (31 feet) in hole 1 and 3.41% Zn across 11.8 m (31 feet) in hole 2. Exploration planned for 1993 includes geological mapping and further prospecting.

During 1992, Minnova geologists at the Winston Lake Division mine discovered a possible sulphide chimney or the remnants of a seafloor, “black smoker,” vent site. The occurrence contained a vuggy, hollow core filled by selenite remnants of a seafloor, “black smoker,” vent site. The occurrence contained a vuggy, hollow core filled by selenite crystals up to 0.5 m across. Massive, concentrically zoned chalcopyrite and pyrite, rimmed by massive sphalerite, surround the selenite crystals. The occurrence was discovered in a section of the thickest ore (approximately 40 m).

Samples of sulphide chimneys from modern hydrothermal vent sites were observed at S. Scott’s, Scotia Bank Marine Geology Research Laboratory at the University of

<table>
<thead>
<tr>
<th>Drill Hole</th>
<th>Mineralized Zone</th>
<th>Assay (g/t Au)</th>
<th>Width (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR-8</td>
<td>Afric Zone, strike extension</td>
<td>3.5</td>
<td>42.4</td>
</tr>
<tr>
<td>NR-3</td>
<td>No. 5</td>
<td>8.1</td>
<td>6.1</td>
</tr>
<tr>
<td>NR-5</td>
<td>No. 2</td>
<td>451.5</td>
<td>0.5</td>
</tr>
<tr>
<td>NST-3</td>
<td>No. 4</td>
<td>7.54</td>
<td>4.0</td>
</tr>
<tr>
<td>NR-9</td>
<td>Afric Zone, strike extension</td>
<td>2.4</td>
<td>11.6</td>
</tr>
<tr>
<td>NR-11</td>
<td>Afric Zone, down-dip extension</td>
<td>1.3</td>
<td>64.0</td>
</tr>
<tr>
<td>NR-13</td>
<td>No. 5</td>
<td>4.8</td>
<td>6.0</td>
</tr>
</tbody>
</table>
described: 1) in the Schreiber-Terrace Bay-Winston Lake
Schreiber, Hemlo-Black River and Heron Bay.

The supracrustal rocks occurring in the 2 belts have been
described: 1) in the Schreiber-Terrace Bay-Winston Lake
area by Marmont (1984), Severin and Balint (1985) and
Patterson et al. (1987); 2) in the Cirrus Lake area by Milne
(1967); 3) in the Hemlo area by Milne (1968), Muir (1982a,
1982b) and Patterson (1984); and 4) in the Manitouwadge
area by Pye (1960), Friesen et al. (1982) and Williams and

The metavolcanic rocks within the Schreiber–Hemlo
District vary from calc-alkalic pyroclastic rocks, breccias,
tuffs, flows, porphyritic flows, schists and gneisses to mafic,
iron-rich tholeiites, which include pillowed and massive
flows, tuffs, schists and gneisses. The metasedimentary rocks
consist of graded turbidites, wackes, mudstones, schists,
paragneisses, minor conglomerates and iron formation.

The supracrustal rocks have undergone up to 4 periods of
deformation (Muir and Elliot 1987). Two periods of folding
are evident in the Hemlo area, while evidence of multiple or
complex folding events is present in the lower Steel River
area (Schnieders 1987). Large-scale faulting and deforma-
tion zones have been recognized in the Hemlo area by Page
(1947a, 1947b, 1948, 1949), Bartley and Page (1957), Hugon
(1984, 1986) and Muir and Elliot (1987); in the Big Duck
Lake area by Williams (1986, 1987, 1988, 1989); and in the
Jackfish–Middleton area by Williams (1987, 1989) and

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deformation (Muir and Elliot 1987). Two periods of folding
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complex folding events is present in the lower Steel River
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(1947a, 1947b, 1948, 1949), Bartley and Page (1957), Hugon
(1984, 1986) and Muir and Elliot (1987); in the Big Duck
Lake area by Williams (1986, 1987, 1988, 1989); and in the
Jackfish–Middleton area by Williams (1987, 1989) and

Proterozoic rocks unconformably overlie the Archean
rocks. The Paleoproterozoic Animikie Group (Gunflint and
Rove formations) sedimentary rocks consist of conglo-
merate, black shale and iron formation.

Mesoproterozoic sedimentary rocks unconformably
overlie the Animikie rocks. The Sibley Group consists of
conglomerate, sandstone, shale, carbonates and chert.

The Schreiber–Hemlo Resident Geologist office is staffed by
B.R. Schnieders, Resident Geologist and M.C. Smyk, Staff

The Schreiber–Hemlo Resident Geologist office is staffed by
B.R. Schnieders, Resident Geologist and M.C. Smyk, Staff
Geologist. D.B. McKay, Resource Geologist, initiated the Manitouwadge Mineral Resource Geologist Program in January 1991, funded under the Canada–Ontario Northern Ontario Development Agreement (NODA). D.B. McKay is responsible for writing the Manitouwadge section of this report. T. Oja assisted the Manitouwadge project during July, August and September. The Resident’s program operated from the Mines and Minerals Division office in Thunder Bay. A field office was maintained at the office of the Northern Development Officer (NDO), Ministry of Northern Development and Mines, in Marathon from May through October 1992. This field office operated every Tuesday afternoon between 1:00 and 5:00 p.m.

During 1992, the Schreiber–Hemlo Program dealt with approximately 1100 inquiries from the mining sector and general public, including 450 visitations and 650 phone inquiries. This figure is down approximately 10% from 1991. Included in the total were 64 visitations and 46 phone inquiries at the Marathon field office.

A total of 60 property visits to 48 properties were conducted in 1992 (Table 7.4). Three underground mine tours were attended as well as 5 surface mine tours. In addition, 10 field trips were conducted. Eight oral presentations and 3 poster displays were also presented to various organizations. The Schreiber–Hemlo program conducted a Basic Prospecting Course in Marathon, involving 18 hours of classes, as well as assisting in the Manitouwadge Basic Prospectors Course, given by D. McKay. Several trips were made with the geologists from the University of Western Ontario, under the supervision of R. Sutcliffe, who completed a two-year mapping program of the Port Coldwell alkaline complex. Six conferences and seminars were attended; 6 oral presentations were given at 5 of these symposia.

The 1992 Northwestern Ontario Mines and Minerals Symposium was organized and hosted in Thunder Bay in April 1992 and was attended by over 300 people. B.R. Schnieders, J. Mason and J. Scott organized the prospectors tent in which 34 prospectors displayed maps, samples and potential properties to interested exploration companies and geologists. M.C. Smyk was involved with the development and production of teachers kits for the PEP (Public Education Program) of the Mining Sequence. In addition, time was spent securing a remote core storage site near Marathon, working on the fiftieth anniversary of the Resident Geologist’s program and the Pukaskwa National Park ecosystem workshop. Staff of the Schreiber–Hemlo Program were involved with presenting the Mining Sequence Display at the Mines and Mineral Symposium, Intercity Mall–Ontario Mining Week, Westgate High School and the Kekeenamawakay Conference in Winnipeg.

C. Komar, S. Warren, A. White, J. Russell and D. Chiasson provided clerical assistance and support in Thunder Bay and Marathon.

Table 7.4. Property examinations in 1992 (numbers keyed to Figure 7.1).

1. Agonzon Lake
2. Aguasabon Gorge
3. Ansell Lake
4. Beggs–Currie
5. Big Duck Creek–Beaver Lake
6. Black River Dam
7. Camp 36
8. Port Cold Spring Quarry
9. Port Coldwell alkalic complex
10. Dead Horse Creek West Subcomplex
11. Dotted Lake pluton
12. Fishnet Lake area
13. Golden Giant Mine
14. Golden Sceptre
15. Harkness–Hays
16. Hemlo highway section
17. Hemlo West
18. Heron Bay
19. Jackpine River (Moschuk)
20. Kabamichigama Lake area
21. Kakeway Barite–Fluorite
22. Little Bruin
23. Manitouwadge
24. Marathon (Fleck)
25. McKenna–McCann
26. Mining Location
27. Neys Provincial Park
28. Nicopor
29. North Shores
30. Obakamiga Lake area
31. Padre Resources
32. Prairie Lake carbonatite
33. Prairie River (Fire Mountain)
34. Quaternary: Hemlo–Marathon
35. St. Ignace Island
36. Schreiber Cemetery (Downey East)
37. Schreiber–Pyramid
38. Shack Lake–Wilkinson
39. Spider Lake area
40. Steel River komatiites
41. Twomey iron formation
42. Twomey power line
43. W3, W3 Extension
44. Victoria Lake
45. Vos Amethyst
46. Wabikoba Creek
47. Williams Mine
48. Winston Lake Mine

1Visited in conjunction with the Manitouwadge Mineral Resource Geologist Program
2Visited in conjunction with the Northwestern Ontario Industrial Minerals Program
3Visited during the course of a field trip conducted in 1992
4Visited in conjunction with the Geological Survey of Canada
5Property receiving OPAP funding in 1992

*Table 7.4: Property examinations in 1992 (numbers keyed to Figure 7.1).*
PROPERTY EXAMINATIONS—1992
Twomey Occurrences

OPAP-assisted prospecting conducted by T. Twomey in September and October 1991 and in the 1992 field season resulted in the discovery of several new gold occurrences west and north of the Schreiber—Pyramid property, approximately 6 km northeast of Schreiber. Gold mineralization occurs in several different geologic environments and is discussed in the following section.

IRON FORMATION-HOSTED GOLD MINERALIZATION

Oxide-facies iron formation consisting of laminated magnetite and chert bands (locally jasper) is observed in several locations throughout the property. The iron formation at location #1 (Figure 7.3) is hosted by fine-grained, pelitic, metasedimentary rocks (DE turbidites) or mudstone, as well as greywacke and minor conglomerate. The iron formation is 3 to 4 m in width and strikes 290° to 320° and dips 55°NE. Mafic intrusive rocks, mainly gabbro, intrude the metasedimentary rocks.

Gold mineralization is associated with secondary sulphides in crosscutting fractures within the iron formation, as well as sulphide replacements of the chert and magnetite layers. Semimassive pyrite is present over widths of up to 5 cm in association with the cross fractures and replaced layers. Pyrite preferentially replaces the chert layers in a “brickwork”-type fashion. The cross fractures strike 100° and are commonly associated with areas of jaspillic iron formation.

Grab sample 92—BTT—1 collected by Resident Geologist staff consisted of pyrite-rich (less than or equal to 20%) iron formation and assayed 0.156 ounces Au per ton.

Approximately 400 m east of location #1 a second iron formation was discovered and stripped by T. Twomey. At this site (see location #2, Figure 7.3), the iron formation is bedded at 300/60NE. Several narrow iron formations hosted by metasedimentary and metavolcanic rocks make up a unit 2 to 3 m wide. Magnetite-rich layers up to 15 cm thick are interlaminated with chert layers. At location #2, sulphide replacement is evident; pyrite preferentially replaces the magnetite layers. Here the chert layers are less affected. Pyrite occurs as a stratabound, replacement feature. The northern part of the outcrop could be arguably classified as sulphide-facies iron formation.

Figure 7.3. Location map of the Twomey iron formation, power line, Schreiber—Pyramid, McKenna—McCann and Johnston—McKenna properties, Schreiber area.
Table 7.5. Assay results from the Twomey power line occurrence.

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Gold (oz/ton)</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>92-BTT-5</td>
<td>0.337</td>
<td>Grab sample from central section of vein; crack-seal quartz vein, minor pyrite, tourmaline and syenite seam.</td>
</tr>
<tr>
<td>92-BTT-6</td>
<td>0.049</td>
<td>Grab sample from vein, western end; minor pyrite, crack-seal texture.</td>
</tr>
<tr>
<td>92-BTT-7</td>
<td>Trace</td>
<td>Grab sample from syenite dike on hanging wall; hornblende-phyric host rock with approximately 1% pyrite.</td>
</tr>
<tr>
<td>92-BTT-8</td>
<td>0.061</td>
<td>Chip sample across 0.6 m, western end of power line. Includes vein and host rock.</td>
</tr>
</tbody>
</table>

Sample 92-BTT-3 assayed 0.014 ounces Au per ton, 3320 ppm Zn and 424 ppm Cu indicating elevated base metal values. Pyrite also occurs in several small crosscutting fractures. A grab sample (92-BTT-04) returned 0.02 ounces Au per ton.

While conducting the property visit, several additional iron formation exposures were observed, some previously stripped by Corporation Falconbridge Copper and others requiring further sampling and exploration for both gold and base metals. This suggests a number of parallel iron formations with potential strike lengths up to 3 km.

VEIN-HOSTED GOLD MINERALIZATION (POWER LINE OCCURRENCE)

Prospecting by T. Twomey along the power line approximately 500 m north of the Schreiber-Pyramid property (see Figure 7.3) resulted in the discovery of gold in quartz veins associated with felsic intrusive dikes within mafic metavolcanic rocks.

A quartz vein strikes 106° and dips 70°SW and was traced for over 200 m along the power line. The vein averages 20 to 25 cm in width and displays a crack-seal texture. The quartz vein occurs in contact with a pink hornblende syenite dike, which is commonly on the footwall contact of the vein. Several syenite dikes were observed in the area, up to 1 m in width. The quartz vein and syenite dikes are hosted by sheared and deformed pillowed mafic metavolcanic rocks.

The quartz vein contains pyrite, minor chalcopyrite, tourmaline, hematite and chlorite. Samples collected and analyzed are displayed in Table 7.5.

McKenna–McCann and/or W3 Vein and W3 Extension Area

Property visits and investigations at the McKenna–McCann and W3 properties, in 1992, revealed a parallel, en échelon set of 2 to 3 quartz veins within a 25 m wide zone over a strike length of greater than 550 m. The en échelon veins follow a dominant 300° to 330° strike, parallel to many regional lineaments (including Big Duck Creek fault) and are commonly offset by 40° to 70°-striking, crosscutting (conjugate?) structures. These northeast-trending structures occasionally host quartz veins which are related to, and offset, the northwest-trending set. However, the northeast-trending structures appear to be more poorly developed and mineralized. In general, the quartz veins attain a maximum width of 1 m, but average 20 to 30 cm in width. The northwest-trending veins dip to the southwest generally between 60° and vertical.

At the McKenna–McCann shaft location, Harcourt (1939) (see Figure 7.3) mapped 4 en échelon veins (nos. 7, 8, 9 and 10) exposed over a strike length of 100 m. Detailed mapping in 1992 revealed 2 exposed en échelon quartz veins and a potential for a third vein and minor northeast-trending displacements exposed over a strike length of 200 m. At the northwest end, the veins are not exposed due to overburden. However, approximately 600 m to the northwest on the Johnston–McKenna property, similar quartz veins are present. It is the opinion of the authors that the veins on the Johnston–McKenna (see Figure 7.3) property are potentially the same vein set or a parallel vein set to that on the McKenna–McCann property. It was the intention of the late prospectors W. Acker and R. Otto to continue exploration and stripping towards the Johnston–McKenna property in order to confirm this hypothesis.

At the W3 vein and W3 Extension (Schnieders et al. 1991, 1992) discovered by W. Acker and R. Otto, 2 parallel, southeast-trending, quartz veins are exposed over a 200 m strike length. The veins are offset by northeast-trending structures and at the extreme southeast exposure intersect a lineament striking 40° and are lost under overburden. Reconnaissance prospecting has indicated additional quartz veins...
southeast of this lineament (M. Joa, Prospector, personal communication, 1991). Between the southeast end of the McKenna–McCann shaft exposure and the W3 exposures, 140 m remains unstripped. It is also the opinion of the authors that the main vein set is continuous, although veins are commonly offset and display lenticular, pinch-and-swell characteristics.

The en échelon quartz vein set at the McKenna–McCann property has a strike length of 550 m and a potential strike length in excess of 1100 m. The narrow (average 20 to 30 cm wide), crack-seal veins contain erratic, commonly high-grade, gold mineralization. Visible gold was noted at the W3 Extension and at the McKenna–McCann (#10 vein) sites in 1992. A grab sample (92-BMM-3) from the #10 vein that displayed a crack-seal texture with chloritic seams and galena assayed 19.13 ounces Au per ton, 5.34 ounces Ag per ton and 0.59% Pb. Assays from 5-ton and 12-ton bulk samples (of mine-run ore) collected in the 1930s from the McKenna–McCann property indicated 0.82 ounces Au per ton and 1.13 ounces Au per ton (Harcourt 1939). Bulk samples collected in the mid-1980s produced similar, but slightly lower results (W. Acker, Prospector, personal communication, 1990). The quartz veins are hosted by pillowed metavolcanic rocks, gabbro and/or diorite and felsic intrusive rocks. The presence of these felsic intrusive rocks in addition to the conjugate fault set may be important to the genesis of gold mineralization. Further prospecting along this potentially greater than 1 km-long, auriferous, vein system is warranted, as is exploration for additional parallel systems, especially in more brittle rocks, such as the felsic intrusive rocks. Brittle fracture zones and areas where intense deformation has "prepared" the rock for accommodating hydrothermal solutions may represent targets for larger tonnage opportunities.

Nicopor Prospect

This prospect is located approximately 10 km north-northwest of the town of Schreiber and 2.4 km east of Lower Ross (Rhea) Lake. It is currently held by Minnova Inc. as part of its Victoria Lake property optioned jointly from Noranda Exploration Company Limited and Cumberland Resources Ltd. The occurrence was first discovered circa 1930 and first described by Bartley (1939) when it was held by Nicopor Mines Limited.

The prospect occurs at the northern contact of the Schreiber greenstone belt with the Crossman Lake granitic batholith. The greenstone belt assemblage consists of an east-trending, homoclinal succession of mafic to felsic metavolcanic rocks intruded by sill-like gabbro bodies. In the vicinity of the Nicopor prospect, the massive amphibolite host had been largely interpreted by various exploration geologists as a metamorphosed and altered mafic to intermediate volcanic rock. Recent mapping, based to a large extent on comparison with other mafic rocks nearby, suggests that this amphibolite unit is gabbroic rather than volcanic. This interpretation also accounts to some degree for the source of the nickel- and copper-rich sulphide mineralization as discussed below.

Base metal sulphides (Figure 7.4) occur as massive to vein-like and net-textured aggregates in a narrow, linear zone that follows the contact between a dark green, massive amphibolite (melagabbro) on the south and medium-grained, equigranular, pink granite on the north. A quartz-bearing, mafic rock typically occurs between the melagabbro and the granite and has been mapped as leucogabbro, possibly representing a hybrid phase between the 2 main host rocks. This mineralized zone has developed a conspicuous, extensive gossan that obscures host rock and sulphide relationships. White iron hydroxides and rare malachite have developed as stains on deeply weathered sulphides. Several shallow pits have been sunk on this northeast-striking zone over a distance of approximately 75 m. The sulphide zone on surface ranges up to approximately 2 m in width and rapidly grades outwards into disseminated mineralization in both the gabbro and granite. The sulphide zone is crosscut by barren aplite, syenite and feldspar porphyry dikes.

A 1970 annual report of Zenmac Metal Mines Ltd. describes the deposit and their drill program results:

The deposit known before this [1969] program was estimated to contain 185 000 tons grading 0.49% nickel and 0.26% copper to the 300 foot [91.44 m] horizon in a zone 300 feet [91.44 m] long, 22 feet [6.7 m] thick and dipping 40 degrees. Three holes have intersected the deposit at greater depth to at least 600 feet [182.88 m] and indicate an additional 190 000 tons grading 0.40% nickel and 0.12% copper. The grade of the central core of the deposit was calculated to be about 1.0% nickel and 0.3% copper over 5 to 15 feet [1.5 to 4.5 m].

(Resident Geologist’s files, Resident Geologist’s office, Schreiber–Hemlo District, Thunder Bay)

The sulphide zone on surface consists mainly of semimassive, net-like veinlets of pyrrhotite, with minor chalcopyrite and isolated porphyroblasts of pyrite. Pentlandite, the nickel-bearing sulphide phase, is visible in cut and polished slabs and accounts for up to 15% of the sulphides in polished section. Sulphide veins and massive sulphides are apparently hosted mainly by the granite, which has been brecciated by the introduced sulphides and occurs as xenoliths within them. Sulphides within the gabbro and in the granite away from the main mineralized zone tend to be fine-grained, disseminated to bleby grains. Fine-grained magnetite grains are disseminated throughout the gabbro and also occur as a minor component within massive sulphides. The occurrence of native copper is noteworthy in that it occurs as small, disseminated grains within granite, apparently as a hypogene, rather than a supergene mineral. Additional petrographic descriptions of the sulphides had previously been provided by Anderson (1951).

Polished, thin section study reveals that the sulphides are pervasively annealed and occur usually as composite veinlets and blebs that are interstitial to silicate mineral grains in the host rocks. The granite displays an ubiquitous micrographic texture developed between quartz and alkali feldspar. In the
Figure 7.4. Geology of the Nicopor prospect. For sample descriptions, see Table 7.6.
Table 7.6. Assay results from the Niconpor prospect.

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Copper (ppm)</th>
<th>Nickel (ppm)</th>
<th>Palladium (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>92 BNI-01</td>
<td>4780</td>
<td>15520</td>
<td>197</td>
</tr>
<tr>
<td>-02</td>
<td>1400</td>
<td>7540</td>
<td>107</td>
</tr>
<tr>
<td>-03</td>
<td>80</td>
<td>105</td>
<td>&lt;10</td>
</tr>
<tr>
<td>-04</td>
<td>10540</td>
<td>34720</td>
<td>99</td>
</tr>
<tr>
<td>-05</td>
<td>2260</td>
<td>1980</td>
<td>387</td>
</tr>
<tr>
<td>-06</td>
<td>6800</td>
<td>33900</td>
<td>193</td>
</tr>
<tr>
<td>-07</td>
<td>1356</td>
<td>45250</td>
<td>456</td>
</tr>
</tbody>
</table>

(note: samples -05, -06, -07 returned only trace amounts of gold and silver)

Sample Descriptions: (see Figure 7.4)

92 BNI-01: medium-grained granite, with disseminated to net-textured sulphides ≤5%, pyrrhotite > chalcopyrite, pyrite; main trench
-02: magnetic, dark green, amphibole-phyric melagabbro, with coarse-grained, net-textured sulphides ≤5%, pyrrhotite > chalcopyrite; main trench
-03: medium-grained, equigranular granite, with fine-grained, disseminated pyrite, pyrrhotite ≤1%; north of main trench
-04: amphibole-rich granite, with fine-grained, disseminated pyrite, pyrrhotite + chalcopyrite ≤2%; rare native copper grains; main trench
-05: massive pyrrhotite, with minor chalcopyrite blebs, subhedral pyrite porphyroblasts; relict patches of host granite; dump, main trench
-06: (same as 92 BNI-05)
-07: (same as 92 BNI-05)

Field observations and petrographic associations suggest that the sulphides and silicates are sharp and straight, whereas, in the gabbro, intimately intergrown sulphides and acicular amphiboles suggest that they crystallized at the same time. Sulphides also occur along cleavage traces in these amphiboles. Pyrrhotite, the predominant sulphide, comprises aggregates that host granular veinlets and small, oriented flames and incipient veinlets of pentlandite along pyrrhotite grain boundaries. Chalcopyrite typically occurs as blebs and anhedral grains at the margins of the sulphide aggregates and locally crosscuts pentlandite. Large (less than or equal to 2 cm), euhedral, inclusion-free porphyroblasts of pyrite are ubiquitous, but relatively minor.

Micrographic granite, grain boundaries between sulphides and silicates are sharp and straight, whereas, in the gabbro, intimately intergrown sulphides and acicular amphiboles suggest that they crystallized at the same time. Sulphides also occur along cleavage traces in these amphiboles. Pyrrhotite, the predominant sulphide, comprises aggregates that host granular veinlets and small, oriented flames and incipient veinlets of pentlandite along pyrrhotite grain boundaries. Chalcopyrite typically occurs as blebs and anhedral grains at the margins of the sulphide aggregates and locally crosscuts pentlandite. Large (less than or equal to 2 cm), euhedral, inclusion-free porphyroblasts of pyrite are ubiquitous, but relatively minor.

Field observations and petrographic associations suggest that the sulphides were most likely derived from the gabbroic rocks. They may have been remobilized during intrusion of the granite and concentrated and precipitated as veins and breccia fillings at or near the intrusive contact. The ore paragenetic sequence seems consistent with that proposed for Sudbury-type, orthomagmatic mineralization (Craig and Vaughn 1981). Magnetite was perhaps the earliest crystallizing phase as it occurs in the gabbro. A nickel- and copper-rich pyrrhotite phase (monosulphide solid solution) would begin to crystallize pyrrhotite and, on cooling, would subsequently exsolve nickel- and copper-bearing phases-pentlandite and chalcopyrite, respectively. Earlier (higher temperature) pentlandite would form veinlets, while flames would develop at lower temperatures and slower diffusion rates. Pyrite is typically a late stage, low temperature phase that has subsequently been recrystallized as porphyroblasts.

Temperatures produced by granitic intrusion (ca. 820°C) could conceivably have initiated the melting and remobilization of primary, gabbro-hosted sulphides, perhaps as something resembling the monosulphide solid solution. Hydrothermal fluids generated by the granitic magma may have facilitated dissolution and remobilization. As cooling began within the granitic melt, the typically paragenetic sequence as outlined above may have ensued, precipitating sulphides within the crystallizing granite itself.

Grab sampling in 1992 returned the analyses shown in Table 7.6.

Ansell Lake (Mitto) Occurrence

Ansell Lake lies approximately 10.5 km north-northeast of Schreiber. The occurrence is located approximately 1 km northeast of Ansell Lake and 2.5 km west of Syenite Lake north of Priske Township. Sulphides were first discovered and explored with surface work in 1921. The property has been the focus of several major exploration projects since that time.

The property is situated near the northern margin of the Schreiber greenstone belt, where it is intruded by the Crossman Lake granitic batholith. It is underlain predominantly by
Table 7.7. Assay results from the Ansell Lake occurrence.

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Copper (ppm)</th>
<th>Zinc (ppm)</th>
<th>Gold (oz/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>92 BBM-02</td>
<td>56</td>
<td>127</td>
<td>nil</td>
</tr>
<tr>
<td>-03</td>
<td>38</td>
<td>53</td>
<td>nil</td>
</tr>
<tr>
<td>-04</td>
<td>180</td>
<td>2210</td>
<td>nil</td>
</tr>
<tr>
<td>-05</td>
<td>1817</td>
<td>255</td>
<td>nil</td>
</tr>
<tr>
<td>-06</td>
<td>75</td>
<td>36</td>
<td>nil</td>
</tr>
</tbody>
</table>

Sample Descriptions:
- 92 BBM-02: grey to buff, massive to weakly foliated quartz-feldspar porphyry; locally rusty, no visible sulphides; island in Ansell Lake
- 03: dark grey, sericite, biotite-rich schist; weakly magnetic; disseminated, fine-grained pyrite ≤1%; locally epidotized; near trenches
- 04: light grey, rusty weathering, cherty, laminated rock with quartz-rich bands; fine-grained, wispy to banded pyrite and sphalerite; trench #2
- 05: rusty weathering, sugary-textured, white to buff massive chert with chlorite ± pyrite, chalcopyrite veinlets; nonmagnetic; trench #2
- 06: buff to grey, locally rusty feldspar-± quartz-phyric dike intruding pillowed basalts; weakly carbonitized; minor malachite; pond, north of Ansell Lake

Northeast-trending, mafic metavolcanic rocks and relatively thin quartz-phyric units, which had been interpreted as dikes, but are now considered to be felsic flows (Bartley 1939; Carter 1988). These felsic rocks may, in part, be pyroclastic. Narrow winter flow metasedimentary units consist mainly of chert and banded iron formation.

In the vicinity of the showings, host rocks are fine-grained, dark green to black, mafic metavolcanic rocks that are locally pillowed. A strong foliation and flattening fabric is developed at 80/85S. The rocks have been variably chloritized, sericitized and silicified. Disseminated and veinlet pyrite, pyrrhotite, chalcopyrite and rare sphalerite occur in the mafic metavolcanic rocks, quartz-phyric rocks and in cherty, highly fractured interflow units. Several test pits have revealed base metal mineralization over an area of approximately 120 by 180 m in size. A weighted average grade of 1.06% Cu over 14.3 m was returned during sampling (Robertson and Hainsworth 1950). A 3 m section of drill core returned 0.6% Cu and 0.3 ounces Ag per ton (assessment files, Resident Geologist’s office, Schreiber-Hemlo District, Thunder Bay).

A small lake situated approximately 400 m to the north is underlain by buff to pink-weathering quartz-feldspar porphyry dikes that intrude pillowed mafic metavolcanic rocks oblique to the foliation at 70°. The porphyries contain conspicuous light blue to dark grey quartz phenocrysts and are themselves chloritized. Minor malachite occurs along fractures in the porphyries. Lenticular, highly vesicular basalt fragments occur in the locally garnetiferous matrix of a flow breccia.

Grab sampling of variably mineralized samples returned the assays shown in Table 7.7.

Reconnaissance carried out to the east of Ansell Lake in 1992 confirmed abundant intermediate to felsic pyroclastic rocks mapped in the Rhumly Lake area by Bartley (1939, 1942) and northwest of Fishnet Lake by Walker (1967). These rocks are dominantly heterolithic, lapilli-tuffs and tuff-breccias and lesser, finer grained units and derived schists. They are commonly foliated, sheared and tightly folded and may be thinly laminated in some cases. Cherty, felsic fragments predominate; they are typically lenticular to tabular and hosted by a quartz-rich, sericitic matrix. Locally, these rocks are mineralized with pyrite and host quartz±iron-carbonate veins. Siderite is apparently the dominant alteration mineral; garnet is notably absent. Sericite-, garnet- and andalusite-bearing felsic rocks were noted by Walker (1967). Grab sampling of pyritiferous rocks only returned up to 84 ppm Cu and 86 ppm Zn.

**RECOMMENDATIONS FOR EXPLORATION**

**Gold**

**HEMLO-TYPE DEPOSITS**

During the initial exploration of the Hemlo camp in the 1940s, geologist T. Page noted the close relationship between structure, porphyritic rocks, alteration and gold mineralization (Page 1948). Empirical observations such as these have been invaluable in developing an exploration model for this type of deposit. Although earlier workers in the camp proposed models that involved dominant epithermal and structural mechanisms, current workers are favouring a model that draws upon similarities with "porphyry-type" molybdenum-copper deposits of the cordillera. A "porphyry-type" model was also put forward for the Hemlo deposit by Kuhns (1986),
Kuhns et al. (1986) and Walford et al. (1986). These similarities include:

1. an average grade of 0.3 to 0.4% MoS₂ (the molybdenite content of the Hemlo deposit ranges up to 0.4%)

2. an association with high-silica, porphyritic granitic intrusions, with K₂O greater than Na₂O, and

3. potassium-dominated hydrothermal alteration, dominated by potassium feldspar, intimately associated with mineralization

The basic model, as will be described below, has most recently been put forward by Johnston and Smyk (1992) and Johnston et al. (1992). The porphyry model as applied to the Hemlo deposit involves the emplacement of a felsic source intrusion enriched in volatile phases with a trace element chemistry characterized by molybdenum, gold, vanadium, arsenic, antimony, mercury, thallium and barium. The intrusion, the Moose Lake quartz-feldspar porphyry, is believed to be related to the large intermediate to felsic volcanic pile that predated the emplacement of granodiorite stocks and plutons. The intrusion was localized in a clastic sedimentary rock-dominated assemblage by a pre-existing, belt-scale structure. The intrusive activity likely involved a number of consanguineous, but distinct, quartz + feldspar porphyry bodies.

A metal-enriched, aqueous phase separated from the crystallizing melt and migrated towards the upper periphery of a felsic intrusive. Microcline and peripheral sericite alteration and replacement of sedimentary and lesser felsic rocks accompanied the precipitation of molybdenite, native gold and the other ore constituents as relatively massive, anastomosing veinlets or in minor quartz veins. Silica dumping proximal to the source intrusion may have resulted in the deposition of the siliceous, high-grade ore.

High fluid over pressures that would have produced the hydro fracturing and stockwork mineralization would have initiated autobrecciation within the porphyry and, to a lesser extent, the ore and host rocks. The mafic fragmental unit, which displays an antipathetic relationship with the ore, may have originated from such brecciation. Porphyry dikes that cut ore and the other rocks represent the last stages of felsic intrusive activity.

Subsequent deformation and alteration of original ore-host relationships accompanied the emplacement of proximal granodiorite plutons and amphibolite-facies regional metamorphism. The rocks in the immediate vicinity of the deposit underwent severe north-south shortening and oblique, ductile shearing. The severity of shearing in and adjacent to the deposit—what some have defined as the Lake Superior or Hemlo shear zone—was perhaps directly attributable to the relative incompetence of previously sericitized rocks and barite-rich, incompetent ore that focussed strain preferentially over unaltered and unmineralized rocks elsewhere.

This rudimentary model is largely predicated on the relative positions of the main ore zone, the mafic fragmental unit and the quartz-eye and feldspathic schists that underlie them. The resolution of sharp contact relationships and variations in ore thickness is key to sorting out pre-deformational stratigraphy, the original shape of the felsic intrusion and the ultimate source of the mineralizing fluids.

There are several suggested exploration criteria derived from empirical observations at Hemlo and the aforementioned genetic model. Quartz-feldspar porphyry intrusion within sedimentary-dominated, greenstone belt assemblages may represent highly fractionated, fluid-rich melts that have preconcentrated metallic trace elements. These bodies may be small apophyses to larger granitoid bodies and perhaps may be only up to several hundred metres in extent. Bimodal volcanism is implicit in generating such intrusions; proximity to a felsic volcanic centre may be important. Pre-orogenic, belt-scale structures may be hosts to these intrusions and should be identified if at all possible.

Evidence of hydrothermal fracturing and alteration is important in assessing the viability of a target area. The development, on any scale, of sericite, potassium feldspar, sulphides or other minerals containing incompatible elements such as arsenic, antimony, or boron, for example, is important in characterizing intrusions in which hydrostatic pressure has exceeded lithostatic pressure to produce fracturing and favourable sites for mineralization.

Radiometric data that identify potassium anomalies, usually as a high potassium to thorium ratio, could be utilized to recognize zones of hydrothermal alteration. As related by Schnieders et al. (1992), in situ gamma-ray spectrometry surveys conducted by the Geological Survey of Canada at Hemlo in 1991 revealed an increase from less than 2*26 K in unaltered rocks to over 4% K in potassium-altered sedimentary rocks and porphyry, locally reaching 10% K within the gold-mineralized zone.

It should be noted that these exploration criteria, while being put forth for Hemlo-type deposits, can be utilized and/or modified for a variety of hydrothermal, precious metal and base metal deposits. As noted by Burnham and Ohimoto (1980), the formation of hydrothermal ore deposits, regardless of type, is dependent largely upon processes that operate during the late stages of felsic magmatism. In addition to the composition, water content and trace element geochemistry of the magma, the geologic environment in which it is emplaced seems to govern its ore-forming potential. Intrusions with which ore deposits are associated have been emplaced at depths generally less than 10 km and may be regarded as parts of subvolcanic systems, emplaced passively in extensional tectonic regimes and localized by basement structures. Mason (1990) has suggested that the similarities between Archean, hydrothermal gold systems and Cenozoic deposits reflects similarities in the tectonic settings of Cenozoic magmatic arc complexes and Archean greenstone belts.
SCHREIBER-HEMLO—1992

SCHREIBER AREA
The following article was found in the News–Chronicle, July 23, 1936:

One of the late pieces of mining news relates to the setting up of a small mill, known as a pilot or experimental mill, on one of the properties in the vicinity of Schreiber. The hope is that this mill will prove the commercial possibilities of the property on which it will be placed, so that a larger one may be installed for more permanent use later on.

Schreiber has been mentioned in the mining news for years. Somehow, however, it has never come into prominence. It has not enjoyed the booms which locate themselves here and there over Canada at different times. It is known, however, that within a few miles of town there are several properties on which gold can be found. Some showings are actually sensational. High grade samples come frequently from various locations.

What has yet to be done is to locate a piece of ground where the gold depositions have been general, in such quantity and so distributed as to warrant a big scale mining operation. It may be that a number of small mills will be kept going on properties already under exploration and development but the big ambition will remain to find a property of size, one which would warrant a mill giving employment to at least a hundred men. That would constitute an important industry and become a valuable contribution to the community.

Hope in this connection is deferred but is not dead. Geologists have reported favorably and practical mining men who are not geologists also express the belief that some day the big find will be made. It is declared to be an impossibility that gold can be so scattered about the territory without the existence at some point of what in some parts of the world is called the "Mother Lode".

It has been 56 years since that article was published, and Schreiber’s "big mine" has yet to be found. However, the opinions and beliefs put forward in 1936 are still shared by the prospecting community today. Prior recommendations made by the Resident Geologist’s Program, most recently last year (Schnieders et al. 1992), echo the sentiment that the Schreiber area remains a viable exploration target for gold and to some extent for base metals. The problem that has persisted since the early days of the camp has been one of focussing on narrow, high-grade quartz veins and shear zones. Such targets are not considered viable by exploration companies and as a result have seldom been explored beyond a grass roots prospecting stage.

With the recent development and evolution of a porphyry-related model for the Hemlo gold deposit (this paper), the Schreiber–Hemlo District offers some excellent targets for consideration. Recent work by Hemlo Gold Mines Inc., as summarized in this volume, suggests potential for large tonnage-low grade deposits hosted in felsic intrusive rocks. On the North Shores property in the Worthington Bay area, gold mineralization is confined to pyrite-chlorite haloes around and within quartz veins and silicified zones (Londry 1992). While mineralized zones are present in quartz-phryic and feldspar-phryic rocks, syenite and felsic metavolcanic rocks, the quartz-phryic rocks appear to preferentially develop the potentially larger tonnage targets. In addition, the conjugate(?), east-northeast-trending structures play a role in the gold mineralization event, likely acting as conduits for auriferous hydrothermal solutions.

Exploration by J. Courtney and G. Daniels on their Worthington Creek property (Schnieders et al. 1991) during the past 3 years has produced gold values up to 4.18 ounces Au per ton associated with northeast-trending, massive pyrite veins (Baker Vein), as well as gold values up to 0.22 ounces Au per ton in quartz porphyry (J. Courtney, Prospector, personal communication, 1992). The Worthington Creek property is approximately 2.5 km northeast of the North Shores property. Quartz porphyry, syenite and felsic metavolcanic host rocks are present on both properties. The entire area represents an excellent target for gold mineralization. Perhaps more viable alternatives may be lower grade but larger tonnage targets, such as mineralized quartz-feldspar porphyries, breccia zones and altered volcanic and granitic rocks.

Another area where a large tonnage-low grade target is associated with quartz porphyry is the Big Duck Lake area located 20 km north of Schreiber. Numerous gold occurrences as well as copper and molybdenum are associated with quartz porphyry at or near the contact with metavolcanic rocks. Gold occurs within quartz ± carbonate veins as well as in silicified and altered zones (Pye 1964; Patterson et al. 1984, 1985). It is interesting to note that work conducted by Schnieders in 1983 (Patterson et al. 1984) indicated pervasive sericite and biotite alteration along with areas of increased pyritization and gold mineralization. At the Coco–Estelle property, gold mineralization appears associated with altered, biotite-rich metavolcanic rocks. Samples collected by the author of biotite-rich, mafic schist assayed 0.17 ounces Au per ton (sample 83–BCE–2; Patterson et al. 1984). Crosscutting structures also appear to have been important in localizing gold. The Big Duck porphyry and its contact zones represent excellent targets for gold mineralization and is highly recommended as an exploration target in light of recently proposed models.

We should not, however, downplay the potential for small-scale mining of narrow, high-grade veins. As has been demonstrated in the Schreiber camp by the late W. Acker, and elsewhere in northwestern Ontario, such veins may be profitable mined and milled on a small scale. Recent work in the McKenna–McCann and W3 vein areas have demonstrated a continuous and persistent nature to the quartz veins with potential strike lengths of greater than 1 km. Erratic, but high-grade gold values have been present in both historic and recent bulk sampling. Exploration by T. Twomey in the Schreiber–Pyramid area has identified zones of high-grade
gold mineralization (0.5 to 1.0 ounces Au per ton). Exploration carried out by Hemlo Gold Mines Inc. on the North Shores–Worthington Bay property delineated new, high-grade zones similar to that found in the mine itself, in addition to wider, lower grade zones. Small scale, high-grade opportunities still exist in the Schreiber area.

In closing, we will leave you with an excerpt from the Lakehead cities News-Chronicle, March 27, 1937, p.14:

It is remarkable of the Schreiber area that a considerable number of finds have been made over a long span of years. There seems to be gold in almost every direction from the town. The difficulty has been to get sizeable deposits, veins with reasonable values that could be measured in something more than inches width. Some people hold the belief that the numerous finds point to the certainty that some day, whenever it is, the discovery of a big main zone in that section will be made.

Base Metals

JACKPINE RIVER–GRAVEL RIVER AREA

This area is host to a number of copper + silver + gold occurrences that are hosted by the north-northeast-striking Jackpine River–Glacier Creek fault. These include the Jackpine River (Moschuk) and Glacier Creek (Potter) occurrences (Schnieders and Smyk 1990). A number of other copper occurrences are located along northwest-striking faults near Barbara, Kabamichigama, Greenhedge and Chapman lakes (Carter 1975). Chalcopyrite, the dominant base metal sulphide, is typically hosted by composite quartz veins, vein networks and vein breccias. OPAP-assisted prospecting by C. Bumbu in 1992 on the Moschuk occurrence returned up to 70 100 ppm Cu and 0.122 ounces Au per ton in a selected grab sample. (Resident Geologist’s files, Resident Geologist’s office, Schreiber–Hemlo District, Thunder Bay). Further work designed to test the strike length and lateral continuity of these occurrences is recommended.

Although this area is underlain predominantly by high-grade metamorphic rocks of the Archean Quetico Subprovince, the aforementioned faults host Mesoproterozoic diabase dikes, some of which host copper mineralization. Therefore, the vein-hosted mineralization is considered to be Mesoproterozoic. In addition, a number of amethyst-bearing quartz veins have been noted in proximity to the same faults. They have been documented by Carter (1975) and Vos (1976).

JACKFISH AREA

Recent prospecting by J. Courtney and G. Daniels in the Tuuri–Walsh townships area has discovered soil horizons anomalous in zinc. This is consistent with lake bottom sediment survey (Friske et al. 1991a) data collected and compiled for this area. The metavolcanic rocks in the Prairie River–Marlhill area host numerous copper and zinc occurrences and warrant further prospecting and exploration. The Prairie River–Marlhill area presents a deformed and schis-
Figure 7.5. Generalized geology of the eastern part of Lake Superior (modified after Sutcliffe 1991) showing distribution of kimberlites in northern Michigan (adapted from Jarvis and Kalliokoski 1988) in relation to major structures, alkalic complexes, carbonatitic rocks and diatremes north of Lake Superior. Key to abbreviations: CAC, Port Coldwell alkalic complex; CL, Chipman Lake fenites; KL, Killala Lake alkalic complex; PL, Prairie Lake carbonatite complex; TF, Thiel fault; TSTZ, Trans-Superior tectonic zone.

In the light of such ideas the authors recommend exploration for base metals in the Victoria Lake, Ansell Lake and Rhumly–Fishnet Lake areas and within the Santoy–Middleton metavolcanic rocks.

Industrial Minerals

A new amethyst occurrence was discovered by J., C. and J. Vos, near Kabamichigama Lake in 1992. Amethyst veins up to 10 cm in width and exhibiting a deep purple colour were discovered. Recent logging activity in the Klersy–Quoits Lake area has resulted in the construction of an extensive new road network that provides access to the area southeast of Upper Roslyn Lake, near the Gravel River fault. Amethyst-bearing veins are usually associated with faults or lineaments that may be recognized on aerial photographs or suggested on the ground by narrow, straight valleys or ravines. Since these areas are low-lying, glacial overburden may accumulate in them. Prospectors should examine drift material for amethyst-bearing float derived from a buried or near-removed source. As noted by Vos (1976), the Little Bear occurrence near Kabamichigama Lake was discovered by tracing pieces of amethyst-bearing granite from a roadside to their source nearby. Further information and recommendations regarding amethyst will be presented by Garland (in press).

Bartley (1955) noted the occurrence of several wide quartz veins that are adjacent and parallel to the Gravel River fault southwest of Dickison Lake. Although some of these veins carry sulphides, the majority are barren and may attain
widths up to 90 m. The absence of sulphides or other deleterious minerals, vein width and development of new access roads may make these veins attractive as industrial minerals targets (see Hinz and Lucas, this volume). Although most of these veins have been discovered on the east side of the fault, it is recommended that the area immediately west of the fault, in the vicinity of Dinkin and Liver lakes, also be prospected. Recent logging activity will facilitate prospecting in this area.

Discussions with G. Stott (Ontario Geological Survey—Geoscience Branch, Sudbury) indicated that units 14 and 15 on the Bedrock Geology of Ontario series maps (OGS 1991 a-d) may represent industrial mineral targets for building and dimension stone (G. Stott, Ontario Geological Survey—Geoscience Branch, personal communication, 1992). These units represent less deformed and altered granodiorite, granite, diorite and monzonite stocks worth exploring.

Diamonds

There has been much renewed interest in diamond exploration of late, largely due to the recent discovery of diamondiferous kimberlite fields in the Slave Province of the Northwest Territories. Although past diamond exploration in Ontario has resulted in the discovery of kimberlites in the Kirkland Lake area and possible correlatives in the James Bay Lowlands, the search area has been expanding as local interest grows from prospectors and explorationists across the province.

There are some considerations that should be taken into account when trying to apply kimberlite exploration criteria to the Schreiber—Hemlo District. Although no known rocks of kimberlitic affinity have been found to date locally, it is interesting to note that the Port Coldwell and Killala Lake alkaline intrusive complexes, the Prairie Lake carbonatite complex and the Dead Horse Creek and McKellar Creek diatremes define a crustal structure that may have some implications for kimberlite occurrence. This structure, the Thiel fault or Trans—Superior tectonic zone (TSTZ), is related to Keweenawan, mid-continent rifting, which resulted in upper mantle magmatism (Figure 7.5). Although Mitchell (1986) stated that there was no relationship between kimberlites and rift zones and between kimberlites and carbonatites (Mitchell 1979), Sage (1982) has suggested that worldwide evidence may indicate that the structures that control alkaline rock and carbonatite intrusion may also govern the emplacement of kimberlites.

Sage (1982) also draws upon the fact that kimberlites have been discovered in Michigan's Upper Peninsula where the southern extension of the TSTZ may be extrapolated. As described by Cannon and Mudrey (1981) and Jarvis and Kalliokoski (1988), the Michigan kimberlites are Jurassic and occur in rocks varying from Archean and Proterozoic cratonic rocks to Ordovician sedimentary rocks. Preliminary research has suggested that these kimberlites were not the source of drift diamonds found in Wisconsin, although the occurrence of as yet undiscovered, diamondiferous kimberlites nearby is supported by some of the mineral chemistry.

Two intriguing possibilities result from these disclosures:

1. If the Michigan kimberlites are not the source for the drift diamonds, then the likely source(s) are undiscovered kimberlites on the opposite side of Lake Superior, in Ontario; and

2. Because kimberlites do occur in Michigan, then the possibility exists that kimberlites may occur in rocks of similar age (Archean to Proterozoic) and tectonic setting (stable cratonic) on the northern extension of the TSTZ in the Schreiber—Hemlo District

The reader is referred to a number of references that will better describe the criteria used in diamond and kimberlite exploration. These include Brummer (1978), Fipke (1990) and Mitchell (1991).

Other recommendations with regard to industrial minerals and dimension stone in the Schreiber—Hemlo District are presented by Hinz and Lucas (this volume).

THE MANITOUWADGE MINERAL RESOURCE GEOLOGIST PROJECT

Introduction

The Manitouwadge Mineral Resource Geologist Project was initiated in January 1991, to stimulate and facilitate mineral exploration within a 50 km radius of the township of Manitouwadge (Figure 7.6). Primary objectives of the project include the compilation, research and investigation of new and previously known mineral occurrences in the Manitouwadge area; preparation of an Open File Report documenting these occurrences; provision of client services via property examinations, field trips, sample analyses and information dispersal; and provision of public education via prospecting classes, technical presentations and poster displays. The project is supervised by, and operates in conjunction with, the Schreiber—Hemlo Resident Geologist Program and is scheduled to terminate on March 31, 1993. Funding is provided by the Canada—Ontario Northern Ontario Development Agreement (NODA). It is hoped that this project will enhance the geologic data base for the Manitouwadge area and possibly assist in the discovery of new mineral resources to replace those currently being depleted.

The project area includes both the Manitouwadge and Hemlo mining camps. Approximately 110 metallic and/or economic mineral occurrences are reported to exist in the area including 4 producing mines (the David Bell, Golden Giant and Williams mines in Hemlo and the Geoco Division Mine in Manitouwadge) and 3 past producers (the Big Nama, Willecho and Willroy mines located near Manitouwadge).

Thirty-three property visits and 4 field trips were conducted in 1992 (Table 7.8; Figure 7.6). A total of 179 grab and chip samples were collected and submitted for multielement analysis to determine metal content and chemical alteration where applicable. The results of these examinations, and of
Several previously undocumented mineral occurrences were discovered in the Manitouwadge area by prospectors in 1992. These include the McKay–Fowler zinc occurrence located in the Spruce Bay area of White Lake by D. McKay and prospector B. Fowler (OPAP funded), the McGraw Lake copper occurrence located approximately 18.6 km east-southeast of Manitouwadge by A. Turner and the Thomas Lake Road sulphide-graphite occurrence located approximately 28 km northeast of Manitouwadge by B. Brinklow, L. Brinklow and P. Nivens (OPAP funded).

A poster display, entitled "Mineral Occurrences, Prospects and Mines in the Manitouwadge Area," was presented at the Ontario Mines and Minerals Symposium held in Toronto during December 1992. A poster display and an oral presentation, entitled "Mineral Occurrences and Exploration Potential of the Manitouwadge Area," were presented at the Northwestern Ontario Mines and Minerals Symposium held in Thunder Bay during April, 1992. A similar display and oral presentation will be presented at the Northwestern Ontario Mines and Minerals Symposium to be held in Thunder Bay during April 1993. An oral presentation, entitled "Prospecting Opportunities in the Manitouwadge Area," was presented at a prospector’s information session held in Marathon during January 1992. A course on basic prospecting was presented in Manitouwadge during February 1992. This course was attended by 58 people and was very well received. Primary and secondary school classes, as well as members of the general public, were given guided tours through a Mining
Table 7.8. Property examinations, Manitouwadge Mineral Resource Geologist, 1992 (numbers keyed to Figure 7.6).

<table>
<thead>
<tr>
<th>Number</th>
<th>Property Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Agonzon Lake property</td>
</tr>
<tr>
<td>2</td>
<td>Beavercross Lake copper occurrence</td>
</tr>
<tr>
<td>3</td>
<td>Beggs-Currie copper-nickel occurrence</td>
</tr>
<tr>
<td>4</td>
<td>Big Nama Creek Mine(^2)(^4)</td>
</tr>
<tr>
<td>5</td>
<td>Bunny Lake sulphide occurrence</td>
</tr>
<tr>
<td>6</td>
<td>Camp 54 Road sulphide occurrence</td>
</tr>
<tr>
<td>7</td>
<td>Dorothy Lake sulphide occurrence</td>
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<tr>
<td>8</td>
<td>Faries Lake property</td>
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<tr>
<td>9</td>
<td>Forty-sixer property</td>
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<tr>
<td>10</td>
<td>Geco Division Mine(^1)(^4)</td>
</tr>
<tr>
<td>11</td>
<td>Halverson sulphide occurrence</td>
</tr>
<tr>
<td>12</td>
<td>Hemlo highway section</td>
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<tr>
<td>13</td>
<td>Hitch Lake sulphide occurrence</td>
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<tr>
<td>14</td>
<td>Husak Road sulphide occurrence</td>
</tr>
<tr>
<td>15</td>
<td>Ice Cream Lake Road sulphide occurrence</td>
</tr>
<tr>
<td>16</td>
<td>Kusins lead-zinc occurrence</td>
</tr>
<tr>
<td>17</td>
<td>Leigh Siding area</td>
</tr>
<tr>
<td>18</td>
<td>McGraw Lake copper occurrence(^3)</td>
</tr>
<tr>
<td>19</td>
<td>McKay-Fowler zinc occurrence(^3)(^4)</td>
</tr>
<tr>
<td>20</td>
<td>Middle Falls Road sulphide occurrence</td>
</tr>
<tr>
<td>21</td>
<td>Moshkinabi sulphide occurrence</td>
</tr>
<tr>
<td>22</td>
<td>Olivier sulphide occurrence</td>
</tr>
<tr>
<td>23</td>
<td>One Otter Lake East property</td>
</tr>
<tr>
<td>24</td>
<td>Rockbound Lake copper occurrence</td>
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<tr>
<td>25</td>
<td>Roger Lake area</td>
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<tr>
<td>26</td>
<td>Summers Lake property</td>
</tr>
<tr>
<td>27</td>
<td>Swill Lake property(^4)</td>
</tr>
<tr>
<td>28</td>
<td>Thomas Lake Road sulphide occurrence(^3)</td>
</tr>
<tr>
<td>29</td>
<td>Trapline property</td>
</tr>
<tr>
<td>30</td>
<td>Two Finger Lake property</td>
</tr>
<tr>
<td>31</td>
<td>Wabikoba Creek property(^4)</td>
</tr>
<tr>
<td>32</td>
<td>Willecho Mine(^2)(^4)</td>
</tr>
</tbody>
</table>

\(^1\)current producer  
\(^2\)past producer  
\(^3\)new occurrence  
\(^4\)visited during a field trip conducted in 1992

Sequence display set up by the Ministry of Northern Development and Mines in Thunder Bay during February and June 1992. Exploration company personnel and/or government geologists were given tours of the Wabikoba Creek property, the Swill Lake property and the Geco Division, Willroy, Big Nama and Willecho mine properties. In addition to the above, exploration in the Manitouwadge area was promoted through numerous informal discussions with prospectors and exploration company personnel.

Assistance was provided to Geological Survey of Canada geologists I. Kettles and E. Zaleski, both of whom are working in the Manitouwadge area on multi-year NODA-funded projects initiated in 1991.

Several geologic short-courses and seminars were attended including: short-courses on "Industrial Minerals" and "Five-Element Vein Systems" presented in Thunder Bay by Dr. S. Kissin of Lakehead University during February and March of 1992, respectively; and a symposium devoted to "Contemporary Approaches to Exploration for Metallic Mineral Deposits" presented in Thunder Bay by the Canadian Institute of Mining and Metallurgy during March of 1992.

Acknowledgments

Numerous prospectors and geologists provided valuable information and assistance during the past 2 years. Exploration personnel from Geco Division (Noranda Inc.) and Noranda Exploration Company Ltd. provided access to proprietary information regarding mineral occurrences in the Manitouwadge area. H. Williams, F. Breaks, E. Zaleski, V. Peterson, I. Wolfson, B. Schnieders and M. Smyk conducted field trips familiarizing the author to various aspects of the geology of the Manitouwadge area. T. Oja provided assistance in the field. B. Nelson provided technical assistance and lapidary services. K. Fenwick, B. Schnieders and M. Smyk reviewed and edited this manuscript. S. Warren and A. White provided typing and word-processing support.

MINING ACTIVITY

Mining activity in the Manitouwadge area (i.e., within a 50 km radius of the township of Manitouwadge) is summarized in the Schreiber-Hemlo Resident Geologist's section of this report.

EXPLORATION ACTIVITY

Mineral exploration in the Manitouwadge area in 1992 consisted of 31 active projects (see Figure 7.2; Table 7.2). This represents an increase in activity of approximately 15% from 1991 (one of the few increases in activity within the district and Ontario in 1992). Of these projects, 20 were base metal-related, 10 were gold-related and 1 was industrial mineral-related.

Prospectors performed the majority of the exploration in the Manitouwadge area, accounting for approximately 58% of the active projects. This represents a 70% increase in the number of prospector-driven projects in the area relative to 1991. This increase can be attributed, at least in part, to government efforts to stimulate exploration in the Manitouwadge area, including both the Ontario Prospectors Assistance Program (OPAP) and the Manitouwadge Mineral Resource Geologist Project.
Major exploration companies active in the Manitouwadge area in 1992 included the Noranda group of companies (Hemlo Gold Mines Inc., Noranda Inc. (Geco Division) and Noranda Exploration Company, Ltd.), Newmont Exploration Ltd., Placer Dome Inc., Williams Operating Corporation and Homestake Canada Ltd. Together, these exploration companies accounted for approximately 42% of the exploration projects carried out in 1992. This represents a 24% decrease in the number of company-driven projects in the area relative to 1991 and reflects the sign of the times in this current recessionary period. No junior exploration companies were active in the Manitouwadge area in 1992.

Gold Exploration

Gold exploration accounted for approximately 32% of the exploration projects undertaken in the Manitouwadge area in 1992. The majority of this work (70%) was performed within the “North Limb” of the Hemlo greenstone belt, primarily in the vicinity of the Hemlo mines. A summary of the gold-exploration projects carried out in the vicinity of the Hemlo mines is provided in the Schreiber–Hemlo Resident Geologist’s section of this report. Other areas explored for gold include the Thomas Lake, Agonzon Lake and Summers Lake areas.

Prospectors L. Brinklow, R. Brinklow, W. Brinklow and P. Nivens were active in the Thomas Lake area located within the Quetico Subprovince approximately 28 km northeast of Manitouwadge. Work performed in 1992 included stripping, trenching and geophysical surveys (ground magnetic survey [GM], VLF–EM, horizontal loop electromagnetic [HLEM]). This exploration was funded by the Ontario Prospectors Assistance Program. Preliminary assay results have returned up to 0.016 ounces Au per ton and 644 ppm Cu in grab samples of sheared, graphite-rich, pyritic, granulite-facies paragneiss. Graphite commonly occurs as coarse-grained flakes within narrow shear zones and locally constitutes up to 20% of the sheared paragneiss. The flake graphite potential of this property is currently under evaluation (see Hinz and Lucas, this volume).

Prospectors G. Gionet and R. Gionet were active in the Agonzon Lake area located approximately 14 km south of Manitouwadge. Work performed in 1992 included small-scale lake and stream sediment sampling program focussed around the south end of Agonzon Lake. Lake sediment geochemical data released by Friske et al. (1991b) indicate the presence of anomalous amounts of Au (30 ppb) and Zn (355 ppm) in a sample collected from the south end of Agonzon Lake. Assay results for lake sediment samples collected by G. and R. Gionet from the south end of Agonzon Lake have returned up to 0.024 ounces Au per ton, 900 ppm Zn and 56 ppm Cu (Resident Geologist’s files, Thunder Bay Resident Geologist’s office, Schreiber–Hemlo District, Thunder Bay). The area is underlain primarily by granitic and granodioritic gneisses and migmatites of the Black–Pic batholithic complex (Milne 1968). Examination of the local geology failed to locate any possible, proximal bedrock sources or explanation for the metals present in the lake sediment samples. The area is, however, covered by appreciable amounts of sandy overburden, and a distal source for the metals remains a possibility.

Newmont Exploration Ltd. was active in the Summers Lake area located within the north limb of the Hemlo greenstone belt approximately 32.5 km south of Manitouwadge. Diamond drilling was performed on the Summers Lake property, and geologic mapping and lithogeochemical sampling was performed on the Summers Lake (east) property (also known as the Armand Lake property). The area is underlain primarily by a mixed sequence of south-facing, mafic, intermediate and felsic metavolcanic rocks and minor metasedimentary interbeds. Samples of pyritic, sericite schist collected from the Summers Lake (east) property have returned assay values of up to 0.086 ounces Au per ton (Resident Geologist’s files, Thunder Bay Resident Geologist’s office, Schreiber–Hemlo District, Thunder Bay). The results of the drilling are not yet known.

Base Metal Exploration

Base metal exploration accounted for approximately 67% of the exploration projects undertaken in the Manitouwadge area in 1992. Exploration for base metals was focussed in 4 major areas including the Manitouwadge synform and surrounding area, the north limb of the Hemlo greenstone belt from the Black River in the west to White Lake in the east, the Quetico Subprovince north of Manitouwadge and the Paries Lake area northeast of Marathon.

Geco Division (Noranda Inc.) was active on 2 properties located within the eastern extension of the north limb of the Manitouwadge synform. Line cutting and geologic mapping were performed on the Banana Lake property located approximately 25 km northeast of Manitouwadge. Diamond drilling, lithogeochemical sampling and soil sampling were performed on the One Otter Lake East property located adjacent to, and immediately north of, the Banana Lake property. A thin, relatively continuous (650 m strike length) zone of anthophyllite- and garnet-bearing “hornfels” and gneiss has been discovered on the One Otter Lake East property. This zone may represent the thin (tectonically “stretched”?) edge of a metamorphosed, hydrothermal alteration assemblage, whose wider core could potentially exist at depth (Wolfson 1992). The results of diamond drilling performed to test this hypothesis are not yet known.

Prospector A. Turner was active in the Faries Lake area and discovered a new copper occurrence located approximately 18.6 km east-southeast of Manitouwadge and 0.5 km west of McGraw Lake. Preliminary assay results have returned up to 0.36% Cu, 63 ppm Zn and 0.36 ounces Ag per ton in grab samples of sulphide-bearing, amphibolite, mafic metavolcanic gneiss (Resident Geologist’s files, Thunder Bay Resident Geologist’s office, Schreiber–Hemlo District, Thunder Bay). The mineralization is erratically distributed and appears to be confined to small (50 by 20 cm), isolated fragments of amphibolite within the brecciated contact zone between the mafic metavolcanic rocks located west of McGraw
Lake and the surrounding tonalitic rocks of the Black–Pic batholithic complex. Minor stripping, trenching and sampling were performed on the property during 1992.

A. Turner also continued exploration on his Swill Lake property located in Leslie Township approximately 9.5 km west of Manitouwadge. Work performed in 1992 included geologic mapping, geophysical surveys (VLF–EM, HLEM), line cutting, trenching, prospecting and sampling. This work was partially funded by the Ontario Prospectors Assistance Program. Local geology consists of hydrothermally altered mafic metavolcanic flows, lesser interflow metasedimentary rocks and thin, aphyric, felsic metavolcanic flows. Some of these units are sulphide-bearing. The best assay results returned to date include 1180 ppm Zn, 532 ppm Cu and 0.071 ounces Au per ton in grab samples collected from the southwest end of the property ( Resident Geologist’s files, Thunder Bay Resident Geologist’s office, Schreiber–Hemlo District, Thunder Bay).

Prospectors B. Fowler and M. Shuman have discovered several new zinc occurrences on their Wabikoba Creek property located within the north limb of the Hemlo greenstone belt approximately 38 km south-southeast of Manitouwadge. Preliminary assay results have returned up to 0.97% Zn and 294 ppm Cu in grab samples of altered, clastic, interflow metasedimentary rocks and up to 0.40% Zn and 0.15% Cu in grab samples of silicified mafic metavolcanic rocks (see “Property Examinations” [Manitouwadge Project] section). Work performed on the property in 1992 included trenching, prospecting, sampling and a small-scale soil geochemical survey. This exploration was partially funded by the Ontario Prospectors Assistance Program. At the time of writing, the property was available for option.

Prospectors D. Saunders and P. Simoneau were active on their Summers Lake and Ihnatko–Kusins properties located within the north limb of the Hemlo greenstone belt approximately 30 km south of and 38 km south-southwest of Manitouwadge, respectively. Linecutting, geologic mapping, prospecting, sampling, trenching and ground geophysical surveys (EM–Beep Mat) were conducted on both properties. Grab samples of folded, sulphide-bearing iron formation collected from the Summers Lake property have returned assay values of up to 0.34% Zn and 517 ppm Cu ( Resident Geologist’s files, Thunder Bay Resident Geologist’s office, Schreiber–Hemlo District, Thunder Bay). Grab samples of well-mineralized, fine-grained, siliceous schist (argillaceous metasedimentary rock?) collected from the Kusins lead-zinc occurrence located on the Ihnatko–Kusins property (see “Property Examinations” [Manitouwadge Project] section) have returned assay results of up to 10.74% Zn, 8.95% Pb, 0.25 ounces Ag per ton and 340 ppb Au (Simoneau 1992). At the time of writing, the Ihnatko–Kusins property was available for option.

G. Goodwin and A. Turner continued to prospect and sample on their Otter Lake property located within the Quetico Subprovince approximately 20 km north of Manitouwadge. Assay results have returned up to 0.169% Cu and 0.021 ounces Au per ton in grab samples of pyrrhotite-rich iron formation collected from the property (Schnieders et al. 1992).

Noranda Inc. (Geco Division) carried out line cutting, geologic mapping, soil geochemical sampling and a ground geophysical survey (HLEM) on its Candybar Lake property located within the Quetico Subprovince approximately 32 km northeast of Manitouwadge. This work constituted a ground follow-up program based on a regional airborne geophysical survey flown by Noranda in 1989. No further work is planned for the property.

**Platinum Group Element Exploration**

No exploration for platinum group elements occurred in the Manitouwadge area during 1992.

**Industrial Minerals Exploration**

A. Turner is currently assessing the building and/or dimension stone potential of his Dotted Lake property located within the Dotted Lake pluton (Milne 1968) approximately 27.8 km south-southeast of Manitouwadge. The area is underlain primarily by light pink to white, massive, coarse-grained, biotite leucograno-diorite (Milne 1968). The area was previously staked by Calicchia Stone Industries of Cleveland Ohio, but no work was done on the property. A test block suitable for cutting and polishing is scheduled to be removed early in 1993.

**PROPERTY EXAMINATIONS**

**Kusins Lead-Zinc Occurrence**

The Kusins lead-zinc occurrence is located in the Amwri Lake area approximately 38.5 km south-southwest of Manitouwadge and 0.9 km west of the Black River. The area is accessible via the Suede logging road, which transects the western part of the Ihnatko–Kusins property (Simoneau 1992) approximately 1.5 km west of the Kusins occurrence. The Kusins occurrence can be accessed by foot along re-
cently cut grid lines that cross the Swede Road approximately 23.5 km south-southwest of the intersection between the Swede Road and Highway 614.

The area surrounding the Kusins lead-zinc occurrence has been sporadically explored by prospectors and exploration companies since the early 1960s. T. and W. Kusins, acting on information provided by an Ontario Paper Company employee named Ihnatko, staked the first claims in the vicinity of the occurrence in the fall of 1963. The claims were examined by geologists of the Mining Corporation of Canada Ltd. and Willroy Mines Ltd. in 1963, but no options were taken on the property (Milne 1968).

In 1964, Ihnatko and Kusins blasted 4 small pits on the occurrence. Grab samples collected from the pits are reported to have returned assay values of over 20 ounces Ag per ton (Simoneau 1992). During the summer of 1965, V. Milne (1968) mapped and described the occurrence for the Ontario Department of Mines. A grab sample collected from 1 of the pits by T. and W. Kusins and submitted to the Ontario Department of Mines for analysis returned assay values of 1.93% Zn, 0.94% Pb, 0.64 ounces Ag per ton and traces of copper and gold (Milne 1968).

The occurrence was optioned to the Consolidated Mining and Smelting Company of Canada Limited (Cominco) in 1965. Cominco conducted geophysical and soil geochemical surveys on the property and drilled 6 shallow holes in the vicinity of the occurrence. Drill logs for 4 of the holes were submitted for assessment credit. Minor sulphide mineralization, including sphalerite, galena and chalcopyrite, was reported to occur in drill core from all 4 holes (assessment files, Resident Geologist's office, Schreiber–Hemlo District, Thunder Bay). Unfortunately, no assay data were submitted for this drill core. The original claims covering the Kusins occurrence were allowed to lapse in 1967.

The property remained idle until 1982 when Pryme Energy Resources Ltd. staked a large block of claims in the area. These claims were subsequently optioned to Noranda Exploration Company Limited who mapped and sampled the area surrounding the occurrence in 1984 (assessment files, Resident Geologist's office, Schreiber–Hemlo District, Thunder Bay). The claims covering the occurrence were allowed to lapse in 1986 and were subsequently restaked in 1987 by Dolphin Explorations Ltd.

In 1988, Corona Corporation, acting on behalf of Dolphin Explorations Ltd., performed geologic mapping and soil geochemical surveys in the area surrounding the Kusins occurrence (assessment files, Resident Geologist's office, Schreiber–Hemlo District, Thunder Bay). Anomalous amounts of copper, zinc and lead were found to occur in the soil samples collected from around the Kusins occurrence (assessment files, Resident Geologist's office, Schreiber–Hemlo District, Thunder Bay). No further work was done and the claims were allowed to lapse.

In 1990, prospector D. Saunders staked 22 contiguous claims in the area surrounding and including the occurrence (at the time of writing, 11 of these claims had lapsed). During 1991 and 1992, D. Saunders and P. Simoneau performed line cutting, stripping, trenching, prospecting, sampling, geologic mapping and ground geophysical surveys (MAG, VLF-EM, Beep Mat) on their Ihnatko–Kusins property. Several conductive zones were located and assay values of up to 10.7% Zn, 8.95% Pb, 907 ppm Cu and 340 ppb Au were obtained from grab samples collected from the number 2 pit on the Kusins occurrence (Simoneau 1992). A 0.75 m long chip sample taken across the main mineralized zone in the number 2 pit returned assay values of 0.84% Zn, 0.13% Pb, 69 ppm Cu, 6.4 ppm Ag and 18 ppb Au (Simoneau 1992).

The Kusins occurrence is located within the north limb of the Hemlo greenstone belt, approximately 8 km north of the Hemlo mining camp. The supracrustal rocks in the vicinity of the occurrence are moderately to strongly foliated (220/60NW) and have experienced upper amphibolite facies grades of metamorphism.

The Gowen and Bullring Lake plutons are located approximately 225 m northwest and 3 km southeast of the occurrence, respectively. The contact between the supracrustal rocks and the Gowen pluton is brecciated in the vicinity of the occurrence (Simoneau 1992). The Bullring Lake fault, a major west-northwest-trending, dextral fault, is located approximately 305 m south of the occurrence (Simoneau 1992; Milne 1968). Several Proterozoic diabase dikes have intruded the supracrustal rocks in the vicinity of the occurrence.

The area surrounding the occurrence is underlain primarily by a northeast-trending sequence of foliated, amphibolitic, mafic metavolcanic schists and gneisses; siliceous, argillaceous metasedimentary rocks; and sericitic, felsic metavolcanic tuffs (Simoneau 1992; Hamilton 1989; Kemp 1984; Milne 1968). The occurrence is located on the northwest side of a low ridge at the contact between argillaceous metasedimentary rocks and felsic metavolcanic tuffs (Simoneau 1992). The argillaceous metasedimentary rocks are generally fine-grained, dark to light gray, thinly laminated, siliceous phyllites and schists. The felsic metavolcanic tuffs are generally fine- to medium-grained, light tan to buff, thinly laminated, quartzphyric, quartzfeldspathic, sericite schists.

A total of 6 shallow pits, varying in size up to approximately 7 m long by 2 m wide by 2.5 m deep, were located on the occurrence (Figure 7.7). For reference purposes, the pits have been numbered sequentially in a clockwise pattern to correspond with the numbering system initiated by Milne (1968). Pits 1 to 3 are located primarily within the argillaceous metasedimentary rocks, while pits 4 to 6 are primarily within the felsic metavolcanic tuffs. Sulphide mineralization is exposed in all of the pits. The main mineralized zone is hosted within the argillaceous metasedimentary rocks and is exposed in pits 1 to 3.

The occurrence consists of disseminated to locally semimassive sulphide mineralization hosted in argillaceous metasedimentary rocks and felsic metavolcanic tuffs. The sulphide mineralization consists primarily of fine- to coarse-grained, generally euhedral pyrite, with minor amounts of
Figure 7.7. Geological sketch map of the Kusins lead-zinc occurrence (see "Property Examinations" [Manitouwadge Project] section for details).

The sulphides, exposed in pits 1 to 3, define a mineralized zone approximately 3 m wide and 15 m long. Disseminated pyrite occurs throughout this zone. Two thin (30 cm wide), foliation-parallel seams, composed primarily of semimassive to massive pyrite, occur within the central part of this mineralized zone. Some of the sulphides display evidence of having undergone recrystallization and remobilization. The coarse-grained pyrite in the central part of the mineralized zone often displays an annealed texture. Narrow (1 to 2 mm wide) veinlets of fine-grained sphalerite containing minor galena crosscut the semimassive sulphide zone exposed in pit number 2. Thin seams (3 mm wide) of massive pyrite crosscut wider, pyrite-rich sulphide seams exposed in pit number 3. These crosscutting pyrite seams parallel a major joint direction 065° in the surrounding host rocks (Milne 1968). Galena and sphalerite were only observed in pits 2 and 3. The galena was often associated with narrow, crosscutting, calcite-rich, quartz-carbonate veins within the central part of the mineralized zone.

The sulphides exposed in pits 4 to 6 define a second mineralized zone located approximately 20 m south of the zone described above. This second zone parallels the zone exposed in pits 1 to 3 and is at least 1 m wide and 20 m long. The mineralization in this zone consists primarily of thin (1 to 2 mm wide), foliation-parallel seams of disseminated to massive, fine- to medium-grained pyrite hosted in thinly laminated, sericitic, felsic metavolcanic tuff. The sulphide content within this mineralized zone varies from 5 to 25%. No sphalerite, galena nor chalcopyrite was observed within this zone.

Grab sampling of the various rock units has returned the assays listed in Table 7.9.
## Table 7.9. Assay results for samples from the Kusins lead-zinc occurrence.

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Gold (oz/ton)</th>
<th>Silver (oz/ton)</th>
<th>Copper (%)</th>
<th>Zinc (%)</th>
<th>Lead (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>91DBM-91</td>
<td>0.001</td>
<td>nil</td>
<td>0.003</td>
<td>0.002</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>91DBM-92</td>
<td>0.005</td>
<td>trace</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>91DBM-93</td>
<td>trace</td>
<td>trace</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>91DBM-94</td>
<td>trace</td>
<td>0.20</td>
<td>0.022</td>
<td>3.820</td>
<td>1.512</td>
</tr>
<tr>
<td>91DBM-95</td>
<td>0.024</td>
<td>trace</td>
<td>0.008</td>
<td>0.097</td>
<td>0.040</td>
</tr>
<tr>
<td>91DBM-96</td>
<td>trace</td>
<td>trace</td>
<td>0.003</td>
<td>0.009</td>
<td>0.010</td>
</tr>
<tr>
<td>91DBM-97</td>
<td>trace</td>
<td>0.10</td>
<td>0.006</td>
<td>0.020</td>
<td>0.011</td>
</tr>
<tr>
<td>91DBM-98</td>
<td>nil</td>
<td>nil</td>
<td>0.008</td>
<td>0.970</td>
<td>0.288</td>
</tr>
<tr>
<td>91DBM-99</td>
<td>0.001</td>
<td>trace</td>
<td>0.004</td>
<td>0.044</td>
<td>0.020</td>
</tr>
<tr>
<td>91DBM-100</td>
<td>trace</td>
<td>nil</td>
<td>0.018</td>
<td>0.031</td>
<td>0.089</td>
</tr>
<tr>
<td>91DBM-101</td>
<td>trace</td>
<td>nil</td>
<td>0.004</td>
<td>0.008</td>
<td>0.006</td>
</tr>
</tbody>
</table>

Note: n.a, not assayed

### Sample Descriptions:

91DBM-91: rusty, light tan, fine- to medium-grained, strongly foliated, thinly laminated sericite-quartz-feldspar schist, 10% fine- to medium-grained pyrite as disseminated anhedral grains and thin (1 to 2 mm wide), semimassive, foliation-parallel seam; pit #4 (grab)

91DBM-92: rusty, buff, fine-grained, strongly foliated quartz-phyric, sericite schist, 2 to 3% rounded, blue-gray quartz eyes (1 to 2 mm across), 3 to 5% fine-grained pyrite as disseminated anhedral grains and euhedra; pit #4 (grab)

91DBM-93: similar to 91DBM-92; small outcrop located approximately 12 m southwest of pit #3 (grab)

91DBM-94: massive sulphides hosted in rusty, dark gray, fine-grained, weakly foliated, argillaceous schist, 60% coarse-grained, recrystallized pyrite euhedra crosscut by narrow (1 to 2 mm wide) veinlets of quartz containing abundant, dark brown, medium-grained sphalerite and minor, coarse-grained galena; found in rubble of pit #3 (grab)

91DBM-95: rusty, medium grey, very fine-grained, thinly laminated, strongly foliated, cherty band approximately 30 cm wide containing up to 90% coarse-grained, recrystallized pyrite euhedra, trace sphalerite and galena as fine- to medium-grained disseminated grains; east wall, pit #3 (grab)

91DBM-96: similar to 91DBM-92, but less pyritic (1 to 2%) with rare, rounded, blue-grey quartz eyes (1 to 2 mm across); south wall, pit #3 (grab)

91DBM-97: rusty, dark grey, fine-grained, moderately foliated, amphibolitic phyllite, moderately magnetic, less than 1% pyrite as fine-grained disseminated grains; pit #3 (grab)

91DBM-98: similar to 91DBM-95, massive sulphides in very fine-grained, medium grey, cherty band approximately 30 cm wide, up to 80% medium- to coarse-grained, recrystallized pyrite with minor disseminated grains of medium-grained, dark brown sphalerite, crosscut by a narrow (3 cm wide) band of coarse-grained galen; east wall, pit #2 (grab)

91DBM-99: rusty, light gray, thinly laminated, very fine-grained, siliceous schist, 2 to 3% medium-grained pyrite localized in thin (1 to 2 mm wide), foliation-parallel laminae; south wall, pit #2 (grab)

91DBM-100: extensively weathered, massive sulphides in very fine-grained, medium to dark grey, siliceous schist, 80% coarse-grained, annealed pyrite euhedra; south wall, pit #2 (grab)

91DBM-101: rusty, light grey-green, fine-grained, strongly foliated sericite-quartz-feldspar schist, 3 to 5% fine-to medium-grained pyrite as disseminated grains; east wall, pit #1 (grab)
Field observations suggest the sulphide mineralization at the Kusins occurrence may have been deposited, at least in part, peneccontemporaneously with the felsic metavolcanic tuffs and argillaceous metasedimentary rocks in the area. Subsequent recrystallization and remobilization of the sulphides have occurred. The Bullring Lake fault located approximately 305 m south of the occurrence may have played a significant role during the mineralizing processes. The true extent of the mineralization in the area, especially at depth, is not clearly understood. At the time of writing, the Ihnatko–Kusins property, including the Kusins occurrence, was available for option.

McKay–Fowler Zinc Occurrence

Prospectors B. Fowler and M. Shuman, together with partners K. Sperle, G. Daniels and D. Kakeeway, have discovered several new zinc occurrences, including the McKay–Fowler zinc occurrence, on their Wabikoba Creek property located approximately 38 km south-southeast of Manitouwadge. At the time of writing, the property consisted of 63 contiguous claim units stretching from just south of Theresa Lake eastwards to Spruce Bay on White Lake. The western part of the property is accessible via the Wabikoba Lake Road, which extends northeast from Highway 614 to the south end of Theresa Lake. A narrow dam, which can be crossed by foot or ATV, spans Theresa Lake and joins the Wabikoba Lake Road with an old logging road that extends southeast from the dam and transects the western and middle parts of the claim group. The eastern part of the property is accessible via boat by travelling north from the public launch located on the west shore of White Lake (immediately north of Highway 17) and then west into Spruce Bay.

The property is located within the north limb of the Hemlo greenstone belt approximately 20 km northeast of the Hemlo mining camp. The property is underlain primarily by a 2.5 km wide, south-facing, southeasterly trending, sequence of mixed mafic to felsic metavolcanic rocks, derived clastic metasedimentary rocks and both mafic and felsic intrusive rocks (Siragusa 1985; Milne 1968). The metavolcanic and metasedimentary rocks underlying the property are moderately to strongly foliated and have undergone amphibolite facies grade of metamorphism. Pillowed, mafic metavolcanic flows comprise the lowermost unit in the volcanic sequence. These are overlain by thin, discontinuous units of intermediate to felsic metavolcanic flows and pyroclastic rocks that in turn are overlain by a relatively thick succession of metaconglomerate and metagreywacke. The Musher Lake pluton transects the western part of the property, and the Dotted Lake pluton is located approximately 1 km to the northeast (Milne 1968). A large amphibolitic intrusion bounds the northern margin of the property. The White Lake fault, a major, northeast-trending, sinistral fault, is located approximately 600 m southeast of the property (Siragusa 1985; Milne 1968). Several sulphide occurrences are present on the property (Siragusa 1985; Milne 1968). Most of these occurrences are located in the sheared contacts between the metavolcanic and the metasedimentary units.

The general area in the vicinity of the Wabikoba Creek property has been explored intermittently by prospectors and exploration companies since the early 1950s. Although several old pits and trenches have been found on the property, no work was filed for assessment credit, and the results of this early exploration are not known (Fowler 1992).

The geology of the area was mapped in 1964 and 1965 by V. Milne (1968) for the Ontario Department of Mines. Milne (1968) noted the presence of sulphide mineralization within the mafic metavolcanic rocks now comprising the western part of the Wabikoba Creek property, but did not describe the nature of the mineralization nor provide any assay data.

In 1976, Noranda Exploration Company Limited conducted a series of ground geophysical (HLEM, vertical loop electromagnetic [VLEM], MAG) surveys in the area now comprising the Wabikoba Creek property. Numerous conductive zones were delineated by the HLEM survey, but interpretation of the VLEM and MAG data suggested the conductive anomalies were of poor quality and insufficient strength to warrant further work (assessment files, Resident Geologist’s office, Schreiber–Hemlo District, Thunder Bay).

During the Hemlo staking rush of 1983–1984, several exploration companies and individual prospectors staked claims and/or carried out exploration on various properties, parts of which now comprise the Wabikoba Creek property. These include Midnapore Resources Inc., Trident Resources Inc., Brass Ring Resources Inc. and Sunexco Energy Corp. (assessment files, Resident Geologist’s office, Schreiber–Hemlo District, Thunder Bay).

In 1983 and 1984, Midnapore Resources Inc. performed geologic mapping, soil geochemical sampling, ground geophysical (VLF–EM, MAG, IP, resistivity [RES]) surveys and diamond drilling (7 holes, aggregate length of 775.9 m) on its Theresa Lake property, which is now part of the Wabikoba Creek property. Assay values of up to 0.31 ppm Au over 1 m and 2500 ppm Zn over 2.5 m were obtained from samples of drill core collected from the Theresa Lake property (Reid and Sears 1984). Based on the results of this exploration, Reid and Sears (1984) concluded that additional work, including more drilling, was warranted in the area.

In 1983, Trident Resources Inc. had geologic mapping, soil geochemical sampling and a ground geophysical (VLF–EM) survey performed on its Wabikoba Lake claim group, which is now part of the Wabikoba Creek property. The work was carried out by Agilis Engineering Limited. Numerous geophysical, geochemical and geologic targets were identified as a result of this exploration (assessment files, Resident Geologist’s office, Schreiber–Hemlo District, Thunder Bay). Assay values of up to 310 ppb Au were obtained from soil samples collected from the property (Lohman 1983). No base metal analyses were performed on any of the rock or soil samples collected.
Brass Ring Resources Inc. and Sunexo Energy Corp. held ground in the area that is now part of the Wabikoba Creek property. The only work filed for assessment credit by these companies included the results of a helicopter-borne geophysical (HLEM, VLF-EM, MAG) survey flown by Aerodat Limited in 1983. This survey covered over 1570 km² centred around the Hemlo mining camp. The results of this survey indicated the presence of several conductors in the area now comprising the Wabikoba Creek property.

The geology of the area was mapped by G. Siragusa (1985) in 1984 for the Ontario Geological Survey. Siragusa (1985) noted the presence of numerous gossans in the area now comprising the Wabikoba Creek property, especially along the shoreline of Spruce Bay on White Lake. Grab samples collected from these gossans by Siragusa (1985) returned assay values of up to 65 ppb Au. No base metal data are given for any of the gossans sampled.

In 1987 and 1988, Noranda Exploration Company Limited held an option on the Midnapore Resources Inc. Theresa Lake property, which is now part of the Wabikoba Creek property. During this period, Noranda Exploration Company Limited carried out a trenching and sampling program. Forty-nine core samples and 21 grab samples were collected and analyzed for Au, Ag and Mo. The core samples were taken from the material obtained during the 1984 drilling performed on the property by Midnapore Resources Incorporated. The best gold assay obtained was 0.4 ppm Au in a grab sample of fine-grained, felsic or chert exhalite (McDonald 1987).

During the period from 1989–1991, several prospectors, including D. Carroll and G. Carroll, carried out manual and mechanical stripping, trenching and sampling on a group of 6 claims, known as the Spruce Bay group, located adjacent to, and south of, the Wabikoba Creek property. Assay values of up to 6850 ppb Au, 0.54% Zn and 969 ppm Cu have been obtained from grab samples collected from the Spruce Bay claim group (Gallo 1990).

Starting in 1991, prospectors B. Fowler and M. Shuman began staking ground in the Theresa Lake–White Lake area. By the fall of 1992, their Wabikoba Creek property had grown to include 63 claim units. Work performed on the property in 1992 included prospecting, sampling, mechanical trenching and a small-scale soil geochemical survey.

Several new zinc occurrences, including the McKay–Fowler zinc occurrence, were discovered as a result of this recent work. Grab samples of altered, clastic interflow metasedimentary rocks and silicified, mafic metavolcanic rocks collected from the McKay–Fowler zinc occurrence have returned assay values of up to 0.97% Zn and 294 ppm Cu, and 0.40% Zn and 0.15% Cu, respectively. Grab samples of strongly foliated, pyrite-rich, graphitic schist collected approximately 300 m west of the occurrence and 1.8 km west of the occurrence returned assay values of up to 0.40% Zn and 411 ppm Cu, and 0.68% Zn and 209 ppm Cu, respectively. A grab sample of strongly foliated, intermediate to felsic metavolcanic schist from the Spruce Bay part of the property returned an assay value of 0.021 ounces Au per ton (Resident Geologist’s files, Resident Geologist’s office, Schreiber–Hemlo District, Thunder Bay).

The McKay–Fowler zinc occurrence is located on the south shore of the channel connecting Spruce Bay to the main body of White Lake. Siragusa (1985) noted the presence of gossanous rock in the vicinity of the occurrence (i.e., gossan number 39), but did not assay the rocks to determine their base metal content. Grab samples of mafic metavolcanic rock collected from gossan number 39 by Siragusa (1985) returned assay values ranging from 7 ppb Au to 65 ppb Au.

The occurrence is underlain primarily by mafic metavolcanic rocks intercalated with occasional, thin (up to 80 cm wide), interflow metasedimentary units. A large (60 m wide), north-northeast-trending diabase dike is located approximately 300 m west of the occurrence. The White Lake fault is located approximately 600 m to the southeast.

Sulphide mineralization occurs, in varying amounts, in both the metavolcanic and metasedimentary rocks composing the occurrence. The mafic metavolcanic rocks are rusty-weathering, dark green, fine- to medium-grained, moderately foliated, locally silicified, locally strongly magnetic, quartz-feldspar-hornblende schists and gneisses. The metasedimentary rocks are generally rusty-weathering, light creamy-tan to mottled grey-white, very fine- to fine-grained, thinly laminated, moderately foliated biotite-quartz-feldspar schists. The sulphide mineralization consists of disseminated grains, thin (1 mm wide), foliation-parallel seams and fracture coatings of fine- to medium-grained, anhedral to euhedral pyrite; fine-grained, anhedral pyrrhotite; fine- to medium-grained sphalerite; and rare, fine-grained anhedral and small, anhedral patches of chalcopyrite.

The true extent of sulphide mineralization in the vicinity of the occurrence is not yet known, as rock exposure is confined to the shoreline of White Lake and to a low (3 to 5 m high), northeast-trending scarp that crosscuts the local stratigraphy. A narrow (20 cm wide) zone of silicified mafic metavolcanic rocks containing up to 35% sulphides, primarily pyrrhotite and pyrite, occurs along this scarp face approximately 50 m inland from the shoreline. Rusty gossans exposed along the face of this scarp define an erratically mineralized zone at least 50 m in length.

Grab sampling of the various units has returned the assays listed in Table 7.10.

Numerous sulphide occurrences, many containing anomalous amounts of base metals and gold, are located on, and near, the Wabikoba Creek property. These occurrences appear to be spatially related to the sheared contact between the mafic metavolcanic and metasedimentary rocks in the area. Collectively, these occurrences define a trend of mineralization that can be traced, intermittently, for approximately 4 km along strike. Other sulphide occurrences containing appreciable amounts of base metals and gold (up to 0.69%
Table 7.10. Assay results for samples from the McKay-Fowler zinc occurrence.

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Gold (oz/ton)</th>
<th>Silver (oz/ton)</th>
<th>Copper (%)</th>
<th>Zinc (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>92DBM-112</td>
<td>0.001</td>
<td>n.a.</td>
<td>0.0027</td>
<td>0.0023</td>
</tr>
<tr>
<td>92DBM-113</td>
<td>trace</td>
<td>n.a.</td>
<td>0.0683</td>
<td>0.6040</td>
</tr>
<tr>
<td>92DBM-114</td>
<td>trace</td>
<td>nil</td>
<td>0.0294</td>
<td>0.9700</td>
</tr>
<tr>
<td>92DBM-133*</td>
<td>trace</td>
<td>nil</td>
<td>0.1476</td>
<td>0.3980</td>
</tr>
</tbody>
</table>

Note: n.a., not assayed
* sample 92DBM-133 also assayed 0.70% Na₂O, 0.31% K₂O, 3.32% MgO and 12.83% CaO

Sample Descriptions:

92DBM-112: rusty-weathering, fine-grained, medium grey, moderately foliated, thinly (mm scale) laminated, quartz-feldspathic schist, no visible sulphides; top of slope approximately 60 m inland from shore of White Lake (grab)

92DBM-113: rusty-weathering, very fine- to fine-grained, medium grey-green, poorly foliated, very hard, silicified mafic schist, locally moderately to strongly magnetic, 3 to 5% fine- to medium-grained disseminated grains of pyrrhotite, pyrite and purple-brown sphalerite; scarp face exposure approximately 50 m inland from shore of White Lake (grab)

92DBM-114: rusty-weathering, fine- to medium-grained, mottled grey and white, strongly foliated, gritty-feeling, poorly laminated, quartz-feldspathic schist, 10% fine- to medium-grained sulphides, primarily pyrite and purple-brown sphalerite, as disseminated grains and localized in narrow (1 mm wide), foliation-parallel seams; lakeshore exposure (grab)

92DBM-133: rusty-weathering, grey-green, fine-grained, moderately foliated, very hard, silicified mafic schist, 35% sulphides as fine- to medium-grained, disseminated grain of pyrrhotite, pyrite and chalcopyrite and as medium- to coarse-grained pyrrhotite, pyrite and sphalerite localized along poorly defined, narrow (1 to 5 mm wide) seams and fracture surfaces, locally moderately to strongly magnetic; scarp face exposure approximately 50 m inland from shore of White Lake (grab)

Zn, 0.64% Cu, 2.3 ounces Ag per ton and 0.004 ounces Au per ton) have been discovered recently in the same package of metavolcanic and metasedimentary rocks hosting the McKay-Fowler zinc occurrence (Gallo 1990). These occurrences are exposed on the east side of White Lake approximately 5 km to the southeast of the McKay-Fowler zinc occurrence.

The area surrounding, and including, the Wabikoba Creek property is considered to have high potential for hosting additional, as yet undiscovered, gold and base metal mineralization. As a consequence, the area warrants continued exploration.

Beggs-Currie Copper-Nickel Occurrence

The Beggs-Currie copper-nickel occurrence is located in the Cirrus Lake area approximately 37.5 km southwest of Manitouwadge, 22.5 km northeast of Marathon and 3.2 km east of the Pic River. The occurrence is accessible via air transport to Louis Lake followed by travel on foot along a partially overgrown tractor road that extends northeast from the northeast arm of Louis Lake. The occurrence is located on the southwest side of a low ridge approximately 1.4 km northeast of Louis Lake and 30 m west of the tractor road.

The area surrounding the occurrence has been explored sporadically by prospectors and exploration companies since the early 1930s. Mineralization in the area was first noted by T. Beggs and F. Currie who blasted a series of small trenches and a shallow test pit on what is now known as the Beggs-Currie copper-nickel occurrence. The occurrence was examined and sampled in 1930 by J. Thomson (1931) for the Ontario Department of Mines. A grab sample of sulphide-rich, altered "diorite" collected from the occurrence by J. Thomson returned assay values of 0.66% Cu and 0.31% Ni (Thomson 1931). Thomson (1931) states that better assay values than these have been reported from this occurrence.

In 1953, Pic Nickel Mines Limited drilled 14 diamond-drill holes, totalling 872.6 m in length, in the vicinity of the occurrence. Drill logs submitted by Pic Nickel Mines Limited for assessment credit indicate the presence of numerous stringers, blebs and disseminated grains of pyrite, pyrrhotite and trace chalcopyrite (assessment files, Resident Geologist's office, Schreiber-Hemlo District, Thunder Bay). Very little...
assay data for this drill core were submitted for assessment credit. One 4.3 m section taken from hole number 15 returned assay values that varied from 0.05 to 0.219% Cu and from 0.03 to 0.09% Ni (assessment files, Resident Geologist's office, Schreiber–Hemlo District, Thunder Bay).

In 1955, MacLeod–Cockshutt Gold Mines Limited acquired an option on the Pic Nickel Mines Limited property and subsequently performed an airborne geophysical (EM, MAG) survey of the area followed by diamond drilling. Five drill holes, totalling 342.6 m in length, were drilled near and around the Beggs–Currie copper-nickel occurrence. In addition, one of the pre-existing Pic Nickel Mines Limited drill holes was deepened by approximately 86.7 m. Traces of pyrrhotite and chalcopyrite were found in almost all of these holes (Milne 1967). No assay data for this drill core were submitted for assessment credit. Pic Nickel Mines Limited transferred the claims covering the occurrence to A. Kimber in 1957 and, by 1959, they had lapsed. The area was restaked and transferred to the International Nickel Company of Canada Limited (INCO) in 1961.

In 1963, INCO drilled 8 diamond-drill holes in the general area surrounding the occurrence. Four of these holes were drilled in the immediate vicinity of the occurrence. Although the total length of drilling done in the vicinity of the occurrence is not known, approximately 914 m of drilling was completed in the general area (Milne 1967). Very weak sulphide mineralization is reported to occur in 2 of the holes collared near the occurrence (assessment files, Resident Geologist's office, Schreiber–Hemlo District, Thunder Bay). No assay data for this drill core were submitted for assessment credit.

The occurrence was examined and sampled in 1963 by V. Milne (1967) for the Ontario Department of Mines. A grab sample collected from the occurrence by V. Milne returned assay values of 0.36% Ni and trace Cu (Milne 1967).

The claims covering the occurrence lapsed in 1967. The area was intermittently restaked during the period from 1967–1982, but no work was recorded for assessment credit.

In 1983, G. Coyne staked the area and subsequently transferred the claims to Canray Resources Limited later that year. In 1984, Canray Resources Limited changed its name to Exall Resources Ltd. and performed an airborne geophysical (EM, VLF–EM, MAG) survey of the general area surrounding the occurrence.

The claims covering the occurrence lapsed in 1986, were restaked later that year, and were subsequently transferred to prospector P. Skalesky in 1987. In 1988, P. Skalesky had an airborne geophysical (VLF–EM, MAG) survey conducted over the general area. A number of VLF–EM conductor axes were found, some of which may be attributable to sulphide mineralization (Barrie 1988). No further work was done in the area, and the claims lapsed in 1990. At the time of writing, the Beggs–Currie copper-nickel occurrence was unstaked.

The occurrence consists primarily of erratically distributed sulphides hosted within altered, mafic metavolcanic flows. The sulphide content within the occurrence varies from less than 1% up to approximately 5% and is exposed over an area approximately 65 m long by 15 m wide. The sulphide mineralization has been traced by drilling for over 76 m along strike (Thomson et al. 1954).

The occurrence is located within the Page Lake greenstone belt at the contact between amphibolitic, mafic metavolcanic flows and a large (4 km wide by 8 km long), north-trending, horseshoe-shaped body of serpentinitized dunite and related intrusive rocks (Milne 1967; Thomson et al. 1954). The metavolcanic rocks in the vicinity of the occurrence are locally brecciated and silicified. The contact between the metavolcanic rocks and the serpentinite is obscured by swampy overburden. A high ridge of serpentinite is exposed, however, approximately 45 m east of the occurrence. The Runnalls Lake fault, a major, northwest-trending, sinistral fault, is located approximately 1.9 km to the northeast of the occurrence (Milne 1967).

During the present examination of the occurrence, 4 shallow trenches, varying in size up to 22.5 m long by 2.5 m wide by 1.5 m deep, were discovered (Figure 7.8). For reference purposes, these trenches have been numbered from 1 to 4 starting with the northernmost trench and proceeding south. The number 2 trench may be the test pit referred to by Thomson (1931).

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The occurrence consists primarily of erratically distributed sulphides hosted within altered, mafic metavolcanic flows. The sulphide content within the occurrence varies from less than 1% up to approximately 5% and is exposed over an area approximately 65 m long by 15 m wide. The sulphide mineralization has been traced by drilling for over 76 m along strike (Thomson et al. 1954).
Table 7.11. Assay results for samples collected from the Beggs–Currie copper-nickel occurrence.

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Gold (oz/ton)</th>
<th>Silver (oz/ton)</th>
<th>Copper (%)</th>
<th>Nickel (%)</th>
<th>Zinc (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>92DBM-150</td>
<td>0.023</td>
<td>nil</td>
<td>0.047</td>
<td>1.080</td>
<td>0.002</td>
</tr>
<tr>
<td>92DBM-151</td>
<td>0.012</td>
<td>n.a.</td>
<td>0.051</td>
<td>0.013</td>
<td>0.001</td>
</tr>
<tr>
<td>92DBM-152</td>
<td>0.014</td>
<td>n.a.</td>
<td>0.073</td>
<td>0.009</td>
<td>0.001</td>
</tr>
<tr>
<td>92DBM-153</td>
<td>0.007</td>
<td>n.a.</td>
<td>0.090</td>
<td>0.055</td>
<td>0.001</td>
</tr>
<tr>
<td>92DBM-154</td>
<td>0.017</td>
<td>n.a.</td>
<td>0.030</td>
<td>0.115</td>
<td>0.002</td>
</tr>
<tr>
<td>92DBM-155</td>
<td>0.007</td>
<td>n.a.</td>
<td>0.022</td>
<td>0.007</td>
<td>0.003</td>
</tr>
</tbody>
</table>

Note: n.a., not assayed

Sample Descriptions:

92DBM-150: rusty-weathering, medium grey, fine-grained, very hard, massive but strongly fractured and brecciated, silicified, mafic metavolcanic rock, 3 to 5% pyrrhotite, pyrite and trace chalcopyrite as disseminated anhedral, localized patches (5 to 10 mm across) and narrow (less than 1 mm wide) seams and/or fracture fillings; breccia zone, trench #2 (grab)

- 151: rusty-weathering, mottled light grey and green, very fine-grained, silicified mafic metavolcanic rock, narrow (2 to 5 mm wide), crosscutting quartz-calcite veinlets, less than 1% pyrite and chalcopyrite as disseminated anhedral and fracture fillings; trench #1 (grab)

- 152: rusty-weathering, medium grey-green, fine-grained, massive, silicified mafic metavolcanic rock, 2 to 3% fine-grained, disseminated anhedral of pyrite and chalcopyrite, minor graphite on fracture surfaces; trench #1 (grab)

- 153: similar to 92DBM-152, but more strongly fractured with 2 to 3% pyrrhotite as fine-grained disseminated anhedral, small cliff face approximately 15 m south of trench #2 (grab)

- 154: similar to 92DBM-152, but less than 1% sulphides localized along fractures and as medium- to coarse-grained patches with quartz and calcite, trace chalcopyrite; small cliff face approximately 30 m south of trench #2 (grab)

- 155: rusty-weathering, dark grey-green, medium-grained, massive mafic metavolcanic rock, weakly silicified, less than 1% pyrrhotite, pyrite and rare chalcopyrite localized in irregular patches along fracture surfaces; trench #3 (grab)

The mafic metavolcanic flows hosting the mineralization are dark to light grey-green, rusty-weathering, fine- to medium-grained, massive, amphibolide and locally silicified and brecciated. Subangular to rounded breccia fragments (varying in size up to 8 cm in diameter) are common within the metavolcanic rock exposed in pit number 2. Relict pillow structures with prominent selvages are exposed in isolated outcrops located approximately 500 m south of the occurrence.

The sulphide mineralization consists primarily of fine- to medium-grained, anhedral, disseminated grains, small (5 to 10 mm in diameter) patches and narrow (1 to 3 mm wide) seams of pyrrhotite, pyrite and trace chalcopyrite. Exposure to dimethylglyoxime suggests the pyrrhotite contains a nickel-bearing phase, probably pentlandite. Narrow (2 to 5 mm wide), sulphide-bearing, quartz-carbonate veins and rare, blotchy patches (up to 3 mm across) of magnetite occur within the mafic metavolcanic rocks exposed in trench number 1. As noted by Milne (1967), some of the sulphides occur within joints and widely spaced fractures in the rocks. The sulphides are interstitial to, and partially replace, the fragments composing the mafic metavolcanic breccia exposed in trench number 2.

Grab sampling of the various rock units has returned the assays listed in Table 7.11 (in addition to the elements listed, all samples were analyzed to determine palladium content, which varied from 11 ppb in sample 92DBM-155 to 136 ppb in sample 92DBM-150).

Field observations suggest the sulphide mineralization present at the Beggs–Currie copper-nickel occurrence was preferentially emplaced along the locally brecciated contact.
zone between mafic metavolcanic flows and a large, serpentinized, ultramafic intrusion. Other copper-nickel occurrences, spatially related to this contact zone, are known to occur (Milne 1967). To date, none have proved economic. The presence of anomalous quantities of gold within the silicified, brecciated zone at the Beggs–Currie occurrence may warrant further exploration.

Rockbound Lake

Copper Occurrence

The Rockbound Lake copper occurrence is located in the Ramsay Lake area approximately 32.25 km north-northwest of Manitouwadge. The occurrence is located within the Beardmore–Geraldton Resident Geologist’s District and is situated on the west shore of Rockbound Lake approximately 250 m south of a small creek that empties into the north end of the lake. The area is accessible via logging roads and an ATV trail that leads to the west shore of Rockbound Lake.

The occurrence was first staked in 1954. In 1965, the area was mapped by Coates (1968) who noted the presence of sulphide mineralization on the west shore of Rockbound Lake. A limited amount of stripping and trenching was done by prospectors during 1971 and 1973 (assessment files, Resident Geologist’s office, Beardmore–Geraldton District, Thunder Bay). Assay values of up to 1.68% Cu, 0.1% Zn, 0.03% Pb and 0.23 ounces Ag per ton were reported for grab samples of mineralized vein material taken from the occurrence (Resident Geologist’s files, Resident Geologist’s office, Beardmore–Geraldton District, Thunder Bay).

The occurrence is located within the Quetico Subprovince and is underlain primarily by moderately foliated (085/ subvertical), coarse-grained, garnet-biotite-quartz-feldspar paragneiss and derived migmatite. The occurrence is spatially associated with a northwest-trending, linear topographic feature (Coates 1968, Map 2141). In the vicinity of the occurrence, a 40 m wide diabase dike has intruded along this lineament. The contacts between the diabase and the host paragneiss are locally brecciated and mineralized with copper-bearing, quartz-carbonate veins.

The occurrence consists of erratically distributed pyrite and chalcopyrite hosted primarily in narrow, coarse-grained, quartz-calcite veins. The veins are confined primarily to the contact zones between the diabase and host paragneiss and vary in width from 1 mm to 50 cm. The veins are parallel to the diabase-paragneiss contact, generally strike 320° and dip vertically. The veins associated with the northern margin of the diabase dike are generally wider than those found along the southern margin. Individual veins display marked vertical and horizontal variations in size and degree of mineralization. The wall rock adjacent to the veins is commonly sheared and locally brecciated, silicified and carbonatized with calcite. Angular fragments of diabase up to 10 cm in size occur proximal to the margins of some of the wider veins. The sulphide mineralization consists primarily of erratically distributed, fine- to coarse-grained, anhedral to euhedral pyrite and anhedral patches of chalcopyrite up to 2 cm in size. The sulphides commonly constitute 3 to 5% of the vein material, but local concentrations of up to 10% occur. Although chalcopyrite usually predominates over pyrite, the relative proportions of the sulphides vary within each vein. The host rocks, particularly the diabase, commonly contain 1 to 2% fine- to medium-grained pyrite and chalcopyrite as disseminated anhedral grains proximal to the veins. Fine-grained malachite and azurite occur along many of the fractures and foliation planes within the veins and host rocks.

During the present examination of the occurrence, 6 pits varying in size up to 3.0 m long by 2.0 m wide by 1.0 m deep were located. Two parallel zones of copper mineralization are exposed in the pits, 1 along the southern margin of the diabase dike, and 1 along the northern margin located approximately 40 m to the northeast. The southern mineralized zone is exposed on the west shore of Rockbound Lake, can be traced inland for approximately 40 m, and varies in width up to approximately 50 cm. The northern mineralized zone is exposed approximately 15 m inland from the west shore of Rockbound Lake, can be traced northwest for approximately 150 m, and varies in width up to approximately 75 cm.

Grab sampling of the various rock units has returned the assays listed in Table 7.12.

The economic potential of this occurrence is limited by the narrow widths (up to 50 cm, but generally 10 to 20 cm where exposed) of the mineralized quartz-calcite veins and by the erratic distribution of the sulphides within these veins. Several other copper occurrences of this type have been discovered in the Manitouwadge area (Coates 1968, 1970; Schnieders et al. 1992). To date, none have proved economic. At the time of writing, the Rockbound Lake copper occurrence was not staked.

RECOMMENDATIONS FOR EXPLORATION

General recommendations regarding exploration for gold, base metals and platinum group elements are presented in the Schreiber–Hemlo Resident Geologist’s section of this report. Additional, valuable recommendations specific to the Manitouwadge area are given in previous annual reports of the Schreiber–Hemlo Resident Geologist.

Recently released regional lake sediment and water geochemical data (Frisk et al. 1991a, 1991b) define several gold and base metal anomalies in the Manitouwadge area that cannot be accounted for by known mineralization. Although anomalous levels of metals in lake sediments may be attributable to a variety of sources (Frisk 1991), including anthropogenic input (man-made contamination), the possibility of proximal, undiscovered mineralization should not be dismissed. When used in conjunction with other geologic data, regional lake sediment geochemical anomalies can help define areas suitable for ground follow-up programs. Several of the anomalies noted by Frisk et al. (1991b) are discussed by Schnieders et al. (1992).
Table 7.12. Assay results for samples collected from the Rockbound Lake copper occurrence.

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Gold (oz/ton)</th>
<th>Silver (oz/ton)</th>
<th>Copper (%)</th>
<th>Zinc (%)</th>
<th>Lead (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>92DBM-85</td>
<td>nil</td>
<td>nil</td>
<td>0.9917</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>92DBM-86</td>
<td>nil</td>
<td>nil</td>
<td>0.0599</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>92DBM-87</td>
<td>nil</td>
<td>nil</td>
<td>1.1537</td>
<td>0.0036</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>92DBM-88</td>
<td>nil</td>
<td>nil</td>
<td>0.7797</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>92DBM-89</td>
<td>nil</td>
<td>nil</td>
<td>0.7377</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>92DBM-90</td>
<td>nil</td>
<td>nil</td>
<td>0.0176</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

Note: n.a., not assayed

Sample Descriptions:

92DBM-85: 10 cm wide, coarse-grained, grey-white, quartz-calcite vein, 2 to 3% coarse-grained pyrite and chalcopyrite as erratically distributed anhedral grains and patches up to 1 cm in diameter; lakeshore exposure, southern mineralized zone (grab)

92DBM-86: medium grey-green, fine-grained, massive, silicified diabase, locally brecciated and intruded by narrow (less than 1 cm wide) quartz-calcite veins, 1 to 2% fine- to medium-grained pyrite and chalcopyrite as disseminated grains and patches localized within veins and along fractures, host to sample 92DBM-85 above; southern mineralized zone (grab)

92DBM-87: 10 cm wide, coarse-grained, glassy, grey-white quartz-calcite vein, 5 to 10% epidotized, angular, fragments of diabase up to 10 cm in size, 2 to 3% erratically distributed, coarse-grained anhedral patches of chalcopyrite (1 to 2 cm in size), minor disseminated grains of fine-grained pyrite, trace bornite; pit #1, southern mineralized zone (grab)

92DBM-88: medium grey-green, fine-grained, massive, locally brecciated and silicified diabase, 1 to 2% chalcopyrite and trace pyrite as fine- to medium-grained disseminated anedra and localized patches and blebs within narrow (less than 1 cm wide) quartz-calcite veins; pit #3, southern mineralized zone (chip sample taken across 50 cm)

92DBM-89: 50 cm wide, coarse-grained, grey-white, quartz-calcite vein, 3 to 5% erratically distributed, coarse-grained, anhedral patches of chalcopyrite up to 1 cm in size, abundant fine-grained malachite and azurite along fractures and on weathered surfaces; pit #4, northern mineralized zone (grab)

92DBM-90: medium grey-green, fine-grained, massive, locally brecciated and silicified diabase, 2 to 3% fine- to medium-grained anhedral pyrite localized within breccia fragments and disseminated throughout narrow (less than 1 cm wide) quartz-calcite veins, no visible chalcopyrite; pit #5, northern mineralized zone (grab)

Gold

HEMLO AREA

Gold mineralization in the Hemlo area is spatially related to metavolcanic-metasedimentary contacts, deformation zones and porphyry contacts and is characterized by the presence of
sericite schists, disseminated pyrite, molybdenite, green mica, barite and pervasive potassic alteration (Schnieders et al. 1991). Exploration for gold in, and around, the Hemlo area should continue to focus on these features. Felsic, quartz-porphryritic intrusive and volcanic rocks appear to have a close spatial relationship with gold mineralization in the Hemlo area. Accordingly, the presence of such rocks is considered indicative of high potential areas.

DEAD OTTER LAKE—THERESA LAKE—SPRUCE BAY AREA

The “North Limb” of the Hemlo greenstone belt, which includes the Dead Otter Lake–Theresa Lake–Spruce Bay area, contains several gold occurrences hosted in a variety of rock units. Schnieders et al. (1991) reported 0.05 ounces Au per ton in pyritic quartz porphyry collected from the Theresa Lake area. Siragusa (1985) reported 8850 ppb Au in gossan, fine-grained, mafic-rich, clastic metasedimentary rock collected approximately 3 km west of Theresa Lake. Recent assays of pyritic, sericite schists collected from the Armand Lake property, located approximately 2.9 km west of Theresa Lake, have returned up to 0.086 ounces Au per ton (Schnieders et al. 1992).

Exploration for gold in the Dead Otter Lake–Theresa Lake–Spruce Bay area should focus on strongly deformed and altered (silicified, carbonatized, sericitized, pyritized) rocks. The contact of the metavolcanic-metasedimentary sequence with the Dotted Lake pluton to the north and the Musher Lake pluton to the south warrants exploration. Areas surrounding sulphide-bearing, quartz- and feldspar-phryic rocks should be prospected carefully. Siragusa (1985) concluded that thin units of chert-magnetite iron formation and fine-grained, clastic-rich metasedimentary rocks contain more gold than other rock types present in the Theresa Lake area. These rocks should not be overlooked as exploration targets. Prospectors B. Fowler and M. Shuman have recently discovered pyritic, green mica-bearing, quartz-eye, sericite schists on their Armand Lake property (Schnieders et al. 1992). The similarity between these rocks and those associated with the Hemlo deposit warrants further exploration for gold in this area.

Prospectors D. Carroll and G. Carroll have recently discovered anomalous quantities of gold (up to 6840 ppb Au) on their Spruce Bay claim group located approximately 6 km southeast of Theresa Lake in the vicinity of Spruce Bay on White Lake (Gallo 1990). Prospectors B. Fowler and M. Shuman have recently obtained assay values of up to 0.021 ounces Au per ton from intermediate to felsic metavolcanic rocks on their Wabikoba Creek property (see “Property Examinations” [Manitouwadge Project] section) also located in the Spruce Bay area of White Lake. The presence of numerous gossans (Siragusa 1985), felsic and mafic intrusions (Milne 1968), the White Lake fault and several pyritic, graphitic shear zones, some containing anomalous quantities of gold (Gallo 1990), in the Spruce Bay area of White Lake warrants further exploration for gold in this area.

MANITOUWADGE AREA

The area surrounding the town of Manitouwadge was first explored in the early 1930s by prospectors searching for gold (Thomson 1933). The discovery of base metal orebodies in the early 1950s resulted in the Manitouwadge area being labelled a base metal camp. As a consequence, little exploration for gold has occurred in the area during the last 40 years.

Although no significant gold occurrences have been discovered in the Manitouwadge area, amphibolite-facies, pyritic, sericite-muscovite schists do occur (Py 1960; Friesen et al. 1954). Similar rocks are known to host the Hemlo orebody, and, therefore, these more traditional base metal targets in the Manitouwadge area should be explored for their gold potential. Pyritic, quartz-eye, sericite schists have been discovered on Albert Turner’s Swill Lake property located approximately 9.5 km west of Manitouwadge. Preliminary assays have returned up to 0.071 ounces Au per ton (Resident Geologist’s files, Resident Geologist’s office, Schreiber–Hemlo District, Thunder Bay). The presence of anomalous concentrations of gold in this area warrants further investigation.

A narrow band of feldspar and/or quartz-feldspar porphyritic, felsic intrusive rocks occurs approximately 200 m north of Manitouwadge Lake (Milne 1974). This unit is locally sulphide-bearing and should be examined to determine its gold potential. Gold is reported at the Foch River occurrence located in Foote Township along the Foch River approximately 4.5 km southeast of Foch Lake (Giguere 1972). The presence of numerous felsic and mafic intrusions, faults and sulphide mineralization warrants further exploration for gold in this area.

Low gold values are associated with many of the known sulphide occurrences in the Manitouwadge area. Sulphide-rich biotite gneiss from the Otter Lake sulphide occurrence (Schnieders et al. 1992), for example, assayed up to 0.021 ounces Au per ton. Samples of sheared, graphite-rich, pyritic, granulite-facies paragneiss from the Thomas Lake sulphide occurrence (see “Exploration Activity” [Manitouwadge Project] section) have returned assay values of up to 0.016 ounces Au per ton. All sulphide occurrences in the Manitouwadge area, especially those located proximal to or within fault and/or shear zones, should be examined to determine their gold potential.

Till samples collected in the Quetico Subprovince just west of Everest Lake approximately 20 km north-northwest of Manitouwadge are reported to contain anomalous amounts of gold (I. Kettles, Geological Survey of Canada, personal communication, 1992). Since the dominant direction of glacial transport in this area was from the northeast, the area surrounding and to the northeast of Everest Lake should be investigated for possible bedrock sources of the gold contained in the till samples. Several sulphide occurrences exist in the areas located to the west of and northeast of Everest Lake (Williams and Breaks 1990). These occurrences should be thoroughly investigated to determine their potential to host gold mineralization.

156
Till samples collected west of Lorne Lake approximately 12 km east-northeast of Manitouwadge are reported to contain anomalous amounts of gold (I. Kettles, Geological Survey of Canada, personal communication, 1992). Several sulphide occurrences are located in the vicinity of Lorne Lake (Williams and Breaks 1990), and these should be thoroughly investigated to determine if they may have provided the gold present in the till samples.

The regional lake sediment geochemistry maps of Friske et al. (1991a, 1991b) indicate several gold anomalies in the Manitouwadge area. Although some of these anomalies, such as those surrounding the Geoc orebodies, can be accounted for by known mineralization, others cannot. The nature and location of these anomalies are discussed by Schnieders et al. (1992). The areas surrounding and underlying these anomalies should be thoroughly investigated to determine possible bedrock sources for the gold contained in the lake sediment samples.

Base Metals

The discovery of the Manitouwadge base metal mining camp has proven that caution and a fair bit of patience are required when assessing mineral showings in amphibolite-facies terranes. The Manitouwadge area (50 km radius of Manitouwadge) has a history of unimpressive-looking mineral occurrences. In addition, deformation, metamorphism and hydrothermal alteration have acted to obscure high-potential rocks, thus, making exploration targets difficult to identify. It is suggested that all sulphide occurrences in the Manitouwadge area, regardless of size or lateral extent, be fully investigated to determine their base metal potential.

Numerous base metal occurrences exist within the Manitouwadge area. These occurrences are hosted in a variety of rock types within several distinct geologic environments. Volcanogenic massive sulphide (VMS) deposits occur proximal to the town of Manitouwadge and are currently being mined for copper and zinc (Pye 1960; Milne 1974; Friesen et al. 1982). Magmatic copper and copper-nickel occurrences are located within the Port Coldwell and Killala Lake alkalic complexes (Milne 1967; Coates 1970), in the Goodchild Lake area (Milne 1967) and in Shabotik Township (Schnieders and Smyk 1989). Vein-hosted, copper-silver occurrences exist in the Vein Lake and Taradale Lake areas (Coates 1968, 1970). To date, economic concentrations of base metals have only been found in the VMS deposits located within the Manitouwadge synform.

Areas considered to have high potential for base metal mineralization include the Page Lake area, the Black River-Dotted Lake-Theresa Lake-Spruce Bay area and the Manitouwadge area (i.e., the area enclosing the Manitouwadge synform including possible eastward and westward extensions of the Manitouwadge stratigraphy).

As noted by Schnieders et al. (1991), sillimanite, cordierite, garnet and anthophyllite (gedrite) are associated with many of the VMS deposits in the Manitouwadge camp and are indicative of hydrothermal alteration and/or high-grade metamorphism. These minerals are considered positive indicators for base metal mineralization, and exploration should focus on their detection. Lithogeochemical surveys to detect sodium and calcium depletion, and magnesium, potassium, zinc and copper enrichment, are considered valuable exploration tools for identifying VMS-related alteration in the Manitouwadge area (Schnieders et al. 1991). Since most of the base metal orebodies in the Manitouwadge camp are hosted in muscovite-quartz schist, the presence of this rock type is considered a positive indicator of base metal mineralization.

PAGE LAKE AREA

Sulphide-bearing, felsic metavolcanic rocks occur in contact with mafic metavolcanic and metasedimentary rocks in the Page Lake area located approximately 45 km southwest of Manitouwadge and 6 km east of Bamoos Lake (Milne 1967).

Reconnaissance investigations in the Page Lake area in 1989 identified sulphide gossans on the north shore of a small lake situated approximately 750 m west of the north end of Page Lake (Schnieders and Smyk 1990). A number of EM conductors occur in the area (assessment files, Resident Geologist’s office, Schreiber–Hemlo District, Thunder Bay). The regional lake sediment geochemistry maps of Friske et al. (1991a) show copper, zinc and lead anomalies in the area around Page Lake.

Assay values of up to 0.08 ounces Au per ton and 1.16% Zn over 5.5 m are reported for sulphide-bearing, felsic metavolcanic drill core from the Knut Kuhner occurrence located approximately 1.6 km east of the Pic River in the vicinity of Page Lake (assessment files, Resident Geologist’s office, Schreiber–Hemlo District, Thunder Bay).

The possibility exists that VMS base metal deposits may occur in the Page Lake area. Further prospecting and sampling in this area is strongly recommended.

Several copper-nickel occurrences are located around the periphery of a large, horseshoe-shaped mafic-ultramafic intrusion located north of Page Lake in the vicinity of Goodchild Lake (Milne 1967). This area may warrant additional exploration, especially in light of the recently reported anomalous gold values associated with the base metal mineralization at the Beggs–Currie copper-nickel occurrence (see “Property Examinations” [Manitouwadge Project] section).

BLACK RIVER–DOTTED LAKE–THERESA LAKE–SPRUCE BAY AREA

Several base metal occurrences and numerous sulphide occurrences exist along the northern boundary of “North Limb” of the Hemlo greenstone belt from the Black River in the west to White Lake in the east. Many of these occurrences have been documented by Milne (1968), Barry et al. (1987), Siragusa (1985), Siragusa and Chivers (1986) and Gallo (1990).
Encouraging new discoveries by prospectors (see “Property Examinations” [Manitouwadge Project] section and Schnieders et al. 1992) further illustrate the potential of this area to host base metal mineralization. Sulphide-bearing, locally garnetiferous, amphibolite schist from the Pinegrove Lake property located approximately 7 km west of Dotted Lake has returned assay values of up to 0.75% Zn (Schnieders et al. 1992). Banded, oxide-facies, iron formation and garnetiferous, mafic metavolcanic schist from the Lampson Road copper-zinc occurrence located approximately 5 km west of Dotted Lake returned assay values of up to 0.325% Cu and 1.34% Zn, respectively (Schnieders et al. 1992). Rusty, chloritic hornblende schist from the Theresa Lake copper occurrence located on the northwest shore of Theresa Lake has returned assay values of up to 1.692% Cu (Schnieders et al. 1992). Sulphide-rich, argillaceous metasedimentary rocks from the Kusins lead-zinc occurrence have returned assay values of up to 10.7% Zn and 8.9% Pb (see “Property Examinations” [Manitouwadge Project] section). Sulphide-rich quartzofeldspathic schists from the McKay–Fowler zinc occurrence have returned assays up to 0.97% Zn (see “Property Examinations” [Manitouwadge Project] section).

Some of the base metal occurrences in the Black River–Dotted Lake–Theresa Lake–Spruce Bay area, including the Fairservice zinc occurrence (Schnieders et al. 1991) and the Theresa Lake copper occurrence (Schnieders et al. 1992), possess some of the mineralogical and geochemical characteristics commonly associated with VMS deposits. These include the presence of alteration minerals such as garnet, biotite and sericite and, in the case of the Fairservice zinc occurrence, a depleted sodium content. Schnieders et al. (1991) concluded that many of the occurrences in the area are syngenetic, but have vein-like features due to intense deformation and subsequent sulphide remobilization.

The Black River–Dotted Lake–Theresa Lake–Spruce Bay area is considered to have high potential for base metal mineralization. Further prospecting and sampling in this area is strongly recommended. The contacts of the metavolcanic–metasedimentary sequence with the Black–Pic batholithic complex, the Dotted Lake pluton and the Mushier Lake and Cedar Lake plutons and contacts between the metavolcanic and metasedimentary units warrant thorough examination. All sulphide occurrences should be examined for base metal mineralization and/or possible hydrothermal alteration.

MANITOUWADGE AREA

Numerous sulphide and base metal occurrences exist within the Manitouwadge synform proximal to the town of Manitouwadge (Pye 1960; Milne 1974; Williams and Breaks 1990). Many of these occurrences display mineralogical, geochemical and textural characteristics commonly associated with Archean VMS deposits. Consequently, the Manitouwadge synform and the extensions of the Manitouwadge stratigraphy into Gemmell, Nickle and Herbert townships, as well as to the north of those townships are considered high potential areas for base metal exploration. Unfortunately, the metavolcanic–metasedimentary limbs of the synform have been extremely disrupted and intensely deformed and subjected to amphibolite-grade metamorphism and hydrothermal alteration. Identification of these rocks as exploration targets is therefore difficult. Since most of the known base metal occurrences in the Manitouwadge area are hosted in muscovite–quartz schist and are associated with sillimanite, cordierite, garnet and anthophyllite (gedrite), the presence of these minerals is considered to be a positive indicator of high potential for base metal mineralization.

The Bedrock Geology Of Ontario Map 2543 (OGS 1991c) shows migmatized supracrustal rocks to underlie the northern parts of Gemmell, Mapledoram and Davies townships and to extend west-southwest of Davies Township to Killala Lake. The possibility exists that inliers of the Manitouwadge mine series stratigraphy may occur in this area. Exploration for base metals is therefore warranted. Specific target areas include the Michal–Fakeloo lakes area and the Little Joe–Vein lakes area.

Coates (1968, 1970) has mapped metavolcanic and metasedimentary migmatites in the vicinity of Michal and Fakeloo lakes approximately 30 km northwest of Manitouwadge. Geophysical anomalies, some of which were ascribed to sulphide mineralization, occur in the Michal–Fakeloo lakes area (Resident Geologist's files, Resident Geologist's office, Schreiber–Hemlo District, Thunder Bay). This area should be investigated to determine its base metal potential.

Several sulphide occurrences and copper occurrences exist in the Little Joe–Vein lakes area located approximately 32 km west of Manitouwadge. These include the Baarts–Donaldson copper occurrence (Schnieders et al. 1992) and the Lloyd Davis sulphide occurrence (Coates 1970). It is recommended that all sulphide occurrences in these areas be thoroughly examined to determine their base metal potential. Prospecting should focus on discovering the source of the copper mineralization now localized in northwest-trending faults in the area.

A large lead anomaly is shown located northeast of Obakamiga Lake approximately 55 km east of Manitouwadge on the Regional Lake Sediment Geochemistry Map of Friske et al. (1991b). Williams and Breaks (1990) have mapped sulphide-bearing, mafic metavolcanic rocks in this area. It is recommended that this area be explored to determine the source of the lead anomaly. All sulphide occurrences in the area should be thoroughly examined to determine their base metal potential.

Till samples collected south of Kern Lake and east of Fox Lake, located approximately 9.5 km northwest and 18 km northeast of Manitouwadge, respectively, are reported to contain anomalous quantities of copper and zinc (I. Kettles, Geological Survey of Canada, personal communication, 1992). The areas surrounding and to the northeast of Kern and Fox lakes should be thoroughly prospected to determine possible bedrock sources for the copper and zinc present in these till samples.

During a reconnaissance survey of the Hornepayne area, a large boulder of very coarse-grained, garnetiferous, amphib-
bolitic gneiss containing abundant amphibole, possibly anthophyllite, was discovered by M. Smyk in southwest Lessard Township approximately 500 m east of Vision Lake and 60 km east of Manitouwadge. A thin, discontinuous belt of mafic metavolcanic rocks, possibly representing the extreme eastward extension of the south limb of the Manitouwadge synform, occurs in this area (Williams and Breaks 1990). Several small sulphide occurrences are present in this part of Lessard Township (Williams and Breaks 1990). It is strongly recommended that this area be thoroughly prospected to determine a possible bedrock source for this boulder.

**Platinum Group Elements**

Exploration for platinum group element (PGE) mineralization in the Manitouwadge area (50 km radius of Manitouwadge) should focus on areas underlain by mafic and ultramafic intrusive rocks. Such rocks occur in many locations within the Manitouwadge area including the Shabotik Township area, the Moshkinabi–Faries lakes area, the Goodchild Lake area, the Port Coldwell alkaline complex and the Killala Lake alkaline complex. Characteristics considered indicative of PGE mineralization include the presence of disseminated sulphides (typically less than 5%), variations in grain size, modal layering, disrupted layering, intermixing of magma types, magmatic-related breccias and pegmatitic dikes or veins (Schnieders and Smyk 1990). Any mafic or ultramafic rocks displaying any of these characteristics, especially those which are sulphide bearing, warrant thorough examination for PGE mineralization.

Since mafic and ultramafic rocks are commonly moderately to strongly magnetic, examination of existing magnetic survey maps may help define potential target areas for PGE mineralization. The Kwinkwaga Lake Aeromagnetic Map 2179G (ODM–GSC 1963), for example, shows several high magnetic anomalies located in and around Shabotik Township located approximately 35 km southeast of Manitouwadge. The Shabotik Cu-Ni-PGE occurrence (Schnieders and Smyk 1989) is located in this area, and the possibility exists that other occurrences may be nearby. Of particular interest are 7 small, elliptical, magnetic anomalies located around Bulldozer Lake. Bulldozer Lake is located approximately 5 km northwest of the Shabotik Cu-Ni-PGE occurrence and is underlain by rocks of similar composition and texture to those that host the Shabotik Cu-Ni-PGE occurrence (Bennett et al. 1987). As a consequence, it is strongly recommended that the Bulldozer Lake area be thoroughly prospected and sampled for PGE mineralization.

Recent mapping by Williams and Breaks (1989, 1990) has identified mafic, layered intrusive rocks in the Moshkinabi–Faries lakes area located approximately 22 km east of Manitouwadge. Peridotite, gabbro and anorthosite occur in the area, and several sulphide occurrences have been noted (Williams and Breaks 1990). Some of these mafic rocks appear to be very similar in composition and texture to rocks hosting PGE mineralization in Shabotik Township located approximately 25 km to the southeast (Williams and Breaks 1990; Schnieders et al. 1954). A sample of very coarse-grained, pyritic, metagabbro collected adjacent to the Ice Cream Lake road approximately 1.9 km northeast of Faries Lake returned assay values of 0.019 ounces Au per ton, 0.39 ounces Ag per ton, 0.47% Cu, 15 ppb Pd and less than 1 ppb Pt (Resident Geologist’s files, Resident Geologist’s office, Schreiber–Hemlo District, Thunder Bay). The presence of copper mineralization and disseminated sulphides in mafic rocks in this area warrants exploration for PGE. Recent logging activity has exposed numerous outcrops and increased access to the area.

**ONTARIO GEOLOGICAL SURVEY ACTIVITIES**

R.H. Sutcliffe (Associate Professor, University of Western Ontario, London), E.C. Walker (Research Associate, University of Western Ontario, London) and R.W. Hodder (Professor, University of Western Ontario, London) completed their field mapping of the Port Coldwell alkaline complex (Walker et al. 1991, 1992). A 1:20 000 scale geologic map will be produced to augment petrogenetic models for local alkaline magmatism and associated base and precious metal and rare element deposits.

**GEOLOGICAL SURVEY OF CANADA ACTIVITIES**

Two Open Files were released by the Airborne Geophysics Section in 1992 that cover surveys flown in 1990 and 1991 in the Hemlo–Marathon and Schreiber areas, respectively (Hetu and Ford 1992; Hetu and Holman 1992). Airborne radiometric, VLF-EM and magnetic data are presented on 1:250 000 scale colour maps and stacked profiles at 1:150 000 scale.

I. Kettles of the Terrain Sciences Division continued drift geochemistry studies and surficial sediments mapping in the Manitouwadge area. An additional 350 till samples were collected over parts of NTS map sheets 42 C/13, 42 E/01, 42 E/08 and 42 F/02 to 07. Field mapping of Quaternary deposits was continued in the Vein Lake area. A Geological Survey of Canada Open File, containing drift geochemistry maps and lists of trace and minor element data for 275 till samples collected in 1991, is scheduled for publication in early 1993. Funding for this project is provided by the Canada–Ontario Northern Ontario Development Agreement.

E. Zaleski and V. Peterson of the Continental Geoscience Division continued a bedrock geologic study of the Manitouwadge area initiated in 1991. The objective of the study is to reassess the geologic setting of the base metal deposits of the Manitouwadge area in order to improve knowledge and understanding of alteration, metamorphism, structure and mineralization. This is being accomplished by detailed bedrock mapping (1:5000 and 1:10 000) and structural, geophysical, petrographic, mineralogical, geochemical and geochronological studies. Preliminary results of this research are scheduled for publication in Geological Survey of Canada Paper 93–1C to be released in 1993. Geologic mapping performed at a scale of 1:5000 suggests that the repetition of units within the Manitouwadge greenstone belt
in the vicinity of the ore deposits may be due to early thrusting. Subsequent folding, during peak metamorphism, produced strong, northeasterly plunging mineral lineations and the dominant foliation now prevalent in the area. Later dextral motion resulted in the map-scale, synformal shape of the belt, localized kink folds and crenulation cleavage (Zaleski and Peterson 1993). Funding for this project is provided by the Canada–Ontario Northern Ontario Development Agreement.

**NSERC STRATEGIC GRANT PROJECT**

The Manitouwadge area was selected for a mineral exploration study involving the use of lead isotopes in glaciated terrains. The study is part of a three-year university Strategic Grant project, funded by the Natural Sciences and Engineering Research Council of Canada (NSERC). The principal investigator is K. Bell of Carleton University; J. Franklin, D. Sangster and W. Shilts of the Geological Survey of Canada are co-investigators. Logistical and technical assistance is provided by J. Card of Carleton University.

During the 1992 field season, glacial overburden samples were collected at about 150 sites. Help in the field was provided by I. Kettles of the Geological Survey of Canada. Geco mine staff provided ore samples. The isotopic lead composition of the glacial overburden and ore samples is being measured on the Finnigan-Mat 261 mass spectrometer at Carleton University.

Parallel projects are underway at Chisel Lake, Manitoba and Buchans, Newfoundland.

**RESEARCH BY OTHER AGENCIES**

R.H. Mitchell and R.G. Platt (Lakehead University, Thunder Bay) are continuing their research in the Port Coldwell alkalic complex. The focus of this year's work were the layered syenites in the Prisoner Cove area.

E.S. Schandl (University of Toronto), D.W. Davis (Royal Ontario Museum, Toronto), M.P. Gorton (University of Toronto) and H.A. Wasteneys (Royal Ontario Museum, Toronto) continued a study of the geochronology of hydrothermal alteration around volcanic-hosted, massive sulphide deposits in the Superior Province. Sampling and study of the Winston Lake Division and Geco Division mines were conducted to investigate the relative timing of host-rock deposition and alteration and the geochemical characteristics of the alteration assemblages.

D. Ohnenstetter (Centre National de la Recherche Scientifique, Orleans, France) and D. H. Watkinson (Carleton University, Ottawa) are continuing their investigations of copper and platinum group element mineralization in the Port Coldwell alkalic complex.

T. Krogh and L. Wilkinson (Geochronology Laboratory, Royal Ontario Museum, Toronto) will be carrying out U-Pb dating of a zirconium-rich, rare metal-mineralized zone at the west Dead Horse Creek subcomplex in conjunction with M.C. Smyk (Ontario Geological Survey–Information Services Branch, Thunder Bay).

Y. Pan (Research Associate, University of Western Ontario, London) and M.E. Fleet (Professor, University of Western Ontario, London) conducted research on the mineralogy and genesis of calc-silicate minerals associated with volcanogenic massive sulphide deposits in Manitouwadge (Pan and Fleet 1992a).

**ONTARIO GEOSCIENCE RESEARCH GRANT PROGRAM**

T.J. Beveridge (Professor, University of Guelph) will continue to study the geochemistry of microbial biofilms associated with gold-pyrite mine tailings and the effect of microbes on the acidification and leaching of tailings. Examination of Hemlo mine tailings revealed a diverse microbial flora that metabolized cyanide and precipitated gold. The role of bacteria in cyanide detoxification at the Golden Giant Mine and the determination of the stability of gold-cyanide complexes in the presence of cyanide-degrading bacteria were studied by Southam et al. (1992).

W.S. Fyfe (Professor, University of Western Ontario, London) will test the potential of surface spectroscopy analysis techniques for tracking the nature of fluids involved in major deformation-mineralization processes in areas such as Hemlo. The potential of such measurements in mineral exploration as well as the relationship between graphite and gold in deep fluid sources will be examined.

M.P. Gorton (Professor, University of Toronto) will investigate rare earth elements as geochemical tracers for volcanogenic massive sulphide deposits in metamorphic Archean terrains. The study will involve study of the factors that contributed to REE enrichment and/or mobility around deposits in Ontario, including those at Manitouwadge, in order to identify the variables that could be used to distinguish between small and large deposits and to be viable exploration tools.

**UNIVERSITY THESSES**

P. Johnston (PhD candidate, Queen's University, Kingston) is conducting a detailed study of the Hemlo Au-Mo deposit, including mineralization on the Golden Sceptre property.

P. Pelletier (BSc candidate, Carleton University, Ottawa) is investigating felsic footwall rocks at the Golden Giant Mine, Hemlo.

S. Osterberg (PhD candidate, University of Minnesota, Duluth) is completing a stratigraphic-alteration study of the Winston Lake stratigraphy.
D. Thomas (MSc candidate, Queen’s University, Kingston) completed a study of the application of mineralogy, whole rock chemistry and mineral chemistry to volcanogenic massive sulphide exploration at the Winston Lake Zn-Cu mine.

C. Shaw (PhD candidate, University of Western Ontario, London) is continuing mapping and research into the genesis and mineralization of the eastern gabbro on the border of the Port Coldwell alkalic complex.

G. Shore (MSc candidate, University of Western Ontario, London) is continuing mapping and research into the genesis of the alkalic gabbro and its relationship to undersaturated syenites in the Port Coldwell alkalic complex.

J. Xiong (MSc candidate, Lakehead University, Thunder Bay) is conducting research into the geochemistry of the Port Coldwell alkalic complex.

**SELECTED PUBLICATIONS RECEIVED**


Thomas, D.A. 1991. The application of mineralogy, whole rock chemistry and mineral chemistry to volcanogenic massive sulphide exploration at the Winston Lake Zn-Cu deposit, northwestern Ontario; unpublished MSc thesis, Queen’s University, Kingston, Ontario.


REFERENCES


Burnham, C.W. and Oshomo, H. 1980. Late-stage processes of felsic magmatism; Mining Geology, Special Issue, no.8, p.1–11.


Mason, R. 1990. Felsic magmatism and hydrothermal ore deposits—a tectonic perspective; unpublished lecture notes, Queen’s University, Kingston, Ontario.


INTRODUCTION

The "Industrial Minerals" project was initiated in March 1991 to monitor and stimulate exploration, development and production of industrial minerals in northwestern Ontario. This project is jointly funded by the Canada-Ontario Northwestern Ontario Development Agreement (NODA).

The primary objectives of the project are: to document and investigate new and previously known industrial mineral occurrences; to provide client services via property visits, sample analyses and information exchange; introduce public education through prospector classes, oral presentations and poster displays; and increase awareness of northwestern Ontario industrial minerals at technical seminars, workshops and conferences.

ACKNOWLEDGMENTS

This report was edited by K.G. Fenwick. M.C. Smyk provided assistance on a number of property visits in the Schreiber-Hemlo District. D. Laderoute and C. Storey provided invaluable assistance and information on numerous properties in the Kenora District. The assistance of the staff of the Mineral Development Office in Kenora is greatly appreciated. S. Warren reviewed this report and provided professional and efficient secretarial support throughout the year. B. Nelson, Assistant Drill Core Library Geologist, was responsible for the preparation of the voluminous samples required by this program. Assistance in the field and office was provided by R. Lucas, whose efforts are gratefully appreciated. Numerous company representatives, prospectors and Ministry of Northern Development and Mines staff provided invaluable information and field assistance on occurrences in northwestern Ontario.

MINING ACTIVITY

Industrial mineral production in northwestern Ontario in 1992 is summarized in Table 8.1. Producing quarries are shown on Figures 8.1a, 8.1b and 8.1c.

Granite Dimension Stone

A new producer, Palin Granite Canada Inc. (a division of Palin Granit Oy, Finland), began production at their Pine Green Granite quarry, located approximately 38 km north-northeast of Kenora. The quarry was officially opened July 15, 1992. Two stones are being produced on site: a yellow granite which appears to be restricted to depths of 6 m; and a lower green granite. Production for 1992 is expected to be around 2400 m³ (84 000 cubic feet) with an increase in 1993 to 3600 m³ (127 000 cubic feet). Palin Granite is producing rough blocks for export to Japan, Italy and other overseas markets. Blocks are hauled approximately 12 km to a rail siding at Jones and loaded onto flatbed rail cars which take the blocks to Montreal for shipping overseas.

Nelson Granite (Division of Granite Monuments Ltd.) continued year-round production from their quarry located in Docker Township, 10 km southwest of Vermilion Bay. The quarry produces a homogeneous, medium-grained, pink granite from a granite plug, which is part of the Dryberry batholithic complex. Fracturing in the granite is negligible, allowing for removal of blocks of any size. Production figures for 1992 are not available. However, in 1990, over 5550 m³ (185 000 cubic feet) was produced (Zielinski 1991). Approximately 2100 m³ was fabricated on site mostly into monuments and monument bases. The remainder was produced as rough blocks and shipped to their fabrication plants in eastern Canada and elsewhere to be made into monuments and architectural products.

Universal Granite Ltd. of St. Cloud, Minnesota removed blocks of stone, totalling 6 m³ from the Butler Station Quarry, 13 km west-northwest of Ignace. The Butler Station Quarry last produced stone (8000 m³) in 1989. The stone was used in the construction of the Ontario Government Building in Thunder Bay. Production is planned for 1993, however, it is dependant on demand and markets.

Granite Quarriers (G.Q.I.) Incorporated’s pink-granite quarry was dormant throughout 1992 due to lack of market caused by the recession. Granite Quarriers offices in Beebe, Quebec were shut down as a cost-cutting measure (A. LaPenna, Granite Quarriers (G.Q.I.) Incorporated, personal communication, 1992). Should demand increase, the quarry would open in 1993.

Quartz

Crystal Quarries Ltd., owned by T. Hansen of Keewatin, operated a quartz quarry, south of Muskeg Bay, Eagle Lake. Crystal Quarries was contracted to supply a total of 19 000 tons of crushed quartz for use in the production of silicon sealant. Hugh Monroe Construction of Winnipeg was subcontracted to quarry, crush and screen (1 to 4 inches/2.5 to 10 cm) the quartz for shipment. Material under the 1 inch (2.5 cm) minimum size requirement was stockpiled and is slated...
<table>
<thead>
<tr>
<th>Producer</th>
<th>Location</th>
<th>Commodity</th>
<th>Products/Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barwick Peat Ltd.</td>
<td>north of Emo</td>
<td>horticultural peat</td>
<td>harvesting of peat, stockpiling at plant site; production figures unavailable</td>
</tr>
<tr>
<td>Crystal Quarries Ltd.</td>
<td>south of Eagle Lake</td>
<td>white quartz</td>
<td>crushed quartz for use in production of silicon sealant, precast panels, landscaping stone; 19 000 tons produced</td>
</tr>
<tr>
<td>Minor, J.A. &amp; Sons</td>
<td>Cygnet Lake</td>
<td>crushed red granite</td>
<td>crushed red granite for precast concrete; landscaping stone; 10 000 tons produced</td>
</tr>
<tr>
<td>Nelson Granite Ltd.</td>
<td>Docker Township</td>
<td>pink granite</td>
<td>rough blocks, slabs, monuments, pavers, curbing, specialty items; 5500 m³ (1990)</td>
</tr>
<tr>
<td>Palin Granite Canada Ltd.</td>
<td>Direct Lake</td>
<td>green granite</td>
<td>rough blocks; 2400 m³</td>
</tr>
<tr>
<td>Universal Granite Systems Inc.</td>
<td>Butler St.</td>
<td>grey granite</td>
<td>rough blocks; 6 m³</td>
</tr>
<tr>
<td>Thorgrimson, P.</td>
<td>Eagle Lake</td>
<td>soapstone</td>
<td>carving stone; 3 tons</td>
</tr>
</tbody>
</table>

Figure 8.1a. Northwestern Ontario Industrial Minerals Project (producing quarries and exploration activity in 1992).
Figure 8.1b. Northwestern Ontario Industrial Minerals Project (producing quarries and exploration activity in 1992).

Figure 8.1c. Northwestern Ontario Industrial Minerals Project (producing quarries and exploration activity in 1992).
to be shipped by Mr. Hansen to the United States for use in precast terrazzo tiles and as landscape stone (T. Hansen, Crystal Quarries Limited, personal communication, 1992).

Crushed Granite

J.A. Minor and Sons of Kenora began production on their Cygnet Lake quarry located approximately 45 km northwest of Kenora. A crushed, red granite is being produced for use as decorative landscaping stone and in precast concrete products. A total of 10 000 tons of granite was crushed and screened into 4 size fractions. The material was stockpiled with a small amount shipped to Steinbach, Manitoba for use in precast concrete, and Red Lake for landscaping stone (J.A. Minor, J.A. Minor and Sons, personal communication, 1993).

Peat

Barwick Peat Ltd. began harvesting peat from the Barnhardt muskeg deposit in November. The deposit is located approximately 13 km north-northeast of the town of Emo. The harvested material is trucked to the town of Barwick, 11 km west of Emo, where it is currently being stockpiled at the former producing Arctic Peat Moss Products plant. The plant was shut down in 1981. The stockpiled peat will be processed and bagged for horticultural use and as an absorbant for cleaning up spilt oil. Production figures have not been released. However, for 1993, approximately 200 000 bales are to be produced. The deposit has potential to produce up to 600 000 bales per year. The finished product is destined to be shipped to the United States and southern Ontario markets (K. Idland, Barwick Peat Ltd., personal communication, 1993).

Soapstone

P. Thorgrimson of Keewatin removed approximately 3 tons of soapstone from the waste dump of the past-producing Grace Mining Company quarry, located on Eagle Lake. Thorgrimson and his father carve animal figurines and aboriginal ceremonial pipes. The soapstone occurrence is described by Gerow et al. (1991).

EXPLORATION ACTIVITY

Exploration activity for industrial minerals in northwestern Ontario is summarized in Table 8.2. The sites of exploration are indicated on Figures 8.1a, 8.1b, and 8.1c.

Granite Dimension Stone

Numerous sites across northwestern Ontario were targets of exploration for granite dimension stone. The bulk of the exploration was concentrated on rocks surrounding the town of Ear Falls, a few sites in the Thunder Bay area, and 1 site northeast of Marathon.

The Township of Ear Falls conducted an evaluation of the dimension-stone potential of the area surrounding the town. The program was run through the Canada Employment and Immigration Centre’s Section 25 Program. Technical assistance was provided by the Industrial Minerals Program and the Mineral Development Office in Kenora. A total of 28 potential sites were identified of which 4 were deemed to be significant. Site descriptions can be seen in the Property Examination section.

R. Bernatchez is currently evaluating a number of dimension-stone occurrences in and around the town of Atikokan. An interesting porphyritic, pink monzonite at van Nostrand Lake was sampled and polished. As well, limestone, in the former workings of the Steep Rock Iron Mine and Caland Ore Mine, is being considered as a source of marble. Samples have been cut and polished. They display 3 textures: brecciated, zebra-like, and banded. All 3 take a high polish and produce an attractive appearance. Mr. Bernatchez is currently collecting samples and technical data to conduct a market evaluation (R. Bernatchez, prospector, personal communication, 1992).

M. Schoor has staked a number of potential dimension-stone occurrences in the Upsala area. West of Upsala, at Norway Lake, Schoor has located an area of massive, pink granite. The outcrops are virtually free of vertical joints, sheet joints are up to 1.5 m at surface. The outcrops are small (180 m²) with thick overburden throughout the area.

A. Turner, of Manitouwadge, staked claims over the Dotted Lake Batholith. The claims cover an area formerly held by Calicchia Stone Industries of Cleveland, Ohio. Plans are to conduct stripping in 1993 and remove a test block for processing into tiles. The tiles would be used for a market study. The stone is a massive, coarse-grained, pink, biotite leucogranodiorite and is described by Hinz in Schnieders et al. (1991).

Silica

A number of prospectors investigated potential silica sources in northwestern Ontario. Most notably, T. Hansen, owner of Crystal Quarries Ltd. staked claims in the Dickison Lake area (see "Property Examinations"). Historical records (Bartley 1954) indicated the presence of a 300 feet long quartz vein in the proximity of the Gravel River. Prospector, M. Stewart of Thunder Bay, reported an occurrence of quartz arenite in the vicinity of Obonga Lake. Grab samples returned values of 98.46% SiO₂.

Spectrolite

Prospectors J. and A. Ferguson hold a patented claim (TB109470), in Pic Township, which has significant amounts of the mineral spectrolite. Spectrolite has been identified by X-ray diffraction as plagioclase feldspar with a minor potassium-feldspar (antiperthite) component (Schnieders et al. 1991). Spectrolite feldspar displays an attractive yellow-orange to blue schillerence. The Ferguson’s obtained an Ontario Prospectors Assistance Program (OPAP) grant and carried out a prospecting program on the site over the summer of 1992. A detailed property description is in the Property Examination section.
### Table 8.2. Exploration activity — 1992.

<table>
<thead>
<tr>
<th>Number on Figure 8.1</th>
<th>Individual or Company (Location)</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Township of Ear Falls (Wenegasa Road)</td>
<td>site evaluation, mapping and sampling, test block removal, beneficiation studies</td>
</tr>
<tr>
<td>2</td>
<td>Township of Ear Falls (McKenzie Bay Road)</td>
<td>site evaluation, mapping and sampling, test block removal, beneficiation studies</td>
</tr>
<tr>
<td>3</td>
<td>Township of Ear Falls (CN Trax – 3)</td>
<td>site evaluation, mapping and sampling, test block removal, beneficiation studies</td>
</tr>
<tr>
<td>4</td>
<td>Township of Ear Falls (CN Trax – 4)</td>
<td>site evaluation, mapping and sampling, test block removal, beneficiation studies</td>
</tr>
<tr>
<td>5</td>
<td>Glatz, A. (Kawashegamuk Lake)</td>
<td>stripping, sampling, assaying</td>
</tr>
<tr>
<td>6</td>
<td>Schoor, M. (Norway Lake)</td>
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<tr>
<td>7</td>
<td>Schoor, M. (North of Upsala)</td>
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</tr>
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</tr>
<tr>
<td>9</td>
<td>Bernatchez, R. (Steep Rock Lake)</td>
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</tr>
<tr>
<td>10</td>
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<td>staking, market evaluation</td>
</tr>
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<td>Clarke, G. (Cavers Hill)</td>
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<td>15</td>
<td>Brinklow, B. &amp; L. (Thomas Lake Road)</td>
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### Other Commodities

Exploration for other commodities such as fluorite, feldspar, graphite and crushed granite was seen during 1992.

A new occurrence of fluorite was staked by prospectors A. Glatz and A. Kozowy, near Kawashegamuk Lake, south of Borups Corners. A property description can be seen in the Kenora Resident Geologist District report. A series of fluorite veins were staked by G. Clarke and A. Eveleigh at Cavers Hill, 46 km east of Nipigon on Highway 17.

Interest in dental-grade feldspar resulted in the staking of the Buda station pegmatite in Goldie Township. J. Williams of Minneapolis, Minnesota staked the claims. Samples were taken for testing and market evaluation.

L. Brinklow and P. Nivens staked a new flake-graphite showing 28 km north-northwest of the town of Manitouwadge. The occurrence is described in detail in the section on "Property Examinations".

Maple Leaf Granite Ltd., owned by M. Schoor and M. McNabb of Thunder Bay conducted tests on their Taman Lake black granite property. Taman Lake is located approximately 29 km north of the town of Raith. The property is being examined for its potential as a source of crushed granite.

### INDUSTRIAL MINERALS STAFF ACTIVITIES

The Industrial Minerals Program is staffed by P. Hinz, Industrial Minerals Geologist and R. Lucas, Assistant Industrial Minerals Geologist, under the general supervision of the Schreiber–Hemlo Resident Geologist Program.

Staff activities included monitoring industrial mineral exploration and development within northwestern Ontario, compilation of data and information related to mineral occurrences and deposits, and daily consultation with prospectors, industry, Resident Geologist's staff and the public.
A total of 52 property visits, representing 18 industrial mineral commodities, were conducted in 1992 (Table 8.3 and Figures 8.2a, 8.2b and 8.2c).

A talk on the Northwestern Ontario Industrial Minerals Program was presented at the Northwestern Ontario Mines and Minerals Symposium, Thunder Bay, in April. Presentations, dealing with prospecting for industrial minerals, were made to prospector information sessions and classes in Red Lake, Ignace, Manitouwadge, Marathon and Thunder Bay.

A display, entitled "Industrial Mineral Activities in Northwestern Ontario", was presented at the Institute on Lake Superior Geology in Hurley, Wisconsin, in May 1992, and at the Current Activities Forum in Chisholm, Minnesota, in October 1992. All findings were presented in display format at the Mines and Minerals Symposium held in Toronto, December 1992 and in April 1993 at the Northwestern Ontario Mines and Minerals Symposium in Thunder Bay. Prospector information sessions are planned to be held in Beadmore, Geraldton, Kenora, Marathon, Red Lake, Sioux Lookout and Thunder Bay.

Industrial Minerals staff provided technical advice to the Township of Ear Falls in regards to their Dimension Stone Evaluation project. A number of sites were examined and recommendations given on their potential. Four sites were deemed significant. Large blocks (average weight 1800 pounds) were removed from 3 of the sites, the fourth was deemed significant. Large blocks (average weight 1800 pounds) were removed from 3 of the sites, the fourth was postponed due to weather. The blocks were cut into 12 by 12 by 3/8 inch sample tiles at Canital Granite Ltd. in Winnipeg.

PROPERTY EXAMINATIONS

Bad Vermilion Lake Anorthosite

The Bad Vermilion Lake anorthosite was examined as part of a province-wide evaluation of anorthosite resources. The Bad Vermilion Lake intrusion is situated approximately 50 km east of Fort Frances in northwestern Ontario. The body is accessible via the town of Mine Centre on Highway 11. It covers an area of 100 km², straddling Bad Vermilion Lake and extending southwest to Seine Bay on Rainy Lake.

The Bad Vermilion Lake anorthosite occurs within a differentiated anorthositic-gabbroic intrusion. The area surrounding the intrusion was mapped by Wood et al. (1980a, 1980b) and a preliminary map was produced. The overall intrusion is exposed over approximately 30 km, with the most promising anorthosite outcrops occurring in the northeast portion of the intrusion. A study conducted by Ashwal et al. (1983) concentrated on the Seine Bay (southwestern) portion of the intrusion and did not sample the more massive northeastern portion.

A boat traverse, covering the northeastern portion of the intrusion (Figure 8.3), was conducted with the assistance of D. Laderoute (Acting Staff Geologist, Kenora Resident Geologist's Office). Outcrop exposures on the western shoreline were primarily gabbro to gabbroic anorthosite. Some shearing was observed and pods of titanomagnetite were noted. One such pod was sampled (IM-92-001) and analysed for its TiO₂ content (see Table 8.1). Outcrops to the east contained an increased amount of anorthosite. The following west to east sequence was observed: gabbro; anorthositic gabbro; gabbroic anorthosite; massive anorthosite. Each rock-type represented an increase in modal plagioclase content.

A considerable amount of time was spent in the Island Bay and Finger Bay areas. An outcrop on the western shore of Finger Bay contained epidote, which indicates that saussuritization had taken place. On the east side of the bay, gabbroic anorthosite was noted. Intercumulate chlorite was seen and could represent altered mafic minerals (amphibole/pyroxene). Outcrops with large plagioclase crystals displayed a "pitted" or "etched" weathering. This may represent a high percentage of an acid-soluble high-anorthite end-member which is etching out due to acidic rainwater. Massive anorthosite was noted in outcrops on the shoreline of Island Bay. Cumulate crystals up to 10 cm were seen and outcrops had a "golf-ball" like appearance. Plagioclase content was above 90% and in some places it neared 95%.

A total of 14 samples were taken. Whole-rock geochemistry was done and thin-sections were examined. Results from the whole rock analyses are shown in Table 8.4.

When these results are compared with what is considered a "good" anorthosite (Braaten 1991), as shown in Table 8.4, it is apparent that the section of the Bad Vermilion we examined does not meet the required criteria. The Al₂O₃ content comes close, however, the Fe₂O₃ percentage is far above acceptable levels. TiO₂ is also high in many of the samples. These results indicate that the anorthosite examined would not be suitable for alumina leaching. However, Ashwal et al. (1983) sampled the southwestern portion of the complex extensively and obtained favourable results as shown in Table 8.4. Plans to re-visit Bad Vermilion Lake in 1993 are intended to sample the area covered by Ashwal in hope of locating suitable material for testing.

Dickson Lake Quartz Occurrence

With an increase in demand for lump silica the authors decided to investigate the occurrence of a number of large quartz veins in the Dickson Lake area (Figure 8.4). The occurrence is located 39 km north-northwest of the town of Schreiber. At present access to the occurrence is difficult and is best achieved by helicopter. The closest road is approximately 13 km to the northeast and accesses the northern end of Dickson Lake. Another road, approximately 5 km to the northwest provides access to the western (opposite) side of the Gravel River valley.

The first reference to the quartz veins is by M.W. Bartley (1954) in an unpublished report for the Canadian Pacific Railway Company. Bartley states: "Many quartz veins were noted in the western part of the area. They range in width from several feet to 90 feet generally, but one measures 300 feet across." The 300-feet wide vein was of prime interest to the authors. Independant confirmation of the existence of the quartz vein was provided by H. Klatt (Newmont Canada Inc.,
### Table 8.3. Industrial mineral property examinations — 1992.

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<tr>
<th>No.</th>
<th>Location</th>
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<tbody>
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</tr>
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<td>Red Deer Lake (Lount Lake batholith)</td>
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</tr>
<tr>
<td>3.</td>
<td>Pine Green Granite Quarry(^1) (Lount Lake batholith)</td>
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<tr>
<td>4.</td>
<td>Wenesaga Lake Road</td>
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</tr>
<tr>
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<td>McKenzie Bay Road</td>
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</tr>
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<td>CN Road #3</td>
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<tr>
<td>7.</td>
<td>Sioux Narrows</td>
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<td>8.</td>
<td>Snake Bay (Lake of the Woods)</td>
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<td>Triangle Lake Road</td>
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<td>22.</td>
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\(^1\)visited during a field trip conducted in 1992  
\(^2\)currently producing

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![Figure 8.2a. Northwestern Ontario Industrial Minerals Project (property visits in 1992).](image-url)
Figure 8.2b. Northwestern Ontario Industrial Minerals Project (property visits in 1992).

Figure 8.2c. Northwestern Ontario Industrial Minerals Project (property visits in 1992).
Figure 8.3. Bad Vermilion Lake anorthosite.


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<th>Al₂O₃</th>
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<th>K₂O</th>
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</table>
Figure 8.4. Dickison Lake quartz occurrence.

Figure 8.5. Thomas Lake graphite occurrence.
Table 8.5. Dickison Lake whole rock geochemistry.

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<th>Fe$_2$O$_3$</th>
<th>MgO</th>
<th>Na$_2$O</th>
<th>K$_2$O</th>
<th>CaO</th>
<th>MnO</th>
<th>TiO$_2$</th>
<th>P$_2$O$_5$</th>
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</table>

personal communication, 1992). Klatt was examining the area when he came across an unusually wide vein which measured 300 m (984 feet) in width.

The occurrence is located within the Archean Quetico Subprovince and was mapped by Carter (1975a, 1975b). The area is underlain by a mixture of Archean metasedimentary schists, gneisses and migmatitic rocks. The occurrence located by the authors is near a contact between the metasediments and migmatites. To the north is the Gravel River Fault zone. The fault is the major structural feature in the area and is marked by a 61 m (200 foot) cliff on its north side. The Gravel River valley occupies the fault zone.

A helicopter was used to access the area. An attempt was made to locate Bartley’s 300-feet long vein which is shown on his map as being 3.2 km southwest of Dickison Lake. The authors prospected the area and located a quartz vein with an apparent width of 61 m (200 feet). Grab samples were taken across the vein, results are shown in Table 8.5. The quartz is bull white in the centre and clouded with almost completely digested host rock inclusions at the margins.

When the results are compared with specifications for silicon metal (see Table 8.5) it is seen that the primary impurities (Al$_2$O$_3$, Fe$_2$O$_3$, CaO and TiO$_2$) are all above the required tolerance levels. The results are encouraging and warrant the authors to return in 1993 to conduct a more thorough sampling program.

**Thomas Lake Road Graphite Occurrence**

A new flake graphite occurrence (Figure 8.5) was found by prospectors L. Brinklow and P. Nivens of Manitouwadge. The occurrence was brought to the attention of the authors by the Manitouwadge Mineral Resource Geologist, D. McKay, who examined and sampled the occurrence to determine its gold and base-metal potential. The prospectors staked 3 claim blocks over the occurrence and conducted prospecting, stripping, blasting, sampling and ground geophysical surveys (HLEM, VLF and magnetic).

The property is accessible by road and is approximately 28 km north-northeast of Manitouwadge. Depart from the Geco road east on the Camp 70 road for 24.0 km to the Jim Lake Road. West on the Jim Lake Road for 6.0 km. Turn right (north) on Jim Lake Road for 10.0 km. Turn left (west) on the Husak Road, drive 3.5 km, turn right (north) on the Thomas Lake Road. Drive 1.5 km to 2 blasted pits which are on the right (east) side of the road.

The occurrence is hosted within a 4 m wide shear zone within paragneiss. Dominant foliation within the paragneiss strikes 110° and dips 85° to the south, the shear zone is subparallel to the foliation. On the south side of the shear zone a pegmatite dike is observed. The width of the dike is unknown as it is covered by extensive overburden. The pegmatite is composed of quartz, feldspar and biotite.

Flake graphite is present within the shear zone as a graphic schist. Graphite generally comprises up to 5% (locally up to 20%) of the rock with trace amounts of chalcopyrite, pyrite, magnetite and pyrrhotite. There is an abundance of biotite within the schist, which is detrimental to the potential of the occurrence as biotite is difficult to separate from flake graphite. Graphite is highly concentrated along shear faces.

Two samples were collected by the authors. One small hand-specimen was taken to produce a polished thin section. The second was a large (40 kg), high-grade sample of graphic schist which was sent for a flotation test. Examination of the thin section revealed quartz, plagioclase feldspar, biotite, flake graphite, minor alkali feldspar, trace pyrite (less than 1%) and possibly some remnant orthopyroxene. Biotite and flake graphite are intimately associated and occur as tabular and lath-like intergrowths. Plagioclase displays myrmekitic intergrowths with quartz and albite and Carlsbad twinning. Alkali feldspar is identified by microcline twinning. A minor saussuritization appears to have occurred and is evidenced by altered plagioclase and resultant epidote masses.
This occurrence is of interest as it is the third and largest such occurrence, north of Manitouwadge. The potential for economic flake-graphite deposits within the Quetico Metasedimentary Subprovince is considered to be quite good.

It was recommended to the prospectors to expose more outcrop through stripping and determine the extent of the mineralization. The Industrial Minerals staff have offered a further visit and investigation once the site has been stripped.

**Shack Lake Spectrolite Occurrence**

The Shack Lake spectrolite occurrence is owned by J. and A. Ferguson of Terrace Bay. They are evaluating the property's potential as a pick-your-own tourist operation similar to the amethyst mines near Thunder Bay. The occurrence (Figure 8.6), previously known as the C.S. Downey Moonstone occurrence, consists of a single patented claim (TB109470).

The occurrence is located north of the town of Marathon and can be accessed by road. From Highway 17 drive towards Marathon approximately 1.6 km, take the bush road which leads to the west. Follow the bush road until it ends at the point where Shack Creek exits Shack Lake. The southern boundary of the claim crosses the creek.

The occurrence is underlain by iron-rich augite syenite (Walker et al. 1992) of the Proterozoic Coldwell alkalic complex. Geological mapping over the area was done by Puskas (1967a, 1967b) and recently by Walker et al. (1991, 1992). The property was last described in detail by Kustra (1968) and Schnieders et al. (1991). The spectrolite occurs within the syenite as 2 phases: large crystals up to 10 cm across in pegmatite dikes cross-cutting the syenite; and smaller crystals within the contact zone between the pegmatite and medium-grained host syenite. In both cases the spectrolite displays bluish to yellow-gold schillerescence. Ribbe (1983) states, "'Schiller' may be used to refer to diffuse, often silvery reflections from mutually oriented, platy inclusions, especially common in labradorite parallel to (010) (Rayleigh, 1923).".

In 1990, M.C. Smyk, Staff Geologist, Schreiber–Hemlo District, sent a sample for XRD analysis to H. de Souza of the Geoscience Laboratories in Toronto. It was reported: "X-ray diffraction analysis of the 'spectrolite' shows the presence of plagioclase and minor potassium-feldspar (anti-perthite). The schiller effects may be brought about by diffraction that occurs at the boundary of exsolution lamellae." (Schnieders et al. 1991).

During 1992, the Fergusons conducted a highly successful prospecting and exploration program over the property. Their work was funded by the Ministry of Northern Development and Mines’ Ontario Prospector Assistance Program. Through the summer, they conducted prospecting, stripping, trenching, mapping, sampling and diamond drilling. Results from their efforts include new showings of pegmatitic dikes containing spectrolite, and areas of massive iron-rich augite.
Figure 8.7. Ear Falls dimension stone study.

The occurrence is located east of Highway 105, and is reached by travelling 16 km south on the CN Trax road. The CN Trax road is located 32 km south of Ear Falls on Highway 105. A ridge trending 20° is located east of the road. The ridge is approximately 500 m long, 200 m wide and 25 m high. The west face consists of a steep slope of several large sheet joints (2 to 3 m) forming a step topography. There is finer sheeting (0.4 to 0.9 m) near the road and much fracturing due to blasting. There is an old skidder road at the base of the west face.

The rock is a fine-grained brown granite. It is very uniform in texture with rare orthoclase phenocrysts (less than 2 cm). A reddish stain (hematite) is concentrated along fractures but this may be a surface feature. There is minor biotite and some chlorite-biotite xenoliths in the outcrop. The mineral composition is orthoclase (35%), plagioclase (27%), quartz (35%), and biotite (3%).

CN TRAX – 3

The occurrence is located east of Highway 105, and is reached by travelling 16 km south on the CN Trax road. The CN Trax road is located 32 km south of Ear Falls on Highway 105. A ridge trending 20° is located east of the road. The ridge is approximately 500 m long, 200 m wide and 25 m high. The west face consists of a steep slope of several large sheet joints (2 to 3 m) forming a step topography. There is finer sheeting (0.4 to 0.9 m) near the road and much fracturing due to blasting. There is an old skidder road at the base of the west face.

The rock is a fine-grained brown granite. It is very uniform in texture with rare orthoclase phenocrysts (less than 2 cm). A reddish stain (hematite) is concentrated along fractures but this may be a surface feature. There is minor biotite and some chlorite-biotite xenoliths in the outcrop. The mineral composition is orthoclase (35%), plagioclase (27%), quartz (35%), and biotite (3%).

CN TRAX – 4

This occurrence is located east of Highway 105, and is approximately 20 km south on the CN Trax road from the highway. Turn east onto the Devlin road and proceed 2.0 km. The outcrop is a very large dome, dipping gently to the north, with little vegetation. The part of the outcrop examined is 600
m long by 600 m wide. The surface slopes 3° to 5° to the north with a 3 m drop-off on the north face. The central part of the body is very massive with little or no sheeting or fractures. Considerable sheeting (0.2 m), and fractures occur to the north. There is a skidder road along the south face. The Devlin road crosses the outcrop making it accessible by truck.

The rock is a medium-grained, pink granite with uniform colour and texture. There are some small quartz veins on the eastern edge of the outcrop, east of the road. The colour gradually gets lighter to the south. There is some biotite and minor leucoxene (a titanium oxide). The leucoxene is deleterious due to the fact that it is soft and weathers easily. The mineral constituents are orthoclase (40%), plagioclase (30%), quartz (25%) and biotite (5%).

**MCKENZIE BAY – 1**

The site consists of several outcrops which are located 46 km southeast of Ear Falls on the McKenzie Bay road. The first is a hill 500 m long by 30 m high, which outcrops along the road, and is located by a gravel pit. The second is a hill, 20 m high, north of Manitou Creek, which outcrops for 2 km to the north. There appears to be sheeting at 1 to 2 m, with only minor vertical fractures. The gravel pit is located on the southeastern bank of Manitou Creek.

The outcrops are light grey, medium- to coarse-grained granite. The granite is uniform in texture and colour with small xenoliths of biotite-hornblende and muscovite.

The mineral constituents are orthoclase (35%), plagioclase (35%), quartz (30%), biotite (3%) with minor muscovite (1%). The feldspar and quartz are coarser than the biotite. Orthoclase is present as crystals up to 2 cm.

**WENNESAGA – 8**

This site is located 63.1 km northeast of Ear Falls on the Wennesaga road. The site consists of a large ridge, with a central area 1 km long, 600 m wide and 50 m high, trending 070°. Sheetin occurs at 1.5 to 2 m over the entire central area with a few fractures, nearly orthogonal to the sheeting. A bush road crosses the ridge at the southwestern end.

The outcrop is composed of a pinkish-brown, medium-grained granite. The rock is very uniform in texture and colour with black, elongated crystals of hornblende. The mineral constituents are orthoclase (70%), plagioclase (15%), quartz (5%) and hornblende (10%). The outcrop was traversed several times and all samples were identical in composition and texture.

The preceding site descriptions were written using data compiled during the 1992 field season by staff hired under the Canada Employment and Immigration Centre's Section 25 program. Tiles produced from these sites will be on display in the Thunder Bay office. The author (P. Hinz) plans to visit the sites during the upcoming field season. Detailed mapping and thin-section examination will be done to further evaluate the occurrences.

**RECOMMENDATIONS FOR EXPLORATION**

**Dimension Stone**

The dimension-stone market in Canada weathered the recession during 1992 fairly well. Forecasts indicate continued growth for the Canadian dimension-stone industry (Vagt 1992). Canadian producers have utilized advanced technologies and aggressive marketing to maintain production and sales. Colours which have maintained a steady demand in the market include black, red, pink and white, while unusual colours, such as green, yellow, blue and variegated granite, are increasingly in demand. This would indicate that virtually any colour with an attractive or unique texture could be marketable.

A number of areas in northwestern Ontario have stimulated interest in their granite dimension stone potential. Of particular interest are areas examined as part of the Township of Ear Falls dimension-stone study, rock types within the Port Coldwell alkalic complex, and the Penassen Lakes stock.

The Ear Falls study examined a total of 28 sites, 4 of which were significant enough to warrant the removal of test blocks (see “Property Examination” section). Figure 8.7 shows the location of these sites in relation to the town of Ear Falls. The 4 sites should be examined in detail to determine if they are quarriable and more importantly, marketable.

Outcrops in the Port Coldwell alkalic complex were quarried in the past. Presently, there is no production, however, large areas to the north-northwest of the town of Marathon are currently staked. Examinations by the authors (Hinz and Lucas 1992) revealed areas of interest surrounding Carden Cove. The complex covers a large area and has potential for black, red, brown and green stones.

The Penassen Lakes are located approximately 11.5 km northeast of Thunder Bay. The area surrounding the lakes was examined by the authors. It is underlain by a porphyritic red granite and is described by Scott (1990). While flying over the area, the authors noted a number of outcrops which appeared massive. The area will be visited during the 1993 field season.

When evaluating dimension-stone sites, the following criteria (Storey 1986) should be considered: fracture and jointing frequency, colour and texture, marketability of colour and texture, deleterious minerals, and size of the deposit.

**Graphite**

Forecasts for the Canadian graphite market indicate that growth should continue (Boucher 1992). Graphite is a product of metamorphism and is found worldwide in a range of schists, gneisses and marbles. Graphite used in industrial processes is grouped into three types: crystalline (flake), lump, and amorphous. Flake graphite which can be upgraded to 90% carbon is in high demand and commands a high price.
The area north of the town of Manitouwadge is underlain by the Quetico Subprovince. Over the past 3 years, new flake-graphite occurrences have been found. The most recent occurrence, located south of Thomas Lake (see “Property Examination” section), is the largest of the 3. The potential for larger occurrences in the area is quite good. The presence of granulite-facies metamorphic mineral-assemblages, represented by an orthopyroxene isograd, indicates a metamorphic environment suitable for the formation of flake graphite.

Other areas in northwestern Ontario which should be examined for potential graphite occurrences are the Quetico and English River subprovinces. Both subprovinces are high-temperature, metamorphic terranes, ranging from upper amphibolite to granulite facies. Ductile shear zones should be investigated for the development of flake graphite. Prospecting and outcrop examination is most effective in evaluating graphite occurrences.

Silica

Overall markets for silica are forecasted to be weak (Boucher 1992). However, opportunities do exist for specialized silica products. These products include fused silica for electronic and chemical industries, silicon carbide for advanced ceramics, monocrystalline silica used in silicon chips, chemical grade silicon for silicones, and high-purity ground silica (minimum 99.5% SiO₂) as abrasives, cleansers and fillers. All require silica which can meet stringent standards for purity.

In northwestern Ontario, an area which has potential to host a very large silica resource is located near the Gravel River fault in the vicinity of Dickison Lake (see “Property Examination” section). Quartz veins ranging in width from 3 to 300 m have been reported. Whether these veins are free of chemical impurities needs to be determined.

Quartz arenites of the Sibley Group are another potential source of silica. The Quarry Island occurrence hosts known reserves of 12.5 Mt with grades ranging from 92.8 to 99.1% SiO₂ (Bernatchez 1986). Due to logistical and environmental difficulties related to developing offshore deposits it may be best to restrict exploration to onshore areas.

When evaluating potential sources, samples should be analyzed for iron, alumina, titanium and heavy metals at ppm levels. Also calcium and sodium should be checked for if carbonate is present.

Other Commodities

More than 50 industrial mineral commodities are known to occur in northwestern Ontario. Resident Geologist’s offices located throughout the province contain files and references on many of the known occurrences. Prospectors are encouraged to contact their local Resident Geologist to obtain the pertinent information.

Other commodities in northwestern Ontario which merit study include: fluorite; marble; brick-red shale for landscaping stone; red and black granites for agglomerate tiles; and landscape stone.

REFERENCES


9. Field Services Section, Northeastern Ontario: Introduction

J.W. Newsome
Manager, Field Services Section (Northeast), Ontario Geological Survey–Information Services Branch

INTRODUCTION

Mineral exploration and mining activity within approximately 444 500 km² of northeastern and northern Ontario is monitored and serviced by MNDM’s Field Services Section of the Ontario Geological Survey–Information Services Branch.

The primary goal of the Field Services Section is to provide professional consultative services and advice on the geology, mineral deposits, and exploration and mining activities within the province to prospectors, mineral exploration companies, internal-government agencies, private-interest groups and the public. Other goals are to attract, stimulate and guide mineral exploration and development.

In northeastern Ontario, these goals are primarily accomplished through the Resident Geologist Program of Field Services Section, which operates 6 offices in Timmins, Kirkland Lake, Cobalt, Sudbury, Sault Ste. Marie and Wawa. Additionally, the Resident Geologist Program also encompasses the Drill Core Library System, with library facilities in Timmins, Swastika, Sault Ste. Marie, and a satellite site in Cobalt, as well as a one-person geological field office located in Elliot Lake as part of the ministry’s Elliot Lake Special Geological Reassessment Project.

Staff of the Resident Geologist Program perform a myriad of routine functions and activities, including:
- providing expert consulting and advisory services to clients;
- conducting property examinations and field trips;
- maintaining assessment files and other geoscience databases;
- monitoring and reporting on the exploration and mining activity through monthly reports to management and the annual Report of Activities;
- stimulating mineral exploration and disseminating information to the public through the presentation of prospector courses, seminars and poster sessions;
- maintaining an active drill core library system; and
- monitoring and inputting into land use planning and other land-related issues.

In the course of performing these duties and responsibilities during 1992, staff of the northeastern Resident Geologist Program responded to over 11 800 office and 17 000 telephone inquiries, and conducted in excess of 70 field trips and more than 200 exploration property and minesite visits. Each district office also participated in Mining Awareness Week celebrations in June by hosting open houses or presenting public poster sessions. They also presented poster displays and/or gave talks at The Mines and Minerals Division’s symposia held in Toronto and Timmins, and prepared and presented prospector courses to a total of 192 participants in Timmins, Kirkland Lake, Temagami, Sudbury, Sault Ste. Marie and Wawa.

The Twelfth Annual Mines and Minerals Northeastern Geoscience Symposium was held in early April in Timmins, with over 300 registrants in attendance. M. Witte, President of Royal Oak Resources Limited, was the keynote speaker. Each Resident Geologist gave an oral presentation and presented a poster display on recommendations for exploration within their respective districts. A total of 39 poster displays, 15 core-shack displays, and 9 oral presentations comprised this two-day event.
Each Resident Geologist office also initiated or continued work on special projects and activities during 1992, some of which are summarized below.

Timmins:
- produced a booklet entitled “Summary: Northeastern Ontario Mining and Development Activity, 1992” for public distribution;
- researched and compared the similarities between the Timmins and Hemlo gold camps, and speculated on the possible extension of the Timmins gold camp to the west of the city;
- completed a statistical study on the historical-to-present trends for exploration, development and mining activity within the Timmins Resident Geologist District;
- prepared the 1992 provincial Drill Core Library catalogue update; and
- co-ordinated the collection of rock and mineral specimens from across the province to be used as teaching aids in MNDM-sponsored prospector courses and as part of teaching kits being prepared for use in elementary schools throughout Ontario.

Kirkland Lake:
- initiated reconnaissance sampling of the hydrothermal alteration zone associated with the Hemlo Gold–Freewest Lightning Zone gold deposit to determine if any detectable, systematic geochemical or mineralogical changes occur within the plane of gold mineralization;
- initiated reconnaissance sampling of Gauthier Town ship hydrothermally altered metavolcanic rocks that are similar in appearance to the above mentioned Lightning Zone;
- compiled information on all currently known kimberlite pipes, dykes, and float occurrences within the Kirkland Lake area for public dissemination;
- continued compiling data on special or significant geological sites of interest for inclusion into a geological field guide of the Kirkland Lake area;
- a prospector’s report writing manual was prepared for distribution to all prospector course participants; and
- a sampling program to test for high concentrations of gold instream water was developed by Staff Geologist D. Guindon. The report on this process, authored by Dr. J. Fortescue, appears in the OGS Summary of Field Work and Other Activities, 1992.

Cobalt:
- organized the PETROCH database for the Cobalt District by correlating the data to specific site locations;
- initiated a data compilation for the evaluation of the base metal potential within the Cobalt District;
- organized and catalogued all maps, mine-plans and related data from all past producers in the area that are on file at the Resident Geologist office and entered this data into a digital database for public access;
- organized and catalogued all rock hand specimen samples stored at the Resident Geologist office and drill core storage facility, and entered this information into a digital database for public access; and
- in conjunction with Temiskaming Testing Laboratories, assisted in the preparation of rock and mineral specimen kits to be used as teaching aids for prospector courses and in elementary schools province-wide.
Sudbury:
- commenced the inventory of representative rock and mineral suites collected from properties within the Sudbury Resident Geologist District for public use;
- continued gathering data to gain a better understanding of the nature and significance of skarn mineralization within the Huronian Espanola Formation;
- updated the Resident Geologist office geology field trip guidebook for the Sudbury area; and
- continued assembling a collection of representative thin and polished sections of various rocks and ore specimens from the district for public use.

Sault Ste. Marie:
- initiated a field investigation of mapping and sampling a dolostone unit in Fenwick Township which may host significant copper mineralization of sedimentary (sabkha) origin;
- provided technical advice for the reconstruction of the historic Simpson Shaft project in the town of Bruce Mines;
- catalogued and filed in excess of 1000 mine plans from abandoned mine properties in the district that are currently stored in the SSM Drill Core Library; and
- initiated compilations in the Elliot Lake Office that include a bibliography of the Elliot Lake area and all geological field trip guidebooks associated with the area.

Wawa:
- initiated the collecting and archiving of data from recently closed mines in the district;
- created a digital database for public use of the description of all underground mine plans from the Renabie, Citadel and Algoma Ore Division mines, as well as other closed historical mines in the Wawa area;
- updated a digital database that serves as an index to assessment files that are maintained at the Wawa Resident Geologist office;
- produced a self-guided geological field trip booklet for the immediate area around the town of Wawa; and
- updated an index guide for public use to all of the published data available at the Wawa Resident Geologist office.

Other changes and activities associated with the Resident Geologist Program that took place during 1992 in northeastern Ontario include the following:

- H. Lovell, Regional Staff Geologist based in Kirkland Lake, retired in January after 26 years of service to the Ministry of Northern Development and Mines and its predecessors;
- to improve client service and interaction, the offices of the Resident Geologist and Mining Recorder in Sault Ste. Marie were moved in April to a new location annexed to the SSM Drill Core Library located at 60 Church Street;
- the compiling and processing of data into the Mineral Deposit Index (MDI) electronic database was completed for most of the Resident Geologist districts in the northeast. An estimated 300 records remain to be entered into the database for the Kirkland Lake Resident Geologist District. The MDI database currently consists of approximately 5600 individual mineral occurrence records for northeastern Ontario;
- the creation of booklets listing "Properties for Sale, Option or Joint Venture" was initiated in each Resident Geologist office. The purpose of this initiative is to assemble a directory with information on properties in each district that individual prospectors and companies may wish to market through the Resident Geologist Program distribution network. The onus is on the individual or mining company to volunteer this information in a simplistic, standardized format. Unfortunately, response to this initiative in the north east has been slow and less than enthusiastic. It is hoped that the people in the mineral exploration industry will realise the value that this initiative can offer to them, and that more property submissions will be forthcoming in 1993;
the provincial Drill Core Library System is currently undergoing a two-year expansion phase as part of the Government of Ontario’s jobsOntario Capital Funds initiative, which began in the autumn of 1992. Off-site drill core storage facilities are being established at strategic locations throughout the province. These new facilities will consist of controlled-access gravelled compounds, within which drill core will be stored on unitized steel pallets designed by the staff at the Swastika Drill Core Library. In the northeast, these off-site drill core storage facilities will be relatively proximal to the existing drill core libraries, and are scheduled to come into service in the latter part of 1993. Currently, there are approximately 612 800 m (1 991 600 feet) of diamond drill core stored at all drill core library facilities in the northeast, including Timmins, Swastika, Sault Ste. Marie and Cobalt; and

numerous drill core donations were received from various individuals and mining companies throughout the northeast, including large donations from Algoma Ore Division, Rio Algom Exploration Inc. and Homestake Canada Ltd. Homestake Canada Ltd. also donated a substantial volume of historical and archival geological data from its Hollinger Mines’ database prior to the permanent closing of its Timmins office.

Land alienation is a major issue being addressed by the Ministry’s Mines and Minerals Division. Of primary concern are provincial park expansions, First Nation land claims, endangered spaces initiatives and wetland policies, all of which impact upon the access to land for mineral exploration and development purposes. Various issues related to these concerns in which staff of the Field Services Section in the northeast were involved during 1992 include: The Temagami Land Caution, expansion to the Mississagi First Nation Reserve, and the proposed expansions to the Polar Bear Provincial Park and the Missinaibi River Provincial Park.

Sixteen geoscience projects were conducted throughout northeastern Ontario during 1992 under the auspices of the Canada–Ontario Northern Ontario Development Agreement (NODA). Briefly, they are listed below.

NODA—Ontario Geological Survey–Geoscience Branch and –Information Services Branch
- Precambrian mapping of the northern Swayze greenstone belt;
- Quaternary evaluation of the Swayze greenstone belt;
- Mineral deposits study (western Abitibi);
- International marketing of Ontario dimension stone;
- Site evaluation and market testing of Ontario anorthosite deposits;
- Mineral aggregate inventory—Highway 17 Corridor, Blind River to Bruce Mines;
- Industrial mineral assessment (Nipissing–Parry Sound–Sudbury areas);
- Industrial mineral assessment of Manitoulin Island; and
- Evaluation of the light and heavy rare earth content within Elliot Lake mine tailings.

NODA—Geological Survey of Canada
- Quaternary data compilation, Timmins area;
- Mineral deposits study, Kidd Creek Mine;
- Drift prospecting for diamonds in the Kirkland Lake area;
- Platinum group elements (PGE) mineral deposits study, Sudbury;
- Airborne geophysical surveys in the Blake River syncline;
- Bedrock geology, western Abitibi greenstone belt; and
- Ore deposit signatures by borehole geophysics.

The Ontario Geological Survey–Geoscience Branch also conducted 4 geoscience field projects in the northeast, while numerous geoscience research projects were conducted by workers associated with various universities or other agencies such as the Geological Survey of Canada. The Ontario Geological Survey–Geoscience Branch and NODA projects, as well as a few of the other research projects, are reported in either the 1992 Summary of Field Work and Other Activities (Ontario Geological Survey, Miscellaneous Paper 160), or in Abstracts, Ontario Mines and Minerals Symposium, (MNDM publication).
EXPLORATION AND MINING HIGHLIGHTS

Mineral exploration activity throughout northeastern Ontario was down slightly compared to 1991. By best estimates, approximately 530 exploration projects were conducted by various prospectors and exploration and mining companies throughout the northeast during the year.

A significant proportion of the mineral exploration projects that were conducted may be attributed to the support received through the ministry's Ontario Mineral Incentive Program (OMIP) and Ontario Prospectors Assistance Program (OPAP). Sixty-six OMIP grants totalling approximately $6.89 million and 237 OPAP grants totalling approximately $2.26 million were awarded to various workers conducting exploration programs within northeastern Ontario during 1992.

By the same token, claim staking was up overall compared to last year. This may be attributed to several factors, including: the current interest in diamond exploration sparked by the recent diamond-bearing kimberlite discoveries in the Northwest Territories, and closer to home, reports of diamond-bearing kimberlite being discovered in McVittie Township (Kirkland Lake area), by Sudbury Contact Mines Limited; 2 mini-staking rushes in the Timmins Resident Geologist District—1 for diamonds in the Attawapiskat area, and the second for base metals in Hurman Township near Kapuskasing; and the re-opening for staking of Best, Cassels and Strathy townships (Temagami area), and James Township (Elk Lake area), released from the Temagami Land Caution by the Teme-Augama Anishnabai Band in late 1991.

At the beginning of 1992, there were 37 active mines, 12 quarries and 1 gold tailings reclamation project in continuous or partial (seasonal) operation throughout northeastern Ontario. Commodities produced include gold, silver, nickel, copper, zinc, platinum group metals, cobalt, uranium, iron ore, talc, serpentine, silica, barite, limestone, dolostone, diabase (trap rock), and building and decorative stone. By the end of the year, the number of active mines had decreased to 33, with the closing of the Redstone Mine in the Timmins District, the Cheminis Mine in the Kirkland Lake District, the Denison Mine in Elliot Lake, and the Magino Mine in the Wawa District. The number of quarries had increased to 14 with the opening of Tundra Granite and Marble Corporation's 2 dimension stone operations in the Kirkland Lake District. The number of tailings reclamation projects remained unchanged.

The following provides a brief summary of the mining and exploration activities on a district by district basis.

Timmins District

Eleven mining operations were active for all or most of the year. These include:

- 2 underground base metal mines: Falconbridge Limited's Kidd Creek Mine and Timmins Nickel Inc.'s Redstone Mine;
- 6 underground gold operations: Falconbridge Gold Corporation's Hoyle Pond and Bell Creek mines, Placer Dome Inc.'s Dome Mine (No.8 Shaft) and Detour Lake Mine, Royal Oak Mines Inc.'s Pamour No.1 Mine, and St. Andrew Goldfields Limited's Stock Mine;
- 2 open pit gold mines: Placer Dome Inc.'s open pit mine, adjacent to the Dome Mine, and Royal Oak Mines Inc.'s collective nos. 2, 3 and 5 pits near the Pamour No.1 Mine; and
- 1 industrial minerals (talc) open pit operation: Luzenac Incorporated’s Reeve Mine.

During the year, 3,577,946 t of ore were mined at the Kidd Creek Mine to produce 138,251 t zinc metal and 94,672 t copper metal. Silver production figures were unavailable at the time of report writing. The Redstone Mine produced 1,360,000 pounds nickel from approximately 34,000 tons of ore milled. Total gold production for all gold operations within the district was 498,337 ounces. Luzenac Incorporated produced 30,000 tons of talc from 125,000 tons of ore.
In January, Falconbridge Gold Corporation began gold mining operations at the Bell Creek Mine, formerly operated by Canamax Resources Inc. Following mine rehabilitation, a small-scale ore production of 600 t per week commenced in July.

At the former Owl Creek open pit gold mine, Falconbridge Gold Corporation spent $6 million to eliminate acid discharge from waste rock piles by returning this material to the open pit and burying it between layers of crushed limestone which acts as a buffering agent. The pit is also being allowed to flood to further reduce acid generation and discharge.

Falconbridge Limited and Marsulex Inc. established a joint venture to produce and merchandise liquid sulphur dioxide from sulphuric acid by-products generated at the Kidd Creek metallurgical site.

Low nickel prices played a significant role in Timmins Nickel Inc.’s decision to suspend mining operations at the Redstone Mine in August. Subsequently, Black Hawk Mining Incorporated have acquired the property and plan to conduct exploration in an attempt to define ore reserves between the 1000 to 2700 feet section below surface.

Noranda Exploration Co., Ltd. announced that it will be closing its regional exploration office in Timmins, effective April 1993, although a small field office will be retained. Exploration projects within the Timmins Resident Geologist District will be managed from the company’s base of operations in Noranda, Quebec. Similarly, other major exploration and mining companies that departed from the Timmins area in 1992 include Rio Algom Limited, Homestake Canada Ltd. and Gold Fields Canadian Mines Ltd.

On the brighter side, surface and underground exploration programs conducted during 1992 in and around several of the area’s producing gold mines proved successful.

Placer Dome Inc. extended the Main Zone gold mineralization at the Detour Lake Mine a farther 800 m westward, as well as discovered a new zone (the “C-Zone”), 300 m north of the Main Zone, where drill intersected gold, for which values of up to 1.2 ounces Au per ton over 20 feet have been reported. As well, a twelve-month, $4.38 million feasibility study is currently in progress at their Dome Mine operations to determine the economic viability of creating a projected 700 feet deep “superpit”.

Royal Oak Mines Inc. conducted over 77 000 feet of surface diamond drilling in the vicinity of its Timmins gold mining operations in an effort to find new gold deposits amenable to open pit mining. Two new gold zones were discovered which may have potential for becoming underground mines. The first, referred to as the “A.K. Zone” and located north of the No. 2 pit, has been delineated on 200-foot drill spacings to a depth of 400 feet over a strike length of 2000 feet. The best drill intersection within a quartz vein stockwork from this zone returned an assay of 0.29 ounces Au per ton over 29 feet. The second mineralized zone discovered consists of a quartz vein at the contact between ultramafic and mafic metavolcanic rocks which recorded an assay of 1.46 ounces Au per ton over 6 feet.

Underground exploration and development at St. Andrew Goldfields Ltd.’s Stock Mine has also resulted in delineating more ore reserves. Underground drilling has extended the N-2 Zone, which has produced approximately 60% of the total ore mined to date, at least 200 feet below the 7th level, the lowest working level in the mine at 975 feet below surface.

There were 3 advanced exploration projects operating in the Timmins Resident Geologist District in 1992: 1) the Claude Rundle Gold Mines Limited’s gold venture in Newton Township, which is currently on-hold following underground dewatering, mapping, and sampling operations conducted earlier in the year; 2) Great White Mineral Ltd.’s silica deposit on the Fripp–Price townships boundary, where a 2500 ton bulk sample was extracted and tested for such uses as high purity silica for crucibles, fibre optics,
silicon metal and decorative aggregate; and 3) the Great Lakes Kaolin Inc.'s (formerly Mineral Research Canada Ltd.) kaolin and silica sand deposit in Kipling Township, where a 13,000 ton portion of a 150,000 ton bulk sample was extracted for market testing the kaolin for use in the paper manufacturing and ceramics industries.

Between 1990 and the beginning of 1992, there were a total of 85 major and junior mining companies active in the Timmins Resident Geologist District. By the end of 1992, this number has dwindled to 23. During the year, it is estimated that approximately 150 different exploration projects were conducted throughout the district by approximately 115 individual prospectors and exploration and mining companies. This estimation of active exploration projects also includes 75 OPAP-funded projects with grants totalling $696,174 and 17 OMIP-assisted projects with grants totalling $2,403,485.

Some of the more noteworthy exploration projects conducted in the Timmins Resident Geologist District during the past year include: Falconbridge Limited's 2 large base metal exploration projects in the vicinity of the Kidd Creek Mine and the Kamiskotia area; the staking of more than 3700 claim units that comprise the "Spider #1" diamond exploration property of KWG Resources Inc.-Blue Falcon Mines Ltd. in the Attawapiskat area; Kirkon Resources Corp.'s base metal "Shunsby" property in the Swayze Greenstone Belt, recently optioned to Phelps Dodge Corp. of Canada Ltd.; and Noront Resources Ltd.'s base metal property in Hurdman township.

Kirkland Lake

During 1992, there were 6 producing mines, 2 active quarries, and 1 gold tailings reclamation operation within the Kirkland Lake Resident Geologist District.

170,483 ounces of gold were produced from the combined operations of the area's 4 underground gold mines and 1 tailings recovery operation. These include Lac Minerals Ltd.'s Macassa Mine and Macassa Tailings Recovery Project in Kirkland Lake (Teck Township); American Barrick Resources Corp.'s Holt-McDermott Mine in Holloway Township; Northfield Minerals Inc.'s Deak Resources Corp.'s Cheminis Mine in McVittie Township; and Deak Resources Corp.'s GSR Mining Ltd.'s Kerr Mine in Virginiatown (McGarry Township). The Cheminis Mine discontinued operations in April, but plans are to resume production in 1993, following dewatering operations that began in November as a result of Deak Resources Corp.'s recent involvement in the mine.

The remaining 2 operating mines include Extender Minerals of Canada Ltd.'s underground barite mine in Yarrow Township, near Matachewan, which produced approximately 10,000 tons of barite for use in the manufacturing of brake linings, paints, plastic and mold lubricants used at several base metal smelters in Canada; and Hedman Resources Ltd.'s open pit hedmanite mine in Warden Township, which produced approximately 3720 tons of hedmanite. Hedmanite is a lizardite mineral filler used in the manufacturing of a variety of products, including brake pads, brake shoes, adhesives, paints, and phenolics (a heat-resistant plastic used in making toaster/cookware handles, distributor caps, telephones, etc.).

Tundra Granite and Marble Corporation operated 2 dimension stone quarries, 1 immediately south of the town of Kirkland Lake, and the second at the Kerr Mine, where they extracted blocks of green carbonate (fuchsitic quartz-carbonate rock) for export to Italy. The company plans to establish a stone cutting and polishing facility at the Adams Mine site in 1993.

At American Barrick Resources Corp.'s Holt-McDermott Mine, underground exploration resulted in the discovery of a new gold zone 900 m below surface. Further definition drilling is planned for 1993.

The only advanced exploration project active in the Kirkland Lake area in 1992 was the Holloway Project in Holloway Township. Hemlo Gold Mines Inc. (operator), in a joint venture with Freewest Resources Inc. and Teddy Bear Valley Mines Ltd., commenced a $12 million underground exploration and development program on their 5 million t, 9.2 g/t grade...
gold deposit. By the end of the year, a four-compartment, 430 m deep planned circular shaft had been sunk to a depth of 180 m below surface, and all planned surface installations (headframe, hoist-room, dry, office, kitchen, and core shack) were in place.

Approximately 190 exploration projects were conducted in the Kirkland Lake Resident Geologist District during 1992. This figure includes those projects assisted through the ministry's OPAP and OMIP programs. A total of 68 OPAP grants worth $673,000 and 27 OMIP grants in excess of $3.13 million were awarded to various prospectors and mining companies active in the area.

Although much of the mineral exploration activity in the Kirkland Lake area is still focussed on gold, diamond exploration has received considerable attention following the announcement of the discovery of diamonds in McVittie Township by Sudbury Contact Mines Ltd. Fourteen diamonds were recovered from drill core from the Diamond Lake kimberlite pipe, 6 of which are considered gem quality. This has sparked considerable staking and exploration activity within the area by other companies such as KWG Resources Inc., Strike Minerals Inc., Regal Goldfields Ltd., Glencain Explorations Ltd., Gwen Resources Ltd., and Greater Lenora Resources Corp. to name but a few.

Some of the more noteworthy exploration projects conducted throughout the district this past year include Kingwood Exploration 1985 Ltd.'s project in Beatty and Coulson townships, where diamond drilling intersected 3 narrow, high-grade gold-bearing horizons, collectively referred to as the Thunder Zone; continued exploration on the Hemlo Gold Mines Inc.—Glimmer Resources Inc. joint venture property in Hislop and Beatty townships; Royal Oak Mines Inc.—Beaverhouse Resources, an affiliate of Queenston Mining Inc., discovered a new gold zone 2600 feet north of the old mine workings on their joint venture Upper Beaver property in Gauthier Township; Glencain Explorations Ltd. extended their gold-bearing A-Zone on their Goodfish property in Morrisette Township; and Battle Mountain (Canada) Inc.—Queenston Mining Inc. confirmed the continuation of the auriferous 102-103 Zone over a strike length of 5000 feet between 1400 and 2500 feet below surface on their Amalgamated Kirkland property in Teck Township.

Sudbury District

Inco Limited, which celebrated its 90th birthday in March, operated 11 underground copper-nickel mines, 1 smelter, 2 refineries, 1 liquid sulphur dioxide plant, and 1 strip rolling mill for coinage during 1992. The operating mines include the Copper Cliff North, Copper Cliff South, Crean Hill, Creighton, Frood, Garson, Levack, Stobie, Little Stobie, Lower Coleman and McCreedy West mines. All of Inco's ore-milling operations were performed at its Clarabelle Mill, which has a processing capacity of up to 45,000 tons of ore per day. They also announced plans to re-open their Garson Mine in late 1993.

Falconbridge Limited produced copper and nickel from 5 area mines—the Fraser, Lockerby, Onaping—Craig, Strathcona and Thayer Lindsley. All milling operations were conducted at their 30,000 tons per day capacity Strathcona Mill. The Thayer Lindsley Cu-Ni deposit was brought into production in May at a total cost of approximately $40 million.

Both Inco and Falconbridge temporarily suspended operations twice during the year, once during their normal summer maintenance shut-down period and again briefly over Christmas, due to low nickel prices.

With regard to industrial minerals: Unimin Canada Limited produced high-grade silica from their Badgeley Island quarry near Killarney; Standard Aggregates Incorporated quarried high-grade dolomite at their Meldrum Bay operation on western Manitoulin Island; Carman Construction Incorporated produced silica for smelter flux from a quarry near Alban and a small exposed aggregate quarry in Roosevelt Township; Hercules Stone Limited extracted 500 tons of Silurian Manitoulin Formation limestone for decorative purposes; Crea-Mac Contracting Company Limited quarried and crushed pink feldspar-rich granite for decorative aggregate from their operation near Warren; and Muligranitics Incorporated stockpiled material from various quarries throughout the district to be used as coloured landscape aggregate in 1993.
Approximately 72 exploration programs were conducted at various times throughout the year within the Sudbury District, 22 of which received OPAP funding totalling $220 000, while 7 received OMIP assistance totalling $412 050.

Advanced exploration and development occurred at most producing mines in the Sudbury District throughout the year.

One of the more noteworthy exploration projects completed within the Sudbury Resident Geologist District during 1992 was Flag Resources (1985) Limited's completion of 3 surface diamond holes on their property within the area of the Wanapitei magnetic anomaly. Of particular note is 1 of these 3 holes, which intersected chromium-bearing green mica (fuchsite) throughout the lower 300 m section of the drill hole. Elsewhere within the district, Inco Exploration and Technical Services Incorporated performed deep diamond drilling programs from surface at its McCreedy East Mine, while shaft sinking on their Victor deposit was deferred due to sustained low nickel prices.

**Cobalt District**

A total of 4 quarries producing industrial minerals and dimension-building stone were operating in the Cobalt Resident Geologist District in 1992.

Dymond Clay Products Limited produced approximately 61 000 t of limestone from their 2 quarries located in Bucke and Dymond townships. Much of this material was utilized by Falconbridge Gold Corp. at their Owl Creek Mine acid neutralization project in Timmins. McLaren's Bay Mica Stone Quarries extracted approximately 3000 t of slab and dimension stone from their McAslan Township quarry for markets in the United States. Thorne Brilliant Stone Quarry produced 68 tons of variably sized flagstone from their quarry in Poitras Township, approximately one-half of which was used as facing stone on a newly constructed church in Quebec.

Advanced exploration projects in the district included diamond drilling and the extraction of a 3250 ton bulk sample by Gwen Resources Limited on their Clenor gold property in Strathy Township; 16 surface diamond drill holes totalling 5851 m were completed by Fort Knox Gold Resources Inc. on their base metal property in Fawcett Township; and Kyanite Mining Corporation completed a baseline aquatic resources assessment of the local watershed as part of their on-going evaluation of a significant kyanite deposit in Butler and Antoine townships. Plans are to extract a bulk sample for metallurgical testing in 1993.

Exploration activity within the Cobalt Resident Geologist District has increased considerably over that in previous years, due to the recent interest in diamond exploration along the Temiskaming rift structure, a renewed interest in base metal exploration, and the opening to staking of 4 townships—Best, Cassels, Strathy and James—which were released from the Temagami Land Caution by the Teme-Augama Anishnabai Band in late 1991. Most of this exploration activity is currently at the grass-roots level.

There were approximately 57 exploration projects conducted by 48 various prospectors and exploration and mining companies active in the district during the year. Included in this figure are 36 OPAP-funded projects valued at $352 945 and 5 OMIP-assisted projects valued at $193 503.

Some of the more noteworthy exploration projects include the acquisition of a significant land package by KWG Resources Inc. in the Tri-town area for diamond exploration, precipitated by the occurrence of a known kimberlite pipe in Bucke Township discovered by Monopros Limited in the late 1970s; and the extraction of a 700 ton bulk sample from a barite vein in North Williams Township by Extender Minerals of Canada Ltd.
Sault Ste. Marie
Rio Algom Limited’s Stanleigh Mine in Elliot Lake became the Sault Ste. Marie Resident Geologist District’s single uranium producer, following the close of Denison Mines Limited’s Elliot Lake operations in March. During its 35 years of continuous operation commencing in 1957, the Denison Mine produced a total of 147.35 million pounds of U₃O₈ from 69.4 million tons of ore mined at an average grade of 2.35 pounds U₃O₈ per ton. The Stanleigh Mine is similarly scheduled for closing in 1996, following the completion of contractual obligations to supply Ontario Hydro with 1.8 million pounds of U₃O₈ through to 1995, and an additional 1.1 million pounds during the first eight months of 1996. There are currently 569 active employees working at the Stanleigh Mine operations.

Ontario Trap Rock Limited continued to expand their trap rock quarrying operations at Bruce Mines. Production for 1992 was in the neighbourhood of 300 000 tons. The material quarried is Nipissing diabase, the bulk of which was used as railway ballast, with lesser amounts being used in the production of rock wool insulation, filter-bed use, and as road and asphalt stone.

Root River Sandstone Quarry produced a limited amount of red Jacobsville sandstone for local fireplace construction and landscaping purposes.

There were no advanced exploration activities within the district during 1992.

Exploration activity remained fairly constant within the Sault Ste. Marie Resident Geologist District during 1992 compared to 1991, although the number of claims units recorded was down a considerable 78%. A total of 23 OPAP-funded mineral exploration projects valued at $230 000 and 2 OMIP-assisted exploration projects totalling $73 830 were conducted throughout the district. Most of these projects are at the grass-roots level of mineral exploration.

Some of the more noteworthy exploration projects include an extensive stripping and channel sampling program conducted by partners G. Lucuik and G.S. Babcock on a specular hematite occurrence within Lorrain Formation pebble conglomerate in Varley Township; the discovery of a new showing in Hughes Township by partners D. Flemming and Y. Desjardins that is similar to the base metal style of mineralization at the Tribag Mine approximately 64 km to the northwest; and encouraging results reported from exploration work conducted on Tri Origin Exploration Ltd.’s property in Runnalls Township.

Wawa District
Muscocho Exploration Ltd.—McNellen Resources Inc. cited low gold prices and a lack of working capital as the primary reasons behind their decision to suspend mining operations at their Magino Mine in August. Prior to its closing, the mine had produced 16 463 ounces of gold for the year. Remaining ore reserves are estimated at 829 187 tons grading 0.16 ounces Au per ton. Total production from the time the mine opened in October 1988, until its August shut-down, was 101 948 ounces of gold from 768 679 tons of ore mined.

With the closing of the Magino Mine, Algoma Ore Division’s G.W. MacLeod Mine once again becomes Wawa District’s only producing mine, marking the 53rd year of continuous iron ore production from the Helen Iron Range. During 1992, it produced 969 819 gross tons of sinter from 617 065 gross tons of mine ore, with an average grade of 34.1% Fe. The total amount of sinter shipped during in 1992 was 1 010 817 gross tons. Ore reserves currently stand at approximately 8 million tons and the mine is expected to remain in operation until 1996.

There were 2 advanced gold exploration projects operating within the Wawa Resident geologist district during the year. Monk Gold and Resources Limited are presently developing a 100-foot east-trending drift through the B-Zone of its Michipicoten River gold orebody in Rabazo Township. Plans are to extract a 10 000 ton bulk sample in
1993 for processing at the former Citadel gold mill. Spirit Lake Exploration Limited performed 10,000 feet of surface diamond drilling and collared a portal approximately 500 m south of the former shaft on its Edwards property in Jacobson Township. Plans are to extract a 500 ton bulk sample from the Porphyry and Carbonate zones in the spring of 1993.

Exploration activity has increased considerably within the Wawa Resident Geologist District over that of 1991, primarily due to an increased number of OPAP and OMIP grants being awarded to workers within the area. Approximately 24 individual prospectors and exploration and mining companies conducted an estimated 33 exploration projects within the district during 1992, of which 13 were OPAP-funded to the sum of $123,070, and 3 were OMIP-assisted to the total value of $513,179.

Some of the exploration and mining companies active in the district during this past year include Freewest Resources Inc., Gold Giant Minerals Inc., Wolverine Resources Inc. and Noranda Exploration Co., Ltd. Noranda Exploration continued exploring within 13.5 townships which form part of Algoma Central Railway's land grant within the Michipicoten greenstone belt. This exploration program, referred to by the company as "Operation Wawa", focussed in 3 specific areas: north-central Cowie Township, southeastern Abotossaway Township and southeastern Aguonie Township.
INTRODUCTION

In 1992, the number of active exploration projects in Wawa showed a slight increase compared to last year. Figure 10.1 and accompanying Table 10.1 provide a summary of the active exploration programs in the district. The increase in activity is a result of the significant increase in the number of area prospectors receiving Ontario Prospectors Assistance Program (OPAP) grants. Thirteen prospectors received grants totalling $123,070, which represents a 100% increase over the number and value of grants awarded for mineral exploration work in the district in 1991.

Three companies working in the area received Ontario Mineral Incentive Program (OMIP) grants totalling $513,179.

The Magino Gold Mine, the last of 3 gold mines to open in the Wawa area as the result of exploration funded by flow-through shares, suspended operations in August. The operators of the mine attribute the suspension to declining gold prices and a lack of working capital (The Northern Miner, June 1, 1992, p.3). One hundred workers have been affected by the decision to suspend operations.

Two companies are currently involved in advanced exploration programs in the district. Spirit Lake Explorations Limited has collared a portal on its Jacobson Township gold property in preparation for the extraction of a 500 ton bulk sample. Drill testing of previously unexplored zones of the deposit has yielded significant gold assays.

Monk Gold and Resources Limited is in the process of extracting a 10,000 ton underground bulk sample at its Michipicoten River gold property that will be processed at the former Citadel gold mill. Once its own ore has been processed, the company plans to operate the facility as a custom gold mill.

MINING ACTIVITY

G.W. MacLeod Mine

With the suspension of operations at the Magino Gold Mine, the G.W. MacLeod Mine resumes its place as the Wawa District's only operating mine. This year marks the fifty-third year of continuous iron-ore production from the Helen Iron Range. The mine is operated by the Algoma Ore Division of the newly restructured Algoma Steel Inc.

Production to the end of December was 969,819 gross tons of sinter from 617,065 gross tons of mine ore, with an average grade of 34.1% iron (A. Stevens, Algoma Ore Division, personal communication, 1993). The company used 236,492 gross tons of limestone and 482,326 gross tons of oxide reverts in the production of their sinter. The total amount of sinter shipped in 1992 was 1,010,817 gross tons (A. Stevens, Algoma Ore Division, personal communication, 1993).

Development work in 1992 consisted of 106,000 feet of blast hole drilling, 3,900 feet of drifting and 200 feet of raising (R. Hoffmann, Algoma Ore Division, personal communication, 1993). The mine currently has a developed ore reserve of approximately 8 million tons.

The restructuring plan of Algoma Steel Inc. includes a continuing, but marginal, operation of the Algoma Ore Division. Depending upon the needs of the steel company, up to 1 million tons of sinter per year would be purchased. The mine is expected to remain open until 1996, based upon current production figures and the anticipated demand for ore.

The operation of the mine also depends upon a renegotiation of freight rates with the Algoma Central Railway. A one-time cash injection into the rail company from the Ontario government has frozen the present freight rates until June 1993. A restructuring of the Algoma Central Railway will be completed by that time (The Sault Star, December 15, 1992, p.1).

Magino Mine

In May 1992, the joint owners of the Magino Gold Mine (Muscocho Explorations Ltd. and McNellen Resources Inc.) announced their decision to suspend operations at the mine. The operator of the mine, Muscocho Explorations Ltd., attributes the closure to declining gold prices and a lack of working capital (The Northern Miner, June 1, 1992, p.3). The mine will be kept on a care and maintenance basis while the company seeks additional capital for underground exploration and development.

The lack of operating cash-flow has prevented any recent exploration programs at the mine site. However, the remaining reserves, as of December 31, 1991, were 829,187 tons, averaging 0.163 ounces Au per ton, calculated above the mine’s deepest level of 650 feet, and mostly above the 500-foot level (E. Durussell, Muscocho Explorations Ltd., personal communication, 1992). Previous deep drilling has indicated that gold mineralization extends to at least 2000 feet (The Northern Miner, October 17, 1988, p.3).

Mining and milling operations continued until the end of August 1992, at an average rate of 653 tons per day for a total...

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<tr>
<th>Number on Figure 10.1</th>
<th>Individual Company or Person</th>
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<th>Exploration Activity</th>
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<td>Naveau</td>
<td>prospecting</td>
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EXPLANATION

Exploration Activity in 1992 (keyed to Table 10.1)

- Producing Mines, 1992
  1. G. W. MacLeod Mine (Algoma Ore Division) ........................................ Fe
  2. Magino Mine (Muscocho Explorations Limited–McNellen Resources Inc.) ........ Au

* Exploration Activity, 1992
  Property Descriptions (included in this report)
  1. Molybdenite Lake property
  2. Gananoque vein
  3. Barton occurrence

Figure 10.1. Wawa Resident Geologist's District exploration activity in 1992.
recovery of 16,463 ounces of gold for the year (E. Durussell, Muscocho Explorations Ltd., personal communication, 1992). Most of the production for 1992 came from the 250-, 300-, 350-, 400- and 650-foot levels, with access to surface by a spiral ramp system.

Development for 1992 included 4190 feet (1289 m) of ramping, level drifting, raising and stope preparation. Long-hole stopes accounted for 98% of stope muck, with the remainder of the tonnage coming from shrinkage stopes.

The Magino Gold Mine began production in October 1988 and at the time of shutdown, the mine had processed a total of 768,679 tons of ore, for a total of 101,948 ounces of gold (E. Durussell, Muscocho Explorations Ltd., personal communication, 1992).

The host for the gold mineralization is the Webb Lake Stock, which was intruded into the east-northeast-striking Goudreau Lake Deformation Zone. This deformation zone overprints the overall westerly trend of the eastern section of the Michipicoten greenstone belt. Ore shoots are controlled by dextral dilatancy associated with the Goudreau Lake Deformation Zone. Shearing, bleaching and silicification were associated with the emplacement of the gold (Deevy 1992).

**ADVANCED EXPLORATION AND DEVELOPMENT**

**Monk Gold and Resources Limited**

Monk Gold and Resources Limited plans to extract a 10,000 ton bulk sample from their Michipicoten River property in Rabazo Township. During the past summer, the company dewatered the adit and extended their ramp approximately 10 m. The company is presently developing a 100 foot east-trending drift through the B-zone of the ore body (The Algoma News Review, June 10, 1992, p.7).

Gold mineralization is hosted by shallow dipping, northeast-trending, quartz-carbonate veins within a strongly sheared, carbonatized and silicified sericite schist. Gold occurs in concordant veins which strike 130° to 140° and dip 90°, parallel to the regional foliation. These veins are up to 1 m in width and are milky to dirty-grey in colour. Discordant quartz veins, which strike in a south or southeast direction and dip west and east (320/10SW, 320/10NE), are subparallel to the strike of the metavolcanic rocks and are the primary host for gold mineralization. These discordant, or flat veins typically are narrow (20 cm or less), shallow dipping, translucent grey and white in colour and are composed of quartz and carbonate (Frey 1990).

Mineralization within the quartz veins consists of pyrite, chalcopyrite and pyrrhotite. The sulphides occur between the quartz and the host rock and, when present, the gold favours the centres of the veins (Frey 1990).

In January 1992, Monk Gold and Resources Limited signed a lease-to-purchase agreement with Bulwark Gold Mills Inc. and Citadel Gold Mines Inc. for the idle Surluga gold mill (The Northern Miner, February 24, 1992, p.18). The Surluga mill was closed in 1989 and has a capacity of 500 tons per day. However, Monk Gold and Resources Limited plans to operate the mill at a capacity of 250 tons per day (The Algoma News Review, September 2, 1992, p.1).

Monk Gold and Resources Limited is interested in developing a custom gold mill and plans to concentrate on milling ore from several small, high-grade, shallow deposits in the vicinity of the mill. The immediate plans for the mill include the processing of a bulk sample from their Michipicoten River property (The Northern Miner, September 7, 1992, p.1). By the end of October, the company had completed a test-milling of several tons of development muck from their mine site.

In accordance with Section 9 of the Mining Act of Ontario, the company has submitted a closure plan for the mill site and is awaiting approval of financial assurances for the project.

**Spirit Lake Explorations Limited**

By the end of October, Spirit Lake Explorations Limited had collared a portal approximately 500 m south of the former Edwards property in Jacobson Township. Extender Minerals has been contracted to drive a ramp to a vertical depth of 70 feet (21.5 m) and drift across 140 feet (43 m) of strike length. In the spring, once the ramp is completed, the company will extract a 500 ton bulk sample from the Porphyry and Carbonate Zones (The Northern Miner, September 21, 1992, p.6).

**EXPLORATION ACTIVITY**

The location of the following exploration projects is keyed to Figure 10.1.

**Freewest Resources Inc.**

Freewest Resources Inc. conducted a program of line cutting and a ground geophysical survey on a group of claims in the Abbie Lake area, west of the Magnacon Mine Road.

**Gold Giant Minerals Inc.**

Gold Giant Minerals Inc. has acquired an option to buy a 50% interest in 700 claims in the Dayohessarah Lake greenstone belt. Exploration work on the claims in 1990 by Hemlo Gold Mines Inc. has indicated a potentially economic shear zone that has been described as being geologically similar to that hosting the Hemlo gold deposits (George Cross Newsletter, April 10, 1992, p.2). A zone that is reportedly 6 by 1400 m has returned gold values exceeding 0.23 ounces Au per ton (Vancouver Stockwatch, June 11, 1992, p.6).

The property is currently under dispute and Gold Giant Minerals Inc. has retained a legal firm to represent its interest in pursuing ownership of the property. Hemlo Gold Mines
Noranda Exploration Company Ltd.

Noranda Exploration Company Ltd. has spent a second summer exploring the 13.5 townships that form the land base for "Operation Wawa". These townships stretch through the central part of the Michipicoten greenstone belt and are part of the Algoma Central Railway land grant.

The company has concentrated its exploration efforts in 3 specific areas of the land option during the past field season. In north-central Cowie Township, the company has conducted a program of trenching, geochemical sampling and diamond drilling west of Forge Lake. Anomalous gold values have been returned from samples taken from a zone of high strain, originally mapped by International Corona Corporation in 1990 (Tortosa et al. 1990, p.185).

A program of stripping, line cutting, detailed mapping and geochemical sampling was completed on the Kozak property in southeastern Abotossaway Township. Details surrounding the geology and economic potential of the former Kozak Mine can be found in Wilson (1992).

The third area of interest was in the vicinity of Locke Lake in southeastern Aguonie Township (H. Bird, Noranda Exploration Co. Ltd., personal communication, 1992). The company conducted a program of overburden stripping, geological mapping and geochemical sampling within a series of clastic metasedimentary rocks (wackes and conglomerates) (Sage, in press). The Locke Lake occurrence lies along a northeast-trending fault zone (Frey and Stewart 1992).

Noranda Exploration Company Ltd. also completed a ground geophysical survey on the Conboy Lake lead-zinc occurrence in Rennie Township. The Conboy Lake occurrence is one of the few, known significant base-metal occurrences within the Michipicoten greenstone belt.

A program of line cutting, bedrock stripping, geochemical sampling and geological mapping to investigate anomalous base-metal values has been initiated for an area northwest of Big Lake in northwestern Corbiere Township (H. Bird, Noranda Exploration Co. Ltd., personal communication, 1992). The area of interest is underlain by pillow, mafic metavolcanic rocks, chlorite schist and hypabyssal intrusive rocks (Sage et al. 1984).

Spirit Lake Explorations Limited

A 10 000 foot diamond-drill program was completed on the company's Edwards gold property in Jacobson Township during the winter of 1991-92. The drilling program was designed to fill in the gaps left by the 1991 drilling program, to test the depth of the previously defined ore zones and to test the high-grade gold mineralization in the New North Zone (The Northern Miner, March 30, 1992, p.A3). The New North Zone, a previously untested zone on the property, has returned assays of 2.59 ounces Au per ton over 7 feet and 0.49 ounces Au per ton over an interval of 4 feet (The Northern Miner, March 30, 1992, p.A3). Additional drilling on the Carbonate Zone yielded results of 0.84 ounces Au per ton over 3 feet, 0.75 ounces Au per ton over 3.5 feet and 3.68 ounces Au per ton over an interval of 2 feet (The Northern Miner, March 30, 1992, p.A3).

Wolverine Resources Inc.

G. Koenig, the owner of the Centennial Gold Mine, has been conducting a sampling program on the veins and muck piles associated with the Centennial Mine (past producer) in Naveau Township. Pyrite, pyrrhotite, chalcopyrite and rare, visible gold mineralization is associated with quartz-carbonate-tourmaline veins within a granodiorite stock (Massey 1985). Free gold has been panned from the veins on the property.

Gold was discovered at the Centennial property in 1900 (Boyd 1901). At least 6 shafts have been excavated on the property between 1900 and 1939, and 3 of the shafts are located on the main vein. The veins strike approximately northwest, dip 40° to 45° northeast and consist of glassy quartz that is associated with minor carbonate and tourmaline (Frohberg 1937). The veins can be traced for up to 350 m along strike and the main vein varies in width from 0.6 to 2.1 m (Massey 1985).

There are no reliable production records for the Centennial Mine. Ferguson et al. (1971) report that, for the period 1939 to 1940, Agawa Gold Mines Ltd. produced 610 ounces of gold and 36 ounces of silver from 8612 tons of ore milled.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The Wawa Resident Geologist's office is staffed by Staff Geologist, A.C. Wilson and Secretary, B. Leschishin. Administrative functions for the office are the responsibility of the Sault Ste. Marie Resident Geologist, while on-site geological consultations are the responsibility of the Staff Geologist. Drill core library facilities for the district are provided by the Sault Ste. Marie Drill Core Library (see Sault Ste. Marie Resident Geologist's District, this volume).

Additional staff for the year included A. LeRoy, contract geologist from January to March 1992, and D. Hatfield, who was hired through the Experience 1992 program as a summer assistant to the Staff Geologist. M. King has been hired as additional clerical support staff when needed. Despite the provincial decline in exploration activity, the office had a total of 705 visitors for the year. In most instances, the clients made use of the assessment files, purchased maps, claim tags and prospectors licences or sought geological advice. In addition, over 580 telephone requests were handled by the office staff.

The interior of the Resident Geologist's office has undergone renovations in order to improve the public work.
space. These renovations have significantly increased the work space available to the public and has facilitated the reorganization of the public files.

B. Leschishin completed the filing of donated assessment files and diamond-drill logs and updated the assessment file database. The majority of this donated material was collected by R. Sage (Ontario Geological Survey-Geoscience Branch) during the preparation of his Open File reports for the Wawa area. Approximately 100 new assessment files have been added to the public files at the office as a result of this compilation.

A. LeRoy was contracted to assemble and collect a representative section of surface and underground plans for both the former Renabie Gold Mine and the Citadel (Surluga) Gold Mine. These maps and associated files have been inventoried and are stored separately from the assessment files. This data is available for public use in the office. Ms. LeRoy also reorganized the filing system for underground plans at the Resident Geologist's office.

A.C. Wilson led field trips for students from Delta College, Lake Superior State University and Sir James Dunn Elementary School, as well as several field trips for clients interested in the geology and mineralization in the area. She made 7 formal property visits and advised many prospectors with regard to their field work for their OPAP grants. For Mining Awareness Week in June, Algoma Ore Division organized a community mining day at the local arena. The company provided underground and surface tours of the mine and sintering plant and prepared a series of displays for the general public. Public response to the event was overwhelming with over 600 individuals participating in the tours, and an estimated 850 people touring the displays. The Staff Geologist prepared and staffed a display detailing the regional geology of the Wawa area. In addition, a self-guided geology tour was prepared for distribution during Mining Awareness Week. Two hundred and fifty copies of the tour guide were distributed during the community day.

In April, a successful prospecting course was taught in Wawa by the Staff Geologist. A full capacity class of 20 attended the weekend class and its accompanying field trip. In addition to participants from the Wawa area, participants travelled from Blind River, Sault Ste. Marie and White River.

The Staff Geologist also participated in the Northeastern and Northwestern Geoscience Seminars, meetings of the Wawa Community Adjustment Committee and a meeting of the Greater Ufukaskwa Ecosystem Management Workshop.

Abandoned Mines Hazard Abatement Program

The Mine Rehabilitation Section of the Mineral Development and Rehabilitation Branch of the Ministry of Northern Development and Mines has been conducting an inventory and assessment of the potential mining hazards in each of the districts in the province. Because of the relatively small size of the district and the high quality of the database available, Wawa was one of the first districts chosen to be evaluated.

The first phase of the project consisted of a literature review of the known mining hazards. This phase was completed in February 1992. Raven Beck Environmental Consultants Ltd. was awarded the contract for the second phase of the program which included a field examination of each of the hazardous sites. Data collection at each site included: the collection of accurate locational co-ordinates using a global positional satellite system; sampling of all tailings dams; assessment of the ground and existing structures for stability; evaluation of sites for their potential for acid drainage; evaluation of each site for historical importance; and suggestions for the rehabilitation of each site.

In the Wawa district, 114 sites were examined. Field work was completed in September and a final report was submitted to the Ministry in December.

PROPERTY DESCRIPTIONS

The locations of the following properties and/or mineral occurrences are shown in Figure 10.2.

Molybdenite Lake Property, Andre Township

The Molybdenite Lake Property, or Canfield Molybdenite Prospect, (Ontario Mineral Deposit Inventory # A0042) is situated at the outlet of Molybdenite Creek on the southeast shore of Molybdenite Lake, approximately 14 km northeast of the town of Wawa. A major logging road which crosses the main showing at Molybdenite Lake connects with Highway 17 approximately 8 km north of the junction between Highway 101 and Highway 17 (Figure 10.3).

The earliest recorded exploration work on the property was conducted by the Superior Molbydenum Company Ltd. between 1939 and 1940. The company widened some pre-existing trenches, and completed a four-hole, X-ray drilling program. A 98 ton bulk sample was removed from the property in 1940 and yielded an average grade of 0.5% MoS₂ (Mandziuk 1981). Subsequent geological and ground magnetometer surveys and a diamond-drilling program consisting of 5 diamond-drill holes, totalling 1534 feet, were jointly conducted by the Algoma Central and Hudson Bay Railway Company and the International Nickel Company of Canada from 1963 to 1965 (Vuori 1965). The property was abandoned when the intersections of molybdenite mineralization in the drill core below the main showing were found to be much narrower and the quartz veins were less numerous than anticipated (Vuori 1965).

Mineralization consists of both disseminated and massive pods of molybdenite associated with erratically distributed to stockwork-like, milky quartz veins. These veins range in width from a few centimetres to 1.2 m and can be traced for up to 25 m. The greatest concentrations of molybdenite can be found along vein contacts and in fractures within the quartz veins and associated host rock. Spectacular euhedral molybdenite crystals up to 1.5 cm across are com-
Property Descriptions (included in this report)

1. Molybdenite Lake property
2. Gananoque vein
3. Barton occurrence

Figure 10.2. Location of mineral occurrences or properties described in this report.

Figure 10.3. Location of and access to molybdenite showings, Molybdenite Lake area.
The veins range in width from approximately 5 to 25 cm in width. quartz veins is also present in the mineralized zone. These veins range in width from approximately 5 to 25 cm in width. The quartz veins strike 20° and dip 30° north within a leucocratic trondhjemite-granodiorite gneiss. In places, the gneiss grades into irregular areas of pink, massive, quartz monzonite. Small mafic xenoliths have been observed by Mandziuk (1981) in the vicinity of the main showing. A northwestern-trending diabase dike outcrops approximately 300 m west of the main showing.

All exploration work on the property has been concentrated on the main showing which trends parallel to a narrow fault zone and covers an area of approximately 100 by 300 m (Mandziuk 1981). Extensive quartz veining has been observed to the southwest of the main showing and spotty molybdenite mineralization has been reported at a number of sites on the lakeshore north of the main showing. No systematic sampling or examination of these occurrences has been undertaken. Molybdenite mineralization appears to be associated with east-trending cross faults which cut the main north-trending Molybdenite Lake fault. A systematic sampling and examination of the mineralization and the faults may yield more significant assays.

Gananoque Vein, Rabazo Township

The Gananoque Vein (Ontario Mineral Deposit Inventory # A0620) is one of the oldest known gold occurrences in the Wawa area. The occurrence is located at the base of a cliff on the powerline approximately 500 m southwest of Dycie Lake. The powerline is 4.1 km east of Highway 17 on the Scott High Falls Road.

The majority of the exploration work conducted on the property was completed prior to 1900. In 1897, a 6 by 8 foot (1.8 by 2.5 m) tunnel was drifted for 17 feet along the vein by property owners J. Legge and S. Barton (Boyd 1900). A second, 5 by 14 foot (1.5 by 4.3 m), tunnel was driven at the base of the cliff for a total length of 53 feet (16.3 m) during 1898–1899 by the Gananoque Gold Mining Company Ltd (Boyd 1900). In 1899, attempts to strike the vein by drifting a third tunnel perpendicular to the vein were unsuccessful (Boyd 1900).

A joint exploration venture between Consolidated Beldkeeno Mines Ltd. and Scope Mining and Exploration Services, consisting of ground geophysical, geochemical surveys and 1 diamond drill hole (101 feet total or 31.1 m) was completed in 1962. Canabec Explorations Ltd. conducted a ground geophysical and geological survey over the area in 1983.

The main vein is composed of coarse, glassy quartz with approximately 2% disseminated pyrite. Rusty, carbonate alteration is common along the margins of the vein. Boyd (1900) reports that the vein ranged from 1.5 to 2.5 m in width and could be traced for over 180 m. Samples collected from the muck pile indicate that a secondary set of narrow, sugary quartz veins is also present in the mineralized zone. These veins range in width from approximately 5 to 25 cm in width.

The Gananoque Vein trends 180° and dips 85° north. The attitude of the secondary veins is variable and above the main showing, Rupert (1979) has reported that the secondary veins have flat or gentle northeast dips. The vein is hosted within fine- to medium-grained intermediate crystal tuffs. The metavolcanic rocks contain approximately 2 to 5% disseminated pyrite and are strongly carbonatized.

Boyd (1899) reported that the vein was well mineralized with pyrite, chalcopyrite, galena and free gold. Sulphides are commonly observed at the margins of the vein and consist of coarse pyrite and chalcopyrite (up to 5 mm in size).

A grab sample of the sugary quartz vein material taken from the muck pile by the author in October 1992 assayed 0.019 ounces Au per ton. An assay from a glassy quartz vein in drill core assayed 0.02 ounces Au per ton over 2.4 feet (Parliament 1962).

Barton Occurrence, McMurray Township

The Barton occurrence (Ontario Mineral Deposit Inventory # A0570) is located on the south side of the Scott Falls road, approximately 4.8 km from the Trans-Canada Highway. The occurrence also ranks as one of the first gold discoveries in the Wawa area.

The Barton occurrence is one of a former group of four claims that hosted several northeast-trending gold-bearing quartz veins. Prior to 1903, 2 short tunnels (40 feet or 12.3 m in total length) were drifted along the vein by J. Barton (Boss 1903). There are no reported assays or production figures available for this work. Canabec Explorations Limited conducted a geological and geophysical survey in the vicinity of the occurrence in 1983 (Archibald 1983).

Assays from samples collected from the vein within the drift in 1906, returned values of 0.11 ounces Au per ton and 0.202 ounces Au per ton (Manlove 1906). A grab sample taken by the author from a coarse-grained glassy quartz vein located approximately 10 m west of the adit yielded a gold value of 0.037 ounces Au per ton.

The vein has been described as being north-trending, vertical dipping and approximately 24 feet wide and mineralized with pyrite, chalcopyrite and pyrrhotite (Manlove 1906). No vein was observed at the occurrence during a property visit by the author in the fall of 1992. One adit was drifted into fine-grained intermediate to mafic crystal tuffs in which large (5 to 15 cm) coarsely crystalline quartz lenses can be observed. These quartz lenses are mineralized with coarse pyrite and chalcopyrite at their margins. These lenses may be boudinaged sections of the vein. Abundant narrow (2 to 5 cm) quartz veins are prominent within the host rock. One of the early descriptions of the occurrence notes the presence of a six-feet- and a four-feet-wide band of iron formation that was traceable for over 100 feet (Collins and Quirke 1926). To the east of the adit, the host rocks are strongly carbonatized. The host rocks are moderately well foliated and dip steeply to the east (268/75E).
RECOMMENDATIONS FOR EXPLORATION

The Michipicoten greenstone belt has historically been known for its potential for small, high-grade gold deposits. The Cline Mine, near Goudreau, for example, produced 63,328 ounces of gold and 10,598 ounces of silver during the period 1938 to 1940 and 1947 to 1948 (Cooper 1991). Similarly, the Parkhill Mine near Wawa, produced a total of 54,301 ounces of gold and 2,896 ounces of silver from 125,778 tons of ore milled, yielding an average grade of 0.432 ounces Au per ton (Frey 1990). The results of exploration activity between 1986 and 1989 in the Michipicoten and Mishibishu Lake greenstone belts indicate that the potential for similar gold deposits still exists.

The recent efforts of Monk Gold and Resources Limited to develop a custom gold mill in Wawa significantly improves the feasibility for production of currently sub-economic deposits, such as the Mickelson-Sunrise deposit in central McMurray Township.

Although the potential for the discovery of new gold deposits is high, the land base available for exploration in the district is limited. The Algoma Central Railway land grant covers 23 townships, 18 of which (or 8,100 ha) are situated in the centre of the Michipicoten greenstone belt (Figure 10.4). Presently, 13.5 of these townships are under option to Noranda Exploration Company Ltd. and the remaining townships are under option to Reed Lake Exploration Ltd.

Although Algoma Central Railway has always been interested in optioning or leasing large parcels of land in the past, their current economic situation may expedite the return of a portion of their land grant to the Crown. If the land does revert back to the province, this would open up new areas of high mineral-potential that have undergone only sporadic exploration. This large land-base also constitutes the basis for the ten-year multidisciplinary study conducted by the Geoscience Branch of the Ontario Geological Survey between 1979 and 1989. The program consisted of geological mapping, airborne geophysical, lake sediment geochemistry, geochronology and metallogenic studies and has resulted in the one of the largest provincial databases for a single greenstone belt.

Algoma Steel Inc. also has recently announced their intention to reduce their land holdings in Ontario (The Northern Miner, November 30, 1992, p. 11). Although a portion of their holdings is leased land, the majority is patented land

Figure 10.4. Land disposition in the Wawa Resident Geologist's District.
from the Crown. In keeping with the interests of the company, most of the property was examined exclusively for its iron-ore potential. No other economic considerations for other mineral associations have been tested on these properties.

The company intends to offer approximately 1285 ha of property in the Wawa area to mining companies and other interested parties. Most of these properties have a moderate to high potential for gold associated with iron formation. This first offering of land constitutes those lands which have been determined to be free of any mining hazards.

The numerous, small greenstone enclaves that lie between the Dayohessarah Lake and the Schreiber–Hemlo greenstone belts are potential targets for grassroots exploration (see Milne et al. 1971). Most of the enclaves are composed of amphibolite-grade mafic to intermediate metavolcanic rocks, although some enclaves also contain metasedimentary rocks reminiscent of those exposed at Hemlo. Several of the smaller enclaves are composed of coarse, ultramafic rocks that have the potential for platinum and palladium or nickel mineralization.

Similarly, the greenstone enclaves that are located east of the Gamitagama greenstone belt also merit consideration as grassroots exploration targets (see Milne et al. 1971). There is no recorded exploration work on any of these enclaves, even though there are reports of sulphide mineralization within them. The greenstone enclaves in Saunders, Suganaqueb and Tabobondung townships have the greatest potential for sulphide mineralization.

RESEARCH BY OTHER AGENCIES

Carleton University

R. Rice (assistant professor, Carleton University) completed the final year of a three-year program of investigation of Archean basin evolution in the Michipicoten greenstone belt. The study examines the relationship between the deformation and the mineralization in the area. This summer, field work was conducted in the northern Doré metasedimentary belt of the Michipicoten greenstone belt.

University of Toronto

H. Halls (professor, University of Toronto, Erindale Campus) and associates examined diabase dikes within the granitoid rocks external to the Michipicoten greenstone belt. The study is investigating the petrology and palaeomagnetism of the Proterozoic Matachewan and Kapuskasing dike swarms that lie within and external to the Kapuskasing Structural Zone (Halls and Palmer 1990).

M. Manson (PhD candidate, University of Toronto) and associates conducted a shipborne magnetometer and acoustical study off the east shore of Lake Superior. Their work involves the completion of a transect between Terrace Bay and Cape Gargantua to study the Midcontinent Rift.

St. Lawrence University

C. Shrady (assistant professor, St. Lawrence University, New York) conducted field work in conjunction with R. Rice. She is assessing the structural history of the rocks in the northern metasedimentary belt of the Michipicoten greenstone belt.

L. Cherichetti (St. Lawrence University, New York) completed field work in Menzies Township for an honours BSc thesis on the structural geology of the township.

University of Massachusetts

G.E. McGill (professor, University of Massachusetts) continued his structural investigations of the central Michipicoten greenstone belt focusing on central and northeastern Chabanel Township.

SELECTED PUBLICATIONS RECEIVED


REFERENCES


INTRODUCTION
Rio Algom Limited continued uranium mining at the Stanleigh Mine at Elliot Lake. The closing of the Denison uranium mine in March 1992 marked the end of an era for Denison Mines Limited, and another financial blow to the community of Elliot Lake.

One of the few bright notes is the continued operation and expansion of the trap rock (diabase) quarrying operations of Ontario Trap Rock Limited at Bruce Mines.

Mineral exploration continued at about the 1991 level, with most of the exploration activity being carried out by local prospectors, many of whom had received financial assistance under the Ontario Prospectors Assistance Program (OPAP).

To improve client service and interaction, the offices of the Resident Geologist and Mining Recorder moved in April 1992 to the MNDM facility at 60 Church Street, Sault Ste. Marie, which continues to house the Drill Core Library as well.

The Minister of Northern Development and Mines, the Honourable Shelley Martel, presided over the official opening of the building on May 7, 1992. The Minister also acknowledged the 30 years of service from the Resident Geologist’s office at Sault Ste. Marie. The success of the reception for guests at the opening ceremonies was largely the result of the organizational skills of B. Fremlin of the Resident Geologist’s office, and C. Kurylo and P. Morra of the Mining Recorder’s office.

MINING ACTIVITY
Denison Mines Limited

Denison Mines Limited ceased underground operations at Elliot Lake on March 11, 1992. By June 30, 1992, deliveries of U₃O₈ were completed and 850 workers laid off. Since production start-up in 1957, approximately 100 000 people have been employed by Denison Mines in Elliot Lake. (A. MacEachern, Denison Mines Limited, personal communication, December 1992).

This was the largest single mining operation in the Elliot Lake camp and was in continuous operation since 1957. Throughout its thirty-five year operating life, the Denison Mine produced 69.4 million tons of ore at an average grade of 2.25 pounds U₃O₈ per ton. A total of 147.35 million pounds of U₃O₈ were produced. Denison also produced an yttrium oxide concentrate containing 35% Y₂O₃ until mid-1990 (A. MacEachern, Denison Mines Limited, personal communication, December 1992).

The mill had a capacity of 15 000 tons per day. During the last three months of operation (January to March 1992) production averaged 7040 tons per day from 258 498 tons milled at an average grade of 2.09 U₃O₈ pounds per ton (grade includes mine water and leaching). Including recycled waste materials from Cameco Corporation, a total of 758 215 pounds of U₃O₈ were produced. Production for 1992 included 29 627 pounds U₃O₈ recovered from mine water and 129 984 pounds U₃O₈ from leaching operations (21% of the total 1992 production) (A. MacEachern, Denison Mines Limited, personal communication, December 1992).

Rio Algom Limited

The remaining uranium producing mine in the Elliot Lake camp is the Stanleigh Mine of Rio Algom Limited. The Stanleigh Mine is scheduled to cease production in 1996 when the contract to supply Ontario Hydro with U₃O₈ is completed. Rio Algom Limited has contracted to produce 1.8 million pounds of U₃O₈ through 1995, and 1.1 million pounds scheduled for the first 8 months of production in 1996. The ore reserves at the Stanleigh Mine are more than sufficient to meet contractual agreements (R. Henderson, Rio Algom Mines Limited, personal communication, December 1992).

In 1992, mining occurred mainly in the main reef ore horizon between the 3500 and 3000 levels. Approximately 10% of the total production was from the upper and lower reefs. Underground bacterial leaching accounted for 80 000 pounds of U₃O₈ or 45% of the contracted uranium. Sill development continued to the west on the 3100 to 3300 levels toward the Geomaque Exploration Ltd. property boundary. In the east, sills from the 3000 to 3500 levels were advanced. It is expected that the main reef ore zone will decrease in thickness and uranium content in this direction (R. Henderson, Rio Algom Mines Limited, personal communication, December 1992).
The Stanleigh Mine has 569 active employees; 270 in the Mine Department, 62 in the mill, 147 in the plant and 90 in administration (R. Henderson, Rio Algom Mines Limited, personal communication, December 1992).

In June 1992, Rio Tinto Zinc Corporation announced that it had sold its 51.5% controlling interest (22.5 million common shares) in Rio Algom Limited (Rio Algom Second Quarter Interim Report to the Shareholders, June 30, 1992).

## Ontario Trap Rock Limited

Ontario Trap Rock Limited commenced its third year of quarrying operations at Bruce Mines in April 1992. The material quarried is Nipissing diabase, often referred to as trap rock. Production has grown from 20,000 tons to 300,000 tons per year in a very short time.

During 1992, a large rail loading area was constructed next to Bruce Station siding on the C.P.R. line, and a previously existing road south of Highway 17, was upgraded to give access to the Lake Huron shore. These activities have given the operation access to road, rail and water transportation. The bulk of production this year was used in railway ballast, with lesser amounts used in rock wool insulation production, filter-bed use, and road and asphalt stone. The material has passed testing for HL-1 asphalt specifications, the U.S. Army Corps of Engineers' certification for breakwater stone, and is presently being tested for DFC (Dense Friction Coarse) certification for high-traffic highway use.

During 1992, the company employed 12 people on staff and another 20 on contract. It is a Canadian corporation with both Canadian and American participation. J. Bourque of Sault Ste. Marie, Michigan, is president of Ontario Trap Rock Ltd.; B. (Skip) Hamilton of Bruce Mines is quarry manager; D. Smith of Sault Ste. Marie, Michigan, is marketing coordinator. The Ontario Trap Rock Ltd. operation was featured in the October 1992 issue of *Pit and Quarry* magazine. (J. Bourque, D. Smith, personal communications, November 1992).

## Root River Sandstone Quarry

In 1992, E. Kosiba, operator of the Root River Sandstone Quarry, continued to supply local demand for red Jacobsville sandstone. Most of this was used for fireplaces and landscaping (E. Kosiba, personal communication, December 1992).

## EXPLORATION ACTIVITY

In 1992, 198 claim units were recorded in the Sault Ste. Marie Resident Geologist's District, down 78% from 1991. However, prospecting and claim development continued in the area, most with financial assistance through OPAP and the Ontario Mineral Incentive Program (OMIP). There were 28 OPAP grants to individuals for work to be carried out within this district in 1992, with a total value of around $200,000. Two firms were allotted OMIP assistance amounting to $73,830. The following short summaries, along with Figure 11.1 and Table 11.1, highlight these exploration activities.

In Varley Township, G. Lucuik, with partners G. and S. Babcock (see Table 11.1, No.1) conducted extensive stripping and channel sampling on a specular hematite occurrence hosted within quartz-pebble conglomerate of the Lorrain Formation. Flaky specular hematite material (micaceous iron oxide) of the right specifications is used in rust-inhibiting paint (see "Stringer Lake Hematite Occurrence" under "Property Examinations" in this report) (G. Lucuik, Prospector, personal communication, 1992).

R. Bridge (see Table 11.1, No.2) continued exploration for gold and base metals on an eight-claim group in Olsen Township in the Batchawana greenstone belt. With OPAP financial assistance, he completed a very low frequency electromagnetic (VLF-EM) survey, prospecting and bedrock outcrop sampling, and he subsequently staked 8 more claims in the township (R. Bridge, personal communication, December 1992).

During 1992, prospector F. Doran (see Table 11.1, No.3) continued prospecting in the areas of the McDonell Mining Location, Kincaid, Palmer and Ryan townships in the Mamainse Point area. There are many small copper occurrences in this area (see "Doran Chalcopyrite Occurrence" in this report) (F. Doran, personal communication, 1992).

In Gaiaish and Joubin Townships, S. Falconer and R. Palkovits (see Table 11.1, No.4) conducted geological mapping and bedrock outcrop sampling on a five-claim block they are exploring for base metal and gold potential. They also hold a four-claim block in an adjacent area and an additional twenty-seven-claim block further southwest in Proctor Township. These claims are within the Archean Whiskey Lake greenstone belt which was mapped by the Ontario Geological Survey during 1990 and 1991 (S. Falconer, personal communication, 1992).

In 1992, Sault Ste. Marie prospectors D. Fleming and Y. Desjardins (see Table 11.1, No.5), with financial assistance from OPAP, conducted additional trenching, stripping, bedrock sampling and assaying on their seven-claim property in Hughes Township. This property is described as the Cooper Showing in Bennett et al. (1992).

The main mineralized zone is an elongate quartz-carbonate vein breccia striking about 320°, and varying in width from 6 to 14 m. Previous drilling and a "new showing" located this season indicated the breccia to be at least 182 m long. Rock fragments within the quartz-carbonate matrix range from relatively fresh to extremely altered granites, felsites and diabase. Sulphide mineralization ranges from tiny specks to large clots of pyrite, chalcopyrite, sphalerite, galena and locally bismuthinite. A grab sample from the "new showing" submitted by the Staff Geologist assayed trace Au; 3.67 ounces Ag per ton; 8930 ppm Cu; 650 ppm Ni; 3490 ppm Pb; 8600 ppm Zn; 169 ppm Co; 1730 ppm Bi; and less than 10 ppm Sb. Tests with a scintillometer and ultraviolet light proved negative on twelve samples checked. The general appearance, nature of the rock fragments and the mineralization give this breccia a strong resemblance to the...
Tribag Mine breccias about 64 km to the northwest. The Sault Ste. Marie Resident Geologist’s office has assessment files, hand samples and complete drill hole cores pertaining to work done on the Fleming–Desjardins property (D. Fleming, Prospector, personal communication, December 1992).

During 1992, Gold Insight Resources Ltd. (see Table 11.1, No. 6) carried out a soil geochemical survey on part of the company’s twenty-six-claim block in Galbraith Township. The former Havilah (Ophir) Gold Mine is situated just west of this area (R. Mori, personal communication, December 1992).

In 1992, with OPAP financial assistance, E. Goodmurphy and I. Murphy (see Table 11.1, No.7) continued work on their nineteen-claim group in Olsen Township. Magnetometer and VLF–EM surveys were completed. Two VLF–EM conductors were located, and prospecting has indicated pyrite and graphite along one of them. Two samples from the property gave anomalously high gold assays, but these were not confirmed by a second set of assays. Work will continue on the property as well as on 6 additional claims (I. Murphy, personal communication, December 1992).

With the help of OPAP funding, Sault Ste. Marie prospectors J. Haugeneder and B. Richards (see Table 11.1, No.8) undertook to drill the Copper Creek showing in Kincaid Township. Two diamond drill holes with a combined total length of 62 m were completed, and the mineralized sections sampled and assayed for Cu, Ag and Au. These drilling results indicate the mineralized zone has an average width of 2 m at a vertical depth of 16 m beneath trenches No.1 and No.2. The Sault Ste. Marie Resident Geologist’s office has assessment files, hand samples and complete drill hole cores pertaining to work done on this property. A more detailed report on this property is provided in Bennett et al. (1991).

M. Hauseaux and S. Surmacz (see Table 11.1, No.9) conducted preliminary reconnaissance prospecting and sampling in Hembuff and Hughson townships. The area is underlain by Archean volcanic rocks of the Ompa Lake greenstone belt. The target for their OPAP-supported program was gold and zinc-copper mineralization (M. Hauseaux, personal communication, 1992).

D. Healy and partner D. Ruff (see Table 11.1, No.10) completed a reconnaissance prospecting and sampling program in Gaia’shk Township near Whiskey Lake (D. Healy, Prospector, personal communication, December 1992).

G. Lucuik and partner U. Pellerin (see Table 11.1, No. 11) have been engaged in trenching and sampling a red ochre occurrence in Grasett Township. They drilled four 50-foot air-track holes on the occurrence to test the material at depth. Assistance from OPAP has allowed them to undertake this work (G. Lucuik, personal communication, November 1992).

During 1992, partners D. MacFarlane, A. McDonald and A. Pederson (see Table 11.1, No.12) continued work in the area of the junction of Norberg, Wishart and Brule townships in the Batchawana greenstone belt. Several new claims were staked and line cutting, geophysical work, trenching and bedrock sampling for gold and base metals was undertaken. One of the three partners had OPAP financial assistance (D. MacFarlane, personal communication, December 1992).

In 1991, A. Murdy (see Table 11.1, No.13) completed 15 km of magnetometer and VLF–EM geophysical surveys on his fifteen-claim group in the western part of Gapp Township. For 1992, with the aid of OPAP funding, geological mapping, soil sampling and some whole rock analyses were completed. Anomalous values in Zn, Pb and Cu were obtained over a two-line VLF–EM conductor on claim SSM1135946 (A. Murdy, personal communication, December 1992).

In 1992, geological mapping and soil sampling were carried out in Ryan and Palmer townships by Noranda Exploration Company Ltd. (see Table 11.1, No.14). These townships are located in the western part of the Batchawana greenstone belt (B. MacLachlin, personal communication, December 1992).

In 1992 with the assistance of OPAP funding, J. Paquette (see Table 11.1, No.15) continued exploration work on his group of 17 claims on the McDonell Mining Location on the eastern shore of Lake Superior. This mining location was originally claimed in 1846 by the Quebec and Lake Superior Mining Association. The presence of several old shafts and trenches on the Paquette property is evidence of exploration over 100 years ago for Keweenawan-type copper deposits when the property was known as the Mamainse Mine.

In 1992, Mr. Paquette finished a self-potential geophysical survey of the property, as well as some prospecting (J. Paquette, personal communication, December 1992).

R. and J-A. Pelky (see Table 11.1, No.16) completed prospecting, trenching and sampling on their jointly owned eight-unit claim block in the northwest corner of Lewis Township. Quartz veins striking west and northwest, and hosting chalcopyrite mineralization, were tested for gold (R. Pelky, Prospector, personal communication, December 1992).

U. Pellerin (see Table 11.1, No.17) has undertaken work on several properties in the Elliot Lake Initiatives area. In Patton Township, on the Jury Mine copper prospect, he has carried out stripping, trenching and a VLF–EM survey. The results of this survey show an easterly trending conductor approximately 125 m south of the original workings (U. Pellerin, personal communication, December 1992).

U. Pellerin (see Table 11.1, No.18) has exposed a copper occurrence in Varley Township through stripping, trenching and sampling (see “Suggestions for Prospectors” in this report) (U. Pellerin, personal communication, December 1992).

Prospectors N. Pipoli and J. Ralph (see Table 11.1, No.19) explored the granitic rocks of Maeck and Jessiman
Figure 11.1. Sault Ste. Marie Resident Geologist’s District.
<table>
<thead>
<tr>
<th>No.</th>
<th>Company/Individual (Property Name)</th>
<th>Township</th>
<th>Exploration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Bridge, R.</td>
<td>Olsen Tp. (Au)</td>
<td>VLF, prospecting, sampling</td>
</tr>
<tr>
<td>3.</td>
<td>Doran, F.</td>
<td>McDonell Location, etc. (Cu)</td>
<td>prospecting, sampling, assays</td>
</tr>
<tr>
<td>4.</td>
<td>Falconer–Palkovits</td>
<td>Gaishk, Joubin, Proctor tps. (Au, base metals)</td>
<td>geology, sampling</td>
</tr>
<tr>
<td>5.</td>
<td>Fleming–Desjardins</td>
<td>Hughes Tp. (Cu, Ag, Zn, Bi)</td>
<td>stripping, trenching, sampling, assays</td>
</tr>
<tr>
<td>9.</td>
<td>Hauseaux–Surmacz</td>
<td>Hembruff, Hughson tps. (Au, base metals)</td>
<td>prospecting, sampling</td>
</tr>
<tr>
<td>11.</td>
<td>Lucuik–Pellerin</td>
<td>Grasett Tp. (ochre)</td>
<td>trenching, sampling, air track drilling</td>
</tr>
<tr>
<td>12.</td>
<td>MacFarlane–McDonald-Pederson</td>
<td>Brule, Wishard tps. (Au, base metals)</td>
<td>VLF–EM trenching</td>
</tr>
<tr>
<td>13.</td>
<td>Murdy, A.</td>
<td>Gapp Tp. (Au, Zn)</td>
<td>geology, soil geochem</td>
</tr>
<tr>
<td>15.</td>
<td>Paquette, J.</td>
<td>McDonell location (Cu, Ag, Au)</td>
<td>self potential, prospecting, sampling, assays</td>
</tr>
<tr>
<td>16.</td>
<td>Pelky, R. &amp; J.</td>
<td>Lewis Tp. (Cu, Au)</td>
<td>prospecting, trenching, sampling</td>
</tr>
<tr>
<td>17.</td>
<td>Pellerin, U.</td>
<td>Patton Tp. (Cu, Au)</td>
<td>stripping, trenching, VLF</td>
</tr>
<tr>
<td>18.</td>
<td>Pellerin, U.</td>
<td>Varley Tp. (Cu)</td>
<td>stripping, trenching, sampling</td>
</tr>
<tr>
<td>19.</td>
<td>Pipoli–Ralph</td>
<td>Maeck, Jessiman Tps. (Au)</td>
<td>prospecting, diamond drill hole</td>
</tr>
<tr>
<td>20.</td>
<td>Sprague, D.</td>
<td>Hembruff Tp. (Au, base metals)</td>
<td>geology, sampling</td>
</tr>
<tr>
<td>23.</td>
<td>Young, T.</td>
<td>Viel Tp. (Cu, Au, Zn, PGE)</td>
<td>prospecting, trenching</td>
</tr>
</tbody>
</table>
townships for gold and base metals in 1992. They presently hold 1 claim in Maeck Township on which a single drill hole was put down. They are also in partnership with M. Pipoli, D. Shelley, and J. Chapman on a thirty-three-claim block in Palmer Township on which some prospecting was done in 1992. A consulting firm examined the Palmer property in late 1992 and results of this are pending (J. Ralph, personal communication, December 1992).

In Hembruff Township, D. Sprague (see Table 11.1, No.20) has conducted geological mapping and sampling on his thirteen-claim block where he is exploring for gold and base metals. Geological mapping by the Ontario Geological Survey (OGS) has added to the understanding of the Archean greenstone belt which extends easterly through the south half of Hembruff and Hughson townships (D. Sprague, personal communication, 1992).

A. Tims (see Table 11.1, No.21) continued work on his fourteen-claim group in Hembruff Township in the Ompra Lake greenstone belt. A ground magnetometer survey was completed and humus sampling undertaken in his search for base metals. The project was assisted by OPAP funding (A. Tims, personal communication, December 1992).

In Runnalls Township, Tri Origin Exploration Ltd. (see Table 11.1, No.22) completed 30 km of line cutting on its north grid. This was followed by an induced polarization (IP) survey, trenching and sampling. Encouraging results were reported and further work is planned for the spring of 1993. A road was recently completed to the project area (D. Robinson, personal communication, November 1992).

T. Young (see Table 11.1, No.23) conducted a prospecting, trenching and sampling program in Viel Township, testing chalcopyrite veins associated with Nipissing diabase for gold, zinc and PGE (platinum group element) mineralization (T. Young, Prospector, personal communication, December 1992).

RESIDENT GEOLOGIST’S OFFICE STAFF ACTIVITIES

During 1992, the staff of the Sault Ste. Marie Resident Geologist’s office consisted of G. Bennett, Resident Geologist, E.J. Leahy, Staff Geologist, B. Fremlin, Secretary, and J. Walmsley, Drill Core Library Geologist.

In the calendar year of 1992, the Sault Ste. Marie Resident Geologist’s office provided service for 930 visitors to the office and responded to 1306 telephone inquiries.

The Sault Ste. Marie Resident Geologist is also responsible for the administration of the Wawa Resident Geologist’s office and the Elliot Lake geology office.

From January 6 to March 31, 1992, R. Henri worked on contract, assisting with database compilation. A. Corbiere was a student assistant from June 2 to August 10, 1992. Co-op student C. Davieaux assisted with field and office duties for a six-week period in the fall of 1992.

Approximately 50% of the Resident Geologist’s time during the past year was spent in administrative matters, including meetings and report writing. About 20% of his time was spent in purely geological activities such as property and mine visits, and about 15% of his activities related to client services. The remainder of the time was spent in public education (prospectors’ courses) and land use planning.

The Resident Geologist is a member of the Information Technology Subcommittee. He attended meetings of URAG (Uranium Resources Assessment Group) at Elliot Lake, a working group for development of an outdoor experiential centre at Elliot Lake, and of the Mines Library Committee at Sudbury.

The Resident Geologist made visits to 5 active exploration properties, to 5 inactive properties hosting mineral occurrences and to 3 producing mines or quarries. He led or participated in 7 geological field trips for members of the OGS, foreign geologists, educators and members of the prospecting classes.

During the summer and fall, the Resident Geologist began a field project which included geological mapping and sampling to establish the geological setting of a recently discovered dolostone-hosted chalcopyrite occurrence in Fenwick Township (Bennett et al. 1992). The dolostone unit is postulated to be the stratigraphic equivalent of the Kona Dolomite of Michigan which hosts large, but subeconomic, copper deposits believed to be of sabkha origin. An oral presentation was made on the results of this work at the December 1992 Mines and Minerals Symposium on Toronto.


In May and June 1992, the Sault Ste. Marie Resident Geologist and Drill Core Library geologist, assisted by P. Morra of the Mining Recorder’s office and M. Hailstone of the Elliot Lake geology office, organized and presented two series of introductory prospecting courses at the new Mines and Minerals offices in Sault Ste. Marie. A total of 52 participants attended, with no “drop outs”. A follow-up field trip was organized by the course participants and led by the Resident Geologist, assisted by staff of the Drill Core Library and Elliot Lake geology office.

An oral presentation on local geology was made to staff and students of Delta College, Saginaw Michigan, while they were conducting a field school in the Batchawana area. The Sault Ste. Marie Resident Geologist’s office has been actively supporting this group in its efforts to set up a permanent summer field school in Ontario, for gifted high school students from the Saginaw area.

During 1992, much of the Staff Geologist’s time was taken up with routine office matters including discussions with prospectors, company geologists, consultants, rock hounds, the general public and various government personnel. Advice was given on rock and mineral identification,
assays, exploration maps and reports, and assessment files, in addition to other topics.

Following the relocation of the Resident Geologist's office to the new facility in the spring of 1992, the Resident Geologist's office library was reorganized. At about the same time, large donations of published geological materials were obtained from the Sault College of Applied Arts and Technology, and also from retired consulting geologist, F. Evoy. A much larger library collection has thus been established at the new office. Lists of duplicate materials were sent to all other Resident Geologists' offices in the Province and for 9 of these offices "wish-lists" were partially filled.

Field work activities of the Staff Geologist in 1992 were limited to 2 property visits, 4 mine-hazard investigations and the Bruce Mines Tourism Project. A poster display was prepared for the geoscience seminar in Timmins in April 1992.

The Staff Geologist provided technical advice for the reconstruction of the historic Simpson Shaft Project in the town of Bruce Mines. He also assisted the Mineral Development and Rehabilitation Branch of the Ministry of Northern Development and Mines (MNDM) in the investigations of several mine hazards in the Mamainse Point, Goulais River and Bruce Mines areas.

**BRUCE MINES TOURISM PROJECT**

In 1989, a small group of people formed a committee to look into the possibility of building, as a tourist attraction, a full-scale replica of an early mining scene at one of the original mining sites of the Bruce Mines. The Sault Ste. Marie Staff Geologist has been a member of this committee since its inception.

The site chosen was originally called "Simpson Shaft", named after Sir George Simpson of the Hudson Bay Company who was also a founding Trustee of the Montreal Mining Company. This particular shaft (an elongate narrow open stope) was mined in 1847–48, and is located close to Highway 17 and the town museum.

Over the last three years, as time, people, money and weather permitted, full-scale replicas of a horse-powered whim hoist, an open log headframe and a small mine office (set up as a display area) were constructed. A boardwalk leading from a split-rail fence parking area was completed. An 8-foot galvanized chain link fence surrounds the main site and a 4.5-foot high safety fence guards against inadvertent access to the stope.

In 1992, a display of copies from original sketches, maps, photographs and reports, ore samples and mining equipment was set up in the "office" and, on June 13, although not completed, the Simpson Shaft attraction was opened to the public.

On August 20, 1992, the Minister of Northern Development and Mines, the Honourable Shelley Martel, officially opened the site. During the three-month period, the site was open in 1992 and, with almost no advertising, there were approximately 1500 visitors and their response was extremely encouraging. Future plans include going underground at the Simpson Shaft, creating walking trails to other sites, and exposing the foundations of a milling and metallurgical works, the old "lixiviation works", located only 900 feet from the Simpson Shaft.

Although the project still requires much work to be done, benefits readily observed are as follows.

1. The local citizens are becoming more aware of their town's beginnings and its "roots", which in itself imparts a sense of pride.

2. Some mining people were made aware of the historical significance of Bruce Mines as the beginning of Canada's copper industry.

3. Several teachers have taken busloads of pupils to explore the site as a learning experience.

4. Several people were employed under the Canada Employment and Immigration, Section 25 Program, in the actual building of components of the project.

5. Two students obtained employment in 1992 as guides to visitors.

6. The Simpson Shaft site had been classified as "mine hazard" land in the town's official plan and essentially rendered sterile. The tourism project has "recycled" this site into usable land.

Most of the small inventory of mining-related display items have been donated and the project could certainly use more. Queries concerning the Simpson Shaft project are most welcome.

**EDUCATIONAL ACTIVITY**

As a means of providing instructional and educational information to the public, the Staff Geologist undertook the following activities in 1992: 1) presented slide show talks on Bruce Mines to the Sault Ste. Marie Naturalist's Association, and to the Sault Ste. Marie Prospector's Association; 2) prepared a display for Mining Awareness Week which was set up at Station Mall and staffed by persons from the Ministry of Northern Development and Mines and the Sault Ste. Marie Prospector's Association; 3) made a presentation on rocks and minerals to the students at the C.O. Somes Public School at Batchawana; 4) supplied several boxes of material, including maps and rock and mineral specimens, to a high school teacher in southern Ontario preparing an advanced Grade 12 level geology course; and 5) collected and shipped rock samples to Timmins for rock and mineral teaching sets being assembled by the Ministry of Northern Development and Mines.
**MINE HAZARDS**

The Staff Geologist took part in investigations of several abandoned-mine hazard concerns in 1992. These include:

1. the Jack Rodda property at Hibbard Bay where reported hazards consisted of two old exploration pits, possibly dating back to the 1800s. Their remote location does not classify them as high priority hazards at this time.

2. the Sill Lake silver mine in Vankoughnet Township where temporary fencing and hazard flagging done in 1991 had been vandalized. This area was again temporarily fenced, signs erected and the gate locked by Sault Ste. Marie District Ministry of Natural Resources.

3. the Ranwick uranium mine in Peever Township where the adit portal, closed by a masonry concrete block wall in the 1980s, had recently been broken apart by vandals and the blocks taken away. P. Morra, Mining Claims Inspector at Sault Ste. Marie, recommended that the adit be plugged for about 20 feet with nearby mine waste rock. This remedial work was performed by the Wawa District of the Ministry of Natural Resources in November 1992.

4. in early 1992, the official closing of Caribou Road in Bruce Mines. The erection of barricades across the road, a vehicle turn-around area and appropriate signage was necessary because of two near-surface stopes with deteriorating crown pillars which pass under this road. Later in the year, someone rammed the eastern barricade with a vehicle and snapped off one post, as well as damaging the fence that surrounds the stope area. The fence was repaired by the Ministry of Natural Resources in Sault Ste. Marie in November 1992.

5. an investigation of the Mamainse copper mine in the McDonell Mining Location. The workings at this site date back to the 1880s and consist of at least 3 shafts, working levels, and surface pits and trenches. Records of this old work are meagre and the exact locations of all the associated hazards are currently unknown. Because of the proximity of these workings to Highway 17, further investigation has been suggested.

**ELLiot Lake geology office**

M. Hailstone began duties as Staff Geologist at the Elliot Lake geology office in December 1991, following the retirement of J. Robertson. From April to June 1992, Y. Fourcaudot carried out duties as a receptionist and typist as part of her Advanced Office Procedures course being offered by the local campus of Sault College. S. Buck assisted in the office and field from June to September as an experience student. The office averaged approximately 40 visitors and 43 telephone requests per month.

M. Hailstone participated with a poster display depicting the geology and exploration activity in the Elliot Lake area at the Northeast Regional Mines and Minerals Symposium in Timmins, and in the December Ontario Mines and Minerals Symposium. He also attended the Prospectors and Developers Association of Canada Convention in Toronto in April.

The staff of the Elliot Lake geology office includes a compilation of all geological field trip guides and manuals, and a bibliography of the Elliot Lake office.

In September, M. Hailstone attended 3 Open Houses for the proposed Mississauga First Nation Settlement to assist with mineral concerns in the proposed settlement area. M. Hailstone also assisted by providing a report addressing concerns about possible uranium contamination in well-water from bedrock sources on the Mississauga First Nation Reserve.

During the year, the office assisted with 2 prospecting classes offered by the Resident Geologist’s office in Sault Ste. Marie in early June. M. Hailstone also participated in 4 field trips in the area.

**PROPERTY EXAMINATIONS**

**Copper Occurrences in Varley and Albanel Townships**

U. Pellerin used a portion of his OPAP funding to investigate a copper vein system in the northwest corner of Varley Township about 33 km north of Iron Bridge. The showing is accessible by the Kynoch logging road, 23 km north of Kynoch on Highway 554.

M. Hailstone observed chalcopyrite, malachite, azurite and pyrite mineralization exposed over a 150 m strike length in 3 trenches along a west-trending, 75 to 85° south dipping, chloritized shear zone cutting laminated to massive siltstone of the Espanola Formation. Chalcopyrite-pyrite mineralization is associated with quartz-carbonate veins up to 3 cm thick, within the chloritic shear zone. The veins cross-cut and are parallel to tightly folded bedding, but generally display no preferred orientation. Values as high as 7.34 % Cu, 4 ppm Ag and 55 ppb Au have been obtained from grab samples in the 6 by 1 m main trench (U. Pellerin, Prospector, personal communication, 1992).

The geology of the area has been described by Siemiatkowska (1978). The area is underlain by units of the Espanola Formation. A basal laminated to massive carbonate unit is overlain by laminated to massive siltstone. These rocks are cut by the northwest-trending Pearl Lake Fault.

Mineralization is associated with west-trending shear zones, possibly conjugate to the Flack Lake Fault system. Other quartz-carbonate veins with chalcopyrite and pyrite were observed in west-trending shear zones on the Castra Lake road approximately 1 km east of the Kynoch road. Assays from this material were not available at the time of writing.
Further east in Albanel Township, A. Roy conducted geological mapping, sampling, soil geochemistry and ground magnetometer and horizontal loop electromagnetic surveys in 1988–89. Mr. Roy holds a seventeen-unit claim block located 34 km northwest of Elliot Lake, 150 m south of Highway 546 on the south side of the White River. Channel samples from the main pit 8 by 3 by 4.5 m deep have returned up to 7 m assaying 5.23% Cu of which a narrow 4 m section assayed 8.76% Cu and 0.191 ounce Au per ton (A. Roy, Prospector, personal communication). Chalcopyrite, chalcocite, malachite, azurite and pyrrhotite mineralization is hosted by narrow quartz-carbonate veins trending 70° within a chloritic shear zone. A 1.8 m channel chip sample from this trench containing 30% quartz veins and abundant chalcopyrite, analyzed 0.025 ounces Au per ton, 11.7% Cu, 0.002% Pb and 0.009% Zn (assessment files, Sault Ste. Marie Resident Geologist’s office). A grab sample containing 50 to 60% vein quartz with carbonate veinlets collected from a chloritic shear cutting dolomite, reportedly assayed 7 ppb Au, less than 1 ppm Ag, 0.007% Cu, 0.015% Pb and 0.402% Zn (assessment files, Sault Ste. Marie Resident Geologist’s office).

These property descriptions serve as examples of potential copper-gold mineralization associated with west-trending shear related to the Flack Lake thrust fault. The trace of this fault through Varley, Albanel, Nicholas and Raimbault townships merits further prospecting for hydrothermal polymetallic mineralization associated with quartz-carbonate veins, hosted within chloritic shear zones.

**The Falconer–Palkovits Properties: Whiskey Lake Greenstone Belt**

The Falconer–Palkovits properties are located approximately 10 km and 18 km, respectively, east-southeast of Elliot Lake, and may be accessed via the Nordic Mine and Pecors Lake bush roads from Highway 108.

S. Falconer, and partner R. Palkovits, hold 36 claim units in 3 separate blocks within the Whiskey Lake greenstone belt. From west to east, the first block in Proctor Township consists of 27 units, which are staked over Archean metasedimentary rocks consisting of interbedded wacke, mudstone and iron formation. In Gaiaish Township, Mr. Falconer holds a four-unit block south of Pecors Lake. This block is staked over Archean intercalated mafic and felsic volcanic rocks, with sulphide-facies iron formation cut by Nipissing diabase. Approximately 2 km further east, Mr. Falconer has staked 5 units over a west-northwest-trending, carbonatized shear zone cutting coarse-grained and pillowved mafic volcanic flows.

The twenty-seven-unit property was staked for gold exploration. Banded oxide facies iron formation hosts quartz veins and sulphidized zones. A sample containing 0.893 ounces per ton Au was obtained from a pit located in iron formation on the west side of Highway 108. However, additional sampling has not returned values of this magnitude. Falconer and Palkovits have completed a VLF–EM survey and a magnetometer survey over their twenty-seven-unit property.

On the four-unit block known as “Gaieast”, Falconer and Palkovits have conducted a base metal and gold exploration program consisting of geological mapping, sampling and trenching. Sulphide mineralization is associated with a banded, sugary chert graphite unit that is exposed by trenching in 2 areas. Sulphides consist of banded pyrrhotite and pyrite up to 1.5 m thick, which have returned assays up to 4500 ppm Zn (S. Falconer, personal communication, 1992). The zone strikes 130° and dips 55° northeast. Farther along strike, 0.6 km to the west-northwest, sulphides are exposed under the power line 200 m south of the Pecors road. Here, brecciated chert-graphite hosts banded pyrrhotite and pyrite up to 15 cm thick. A diabase intrusion occurs on the footwall of the zone. This breccia also contains rare rounded clasts of ultramafic rock (up to 0.3 m in diameter). The area has been mapped by Jensen (1990) as west-northwest-trending intermediate to felsic interlayered tuff and wacke, intercalated with pillowved and massive tholeiitic flows, intruded by Nipissing diabase and offset by 2 northeast-trending faults. Dextral movement on the Pecors fault may have resulted in drag folding of volcanic units along the northwest-trend of the fault.

At the five-unit block known as “Gaieast”, Falconer and Palkovits have completed an OPAP-sponsored geological mapping and sampling program for gold and base metal. A 290° trending, 2 cm thick shear zone cuts pillowved and massive coarse mafic flows. This chloritized shear zone is carbonatized, and hosts pyrite and minor chalcopyrite mineralization. Locally, the lens contains quartz veins with chloritic fragments of wall rock. Sampling on this structure by M. Byron has produced assays as high as 13 000 ppb Au (Byron 1992).

**Anomalous Gold Content in Huronian Conglomerate**

Bennett (1983) reported the presence of anomalous gold concentrations in 2 occurrences of Huronian quartz-pebble conglomerates of the Elliot Lake Group in the Thessalon area. One of these occurrences is a 5 to 10 cm thick unit on private, recreational waterfront which is no longer available for further sampling. Two samples taken at this location in 1982 returned 600 and 200 ppb Au. The second occurrence is near the south shore of Cullis Lake in Day Township (UTM Zone 17, 5129620N 314450E). Sampling at this location in 1982 (Bennett 1983) returned 4300 and 320 ppm Au. Since then, there have been unconfirmed reports that individuals and companies have determined the gold content of the conglomerate to be in the range of 100 to 1000 ppb.

Table 11.2 shows the results of 33 analyses for gold, uranium and thorium from samples of sedimentary and volcanic rocks, collected by the writer (G. Bennett) from near the base of the Huronian assemblages in the Thessalon and Otter Township areas (UTM Zone 17, 515590N 304850E).
Table 11.2. Gold, uranium and thorium content of volcanic and sedimentary rocks from the base of the Huronian Supergroup, Thessalon and Otter townships.

<table>
<thead>
<tr>
<th>Feet</th>
<th>Rock</th>
<th>Fm.</th>
<th>Au (ppb)</th>
<th>U (ppm)</th>
<th>Th (ppm)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>QPC</td>
<td>Thes.</td>
<td>1190</td>
<td>21</td>
<td>120</td>
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<tr>
<td>1</td>
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<td>Thes.</td>
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<tr>
<td>0</td>
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<td>Thes.</td>
<td>610</td>
<td>12</td>
<td>50</td>
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<tr>
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<td>QPC</td>
<td>Thes.</td>
<td>490</td>
<td>26</td>
<td>70</td>
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<tr>
<td>2.5</td>
<td>QPC</td>
<td>Thes.</td>
<td>350</td>
<td>12</td>
<td>50</td>
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</tr>
<tr>
<td>0.5</td>
<td>QPC</td>
<td>Thes.</td>
<td>140</td>
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<td>30</td>
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</tr>
<tr>
<td>2</td>
<td>QPC</td>
<td>Thes.</td>
<td>65</td>
<td>14</td>
<td>30</td>
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</tr>
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Paleosol: <2 2 10 Otter Tp.
QPC Mat. 6 <1 <10 Otter Tp.
QPC Mat. <2 <1 <10 Otter Tp.
QPC Mat. 4 2 <10 Otter Tp.
QPC Mat. 14 <1 <10 Otter Tp.
QPC Mat. .8 <1 <10 Otter Tp.
ARK Mat. 10 1 30 Otter Tp.
QPC Mat. 24 17 10 Otter Tp.
QPC Mat. 8 3 <10 Otter Tp.
ARK Lc. 14 2 30 Otter Tp.
ARK Gow. <2 <1 <10 Otter Tp.
QPC Thes. 24 22 200 Weirs Farm
ARK Thes. 4 8 80 Weirs Farm
ARK Thes. <2 2 10 Weirs Farm
QPC Thes. 24 19 160 Peterson occurrence
QPC Thes. 14 4 20 Peterson occurrence

Feet = feet above base of Thessalon Formation

Legend:
- QPC  = Quartz-pebble conglomerate
- ARK  = Arkose
- BAS  = Basalt
- Thes. = Thessalon Formation
- Lc.  = Livingstone Creek Formation
- Mat. = Matinenda Formation
- Gow. = Gowganda Formation
The results illustrate the elevated gold content of the pyritic-quartz-pebble conglomerate found at the base of the predominantly volcanic Thessalon Formation at Cullis Lake.

There are at least 12 known occurrences of quartz-pebble conglomerate with overlying coarse arkose at this stratigraphic position between the eastern end of the Quirke Lake Syncline and Duncan Township near Sault Ste. Marie. The conglomerate-arkose units are co-extensive and locally intercalated with the mafic flows of the Thessalon Formation (Bennett et al. 1991). Most, if not all, of these units have been sampled and analyzed for gold, but only the conglomerate at Cullis Lake was found to have elevated gold content (W. Meyer, Resident Geologist, Sudbury, personal communication, 1992).

At Cullis Lake, an approximately 1 m thick unit of conglomerate lies upon the fine-grained, grey, arkosic sandstones which make up the Livingstone Creek Formation. The conglomerate is overlain by coarse arkose and grit up to 7 m thick which is in turn overlain by mafic flows of the Thessalon Formation. The basal Huronian rocks at Cullis Lake lie within a fault-bounded block on the north side of the Murray Fault. Its isolated position and low gold content makes this specific occurrence of relatively minor economic significance. However, to the writer's knowledge, this is the only occurrence of gold content greater than 1000 ppb in Huronian quartz-pebble conglomerate which has been confirmed by replicate analyses.

Since most other pyritic quartz-pebble conglomerates at the base of the Thessalon Formation do not have anomalously high gold contents, it cannot be said with assurance that the Cullis Lake occurrence is the result of primary sedimentary processes of concentration. It is conceivable that gold has been introduced along adjacent faults and fixed by the pyrite originally present in the conglomerate. The geological setting of this occurrence warrants further detailed study to determine the distribution and relationship of gold within the unit and among the minerals present.

**Chalcopyrite in Dolostone in Fenwick Township**

**INTRODUCTION**

Bennett et al. (1989) described a recently discovered dolostone unit (Born 1987) in Fenwick Township about 27 km north of Sault Ste. Marie. The authors tentatively concluded that the dolostone is stratigraphically equivalent to the Gordon Lake Formation (Cobalt Group, Huronian Supergroup) which is well exposed about 50 km southeast of Fenwick Township. They also reopened an old controversy by suggesting that the location and general appearance of the dolostone in Fenwick Township supported the view of those authors who argued for a correlation of the Cobalt Group of the Huronian Supergroup of Ontario with the Chocolay Group of the Marquette Range Supergroup of Michigan. The latter correlation has economic implications since the Kona Dolomite of the Chocolay Group has long been known to host significant but sub-economic stratabound copper deposits which have been interpreted as having a sabkha origin (Clark 1974). The presence of low-grade stratabound copper deposits at what is interpreted as the contact of the Gordon Lake Formation and the Lorrain Formation in the Stag Lake area north of Elliot Lake, invites the possibility of further intriguing correlations.

In November 1991, Geological Assistant A. Plackitt, called attention to very fine-grained pyrite in an outcrop of dolostone in Fenwick Township. Further examination revealed that pyrite, specular hematite and minor chalcopyrite were found to be widely distributed through the western limit of dolostone outcrops in Fenwick Township (Bennett et al. 1992). In view of the stratigraphic correlations suggested earlier, an attempt to determine the nature and distribution of the sulphide mineralization was made in 1992.

**LOCATION AND FIELD METHODS**

The area of interest is located in the central portion of Section 7, Fenwick Township, centred around lat. 46°45'50"N, long. 84°28'30"W. The area is shown on the claim map as being patented for surface and mining rights with gold and silver reserved for the crown (Canada). This area is about 800 m west of the area referred to as the "dolostone knob" by Bennett et al. (1989).

During the summer and fall of 1992, about 5500 m of line was flagged using a hip chain and a Global Positioning System (GPS) receiver for control. G. Bennett was assisted by P. Morra of the Sault Ste. Marie Mining Recorder's office, J. Walmsley, C. Davieaux, A. Corbiere, all of the Sault Ste. Marie Resident Geologist's office, and by D. Bennett. J. Walmsley assisted with the mapping.

The field observations were plotted at a scale of 1:1666. Samples were analyzed by the Temiskaming Testing Laboratory of the MNDM.

**GENERAL GEOLOGY**

At the northern part of the map area (Figure 11.2), there are outcrops of strongly foliated, fractured and sheared felsic and mafic, Archean metavolcanic rocks (Born 1987). Both dark greenish-grey, mafic metavolcanic rocks and very pale grey, felsic metavolcanic rocks are recognized. Some of these outcrops are strongly hematized. The hematization occurs as planar zones of deep red, earthy hematite a few centimetres to at least a few metres wide which are parallel to the foliation. The hematization and deformation of the Archean rocks is more prominent near the contact with the dolostone, suggesting that the contact is a fault.

Pale grey, quartz arenite of the Lorrain Formation, Huronian Supergroup, is well exposed in the southern and western parts of the area mapped (see Figure 11.2). Many exposures of quartz arenite are fractured and discoloured to pinkish or brownish tints possibly by albite alteration. Clearly defined primary structures were not observed within the unit. The lack of distinctively coloured units suggests that the quartz arenite is probably part of the uppermost "white orthoquartzite member" of the Lorrain Formation (Frary...
Jasper-pebble conglomerate, characteristic of the Lorrain Formation, is present apparently within the same unit about 2 km southwest of the area (Born 1987).

Dark-brown weathering dolostone is exposed mainly along the north-facing slope of a steep hill in the central portion of the area. Many of the exposures have been in part rotated and transported down the slope. A tenacious green moss grows abundantly on the carbonate rocks making it difficult to observe weathered surfaces. The area is privately owned, and it was necessary to keep stripping of outcrops to a minimum.

The dolostone can be roughly subdivided into pale to medium grey, medium-grained recrystallized dolostone and very fine-grained, pink to grey or bluish grey dolostone (dolomicrite). The latter is generally interlaminated with grey to pink chert or silty units. The few bedding attitudes measured suggest a generally easterly to southeasterly strike with steep but variable dips. However, measurements were taken from small stripped areas and may not be representative.

An east-trending mafic unit, interpreted to be a dike or sill, extends through the dolostone unit in the central portion of the area (see Figure 11.2). The mafic rock is dark grey to dark greenish-grey, locally carbonitized and brownish weathering. Like most other rocks of the area, it is strongly fractured to the extent that it is generally not possible to obtain a sample larger than a few centimetres across. Locally however, the presence of a fine-grained “chilled” zone can be discerned, indicating an intrusive relationship.

The contact between the dolostone and quartz arenite is in part occupied by a distinct lineament and is interpreted as a fault. In other places, the nature of the contact is essentially undefined.

CHALCOPYRITE MINERALIZATION

Finely disseminated pyrite, specular hematite and chalcopyrite is widely distributed within dolostone on the north face of a hill at UTM Zone 16, 693324E 5181815N. A 2 to 4 cm thick chalcopyrite-rich lens in a displaced block of dolostone was found to contain 3.7% Cu. Samples with small amounts of visible pyrite and chalcopyrite returned from 100 to 2174 ppm Cu. In contrast, laminated dolostone and arenaceous dolostone from the “dolostone knob” are essentially devoid of sulphides.

The results of 44 analyses of copper in dolostone are given in Figure 11.3. The figure shows that dolostone samples of pyrite-free Proterozoic dolostone from the Espanola Formation, Kona Dolomite, Michigan and the “dolostone knob”, Fenwick Township, do not exceed 30 ppm Cu, whereas the samples from the western part of the dolostone area are anomalous. The object was not to attempt to determine a
copper grade for the dolostone (it was clearly much less than 0.1%), but to attempt to establish whether the copper mineralization could be syngenetic with the dolostone.

Observations which bear on this question are:

1. disseminated grains and thin seams of pyrite and chalcopyrite were also found in some outcrops of fractured quartz arenite of the Lorrain Formation south of the dolostone area. The general grain size and distribution of chalcopyrite in the Lorrain Formation suggests a common origin with the sulphides found within the dolostone.

2. sulphide minerals were found almost exclusively within recrystallized dolostone. Sulphides are virtually absent in relatively undeformed, micritic dolostone with observable primary features.

3. sulphides appear to be most abundant in dolostone in proximity to a diabase intrusion.

4. narrow quartz veins are locally present in the area where the chalcopyrite mineralization was found.

It was tentatively concluded that the sulphides found in the dolostone of Fenwick Township are probably epigenetic variants of the more common chalcopyrite-bearing veins commonly found within Huronian rocks along the north shore of Lake Huron.

Additional field and laboratory work on this occurrence is planned for 1993.

**BARITE MINERALIZATION**

A 20 to 30 cm wide zone of anastomozing veins of pale pink to grey barite was found in a dolostone outcrop in the southeast part of the map area (see Figure 11.2). The presence of this sulphate mineral may be the result of sulphate concentration in an evaporite setting commonly associated with primary type dolostone formation.

**Stringer Lake Hematite Occurrence**

The Stringer Lake hematite occurrence is located in south-central Varley Township, at the northwest corner of Stringer Lake, approximately 30 km northeast of Iron Bridge, Ontario (UTM Zone 17, 335974E 5156474N). The property was originally staked in 1944 by J. Ferguson, and subsequently sold to Westland Mining Co. Ltd. in 1945 as an iron ore prospect. Westland carried out diamond drilling and trenching over 2 years, after which the claims were allowed to lapse (assessment files, Sault Ste. Marie Resident Geologist’s office).

G. Lucuik staked 1 claim to cover the showing in 1990 as an industrial mineral prospect (micaceous iron oxide). In 1992, 4 claims were added and the property is now jointly held by Mr. Lucuik and S. Babcock. Work completed by the
claim holders includes prospecting, a VLF-EM survey, strip-
ning, channel sampling and trenching. Funding has been 
primarily through OPAP grants (G. Lucuik, Prospector, 
personal communication, 1992).

The southern part of the township is underlain by Huronian 
sedimentary rocks of the Cobalt Group with a general east to 
est-southeast strike and a shallow to moderate south dip. To 
the north, the township is underlain by Huronian sedimentary 
rocks of the Quirk Lake Group and by Archean volcanic, 
intrusive and migmatitic rocks. Nipissing diabase is found 
throughout the township as sills and dikes (Siemiatkowska 
1978).

The dominant fault structure in the vicinity of the prop-
erty is the Pearl Lake Fault. The fault strikes southeast 
through the south-central part of the township, oblique to the 
strike of the geology, and has a vertical dip. Mapping by 
Siemiatkowska (1978) shows a dextral displacement of up to 
2 km.

Rock exposure on the property is generally poor. A 
valley demarcating the Pearl Lake Fault transects the prop-
erty with a strike of 130°. This fault marks the contact between 
Lorrain Formation rocks which form the southwest valley 
wall, and Gowganda Formation rocks to the northeast (Siemiatkowska 1978). The Gowganda rocks are not ex-
posed on the property, but large boulders of Gowganda 
conglomerate litter the valley floor. A diabase ridge forms the 
northeast wall of the valley.

J. Walmsley visited the property in October 1990, Octo-
ber 1991 and October 1992. The latest visit found 3 areas of 
stripping that have exposed specularite mineralization along 
the floor and southwest wall of the valley.

Although deep overburden covers the mineralized zone 
between the stripped areas, it is believed the mineralization is 
continuous for over 350 m. All 3 zones are within the Lorrain 
Formation and line up along the strike of the Pearl Lake Fault.

NORTHWEST STRIPPED AREA

The largest stripped area is about 100 by 20 m in size and is 
650 m northwest of the northwestern corner of Stringer Lake 
(Figure 11.4). The work uncovered a quartz vein system 
within weakly sheared quartzite and quartz-pebble conglomer-
tate. The strike of the bedding is about 075° with a moderate 
south dip. The quartzite is generally milky white, massive 
and course-grained and is interbedded with lenses of quartz-
pebble conglomerate. The conglomerates are clast-supported 
with predominantly translucent quartz pebbles and rare jas-
per pebbles.

Shearing and faulting is evident by southeast-striking 
fractures and local zones of tectonic breccia.

Hydrothermal alteration of the host within a metre of the 
veins is visible as a faint yellowish tint caused by sericite. A 
few bright green patches were also observed within the 
quartzite close to the veins. These patches are similar in 
colour to the green quartzite once quarried in Kehoe Town-
ship known as “Algoma Jade”. The green colour of the 
Algoma Jade is caused by interstitial chromium mica (T.
Leahy, personal communication, 1992).

The quartz veining has a strike varying from 075° to 105° 
and generally dips from 70° to 80° north. The quartz is milky 
white, often with a slight reddish tint due to hematite staining. 
Minor carbonate occurs as fracture infills in the quartz. The 
system is made up of 1 main vein which is less than 0.25 m 
wide at the southeast end of the exposed area, swells to more 
than 4 m in width near the centre, and then pinches to less than 
0.25 m in width at the northwest end. Part way along the 
strike, the main vein splits in 2 with the northern finger 
pinching out within 5 m northwest of the split. Near its 
southeast end, the vein is displaced about 1.25 m by 2 parallel 
faults striking 130°, which is concordant to the Pearl Lake 
Fault.

Specularite is the only metallic mineralization found in 
any of the stripped areas. In this zone, specularite occurs as 
massive lenses, patches and fracture fillings within the quartz 
and as fracture fillings and breccia matrix, both ± quartz, 
within the host rock. Grain size ranges from coarse in the 
massive lenses to very fine in the breccia matrix. Most of the 
mineralization occurs within the quartz vein. The best miner-
alized section of the vein has a strike length of 30 m with an 
average width of 1.0 m and grades about 20 to 30% specularite. 
At the widest point of this section, a zone of about 3 m² grades 
60 to 70% specularite. The mineralization disappears under 
overburden at both ends of the stripped area.

CENTRAL STRIPPED AREA

The central area, approximately 300 m northwest of the 
lakeshore, was stripped to uncover a trench from the old 
exploration work (see Figure 11.4). This zone is at the base 
of a small cliff of quartz-jasper-pebble conglomerate, locally 
known as “puddingstone”. A 1.5 m wide fault gouge is 
exposed along the face of the cliff and is probably part of the 
main Pearl Lake Fault. The strike of the fault zone and cliff 
face is 130° with a steep north dip. On top of the cliff, directly 
above the old trench, a mineralized splay can be followed for 
a short distance, curving to a more easterly strike which is 
closer to the regional strike of the metasedimentary rocks.

Mineralization within the fault zone is predominantly 
red hematite (almost the colour of ocher), with stringers of 
specularite throughout. The specularite can be seen passing 
through fractures in the breccia clasts, and completely replac-
ing pyrite cubes within the clasts. The fault gouge is silicified. 
A zone of specularite, about 15 m long and varying in width 
from 0.25 to 1.0 m, was exposed at the base of the cliff. The 
zone disappears under overburden to the east, south and 

STRINGER LAKE STRIPPED AREA

The third area of stripping is located about 175 m northwest 
of the lakeshore and exposes an area 10 by 20 m (see Figure
11.4). The host rock is quartz-jasper-pebble conglomerate and is strongly fractured, with predominant attitudes of 070/90 and 315/75N. Mineralization is specularite ± quartz, and occurs as fracture fillings with massive lenses, similar to the northwest stripped area.

Two main mineralized zones were found. One zone was stripped for 21 m, with widths varying from 0.25 to about 2.0 m. It has a strike of 075°, and a near vertical dip. The second zone, north of the first, was uncovered for a length of 10 m with widths varying from 0.1 to 1.5 m, and has a strike of 130°, with a steep south dip. This zone curves to a strike of 075° towards the northwest end of the stripping. Specularite-filled fractures are dispersed throughout the area between the 2 main zones.

The overall percentage of specularite over the stripped area is roughly 10 to 15%. The most significant lens is about 3 by 2 m and grades 60 to 70% very fine- to medium-grained specularite.

**PROPERTY MINERALIZATION**

Specularite stringers can be found up to 300 m south of the fault valley. The density of stringers decreases away from the valley. The style of mineralization is fracture fillings with minimal associated quartz. Widths vary from 1.5 cm to hairline. Attitudes are predominantly east-trending with some stringers striking northwest. The stringers are discontinuous but can sometimes be followed along strike for distances greater than 100 m.

Frapey (1977) mentions that specularite is widespread and abundant throughout the Huronian belt between Sault
Ste. Marie and Blind River, and that the occurrences are genetically related to diabase intrusions. Controls for emplacement are post-diabase faults. The Stringer Lake occurrence fits this model. Mineralization is mapped as being spatially related to the Pearl Lake Fault. The diabase to the northeast of the property is likely the heat source for the hydrothermal fluids which deposited the quartz and specularite.

INDUSTRIAL USES

Iron oxide can be used as a pigment for paints, cement, plastics, dog food and many other products. Micaceous iron oxide (a variety of specularite) is particularly useful as a pigment because its flake-like crystals align themselves and lock together in such a way that they form a moisture barrier. To be of use as an anti-corrosive pigment, the flakes must be able to retain their structure after being crushed to a size smaller than 230 mesh (Traede 1974). Most of the world’s micaceous iron oxide is produced in Austria.

Samples of specularite from the Stringer Lake occurrence have been sent to a possible consumer in the United States. Testing can take up to 2 years because the paint samples made from the material have to be exposed to the weather for a sufficient length of time to see if water can penetrate the iron oxide barrier (G. Lucuik, Prospector, personal communication, 1992). Results from the samples are pending.

A possible side commodity from the property could be the quartz-jasper-pebble conglomerate (puddingstone). If an open pit were developed to mine the iron oxide, some of the waste rock would be this conglomerate. This waste could be marketed for use in small craft items such as clocks, tiles and headstones. Puddingstone is a popular rock with local lapidary enthusiasts, but a good source of the rock is difficult to find. Future work planned for the property, depending on test results, could include further stripping, and diamond drilling.

Glenrock Showing

The Glenrock showing is located in the southwest part of Palmer Township, approximately 60 km northwest of Sault Ste. Marie, Ontario (UTM Zone 16, 683652E 520850N). It is composed of a number of mineralized zones containing gold, cobalt, copper, silver and minor amounts of nickel.

The following summarizes the history of work on file at the Sault Ste. Marie Resident Geologist’s office and the Sault Ste. Marie Mining Recorder’s office:

1952: O. Bjornaa staked the original showing after discovering cobalt bloom on boulders. Mr. Bjornaa completed some trenching.

1952: Conwest Exploration Company Limited optioned the claims from Mr. Bjornaa and completed stripping and diamond drilling on three mineralized zones. The work uncovered vein and disseminated cobaltite along with pyrite, arsenopyrite, minor chalcopyrite and flecks of visible gold. The best assay returned from the trenching was 1.8 ounces Au per ton, 0.5 ounces Ag per ton and 13.7% Co. Diamond drilling did not find any mineralization at depth and the option was dropped.

1953: Glenrock Gold Mines Ltd. next optioned the claims and completed extensive trenching. Another showing was discovered (zone 6) approximately 183 m northeast of the original. The best assay from this showing was 1.99 ounces Au per ton, 13.39% Cu and 0.04% Co. A total of 11 diamond drill holes were drilled, mainly to test zone 6. The drilling did not find any mineralization at depth and the option was dropped. The claims had lapsed by 1960.

1979: The showing did not see any serious exploration work again until 1979. R. Rupert and L. Polumbo jointly held 11 claims covering the showing. A geological mapping and sampling program found gold, pyrite, cobalt and chalcopyrite mineralization in and near fractures.

1984: The claims again lapsed. R. Rupert staked a single claim to cover the original Glenrock showing and J. Watkins staked zone 6. R. Rupert completed a magnetometer survey on his claim, after which the claim was cancelled.

1985: J. Watkins added the original showing to a large block of claims held in Palmer and Ryan townships and completed an airborne geophysical survey over the entire block the following year.

1987: J. Watkins transferred 100% interest of his claim block to Locator Explorations Ltd. (later to become Duration Mines Ltd.). Assessment work completed included power stripping and 9 diamond drill holes. (This drill core is available for viewing at the Sault Ste. Marie Drill Core Library).

1991: Duration Mines Ltd. transferred 100% interest of the entire claim block to Noranda Exploration Company Limited. Noranda completed prospecting, an IP survey, trenching and sampling. Most of the trenching and sampling was done on a new showing called the New Glenrock showing. The best gold assay was 0.47 ounces Au per ton. Noranda currently holds the ground in good standing.

The author visited the trenching at the New Glenrock showing with G. Bennett in the summer of 1991. Two sites were examined—a trench and washed outcrop on gridline 2+00 East at 1+00 North (Figure 11.5), and a trench on gridline 4+00 East at 2+50 North.

At first glance, the washed outcrop and trench on line 2+00 East appear to have uncovered mafic volcanic rocks of little interest. The area exposed is about 55 m long (north to south) and from 2 m wide in the trench at the south end of the washed outcrop, to about 20 m wide at the widest part of the
laumontite fault gouge

Contact Fracture

Massive mafic volcanic rocks/flow breccia
Fractured mafic volcanic rocks
Diabase dike
Strongly fractured mafic volcanic rocks
Massive mafic to intermediate volcanic rocks

Figure 11.5. Sketch of Glenrock showing, Noranda stripping.

washed outcrop. Three distinct units were observed in the outcrop, with contacts striking at about 090° and dipping 65° to 75° south.

The most northerly flow is a moderately fractured mafic volcanic rock with flow breccia evident at the north end of the exposure. The breccia matrix is chlorite with minor pyrite occurring as blebs and as medium-grained subhedral to anhedral crystals.

The central unit is medium- to coarse-grained and massive, with moderate pervasive chlorite alteration. It is moderately fractured with local zones of more intense fracturing. The contacts with the north and south units are sheared. A 1 m wide zone of intense fracturing was observed at the south contact. This fracture zone is hematized along fracture slips and has local concentrations of 3 to 5% pyrite.

About 5 m along strike to the east of this unit, a trench exposed mafic volcanic rocks that appear to be pillowed. Fracturing made conclusive identification of pillow selvages difficult.

Pods of sulphides, less than 10 cm in size, occur within this unit. These pods are composed of pyrite and very minor chalcopyrite.

The south unit is a fine- to medium-grained, massive, weakly fractured mafic to intermediate volcanic rock. A faint, east-trending lineation was observed.
A narrow, fine-grained, weakly fractured diabase dike (275/60) transects the south contact of the middle unit. This dike marks the northern extent of the hematized fracture zone mentioned above.

The strongest fracture set observed has a strike of 090° and a dip of 80°S. Other fracture attitudes are: 220/40; strike 285° and near vertical dip; and 360/90. The last fracture transects all other fractures and is the only fracture that transects the diabase dike.

A narrow fault (140/85) cuts through the centre part of the washed area and transects the north contact of the central unit. This fault is up to 5 cm wide, with chlorite-altered gouge and a continuous 1 cm wide vein of laumontite. (Laumontite is a zeolite mineral, common in fractures and faults in Archean rocks near the west end of the Batchawana greenstone belt and in the Keweenawan rocks along the Lake Superior shore.) There may be some displacement of the northern contact of the central unit by this fault, but fracturing and overburden mask the contact along strike to the east. Apparent pillow selvages east of the central unit and the massive appearance of the central unit itself could indicate that movement has displaced the lateral extensions of these units.

Sampling by Noranda was evident by a 12 m channel cut with a rock saw along a north-south line near the western edge of the washed outcrop. The best assay result was 0.36 ounces Au per ton over about 1.5 m taken from the fracture zone at the south contact of the central unit. (Sault Ste. Marie Mining Recorder's files).

The trench examined on line 4+00 East has an approximate northern orientation, is about 125 m long and about 2.5 m wide. The north half of the trench was mostly covered at the time of the visit. The central part of the trench exposes a fractured mafic volcanic rock. One mineralized zone within strongly fractured flowtop breccia has some pyrite mineralization over about 0.6 m. A sample taken by Noranda from this zone returned 0.075 ounces Au per ton (Sault Ste. Marie Mining Recorder's files). The flow breccia unit grades into a weakly fractured, massive, mafic volcanic rock to the south. A 25 m wide diabase-gabbro intrusive is exposed in most of the southern part of the trench. At the extreme south is an amygdaloidal mafic flow that Noranda has mapped as being pillowed. (Sault Ste. Marie Mining Recorder's files).

The main fracture set strikes 090° with a vertical dip. The second most prevalent strike is 040° with a vertical dip. Three other trenches were stripped by Noranda, but were not visited by the author. Little assaying was done in these trenches and values returned from those taken were less than 0.001 ounce Au per ton (Sault Ste. Marie Mining Recorder's files).

Future work recommended by Noranda is diamond drilling to test the mineralization at depth below the stripped areas (Sault Ste. Marie Mining Recorder's files).

An Occurrence of Domeykite North of Sault Ste. Marie

Several years ago, E.J. Leahy of the Sault Ste. Marie Resident Geologist's office noted the presence of an unusual metallic mineral in a Keweenawan-age felsic intrusion exposed in a roadcut on Highway 17, about 50 km north of Sault Ste. Marie (UTM Zone 16, 669600E 5204600N) Montreal Mining Location. These pink to brick-red, syenitic to rhyolitic Keweenawan minor intrusions are referred to by local prospectors and geologists as "felsite". Analyses by the Geoscience Laboratories of the OGS showed that the mineral was domeykite (Cu3As). To the writers' knowledge, this is the only known occurrence of domeykite on the east shore of Lake Superior, although it has been reported in some copper mines of the Keweenaw copper district of Michigan and on Michipicoten Island (Dana and Ford 1932).

Domeykite is metallic, steel-grey on fresh surfaces, but readily tarnishes to a dull grey, pinkish-grey. Malachite is a common associate. An analysis of domeykite-bearing felsite collected by G. Bennett in August 1992, was analyzed by the Temiskaming Testing Laboratory and found to contain 2.8% Cu and 1.8% As. This Cu-As ratio of 1.6 contrasts with the theoretical Cu-As ratio of 2.5 for pure domeykite. The difference may be due to the presence of other arsenide minerals in the sample.

During the summer of 1991, highway construction exposed a greater part of the domeykite occurrence, so it was decided to examine the occurrence more closely.

GEOLOGICAL SETTING

The domeykite mineralization is restricted to a sill-like, or obliquely cross-cutting body of predominantly pink to red, fine-grained rock of rhyolitic composition which intrudes fractured, dark green to dark purplish-grey, amygdaloidal, olivine tholeiite flows of Keweenawan age. Annells (1973) gives the following partial analysis of the massive portion of the felsite: 78.0% SiO₂, 0.1% MgO, 1.8% K₂O, 1.5% Na₂O.

The felsite intrusion dips from 30° to 40° to the north-west and has an overall thickness of from 10 to 15 m (Figure 11.6). The lower contact with the basalt is sharp and has an aphanitic chilled zone in the felsite of 2 to 10 cm. Amoeboid to spherical calcite-filled amygdules occur within the felsite up to a few centimetres from the underlying basalt. There is no chilled zone or decrease in grain size in the basalt adjacent to the felsite.

The lowermost 3 to 4 m of the felsite body are strongly foliated and locally deformed into tight asymmetric folds with an amplitude of about 10 cm. The presence of relatively undeformed basalt fragments in the foliated zone indicates that the foliation is a flow layering which developed prior to final solidification of the sill. The deformed zones of the felsite locally have yellowish to grey reduced and kaolinized patches. Much of this lower part of the felsite is intrusion breccia consisting of abundant fragments of felsite and basalt...
in varying stages of alteration. Narrow veins of white calcite and some pink laumontite cut both the felsite and the underlying basalt.

The central part of the intrusion consists of massive felsite with blocky jointing. A few isolated patches of domeykite were noted in this area as well. Near its upper contact with the basalt, the felsite is strongly foliated, sheared and crowded with altered basalt fragments. Some domeykite was also found within this sheared area.

**MINERALIZATION**

Domeykite occurs as green to grey or pinkish grey weathering patches up to 6 cm across. In places, the copper arsenide is crudely lens-like, but the base of the sill, amoeboid areas of domeykite about 1.0 cm across may be amygdule fillings. Locally, tabular bodies of domeykite, 1 to 2 cm wide and about 20 cm long, follow the foliation of the felsite for about 10 cm, then bend to cross the foliation almost at right angles.

Domeykite appears to be best developed in the lower and central parts of the intrusion although small amounts were noted throughout. It is well developed in foliated zones and was not observed in the basalts stratigraphically above or below the felsite. No other sulphides or copper mineral, other than weathering products, were noted in the felsite.

The restriction of the copper arsenide mineralization to the felsic intrusion and especially to the zones of flow layering, suggests that the mineralization may be genetically related to the felsic magma, perhaps concentrated in late-stage magmatic fluids migrating along zones of shearing and deformation during the last stages of crystallization of the magma.

**The Artistan (Alur) Molybdenite Prospect**

In September of 1992, G. Bennett, and co-op student C. Davieaux, spent 2 days examining the geological setting of the Artistan molybdenite prospect (also known as the Alur, Marboy or Critchton–Rivers deposit). Preliminary geological mapping of an area about 150 by 120 m was done using flagged lines for control.

The Artistan occurrence (MDI number A 0259) is located near the Goulais River in Gaudette Township about 40 km northeast of Sault Ste. Marie. The UTM grid location is Zone 17, 271661E 5188597N. The property can be reached via a short trail from the Whitman Dam road which joins Highway 532 at the community of Searchmont.

**PREVIOUS WORK**

Although records are incomplete, the Artistan prospect seems to have had a long and colourful history. The earliest record of work on the occurrence is a copy of a crude geological map, dated 1935, from the files of Algoma Ore Properties (Algoma Steel Corp). The map identifies the property as that of Selby–Kutchie–Powell claims and shows the approximate location of four molybdenite occurrences (assessment files, Sault Ste. Marie Resident Geologist's office, Gaudette 0015–B1, Alur Mines.)

In 1961, Marboy Mines Limited carried out an SP (self-potential) survey and completed 2 diamond drill holes. The property is also known as the Idziac–Meyer property and assessment files in the Sault Ste. Marie Resident Geologist’s office indicate 6 short holes were drilled totalling 537.8 feet. It is not clear if these include the Marboy holes or if this is an
Earlier drilling program. Four individual molybdenite occurrences are reported on the property. A chip sample over 2.5 feet returned 0.74% MoS₂ and a grab sample gave 1.46% MoS₂. The locations of the samples are not given (assessment files, Sault Ste. Marie Resident Geologist's office, Gaudette 0015–C1, Idziac, B., Meyer, G.).


**GENERAL GEOLOGY**

The area is within the Algoma Gneiss Terrain of the Superior Province of the Canadian Shield (Card 1979).

Within the relatively small area examined, 4 distinct rock types were recognized. These will be referred to as paragneiss, amphibolite, gneissic tonalite and diabase (Figure 11.7).

The paragneiss is a fine- to medium-grained gneissic to schistose rock, with a distinct pale grey to dark grey layering on freshly broken surfaces. The dark, biotite-rich gneissic layers, from about 1.0 mm to 10 cm thick, are subordinate to the pale quartz-feldspar-rich layers. Fine-grained anhedral to cubic grains of pyrite are common in the fine-grained grey gneiss. Locally, pyrite is concentrated as up to 10% disseminated pyrite. The sedimentary origin of the rock is inferred from its relatively fine grain size.

Dark green to black foliated amphibolites in the northern part of the mapped area (see Figure 11.7) represent metamorphosed mafic volcanic rocks or mafic intrusions in the Archean sedimentary assemblage.

A diabase body occurs at the northwest end of the area (see Figure 11.7). An apophysis of the body extends across the property as a northeast dipping dike or sill. The diabase is a medium-grained dark grey-green rock which is not notably magnetic. It is clearly younger than the high grade metamorphic events. Its general appearance and form is similar to the Nipissing diabase common in the Huronian rocks along the North Shore of Lake Huron.

A pale grey, medium- to coarse-grained rock with indistinct to distinct gneissic texture was tentatively classified as gneissic tonalite. The gneissic tonalite intrudes the paragneiss and is easily distinguished from the latter by its notably coarser grain size, paler colour and apparent lack of sulphides.

**CARBONATE ALTERATION**

Medium-grained brownish weathering, massive to foliated carbonate-rich rocks occur in the northeast-trending trench (see Figure 11.7). Carbonatization is particularly prominent near the southern end of the trench and appears to have affected both the Archean rocks and the diabase.

The rock is 30 to 80% ferruginous carbonate with grains of fine quartz dispersed throughout. The size and distribution of the quartz suggests some of the carbonate rocks were originally fine-grained gneisses.

**MINERALIZATION**

Four separate occurrences of molybdenite on the prospect were noted, though it is not certain that these are the 4 occurrences mentioned in earlier reports.

At occurrence (1) on the accompanying map (see Figure 11.7), coarse flakes of molybdenite are present in seams generally along the edges of 3 parallel, milky white to rusty weathering quartz veins from 14 to 30 cm wide. The veins cut grey paragneiss and tonalite gneiss and strike 130° and dip 45° to the northeast. The zone of veins and gneiss has an overall thickness of approximately 1.5 m. Molybdenite is also present as coarse flakes with pyrite in paragneiss adjacent to the vein. A diabase body is emplaced in the Archean rocks just north of the molybdenite-bearing vein. This intrusion, which is about 15 m across at the vein, appears to truncate the westward extension of the quartz vein.

Molybdenite at occurrence (2) also occurs as disseminated flakes in rusty weathering, pyritic paragneiss about 50 m east-southeast of the above occurrence. This zone is not well exposed, but the width of the molybdenite-bearing zone appears to be less than 1.0 m.

About 15 m east of the molybdenite, a 3 to 5 m wide by 1 m deep trench has been dug in a southeast direction for about 10 m. A quartz vein at least 1 m thick dipping less than 45° to the east is partly exposed on the east wall of the trench. Disseminated grains of pyrite were the only sulphides seen in the immediate area of this trench. The southwest wall of the trench is pyritic paragneiss, but a very fine-grained massive, relatively unmetamorphosed rock in contact with the quartz vein on the east wall of the trench is probably the chilled eastern end of the diabase body.

Molybdenite location (3) is about 25 m west of the concrete foundation of the former mill site (see Figure 11.7). The only molybdenite found in situ was as disseminated coarse flakes in pyritic amphibolite, and as scattered grains of molybdenite in a pegmatite or feldspar-rich quartz vein exposed in a small shallow pit. A few samples from a pile of broken rock at the side of the pit are very rich in molybdenite (estimated to be up to 20% molybdenite in selected samples).

Occurrence (4) of molybdenite was found in pyritic paragneiss about 10 m east of the mill site. The molybdenite was sparse (estimated to be much less than 1% by volume) and its distribution seems to be sporadic and limited in area.
There are several piles of broken rock on this property, most of which seem to have accumulated during the activity of the 1960s and perhaps the 1970s. Although the overall grade of the piles is obviously very low, there are some impressive samples of molybdenite.

CONCLUSIONS

The preliminary nature of the investigations allows only the following conclusions:

1. the emplacement of the sulphides predates the diabase intrusion.
2. the carbonatization postdates the diabase and is the youngest event noted.

OBSERVATIONS

1. The close spatial relationship of the quartz vein and diabase suggest that the diabase intrusion produced quartz veins which included some molybdenum and sulphur from the paragneiss.
2. The association of pyrite and molybdenum with the paragneiss but not the tonalitic gneiss, suggests that the sulphides predate the tonalite and that the pyrite, at least, may have a primary sedimentary source.

Further laboratory analysis of the samples from the prospect will be carried out during the winter months. Additional field work is planned for 1993 to determine the extent of the pyritic paragneiss unit.

Doran Chalcopyrite Occurrence

Prospector F. Doran and associates D. MacDougall, J. Korab, and J. Palumbo of Sault Ste. Marie, hold 6 claims in north-central Ryan Township. In the spring of 1992, they carried out mechanical trenching, stripping and sampling of a chalcopyrite occurrence found on the east side of a timber haulage road. The occurrence is on claim SSM 1098997 (UTM Zone 16, 675710E 5213510N). Mr. Doran states that he found no evidence of previous work on the showing.

In the area of the occurrence, the country rocks are Archean mafic and felsic metavolcanics, although the
unconformably overlying Keweenawan volcanic rocks lie, at most, a few hundred metres to the west (Giblin et al. 1973).

At this occurrence, a southeast-striking mafic dike about 3 m wide, intrudes foliated, deformed, fine-grained mafic metavolcanic rocks (Figure 11.8). Within the metavolcanic rocks immediately adjacent to the south contact of the dike, is a zone 10 to 20 cm wide of shearing and quartz veining, with seams and irregular veinlets of massive chalcopyrite and some bornite and malachite. A 20 to 40 cm wide zone of coarse, crystallized, white calcite is present at a similar position along the north contact of the dike and surrounding mafic volcanic rocks. The dike throughout most of its width is altered, perhaps kaolinized, to the extent that it is easily excavated by a back-hoe.

Mr. Doran reports he obtained assays of 13 208 ppm Cu and 798 ppm Cu from 2 grab samples. Gold and silver values were low.

A dike of pale-pinkish weathering quartz-feldspar porphyry intrudes the mafic volcanic rocks, but is, in turn, intruded by the mafic dike. The porphyry has an appearance similar to Keweenawan felsic intrusive rocks which are common in the Mamainse area. The cross-cutting relationships suggest that the mineralization is of Keweenawan age.

Mr. Doran also took the writer to a location about 100 m northwest of the above occurrence where mafic volcanics are cut by narrow quartz veins carrying scattered blebs of chalcopyrite and some traces of pink cobalt staining. Two selected samples taken from this area by the writer assayed 2730 ppm Cu, 158 ppm Co, and 1204 ppm Cu, 199 ppm Co. The latter sample returned trace gold. There was no evidence of previous work at this location.

Current information suggests that although these are relatively minor copper occurrences, they appear to be new finds in an area affected by both Archean and Keweenawan metallogenic events. The area is worthy of further prospecting.

THE SAULT STE. MARIE DRILL CORE LIBRARY PROGRAM


The Drill Core Library Geologist for Sault Ste. Marie is J.R. Walmsley. Contract staff acting as Drill Core Library
The Drill Core Library staff welcomed the staff of the Resident Geologist’s office and the staff of the Mining Recorder’s office to the new addition of the Drill Core Library facility at the end of March 1992. Comments from clients so far indicate they appreciate the “one-stop shopping” concept.

A total of 9200 m of drill core was collected by library staff in 1992. This included 6450 m from the Sault Ste. Marie Resident Geologist’s District, and 2750 m from the Wawa Resident Geologist’s District.

Staff at the Sault Ste. Marie Drill Core Library organized retrieval of a significant amount of core donated by Algoma Steel Corporation, Ltd. The donated drill core is from properties across northwestern Ontario, properties north of Sault Ste. Marie and properties around Wawa. Algoma Steel explored most of these properties for iron ore and usually assayed for iron only. Many of the properties cover iron formations within greenstone belts and may be excellent gold exploration targets. Most of these properties were put up for sale by Algoma Steel late in 1992 (The Northern Miner, November 1992).

Staff of both the Sault Ste. Marie and Thunder Bay Drill Core Libraries have retrieved the Algoma Steel core for their districts. Due to budget restraints, the Kenora library has had to defer retrieval of core from its district until sometime in the near future. The 7600 m of core that was retrieved for the Sault Ste. Marie library is a representative selection of the core that was available (Table 11.3). The core that was not selected remains at Algoma Steel’s compound in Sault Ste. Marie and can be viewed by making arrangements with Algoma Steel.

Some of the pulps from the assayed sections of the Algoma Steel drill core were also retrieved. The rest of the pulps await storage space at the library. Most of the core collected by the library is awaiting processing and storage space before it will be available for viewing.

Great Lakes Power donated drill core from 36 short holes from the Magpie River Development Project (see Table 11.3). These holes were collected for a stratigraphic reference of the area around the new dams in Lendrum and Chabanel townships near Wawa.

W. Richards and J. Haugeneder donated core from 2 holes from the Copper Creek showing in Kincaid Township (see “Copper Creek Showing” in Bennett et al. 1992). The core was logged and sampled at the Drill Core Library. Along with copper mineralization, assaying returned low but continuous gold values. The known strike length of the mineralized zone is about 350 m; the zone remains open at both ends.

M. Hailstone of the Elliot Lake geology office was able to secure a number of uranium ore intersections from past producing mines operated by Rio Algom, before site reclamation levelled the drill core shack. He was also able to obtain a type section of the ore zone at the Denison Mine.

Site preparation for the outdoor storage compound for the Sault Ste. Marie Drill Core Library has begun. The first phase involved clearing a site and laying a base of crushed gravel. Currently, the Drill Core Library stores drill core outdoors at 2 temporary sites supplied by the Ministry of Natural Resources. While the offsite storage is being prepared, this core is temporarily unavailable for viewing.

Visitors to the Drill Core Library totalled 168 as of November 30, 1992. This is up sharply from the previous year and can be attributed mainly to the addition of the Resident Geologist’s office to the Drill Core Library facility.

Most of the visits were from geologists working on grassroots projects who looked at core related to areas or geologic settings rather than specific properties. One geologist from the Indiana State government spent several days viewing core containing sediments of the Huronian Supergroup for the National Aeronautics and Space Administration (NASA). His project is to relate rhythmic sedimentation in finely laminated rocks (such as the argillites of the Gowganda Formation) with lunar cycles in order to determine if there has been any variance in lunar cycles over the Earth’s history. An economic side benefit could be a better understanding of basin sedimentation that may help in finding regimes of low-sulphur coal deposits (Dr. Fraser, Indiana State Government, personal communication, 1992).

Involvement of Drill Core Library staff in projects not directly related to drill core included: organization and participation in the presentation of 2 prospecting courses which included a one-day field trip; assistance to the Economic Development Council representing the municipalities of Beardmore, Geraldton, Long Lac and Nakina, by slabbing and polishing over 30 rock samples for promotion of the areas for building stone prospects; assisting the Mining Recorder’s office with claims inspections; assisting with property visits and client services in the Resident Geologist’s office; and participation in a local mall display and open house set up for Mining Awareness Week.

Those wishing to view drill core should notify the Sault Ste. Marie Drill Core Library in advance to ensure that complete service can be provided. This is of particular importance during the first half of 1993 due to the inaccessibility of core stored at our temporary offsite storage locations. Anyone wishing to donate drill core or requiring a copy of the inventory catalogue should contact the drill core library. Please take note that the new mailing address is 60 Church Street, Sault Ste. Marie, Ontario, P6A 3H3, and the new telephone number is (705) 945-6931.

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<th>Total Length</th>
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<td>Rio Algom</td>
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</table>

SUGGESTIONS FOR PROSPECTORS

The Batchawana greenstone belt remains a prime area for mineral exploration in the Sault Ste. Marie Resident Geologist's District. The western part of the belt, including Wishart, Palmer and Ryan townships, saw the discovery of previously unrecorded gold occurrences about 5 years ago and has the potential for further discoveries. The eastern part of the Batchawana belt, running southeastward through Lunkie Township has potential for base metals.

The presence of distinctive Keweenawan-age diabase, felsite and porphyry dikes indicates that the eastern shore of Lake Superior has seen the effects of Keweenawan-age igneous and hydrothermal activity well beyond the present distribution of Keweenawan volcanic rocks. Those areas within 30 km of the east shore of Lake Superior, including those underlain by granitic rocks, have potential for copper, molybdenite and tungsten-bearing breccia deposits.

The small Archean greenstone belt in Deroche Township has been little explored north of the Goulais River. The portion of this belt south of the river has for a long time been actively explored for gold, lead-silver veins and base metals.

Although shown on compilation maps as being underlain by granitic rocks, the area of Shields and Gaudette townships is known to contain significant areas of Archean greenstone (assessment files, Sault Ste. Marie office). The Archean molybdenite occurrence, described in this report, occurs in one such greenstone enclave. The area is worthy of further prospecting for gold and molybdenum as well as other base metals.

The recent discoveries of microdiamond-bearing kimberlites in Ontario and the Northwest Territories has prompted some local prospectors to express an interest in exploring for kimberlites in the Sault Ste. Marie district.

The recently discovered kimberlites in the Larder Lake area are known to be younger than at least some of the Paleozoic rocks in that same area (R.A. MacGregor, Consulting Geologist, personal communication, 1992). The presence of Paleozoic rocks near the north shore of Lake Huron suggests that the Huronian and Archean rocks of this area have not been deeply buried since the Ordovician. Therefore, the relatively shallow structures of kimberlite pipes (if they ever existed in the area) may not have been completely removed by erosion.

Since kimberlites are rare rocks (or at least rarely identified by most geologists and prospectors), prospectors and geologists wishing to explore for kimberlites may take advantage of the text and research articles on file in the library at the Sault Ste. Marie Resident Geologist's office. Several examples of African and North American kimberlites are also available for examination.

We would like to stress again the importance of thorough research of the assessment files and other sources of information prior to incurring significant expenditures of money, time and energy in the field. Over the years, the drill core libraries have accumulated a very valuable rock record which is available to all explorationists. A careful, co-ordinated examination of the Drill Core Library catalogue, assessment files and selected sections of drill core, should make a useful and relatively inexpensive way to start an exploration project.
The Huronian Supergroup of the Sault Ste. Marie district contains many colourful quartzites, conglomerates and siltstones which may be marketable as crushed stone or decorative stone. There is still a strong demand for uniformly white quartzite.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

Preliminary reports of the following projects can be found in *Summary of Field Work and Other Activities 1992* (Ontario Geological Survey, Miscellaneous Paper 160).

In June 1992, S.L. Jackson, of the Precambrian Geoscience Section, Ontario Geological Survey–Geoscience Branch, began what we hope will be a multi-year, integrated study of the stratigraphic and structural features of the Huronian Supergroup of the north shore of Lake Huron. This first year was concerned mainly with the regional structure, stratigraphy and alteration of the Huronian rocks in the Aberdeen area. Geological mapping was carried out mainly in the areas of Aberdeen and Johnson townships (Jackson and Henderson 1992).

M. Rogers, of the Ontario Geological Survey–Geoscience Branch, continued geological mapping in the Ompa Lake greenstone belt in Hembruff, Rainibault and Hughson townships north of Elliot Lake. About 115 km² were mapped at a scale of 1:5 840 (Rogers 1992).

F.J. Kristjansson and R.I. Kelly began the pre-field work phase of an aggregate resources inventory along Highway 17 between the towns of Blind River and Bruce Mines. The purpose of the study is to provide an inventory and evaluation of sand, gravel and bedrock resources within the study area (Kristjansson and Kelly 1992).

M. Byron continued a lithogeochemical study of the Archean rocks of the Whiskey Lake greenstone belt, begun in 1990. During the 1992 field season, 4 individual areas within the belt were mapped in detail (Byron and Whitehead 1992).

RESEARCH BY OTHER AGENCIES

M. Manson of Erindale College, University of Toronto, has completed the second year of a study of Keweenawan and post-Keweenawan tectonic activity along the east shore of Lake Superior. Mr. Manson, who continued a gravity survey begun in 1991, is working with Dr. H. Halls of Erindale College.

SELECTED PUBLICATIONS RECEIVED


REFERENCES


INTRODUCTION

In 1992, there were 11 active mining operations in the Timmins Resident Geologist's District: 2 underground base metal mines, 6 underground gold operations, 2 open pit gold mines and 1 open pit industrial mineral producer. There was 1 advanced underground gold development project and 2 surface industrial mineral development and evaluation projects (Figures 12.1 and 12.2).

Operations at the Redstone Mine of Timmins Nickel Incorporated in Eldorado Township were suspended in mid-1992. Low metal prices continued to place stress on the remaining producing mines.

Exploration companies based in the area suffered reduced budgets resulting in staffing cuts, office closures and announced closures.

Prospectors and exploration companies working in the area continued to use funding provided by the Ontario Prospector's Assistance Program (OPAP) and the Ontario Mineral Incentives Program (OMIP)(Table 12.1).

Five geological programs sponsored by the Canada-Ontario Northern Ontario Development Agreement (NODA) took place in the Timmins Resident Geologist's District.

CLAIM STAKING ACTIVITY

Claims Recorded in the Timmins Resident Geologist's District—1992

There are currently 28,079 active claims (16-hectare units) in the Porcupine Mining Division. From January to December 1992, 9,405 claims (16-hectare units) were recorded. This represents a surprising 100% increase over the number of claims recorded during that same period in 1991 (Table 12.2).

The increase in claims recorded is a direct result of 2 major staking "rushes". From August to October, KWG Holdings-Blue Falcon Mines Limited recorded 3,734 claims as part of a diamond exploration program in the Attawapiskat River area. An additional 2,364 claims were staked in an 8 township area adjacent to the Noront Resources base metal project in Hurdman Township.

Other staking activity included 1,804 claims recorded on gold and base metal prospects within a 50 km radius of Timmins and 900 claims recorded on gold and base metal prospects in the Swayze greenstone belt.

MINING ACTIVITY

For a complete summary of production totals for the Timmins Resident Geologist's District, please refer to Tables 12.3, 12.4 and 12.5.

Base Metals

FALCONBRIDGE LIMITED, KIDD CREEK MINE

Production from the Kidd Creek Mine in Kidd Township in 1991 was 3,577,946 million t at a grade of 3.189% Cu, 5.03% Zn, 0.09% Pb and 42 g/t Ag. There was a slight shortfall from the budgeted tonnage of 3.7 million t due to ground and blasting problems at the mine. Production has been decreasing in the last few years resulting in an excess capacity at the company's metallurgical site in Hoyle Township. Falconbridge has therefore been increasing its custom feed business processing copper and zinc concentrates from other companies (Falconbridge Limited, personal communication, 1992).

Approximately 70% of the production came from the No. 1 Mine, the bottom level of which is 2,500 feet below surface. The No. 2 Mine produced 26% with its bottom level at 4,600 feet below surface, and the new No. 3 area produced the remaining 4%. In late 1991, the new, internal No. 3 shaft was completed to 6,922 feet below surface. At the end of 1992, the bottom stoping area was at 5,100 feet below surface. A stope is planned to be in production on the 6,000-foot level in 1993. An internal ramp from surface is now down to the 6,100-foot level where a crusher will be installed.

One hundred feet of an exploration drilling drift was started on the 6,100 level in late 1992. Six hundred feet of drifting remains to be completed before underground exploratory diamond drilling commences in 1993. The purpose of the underground exploration program is to define the extension of known ore below 6,000 feet. It has been established that the tons per vertical foot within the mine decrease with depth. However, underground exploration will also continue in an attempt to find another mineralized system in the favourable package of rhyolitic rocks.
Figure 12.1a. Timmins Resident Geologist's District (northwest portion), no activity.
EXPLANATION

Township/Area in which claims staked, 1992 (more than 100 16-ha units)

* Exploration Activity, 1992 (keyed to Table 12.6)

District Boundary

Figure 12.1b. Timmins Resident Geologist's District (north-central portion).
EXPLANATION

+ Township/Area in which claims staked, 1992 (less than 100 16-ha units)

⊕ Township where 1992 OMIP funded project in progress

■ District Boundary

Figure 12.1c. Timmins Resident Geologist’s District (west-central portion).
EXPLANATION

▲ Township/Area for which exploration data received, 1992
+ Township/Area in which claims staked, 1992 (less than 100 16-ha units)
⊕ Township/Area in which claims staked, 1992 (more than 100 16-ha units)
※ Exploration activity, 1992 (keyed to Table 12.6)
⊗ Township where 1992 OPAP funded project in progress
⊕+ Township where 1992 OMIP funded project in progress
● Producing mine, 1992 (keyed to Legend for Figure 12.2)
○ Advanced exploration project, 1992 (keyed to Legend for Figure 12.2)

Figure 12.1d. Timmins Resident Geologist's District (east-central portion).
EXPLANATION

- Township/Area for which exploration data received, 1992
+ Township/Area in which claims staked, 1992 (less than 100 16-ha units)
++ Township/Area in which claims staked, 1992 (more than 100 16-units)
* Exploration activity, 1992 (keyed to Table 12.6)
** Township where 1992 OPAP funded project
*** Township where 1992 OMIP funded project

District Boundary

Figure 12.1e. Timmins Resident Geologist's District (south portion).
EXPLANATION

* Exploration activity, 1992 (keyed to Table 12.6)

◆ Property examinations, 1992 (keyed to Table 12.6)

8 Producing Mine, 1992
1. Falconbridge Gold Corp., Hoyle Pond Mine .............................................................. Au
2. Falconbridge Limited, Kidd Creek Mine .............................................................. Cu, Zn, Ag, Pb, Cd, Sn, In
3. Luzenac Incorporated, Penhorwood Mine .............................................................. talc
4. Placer Dome Inc., Detour Lake Mine .............................................................. Au
5. Placer Dome Inc., Dome Mine .............................................................. Au
6. Royal Oak Mines Inc., Timmins Operations .............................................................. Au
7. St. Andrew Goldfields Ltd. .............................................................. Au
8. Timmins Nickel Inc., Redstone Mine .............................................................. Ni

Advanced Exploration and Development Project, 1992
10. Great Lakes Kaolin Inc. .............................................................. kaolin
11. Great White Minerals Limited .............................................................. Se

Figure 12.2. Exploration activity, property examinations, producing mines, and advanced exploration and development projects in the Timmins Resident Geologist’s District, 1992.

<table>
<thead>
<tr>
<th>Year</th>
<th>OPAP Programs</th>
<th>Total $ Awarded</th>
<th>OMIP Programs</th>
<th>Total $ Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>75</td>
<td>706 000</td>
<td>20</td>
<td>2 627 197</td>
</tr>
<tr>
<td>1991</td>
<td>57</td>
<td>558 542</td>
<td>35</td>
<td>2 484 604</td>
</tr>
<tr>
<td>1990</td>
<td>65</td>
<td>622 909</td>
<td>14</td>
<td>595 836</td>
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</table>

Table 12.2. Summary of claims recorded and assessment work credit for 1992 in the Timmins Resident Geologist’s Office.

<table>
<thead>
<tr>
<th>Year</th>
<th>Claims Recorded</th>
<th>Claims Cancelled</th>
<th>Claims Active</th>
<th>Diamond Drilling</th>
<th>Geophysical Surveys</th>
<th>Geological Surveys</th>
<th>Total Work Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>10 474</td>
<td>2248</td>
<td>28 987</td>
<td>$807 799</td>
<td>$756 454</td>
<td>$395 934</td>
<td>$2 323 218</td>
</tr>
<tr>
<td>1991*</td>
<td>4682</td>
<td>4367</td>
<td>19 879</td>
<td>62 409</td>
<td>199 836</td>
<td>8140</td>
<td>279 806</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$624 764</td>
<td>$104 667</td>
<td>$76 540</td>
<td>$1 067 217</td>
</tr>
<tr>
<td>1990</td>
<td>4864</td>
<td>10 431</td>
<td>19 472</td>
<td>130 847</td>
<td>112 881</td>
<td>20 638</td>
<td>313 085</td>
</tr>
<tr>
<td>1989</td>
<td>4724</td>
<td>12 347</td>
<td>24 715</td>
<td>172 600</td>
<td>218 347</td>
<td>46 227</td>
<td>522 490</td>
</tr>
<tr>
<td>1988</td>
<td>5867</td>
<td>6117</td>
<td>34 553</td>
<td>119 758</td>
<td>325 685</td>
<td>17 260</td>
<td>532 820</td>
</tr>
<tr>
<td>1987</td>
<td>8934</td>
<td>4402</td>
<td>34 474</td>
<td>120 384</td>
<td>612 631</td>
<td>32 001</td>
<td>807 277</td>
</tr>
<tr>
<td>1986</td>
<td>17 889</td>
<td>8689</td>
<td>33 181</td>
<td>129 932</td>
<td>481 547</td>
<td>26 266</td>
<td>717 522</td>
</tr>
<tr>
<td>1985</td>
<td>6052</td>
<td>10 024</td>
<td>23 207</td>
<td>131 330</td>
<td>278 881</td>
<td>34 032</td>
<td>503 338</td>
</tr>
<tr>
<td>1984</td>
<td>7633</td>
<td>11 040</td>
<td>27 179</td>
<td>140 864</td>
<td>495 323</td>
<td>51 723</td>
<td>738 038</td>
</tr>
<tr>
<td>1983</td>
<td>11 859</td>
<td>4967</td>
<td>30 586</td>
<td>128 126</td>
<td>199 892</td>
<td>44 755</td>
<td>407 161</td>
</tr>
<tr>
<td>1982</td>
<td>5420</td>
<td>6457</td>
<td>23 694</td>
<td>91 203</td>
<td>359 970</td>
<td>36 178</td>
<td>596 097</td>
</tr>
<tr>
<td>1981</td>
<td>8934</td>
<td>2934</td>
<td>24 731</td>
<td>114 823</td>
<td>261 301</td>
<td>23 177</td>
<td>471 827</td>
</tr>
<tr>
<td>1980</td>
<td>10 742</td>
<td>1778</td>
<td>18 753</td>
<td>59 993</td>
<td>212 208</td>
<td>5246</td>
<td>296 852</td>
</tr>
<tr>
<td>1979</td>
<td>3975</td>
<td>2504</td>
<td>9597</td>
<td>40 850</td>
<td>59 605</td>
<td>5480</td>
<td>151 003</td>
</tr>
<tr>
<td>1978</td>
<td>3623</td>
<td>4429</td>
<td>8126</td>
<td>38 056</td>
<td>47 333</td>
<td>1880</td>
<td>94 045</td>
</tr>
<tr>
<td>1977</td>
<td>2438</td>
<td>4336</td>
<td>8932</td>
<td>77 496</td>
<td>135 134</td>
<td>3755</td>
<td>228 090</td>
</tr>
<tr>
<td>1976</td>
<td>5837</td>
<td>3621</td>
<td>10 830</td>
<td>25 819</td>
<td>43 920</td>
<td>2140</td>
<td>97 258</td>
</tr>
<tr>
<td>1975</td>
<td>4162</td>
<td>4142</td>
<td>8614</td>
<td>83 388</td>
<td>108 420</td>
<td>1300</td>
<td>200 034</td>
</tr>
<tr>
<td>1970</td>
<td>3903</td>
<td>3916</td>
<td>(8600)</td>
<td>96 946</td>
<td>59 013</td>
<td>5560</td>
<td>167 465</td>
</tr>
<tr>
<td>1965</td>
<td>47 900</td>
<td>9922</td>
<td>(19 000)</td>
<td>242 869</td>
<td>224 959</td>
<td>(6500)</td>
<td>486 246</td>
</tr>
<tr>
<td>1960</td>
<td>1321</td>
<td>2296</td>
<td>(4750)</td>
<td>(21 000)</td>
<td>(9000)</td>
<td>(1400)</td>
<td>(39 000)</td>
</tr>
<tr>
<td>1955</td>
<td>1793</td>
<td>757</td>
<td>(5250)</td>
<td>(4000)</td>
<td>(3000)</td>
<td>(1500)</td>
<td>(10 000)</td>
</tr>
</tbody>
</table>

Unless indicated otherwise ($), the assessment work credit is given in “man days”. Parentheses indicate approximate figures.

Note: Due to regulation changes implemented by the new Mining Act, as of June 1991, total assessment work values shown in this table are reported in “man days” for January to June, 1991, and in dollar value of expenditures for July to December, 1991.
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Total proven and probable reserves</td>
</tr>
<tr>
<td>2</td>
<td>Milled in Sudbury</td>
</tr>
<tr>
<td>#</td>
<td>Approximate figure only</td>
</tr>
<tr>
<td>T</td>
<td>Imperial ton</td>
</tr>
<tr>
<td>t</td>
<td>Metric tonne</td>
</tr>
<tr>
<td>L</td>
<td>Lateral mine development</td>
</tr>
<tr>
<td>V</td>
<td>Vertical mine development</td>
</tr>
<tr>
<td>R</td>
<td>Ramp development</td>
</tr>
<tr>
<td>S</td>
<td>Surface diamond drilling</td>
</tr>
<tr>
<td>U</td>
<td>Underground diamond drilling</td>
</tr>
<tr>
<td>opT</td>
<td>Ounces per ton</td>
</tr>
<tr>
<td>gA</td>
<td>Grams per ton</td>
</tr>
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</table>

### Table 12.3: Production statistics for 1992 for active mining operations in the Timmins Resident Geologist’s District

<table>
<thead>
<tr>
<th>Company/Property (No. employed)</th>
<th>Production</th>
<th>Grade</th>
<th>Tons Milled</th>
<th>Recovery</th>
<th>No. of Stopes</th>
<th>Mine Dev.</th>
<th>Drilling</th>
<th>Reserves (yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falconbridge Limited</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kidd Creek Mine (1946)</td>
<td>138 251 t Zn</td>
<td>5.03% Zn</td>
<td>3 577 946 (ore mined)</td>
<td>30</td>
<td>7332 m L</td>
<td>15 518 m S</td>
<td>37 168 577 t @ 5.06% Zn, 3.18% Cu, 0.14% Pb, (Jan/92)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>94 672 t Cu</td>
<td>3.18% Cu</td>
<td>2 577 946</td>
<td>30</td>
<td>3589 m V</td>
<td>23 092 m U</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timmins Nickel Inc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Redstone Mine (N/A)</td>
<td>1 360 000 lbs#</td>
<td>2.5% Ni</td>
<td>34 000 T#</td>
<td>80%</td>
<td>6</td>
<td>2000 ft L#</td>
<td>30 000 ft S#</td>
<td>40 000 T @ 2.6% Ni (Dec/92)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+2.1% Ni</td>
<td>4000 T#</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Falconbridge Gold Corp. (Au)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hoyle Pond Mine (132)</td>
<td>58 864 oz</td>
<td>18.15 g/t</td>
<td>109 265 t</td>
<td>96.35%</td>
<td>14</td>
<td>218 m L</td>
<td>3220 m S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>144 m V</td>
<td>3275 m U</td>
<td></td>
</tr>
<tr>
<td>Bell Creek Mine (Au) (N/A)</td>
<td>1065 oz</td>
<td>7.66 g/t</td>
<td>4527 t</td>
<td>96.35%</td>
<td>2</td>
<td>260 m L</td>
<td>2400 m U</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>260 m V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Placer Dome Inc. (Au)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detour Lake Mine (254)</td>
<td>4 076 500 g</td>
<td>4.94 g/t</td>
<td>873 235 t</td>
<td>94.5%</td>
<td>9</td>
<td>8095 m L</td>
<td>24 265 m U</td>
<td>5 890 000 t @ 5.4 g/t Au (Jan/92)</td>
</tr>
<tr>
<td></td>
<td>(131 000 oz)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dome Mine (Au) (350)</td>
<td>172 997 oz</td>
<td>2.295 opT</td>
<td>1 507 800 T</td>
<td>95.21%</td>
<td>40#</td>
<td>12 960 ft L</td>
<td>3154 ft V</td>
<td>9 337 449 T @ 0.137 opT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3154 ft V</td>
<td>74 310 ft U</td>
<td></td>
</tr>
<tr>
<td>Royal Oak Mines Inc. (Au)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timmins Operations (323)</td>
<td>98 161 oz</td>
<td>0.089 opT</td>
<td>1 224 797 T</td>
<td>90.05%</td>
<td>43</td>
<td>19 655 ft L</td>
<td>14 240 ft S</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6886 ft V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Andrew Goldfields Limited (Au)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stock Mine (110)</td>
<td>36 250 oz</td>
<td>0.198 opT</td>
<td>191 152 T</td>
<td>96%</td>
<td>8</td>
<td>4521 ft L</td>
<td>20 767 ft U</td>
<td>595 365 T @ 0.193 opT (Aug/92)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>985 ft V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luzenac Incorporated (talc)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penhorwood Mine (45)</td>
<td>30 000 T</td>
<td>24%</td>
<td>125 000 T</td>
<td>—</td>
<td>open pit</td>
<td>none</td>
<td>none</td>
<td>1 250 000 T</td>
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</table>
Table 12.4. Base metal production to the end of 1992 in the Timmins Resident Geologist’s District.

<table>
<thead>
<tr>
<th>Mine</th>
<th>Township</th>
<th>Dates</th>
<th>Ore Milled</th>
<th>Grades</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alexo</td>
<td>Dundonald</td>
<td>1912-19</td>
<td>51 857 tons</td>
<td>4.5% Ni, 0.5% Cu</td>
<td>Coad 1979; Shklanka 1969</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1943-44</td>
<td>4923 tons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cdn Jamieson</td>
<td>Godfrey</td>
<td>1966-71</td>
<td>816 173 tons</td>
<td>2.44% Cu, 4.22% Zn</td>
<td>Canadian Mines Handbook 1972-73</td>
</tr>
<tr>
<td>Jamieson</td>
<td>Jamieson</td>
<td>1969-72</td>
<td>509 356 tons</td>
<td>0.99% Cu, 0.88% Zn</td>
<td>Canadian Mines Handbook 1974-75</td>
</tr>
<tr>
<td>Kam Kotia</td>
<td>Robb</td>
<td>1943-44,</td>
<td>6.6 Mtons</td>
<td>1.1% Cu, 1.17% Zn, 0.10 oz/T Ag</td>
<td>Jensen and MacRae 1986</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1961-72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kidd Creek</td>
<td>Kidd</td>
<td>1966-</td>
<td>97.5 Mtonnes</td>
<td>2.31% Cu, 7.04% Zn, 0.29% Pb, 96g/t Ag</td>
<td>Falconbridge Ltd., pers. comm. 1993</td>
</tr>
<tr>
<td>Langmuir #1</td>
<td>Langmuir</td>
<td>1990-91</td>
<td>11 502 tons</td>
<td>1.74% Ni</td>
<td>Luhta 1992</td>
</tr>
<tr>
<td>McIntyre</td>
<td>Tisdale</td>
<td>1963-82</td>
<td>10 Mtonnes</td>
<td>0.67% Cu</td>
<td>Burrows and Spooner 1986</td>
</tr>
<tr>
<td>Redstone</td>
<td>Eldorado</td>
<td>1989-92</td>
<td>294 895 tons</td>
<td>2.4% Ni</td>
<td>Luhta 1992</td>
</tr>
<tr>
<td>United Obalski</td>
<td>Godfrey</td>
<td>1966</td>
<td>produced 240 tons Cu concentrate</td>
<td></td>
<td>Shklanka 1969</td>
</tr>
</tbody>
</table>

Table 12.5. Gold production to the end of 1991, Timmins Resident Geologist’s District.

<table>
<thead>
<tr>
<th>Mine Name</th>
<th>Township</th>
<th>Years of Production</th>
<th>Tons Milled</th>
<th>Ounces Produced</th>
<th>Grade</th>
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<tbody>
<tr>
<td>Ankerite</td>
<td>Deloro</td>
<td>1926-53,-78</td>
<td>4 993 929</td>
<td>957 292</td>
<td>0.19</td>
</tr>
<tr>
<td>Ankerite-March</td>
<td>Deloro</td>
<td>1926-35</td>
<td>317 769</td>
<td>61 039</td>
<td>0.19</td>
</tr>
<tr>
<td>Aquarius</td>
<td>Macklem</td>
<td>1984, 1988-89</td>
<td>139 634</td>
<td>27 117</td>
<td>0.19</td>
</tr>
<tr>
<td>Aunor (Pamour No. 3)</td>
<td>Deloro</td>
<td>1940-84</td>
<td>8 482 174</td>
<td>2 502 214</td>
<td>0.30</td>
</tr>
<tr>
<td>Banner</td>
<td>Whitney</td>
<td>1927-28,-33,-35</td>
<td>315</td>
<td>670</td>
<td>0.13</td>
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<tr>
<td>Bell Creek</td>
<td>Hoyle</td>
<td>1987-91</td>
<td>622 227</td>
<td>111 988</td>
<td>0.18</td>
</tr>
<tr>
<td>Bonetal</td>
<td>Whitney</td>
<td>1941-51</td>
<td>352 254</td>
<td>51 510</td>
<td>0.15</td>
</tr>
<tr>
<td>Bonwhit</td>
<td>Whitney</td>
<td>1951-54</td>
<td>200 555</td>
<td>67 940</td>
<td>0.34</td>
</tr>
<tr>
<td>Broulan</td>
<td>Whitney</td>
<td>1939-53</td>
<td>1 146 059</td>
<td>243 757</td>
<td>0.21</td>
</tr>
<tr>
<td>Cincinnati</td>
<td>Deloro</td>
<td>1914, 1922-24</td>
<td>3200</td>
<td>736</td>
<td>0.23</td>
</tr>
<tr>
<td>Concordia</td>
<td>Deloro</td>
<td>1935</td>
<td>230</td>
<td>16</td>
<td>0.07</td>
</tr>
<tr>
<td>Coniaurum–Carium</td>
<td>Tisdale</td>
<td>1913-18, 1928-61</td>
<td>4 464 006</td>
<td>1 109 574</td>
<td>0.25</td>
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<tr>
<td>Crown</td>
<td>Tisdale</td>
<td>1913-21</td>
<td>226 180</td>
<td>138 330</td>
<td>0.61</td>
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<td>Davidson</td>
<td>Tisdale</td>
<td>1918-20</td>
<td>9371</td>
<td>2438</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1988</td>
<td>43 850</td>
<td>7301</td>
<td></td>
</tr>
<tr>
<td>Delnite</td>
<td>Deloro</td>
<td>1937-64</td>
<td>3 847 364</td>
<td>920 404</td>
<td>0.20</td>
</tr>
<tr>
<td>Delnite (open pit)</td>
<td>Deloro</td>
<td>1987-88</td>
<td>59 067</td>
<td>3602</td>
<td>0.77</td>
</tr>
<tr>
<td>DeSantis</td>
<td>Ogden</td>
<td>1933, 1939-42, 1961-64</td>
<td>196 928</td>
<td>35 842</td>
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<tr>
<td>DeSantis</td>
<td>Turnbull</td>
<td>1926</td>
<td>13</td>
<td></td>
<td></td>
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<tr>
<td>Detour Lake Mine</td>
<td>Sunday Lake</td>
<td>1983-</td>
<td>7 428 000</td>
<td>807 597</td>
<td>0.11</td>
</tr>
<tr>
<td>Dome Mine</td>
<td>Tisdale</td>
<td>1910-</td>
<td>49 469 667</td>
<td>11 843 863</td>
<td>0.24</td>
</tr>
<tr>
<td>Faymar</td>
<td>Deloro</td>
<td>1940-42</td>
<td>119 181</td>
<td>21 851</td>
<td>0.18</td>
</tr>
<tr>
<td>Mine Name</td>
<td>Township</td>
<td>Years of Production</td>
<td>Tons Milled</td>
<td>Ounces Produced</td>
<td>Grade</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------</td>
<td>---------------------</td>
<td>-------------</td>
<td>-----------------</td>
<td>-------</td>
</tr>
<tr>
<td>Fuller</td>
<td>Tisdale</td>
<td>1940–44</td>
<td>44,028</td>
<td>6,566</td>
<td>0.15</td>
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<tr>
<td>Gillies Lake</td>
<td>Tisdale</td>
<td>1929–31, 1935–37</td>
<td>54,502</td>
<td>15,278</td>
<td>0.28</td>
</tr>
<tr>
<td>Goldhawk</td>
<td>Cody</td>
<td>1947</td>
<td>636</td>
<td>53</td>
<td>0.08</td>
</tr>
<tr>
<td>Goldhawk (open pit)</td>
<td>Cody</td>
<td>1980</td>
<td>40,000</td>
<td>3,967</td>
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<tr>
<td>Halcrow–Swayze</td>
<td>Halcrow</td>
<td>1935</td>
<td>211</td>
<td>40</td>
<td>0.19</td>
</tr>
<tr>
<td>Hallnor (Pamour No. 2)</td>
<td>Whitney</td>
<td>1938–68,–81</td>
<td>42,264,19</td>
<td>1,645,892</td>
<td>0.39</td>
</tr>
<tr>
<td>Hollinger–Schumacher</td>
<td>Tisdale</td>
<td>1915–18</td>
<td>112,124</td>
<td>27,182</td>
<td>0.24</td>
</tr>
<tr>
<td>Hollinger (Pamour Timmins prop.)</td>
<td>Tisdale</td>
<td>1910–68</td>
<td>65,778,234</td>
<td>19,327,691</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td>Tisdale</td>
<td>1976–88</td>
<td>2,615,866</td>
<td>182,058</td>
<td>0.07</td>
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<tr>
<td>Hoyle</td>
<td>Whitney</td>
<td>1941–44, 1946–49</td>
<td>725,494</td>
<td>71,843</td>
<td>0.10</td>
</tr>
<tr>
<td>Hoyle Pond</td>
<td>Hoyle</td>
<td>1985–</td>
<td>616,608</td>
<td>325,963</td>
<td>0.61</td>
</tr>
<tr>
<td>Hugh–Pam</td>
<td>Whitney</td>
<td>1926, 1948–65</td>
<td>636,751</td>
<td>119,604</td>
<td>0.19</td>
</tr>
<tr>
<td>Jerome</td>
<td>Osway</td>
<td>1941–43, 1956</td>
<td>335,060</td>
<td>56,893</td>
<td>0.17</td>
</tr>
<tr>
<td>Joburke</td>
<td>Keith</td>
<td>1973–75, 1979–81</td>
<td>440,117</td>
<td>43,571</td>
<td>0.10</td>
</tr>
<tr>
<td>Kingbridge–Gomak</td>
<td>Chester</td>
<td>1935–36</td>
<td>1387</td>
<td>98</td>
<td>0.07</td>
</tr>
<tr>
<td>McIntyre (Pamour Schumacher)</td>
<td>Tisdale</td>
<td>1912–88</td>
<td>37,634,691</td>
<td>10,751,941</td>
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<tr>
<td>McLaren</td>
<td>Deloro</td>
<td>1933–37</td>
<td>876</td>
<td>201</td>
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<tr>
<td>Moneta</td>
<td>Tisdale</td>
<td>1938–43</td>
<td>314,829</td>
<td>149,250</td>
<td>0.47</td>
</tr>
<tr>
<td>Naybob</td>
<td>Ogden</td>
<td>1932–64</td>
<td>304,100</td>
<td>50,731</td>
<td>0.17</td>
</tr>
<tr>
<td>Owl Creek</td>
<td>Hoyle</td>
<td>1981–89</td>
<td>1,789,247</td>
<td>(head grade 0.14)</td>
<td></td>
</tr>
<tr>
<td>Pamour No. 1 (includes pits 3 &amp; 4 &amp; heap leach)</td>
<td>Whitney</td>
<td>1936–</td>
<td>46,437,259</td>
<td>4,315,892</td>
<td>0.09</td>
</tr>
<tr>
<td>Paymaster</td>
<td>Tisdale</td>
<td>1915–66</td>
<td>5,607,402</td>
<td>1,192,206</td>
<td>0.21</td>
</tr>
<tr>
<td>Porcupine Lake–Hunter</td>
<td>Whitney</td>
<td>1937–40, 1944</td>
<td>10,821</td>
<td>1,369</td>
<td>0.13</td>
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<tr>
<td>Porcupine Peninsular</td>
<td>Cody</td>
<td>1924–27,–40,–47</td>
<td>99,688</td>
<td>27,354</td>
<td>0.27</td>
</tr>
<tr>
<td>Preston</td>
<td>Tisdale</td>
<td>1938–68</td>
<td>6,284,405</td>
<td>1,539,355</td>
<td>0.24</td>
</tr>
<tr>
<td>Preston N Y</td>
<td>Tisdale</td>
<td>1933</td>
<td>2800</td>
<td>153</td>
<td>0.05</td>
</tr>
<tr>
<td>Preston–Porcupine Pet</td>
<td>Deloro</td>
<td>1914–15</td>
<td>314</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preston–Porphyry Hill</td>
<td>Deloro</td>
<td>1913–15</td>
<td>46</td>
<td>312</td>
<td>6.78</td>
</tr>
<tr>
<td>Reef Mine</td>
<td>Whitney</td>
<td>1915–65</td>
<td>2,144,507</td>
<td>498,932</td>
<td>0.23</td>
</tr>
<tr>
<td>St. Andrew Goldfields</td>
<td>Stock</td>
<td>1989–</td>
<td>377,792</td>
<td>55,430</td>
<td>0.15</td>
</tr>
<tr>
<td>Tionaga–Smith–Thorne</td>
<td>Horwood</td>
<td>1938–39</td>
<td>6653</td>
<td>2299</td>
<td>0.35</td>
</tr>
<tr>
<td>Tisdale Ankerite</td>
<td>Tisdale</td>
<td>1952</td>
<td>14,655</td>
<td>2236</td>
<td>0.15</td>
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<tr>
<td>Tommy Burns–Arcadia</td>
<td>Shaw</td>
<td>1917</td>
<td>21</td>
<td>14</td>
<td>0.28</td>
</tr>
<tr>
<td>Vipond</td>
<td>Tisdale</td>
<td>1911–41</td>
<td>1,565,218</td>
<td>414,367</td>
<td>0.26</td>
</tr>
</tbody>
</table>

Note: ERG Resources Inc. produced 18,160 ounces Au from treatment of 2,549,189 tons of tailings from March 1988 to June 1989.
Deep surface diamond drilling continued in 1992 northwest of the mine workings exploring the “North Rhyolite”. Diamond drilling in the last few years has located suitable stratigraphy, alteration, and base metal values in this area; however, a deposit of economic significance has yet to be found. Further exploration is planned for this area in 1993.

Surface diamond drilling continued in 1992 to test the stratigraphic hanging wall area of the Kidd Creek deposit for possible stacked ore lenses down to a depth of 1000 feet below surface. Underground drilling from the 1600-foot level was also conducted to explore the hanging wall area beyond the 1000-foot level down to 2000 feet below surface.

A detailed geological investigation of the Kidd Creek Mine, funded by NODA, is taking place. A comprehensive program of field and laboratory studies will document the structure, volcanology, alteration, ore mineralogy, geochemistry and isotopic characteristics of the deposit. The project is being undertaken jointly by the Geological Survey of Canada, Falconbridge Limited and Laurentian University. The Kidd Creek Mine is a world-class volcanogenic massive sulphide deposit, and a detailed documentation of the geologic setting of the deposit is not only a prerequisite for the discovery of additional ore reserves proximal to the mine, but also will provide exploration strategies for similar deposits in northern Ontario and elsewhere.

As of January 30, 1992, published ore reserves for the Kidd Creek Mine were: 37 168 577 t grading 3.2% Cu, 5.06% Zn, 0.14% Pb and 61 g/t Ag (Falconbridge Limited, personal communication, 1992).

Falconbridge Ltd. and Marsulex Inc. have established a joint venture which will establish a new plant at the Kidd Creek metallurgical site to produce liquid sulphur dioxide from sulphuric acid by-products. Marsulex will merchandise the product across North America. The Northern Ontario Development Corporation (NODC) has approved a $300 000 term loan for the venture (Falconbridge Limited, personal communication, 1992).

Precious Metals

FALCONBRIDGE GOLD CORPORATION, BELL CREEK MINE

Falconbridge Gold Corporation began a small program to rehabilitate the underground workings of the Bell Creek Mine in January 1992, after its closure in November 27, 1991, by the previous owner Canamax Resources Incorporated. The property is located in Lot 10, Concession II of Hoyle Township. A minor amount of exploration was done with 1000 m of underground drilling in 4 holes to test the down-dip and western extension of the North A vein. After some underground development and stope preparation, mining on a small scale began in July with production averaging 600 tonnes per week.

A total of 4527 t were produced at an average grade of 7.66 g/t Au in 1992 (Falconbridge Gold Corporation, personal communication, 1992). Even though further exploration potential exists on the Bell Creek property, budget constraints are preventing programs from being initiated (Falconbridge Gold Corporation, personal communication, 1992).
FALCONBRIDGE GOLD CORPORATION, HOYLE POND MINE

Production at the Hoyle Pond Mine for 1992 was 109,265 t at a grade of 18.15 g/t Au. All of the ore was processed at the Bell Creek mill purchased from Canamax Resources Inc. in 1991. Previously, the ore had been processed on a custom milling basis at the gold milling facility at the Falconbridge Limited, Kidd Creek Division metallurgical complex. Lower processing costs at Bell Creek mill as well as higher recoveries (97% versus 90.5%) were obtained, thus lowering the cost per ounce produced (Falconbridge Gold Corporation, personal communication, 1992).

The Hoyle Pond deposit is located in Lot 4 Concession II of Hoyle Township approximately 4 km east of the Bell Creek deposit. The Hoyle Pond deposit is accessed via a ramp. The development of mining of the orebody has taken place on 6 levels, the lowermost of which is 295 m below surface with 1 stope currently operating just above this level. Five gold-bearing quartz veins are being mined within carbonate-altered tholeiitic rocks. The No. 16 vein which occurs in a flow top breccia with graphite is the most productive and is subparallel to the tholeiitic-argillite contact to the north. All other veins are irregular, crosscutting fracture fills. At any single time, between 10 and 12 cut-and-fill stopes are being mined. A minor amount of longhole mining has also been done.

Surface exploration around the mine site during 1992 included 3 diamond-drill holes, totalling 679 m, drilled on the Owl Creek West Zone to assess the near surface potential of gold mineralization. Nothing of economic significance was intersected. Beginning in September, 1992, a nine-hole, 2400 m surface diamond-drill program was done to explore north and northeast of the vein systems at Hoyle Pond. Nothing of significance was found. In late 1992, 4 surface diamond-drill holes were drilled in the southeast quadrant of the Hoyle Pond Mine to explore for the updip extension of No. 7 vein. No results were available at the end of 1992.

In 1992, no exploratory diamond drilling was done underground, only ore delineation drilling.

No further exploratory drilling was done on the South Zone which was discovered in 1990 and explored by surface and underground drilling in 1990 and 1991. This gold zone occurring as quartz veins and disseminated pyrite is to the south of the mine workings and occurs along the contact between komatiitic rocks and tholeiitic rocks. No work is scheduled here for 1993 due to budget restraints even though the zone still has good exploration potential (Falconbridge Gold Corporation, personal communication, 1992; personal observation, 1992).

FALCONBRIDGE GOLD CORPORATION, OWL CREEK MINE

To eliminate acid discharge from waste rock piles from the Owl Creek open pit, Falconbridge Gold Corporation spent $6 million in 1992 to return this rock to the pit. Much of this rock contains pyritic, argillaceous material and was removed from the open pit during mining. Between the layers of waste rock, layers of crushed limestone were emplaced to act as a buffer to neutralize the acid drainage. The pit was filled to the second bench 70 to 80 feet below surface and is being allowed to flood. The included limestone and the fact no oxidation of the sulphide minerals will occur below this depth of water should prevent acid generation. This solution to the acid generating problem could destroy the potential of mining remaining gold mineralization below the pit by underground methods (Falconbridge Gold Corporation, personal communication, 1992).

PLACER DOME INCORPORATED, DETOUR LAKE MINE

The following report is based on a mine visit made during 1992, discussions with the mine geological staff and various reports written previously by the writer.

The Detour Lake Mine, owned and operated by Placer Dome Inc., is located 250 km northeast of Timmins. Access is via Highway 652 east and then north from Cochrane (Sunday Lake Area, NTS 32L/04SE).

In 1992, the Detour Lake Mine recovered 131,000 ounces of gold from the milling of 873,235 t of ore at an average grade of 4.94 g/t Au. Production is by underground mining methods. The current milling rate is 2600 tonnes per day (tpd). An average of 400 tpd grading 1.5 g/t Au is derived from a 200,000 t low-grade stockpile obtained from previous open pit mining. Close to 7 million t at an average grade of 5.2 g/t Au have been mined since mining began July 27, 1983. In mid-1993, the mine will produce its one millionth ounce of gold. As of January 1, 1992, the proven and probable reserves were 5.89 million t at a grade of 5.4 g/t Au. The mine presently employs 254 people (Placer Dome Inc., personal communication, 1992).

History

In 1974, Amoco Canada Petroleum Company Ltd. discovered auriferous sulphide mineralization while diamond drilling an airborne magnetic-electromagnetic anomaly. In 1977, the company completed underground development on the 120 m level via a decline ramp from surface and further drilling outlined a possible mineral inventory of 10 million tons at a grade of 0.204 ounces Au per ton.

In 1979, Amoco made an agreement with Dome Mines Ltd. and Campbell Red Lake Mines Ltd. (these companies amalgamated in 1987 to become a part of Placer Dome Inc.) to form a joint venture to conduct further work on the deposit. Amoco retained a 50% interest, with Dome Mines and Campbell Red Lake Mines earning an interest of 25% each. An underground development program, managed by Campbell Red Lake Mines, began in October of 1979 and included detailed sampling and underground exploratory diamond drilling.
In early 1981, a production decision was announced and the construction of a road, power line, mine, mill and accommodation facilities began. Possible reserves were quoted at 20 million tons grading 0.125 ounces Au per ton to 1800 feet below surface.

At the beginning of 1983, Campbell Red Lake Mines purchased the 25% interest held by Dome Mine's to attain a 50% interest in the project with Amoco retaining the other 50%. Campbell Red Lake Mines continued management of the program. Processing of gold ore obtained from open pit mining began, at the end of July 1983, with a planned production rate of 2500 tpd attempted in October of that year. The pouring of the first gold bar took place September 29, 1983. The total cost of bringing the mine into production by open pit methods was $139 million. Initially, lower than planned production and mill head grades were realized due to low mill grinding rates, higher than anticipated dilution in mining and the tying-up of gold in the new mill.

Shaft sinking to develop an underground mine at an additional cost of $110 million was started December 10, 1984. The shaft was sunk to 605 m below surface with the deepest level directly off the shaft being at 560 m. Detour Lake officially became an underground mine on December 1, 1987, after over 3.5 million t had been mined by open pit methods. In 1988, Placer Dome Inc. became the sole owner of the mine after having acquired the additional 50% interest from Amoco Canada Petroleum Company Limited.

Geology

The Detour Lake deposit is located in the northwestern part of the Abitibi greenstone belt close to the contact with the migmatic terrain of the Opatika Subprovince. Gold mineralization is hosted within a deformation zone at the contact between mafic and ultramafic rocks. The rocks have been metamorphosed to lower amphibolite grade.

Within the mine area, rocks from south to north are: clastic metasedimentary rocks and volcanoclastic rocks; komatitites which vary from chlorite schist to talc-chlorite schist to talc-carbonate schist; the mine "chert" which is interpreted as a silicified shear zone, and massive tholeiitic basalts interfingered with pillowed flows. A quartz feldspar porphyry body intrudes the komatiitic rocks. The main zone of gold mineralization is within the "chert" horizon at the contact between the komatitites and the tholeiitic rocks. Other major ore zones include quartz zones within Riedel fractures striking from 010° to 030° off the main zone into the adjacent tholeiitic rocks. Also, broken up gold-bearing quartz zones occur within the komatititic rocks to the south adjacent to the contact with the tholeiitic rocks.

In the area of the mine, the main zone or the "chert" horizon at the komatiite-tholeite contact strikes 045° and dips generally at 50° to the north, with variances between 30° and 70°. It assumes a 60° to 90° dip below the 560 m level. The strike of the contact at both the east and west ends is 070°. In other words, the mine is located at a flexure in the stratigraphy. The komatitites to the south are locally thickened to 80 m in width at this flexure. The plunge of the main zone is 40° to the west and flattens to almost horizontal between the 560 m and 760 m levels. No reserves exist below the 760 m level. However, the potential for finding additional reserves in the main zone is to the west above the 760 m level.

The plunge of the quartz feldspar, porphyry body is parallel to the plunge of the main zone as well as the lineation found in these rocks and the lineation defined by elongated variolites occasionally found in the tholeiitic basalts.

Sulphide mineralization, which includes pyrrhotite, pyrite and chalcopyrite, occurs as clots and disseminations within the "chert" horizon of the main ore zone, within the quartz fracture zones in the tholeiites, and within the gold-bearing broken up quartz boudins in the komatitites.

Main alteration types consist of silicification within the main zone and potassic alteration adjacent to the quartz-filled Riedel fractures in the tholeiitic rocks. This latter alteration consists of reddish, purplish, brown-coloured zones containing biotite surrounding the quartz veins.

New Ore Zones

Two large quartz-filled fracture zones were located in the tholeiitic rocks a few years ago. Called the Q-100 and Q-120 ore zones, they are not connected to the main zone as are all of the other quartz fracture zones in the tholeiites. The Q-100 zone was found by drifting out to a high-grade gold intersection obtained from previous diamond drilling on the 330 m level. It was later found that the zone could possibly be traced back to the main zone by a few very narrow fractures. The Q-100 zone is characterized by en échelon quartz veining and drag folding with boudinaged quartz at its west end. As development continued west on the Q-100 zone, it was found that the ore grade of the zone depended on its sulphide content.

Farther to the west, it was then found that the Q-100 quartz fracture zone intersected a sub-parallel sulphide breccia zone characterized by a sulphide matrix of pyrite, pyrrhotite and chalcopyrite with clasts of sulphide, quartz and wall rock. The quartz fracture zone dips steeply north, while the sulphide breccia zone, which is later and cuts the quartz fracture zone, dips steeply south. Biotite alteration is associated with the quartz fracture zone, but no alteration is associated with the sulphide breccia zone. At the direct intersection of the 2 zones, very high-grade gold values occur with some spectacular visible gold. Sulphides and ore-grade gold values occur for over 50 m on both sides of this intersection along the quartz fracture zone. The ore zone in the Q-100 vein has a strike length of over 150 m and is presently being mined between the 315 and the 370 m levels. The average grade is 8 g/t Au.

The Q-120 zone occurs 20 m to the north and below the Q-100 zone between the 400 and 460 m levels. Average mine grade of the Q-120 zone is between 5 and 6 g/t Au.

It is interpreted that the quartz-filled fracture zones were refractured, with gold-bearing sulphides being injected later.
into them. The recent re-examinations of the other zones has indicated that sulphide emplacement in these was also later.

A sulphide breccia zone grading approximately 10 g/t Au is being mined on the 360 m level by a small longhole stope. Because of the irregular nature of the zones, exploration of and establishing continuity for these zones is difficult.

**Pebble Dikes**

An irregularly shaped dike with a matrix of mafic to ultramafic material was observed on the 525 m level. Within this matrix rounded gneiss and granitic clasts and rounded to subangular clasts of mafic rock, quartz and quartz with sulphide (ore material) occur. The writer interprets this to be a late lamproite or possibly a kimberlite intrusive.

**Mining**

In 1992, 60% of the ore came from the Main Zone using mechanized cut-and-fill methods. Forty percent of the ore came from quartz stockworks in the tholeitic rocks and was mined by blast-hole techniques. At the end of 1992, only 7% of the mine's ore reserves occur above the 360 m level. The 660 m level is the lowest working level at present. Since the shaft only extends to the 590 m level, the 660 m level is accessed by a ramp from the 560 m level. Most of the development in 1992 occurred in the Main Zone between 560 and 660 m below surface to prepare this area for sublevel retreat mining in 1993. Cut-and-fill mining will be phased out for this lower cost bulk mining method.

Ramping below the 660 m level is being done to establish sumps. Ramping may continue down to the 760 m level to access the ore above. No mineable ore reserves exist below the 760 m level and as previously mentioned, the plunge of the ore flattens to being horizontal at 760 m below surface. Underground diamond drilling in late 1991 and in 1992 was primarily restricted to finding the extensions of gold-bearing quartz fracture zones in the tholeitic rocks north of the Main Zone. Most of this drilling was done from the 525 m level. In the fall of 1991, the 560 m level was driven westward to the north of the ore horizons and was used as a diamond-drill drift to explore for the westward and downdip extensions of the Main Zone.

The Detour Lake Mine received $3 million in late 1992 to spend in Phase I of a program to extend the 560 m level westward a further 350 m. A raise from the 560 m level must be driven to surface for ventilation purposes. Further underground diamond drilling will be done from the extended drift.

If Phase I is successful, Phase II costing $4 million may be started. This includes driving the 560 m level a further 1000 m westward and diamond drilling to attempt to increase reserves in the Main Zone and quartz fracture zones. If Phase II is successful, the shaft may be deepened and a drift driven on the 800 m level or below to access the ore downdip and to the west.

A deep surface diamond drilling program managed by Placer Dome Exploration is exploring the western projection of the ore zone. Core observed by the writer contained some mineralized quartz veins within tholeiitic rocks. The "chert" zone at the contact between the tholeiites and komatiites was also observed in the core (see "Exploration Activity, Placer Dome Inc.").

Potential exists for extending the Main Zone and quartz fracture zones to the west. Since the plunge of the Main Zone flattens to the west, exploration and development will not be as expensive as if it continued at a steeper downward plunge. Since the dip of the ore zone steepens at depth, less expensive longhole mining is replacing cut-and-fill mining. The discovery of the Q-100 has greatly enhanced the potential of finding other gold-bearing fracture zones within the tholeiites.

In the last few months of 1992, the milling rate was constantly 2600 tpd without using stockpiled feed. A study is being done to increase the mined tonnage in order to lower the unit costs of mining at Detour Lake (Placer Dome Inc., personal communications, 1992).

**PLACER DOME INCORPORATED, DOME MINE**

In 1992, the Dome Mine in Tisdale Township recovered 172 997 ounces of gold from 1 507 800 tons of ore at an average grade of 2.295 ounces Au per ton with a mill recovery of 95.21%. At the end of 1992, the mill was processing 4300 tons per day compared to 3700 tons per day at the end of 1991 (Placer Dome Inc., personal communications, 1992).

Currently 25% of the mill feed is obtained from open pit mining. This ore is mined during the winter and most of it is stockpiled for milling later in the year. Since open pit mining began in 1987, over 1.5 million tons at a grade of 0.08 ounces Au per ton have been mined to the end of 1992. This past summer, over 800 000 tons of waste were removed. Some of the waste was dumped into raises from surface for backfill underground with the remaining waste being brought to the site of the former Dome Extension townsite, where it was used to level the topography.

At the end of 1992, the main pit, which is now the combination of 2 pits, was approximately 100 feet below surface. In the east face of the pit, going from north to south, the rocks exposed are: the south greenstone; the Preston porphyry surrounded by carbonatized komatiites ("Carb Rock"), which contains gold ore; the Paymaster porphyry, which contains very little gold mineralization; and the main ore host, which is the conglomerate greenstone fold nose area.

Since there are old shrinkage stopes within the pit area, mining is done by initially putting drop raises into the stopes, filling them with waste rock and then continuing to mine down. Pit blasts are large, over 20 000 tons, with ore and waste blasted together, but mucked and trucked selectively.
A new mineralized area, called the "Blueberry Hill Zone", is located along strike and to the northeast of the ore zone in the main pit and is adjacent to, and just to the north of, the Number 8 Shaft. The zone was partially outlined by the exploration department of Placer Dome in 1991. In the spring of 1992, 75,000 tons were mined from this zone at an average grade of 0.051 ounces Au per ton. The zone is within a hill and part of the hill was mined. The ore at "Blueberry Hill" occurs within quartz veins and stringers associated with carbonatized, pillowed, mafic lavas, which are in a sheared contact with porphyry to the north.

In 1991, the potential for an expanded pit was recognized. A surface diamond drilling program (which included 60,000 feet drilled in 1992) and a resource estimate were initiated. While the present open pit is bound by the mill to the west and plant buildings to the north, a portion of the ore is recoverable from surface and these reserves at the present mining rate will be depleted by the end of 1995. A twelve-month $4.38 million feasibility study is underway to evaluate the economics of expanding the pit which would include relocating or replacing many of the existing surface buildings and facilities, including the decommissioning of the No. 3 Shaft. Preliminary estimates suggest the proposed "super pit" could be up to 700 feet deep.

In the underground mine, the bottom production level is the 32 level, which is 4600 feet below surface. One new longhole stope has recently been brought into production on the 32 level. The bulk of the mine's production comes from above the 26 level (3500 feet below surface). Longhole mining is providing 70% of the underground production. The balance comes from mechanized cut-and-fill mining, some shrinkage mining and development in ore. The evaluation of potential ore zones amenable to longhole mining is being done by more underground diamond drilling at closer spaced intervals than before. Stope development is carried out on the levels 150 feet apart. Previously, less diamond drilling was done by more underground diamond drilling at closer spaced intervals than before. Stope development is carried out on the levels 150 feet apart. Previously, less diamond drilling was used and sublevels were developed at 50-foot intervals. Longer blast holes are being drilled now, down from the levels above and up from the levels below in the ore zone. These innovations have resulted in bringing stopes into production faster and have decreased stope preparation costs.

Mine exploration was focussed on exploring for and delineating ore below the 29 (4000-foot) level. Below that elevation, the main ore structures seem to be breaking up. There are indications that some new ore zones may also exist at depth. Also, the re-evaluation by underground diamond drilling of known mineralized areas above the 29 levels is being done. New reserves amenable to longhole mining are being identified.

Placer Dome Inc. now owns 100% of the adjacent Paymaster property where underground evaluation of mineralization below the 6000-foot level was conducted in 1989 and 1990. The feasibility report was done in 1991. Although an official announcement has yet to be made by the company, plans are to bring the Paymaster Mine into production. Proven and probable reserves between 6000 and 6500 feet are 1 million tons grading 0.25 ounces Au per ton. A drift connecting the Dome and Paymaster mines will be driven on the 29 level, 4000 feet below surface, for ventilation and escape purposes. The ore mined at the Paymaster will be hoisted up the internal winze then up the shaft to surface and trucked to the Dome mill. Pre-production work is to start at the beginning of 1993 and will take eighteen months (Placer Dome Inc., personal communication, 1992; personal observation, 1992).

ROYAL OAK MINES INC., TIMMINS OPERATIONS

In 1992, the total production from the Timmins operations was 1,224,797 tons at an average grade of 0.089 ounces Au per ton and an average recovery of 90.05% (Royal Oak Mines Inc., personal communication, 1992).

Production from the Timmins operations was centred around the Pamour No. 1 Mine site where ore was mined from the Pamour No. 1 underground mine; the Hoyle underground mine; the No. 3 pit adjacent to the No. 1 Mine; the No. 2 pit to the east of No. 3 pit and on the Hoyle property. Minor production was obtained from the No. 5 pit, which is a surface pillar recovery program near the Broulan property to the west. Approximately 60% of the ore was produced underground and the remaining 40% came from the open pits. A minor amount of gold was produced from the 1990 heap leach ore pads. No new ore was placed on the pads in 1991 and 1992.

Production at the No. 1 underground mine at present is mostly from the areas east of the shaft towards the Hoyle property. The lowest mining level is 1600 feet below surface. Most of the ore comes from bulk mining in gold-bearing quartz veins and stockworks in conglomerate. Some bulk mining is also done in gold-bearing quartz veins in greywacke. A small percentage of the total ore processed comes from narrow high-grade veins in the northern part of the mine.

The Hoyle underground mine at present produces ore above the 1000-foot elevation. Most of the ore comes from the conglomerate zone. However, the potential of mining ore zones in greywacke found at the south (footwall) side of the conglomerate is being studied. Ore presently being mined in the lower conglomerate zone at the east end of Pamour No. 1 may be eventually mined at depth at the Hoyle Mine. Most of the ore produced at the Hoyle Mine is conveyed to the Pamour No. 1 Mine (#3 shaft) along the 1400-foot level where it is hoisted to surface. Some ore is mined above the 400-foot level and is tramned up a decline to surface and trucked to the Pamour No. 1 mill.

An 11,500-foot surface diamond drilling program, started in late 1992 with flow-through and OMIP funding, was managed by the mine geology department. The program was held in tandem with the large drill program managed by Royal Oak Mine Inc. exploration division. The purpose of the program was to extend the mineralization in the No. 2 and No. 3 pit areas, find potential open pit ore on the Hallnor Mine site and explore the 35 and 51 vein areas in the volcanic rocks in the north part of Pamour No. 1 Mine. Results were not yet
available at the end of 1992. Over 70,000 feet of underground diamond drilling was done primarily, for ore delineation purposes (Royal Oak Mines Inc., personal communication, 1992).

ST. ANDREW GOLDFIELDS LIMITED, STOCK MINE

Introduction

The information in this report has been obtained from various sources, including property visits, personal communications with the mine geology staff and examination of files in the Timmins Resident Geologist's office.

History

Quebec Sturgeon River Mines Limited discovered gold mineralization on its property 50 km east of Timmins in south central Stock Township in 1973. The property had previously been held by Hollinger Mines Ltd., but the claims had been allowed to lapse. An initial reserve of 700,000 tons grading 0.14 ounces Au per ton was indicated after a 25,000 foot diamond-drill program by Quebec Sturgeon River Mines Limited.

Development began in 1974 and included construction of a headframe with a shaft being collared and driven through 48 feet of overburden and 12 feet of bedrock. Development was stopped in 1976 to await higher gold prices after a total of 1.6 million had been spent on the project. Shaft sinking resumed in 1980 and, by 1981, had reached a depth of 235 feet. Following 1300 feet of underground development at the 200-foot level and 15,000 feet of underground diamond drilling, reserves were recalculated to 580,575 tons at 0.14 ounces Au per ton between the 200- and 325-foot levels.

In 1983, a $14 million equity financing was completed by turning the property over to St. Andrew Goldfields Ltd., a 68% owned subsidiary of Quebec Sturgeon River Mines Limited. Development resumed on the property in mid-1983 and by the end of 1985, the shaft had been deepened to 884 feet and underground development had been conducted on 4 levels. Ore reserves to a depth of 1000 feet were reported to be 735,625 tons grading 0.135 ounces Au per ton, which included 525,626 tons of 0.17 ounces Au per ton.

In 1986, St. Andrew Goldfields Ltd. acquired additional property along the Porcupine–Destor deformation zone by purchasing Labrador Mining and Exploration Company Limited's (the successor of Hollinger Consolidated Gold Mines Limited) interest in properties in 3 townships and by entering into joint venture agreements with Esso Minerals and Quebec Sturgeon River Mines. These properties included 2 known gold occurrences in Taylor Township, the "Shoot" and "Porphyry" zones. The agreement required the sinking of a 500-foot shaft, completion of 1300 feet of underground development and 5000 feet of underground diamond drilling on the "Porphyry" zone by early 1987.

In mid-1987, St. Andrew Goldfields Ltd. announced that the Stock Township deposit would be brought into production. Financing was raised in Europe in 1988. It was also announced that a 500 ton per day mill would be constructed by late 1988. A 5000-ton bulk sample was taken from 4 zones within the mine and ore reserves were calculated to be 1 million tons grading 0.196 ounces Au per ton.

Production did not officially begin until October 1, 1989; however, the milling of stockpiled development ore began in June of that year. St. Andrew Goldfields Ltd. had established a reserve of 1.3 million tons grading 0.186 ounces Au per ton.

In 1989, St. Andrew Goldfields bought out the remaining interests of Esso Resources Canada Limited. After an extensive surface exploration and diamond drilling program on the mine property in Stock Township, the Shoot Zone and West Porphyry Zone in Taylor Township, the potential for finding additional ore reserves was realized. By the end of 1989, 5 levels had been developed and 100,850 tons of ore had been milled to produce 17,999 ounces of Au. The shaft could not be used below the fourth level due to bad ground conditions and the fifth, sixth and seventh levels had to be accessed by a ramp. Mining methods included; cut-and-fill, room-and-pillar and longhole.

In 1990, St. Andrew became the operator of the Hislop East gold property of Goldpost Resources Incorporated for 50% of the profit. A total of 22,784 tons of ore grading 0.195 ounces Au per ton was processed from that property to produce 4199 ounces of Au.

During April 1991, a breach in the tailings dam allowed between 60,000 and 70,000 m^3 of tailings-laden water to escape into the Driftwood Creek. The escaping water contained higher than permitted levels of cyanide and heavy metals. Underground operations were suspended during July and August as a cost saving measure. However, the mill was kept at its capacity by milling ore from the Hislop Mine and ore from the Stock Township Mine that had been stockpiled on surface. Ore processed from the Goldpost property in 1991 totalled 62,282 tons, producing 12,647 ounces of Au. An extensive maintenance and rehabilitation program was conducted during this period.

Geology

The Stock Township Mine of St. Andrew Goldfields is situated within the Stoughton-Roquemaure Group of mafic and ultramafic rocks along the Porcupine–Destor deformation zone (PDDZ). The deformation zone trends east-north east, dips steeply to the south and occurs between sedimentary rocks to the north and an east-northeast-trending diabase dike in contact with relatively unaltered, mafic volcanic rocks to the south. At the contact with the sedimentary rocks is the "Major" break, which is a broken up talc-chlorite schist zone 300 to 500 feet in width. Between this break, and another smaller talc-chlorite schist zone to the south called the "Minor" break, is a zone of carbonatized, ultramafic rocks (peridotitic komatiites) which contains a swarm of porphyry dikes. This area is like an island 2400 feet long surrounded by a talc-chlorite schist for this "Minor" break joins the "Major" break to the east and to the west.
Between the “Minor” break and the diabase is a sequence of pillowed mafic flows (iron and magnesium tholeiites), which are carbonatized and sericitized to varying degrees and form a northeast-trending wedge up to 100 m wide. This wedge is surrounded by fuchsite-rich, ultramafic rocks (peridotic komatiites) altered to talc-chlorite, talc-carbonate and carbonate. Occurring here, as well, is a porphyry body 200 feet in diameter and plunging 60° to the west, which is sericitized, carbonatized and silicified to varying degrees.

A branch of the PDDZ, another broken up talc-chlorite schist zone called the “South Fault”, occurs within the ultramafic rocks to the south of the mafic rocks. This zone averages 30 feet in width.

Until 1986, surface and underground exploration defined gold mineralization mainly south of the Minor break. The M–1 Zone, the largest gold zone in the area, is within the altered mafic sequence. The gold mineralization is within quartz veins up to 1 m wide as well as within veinlets and stringers with about 5% finely-disseminated pyrite, native gold and minor chalcopyrite and arsenopyrite. The mafic rocks surrounding the ore have undergone a high degree of carbonatization and sericitization. The M–1 Zone subcrops near the shaft and strikes 240°, dips steeply south and plunges 040° west. Mining within this zone occurred from just above the first level (200 feet below surface) to the fourth level (575 feet below surface).

The M–2 Zone occurs in the upper levels of the mine at the south contact of the mafic-ultramafic contact. Irregular quartz veins with minor disseminated pyrite host the gold mineralization. The ultramafic rocks are carbonatized, and the mafic rocks are carbonatized and sericitized.

Minor amounts of mining were done on the N–1 area which can be described as small gold-bearing quartz zones at the north mafic-ultramafic contact. The mineralization is similar to the M–2 Zone except that the zones are smaller and of lower grade.

Development has occurred within the altered porphyry body between the “Minor Break” and the “South Fault” in what is called the S-Zone, but it has not been mined. Average gold grade here is 0.05 ounces Au per ton with the gold occurring in pyritic fractures.

In 1985, Esso Minerals discovered a gold zone 2500 feet east of the shaft in the north part of the PDDZ. This property became 100% owned by St. Andrew Goldfields in early 1988. Not yet accessed by underground development, the “East Zone”, as it is called, is characterized by gold-bearing quartz breccia within carbonate-altered, ultramafic rocks. A mineral inventory of 650 000 tons grading 0.080 ounces Au per ton was established in this area by surface diamond drilling.

In early 1986, St. Andrew Goldfields discovered the N–2 Gold Zone by drilling northward beyond the “Minor Break”. The gold ore is within and adjacent to a swarm of “porphyry dikes” within ultramafic rock. The average width of these dikes is 10 feet. Called porphyry dikes, these rocks are really fine-grained, grey siliceous zones within light buff to grey-green, carbonatized komatiites and do not have a real porphyritic texture. The komatiites contain abundant, irregular, white, quartz-carbonate stringers and veinlets. These stringers and veinlets are also within the siliceous zones which also commonly contain up to 10% disseminated euhedral pyrite. Pyrite is also found within the komatiites near the contacts. Stoping areas in the N–2 Zone could be up to 100 feet wide containing more than 1 gold-bearing siliceous zone and gold mineralization in the adjacent pyritized komatiites. The N–2 Zone has provided the mine with over 60% of its total mined tonnage thus far and has been mined from the second level to the sixth level, a vertical distance of 650 feet. Mining here is presently taking place above the seventh level, 1000 feet below surface.

Fifty feet to the south of the N–2 Zone and within the carbonatized komatiites, a gold zone was mined between the fourth and fifth levels (between 575 and 700 feet below surface). This zone was 150 feet in length and 20 feet in width and produced over 30 000 tons of ore and is included with the N–2 production figures. The rock contains quartz-carbonate veinlets, which are common to all of the carbonatized komatiites in the mine area, but also has 2% disseminated pyrite. This zone was not located by diamond drilling, but rather by mining in the N–2 area. Its contacts are defined by an assay cut-off.

The “Satellite Zones” are areas of economic gold mineralization west of the N–2 Zone. This gold mineralization, which varies in width from 5 to 8 feet, is located at the contacts of 3 en échelon, discontinuous porphyry bodies, which are 20 to 30 feet in width and contain no economic gold mineralization. These porphyry bodies are 200, 300 and 400 feet, respectively, west of the N–2 Zone.

The “West Zone”, located 1500 feet west of the shaft and between 800 and 1000 feet below surface, was discovered by a surface diamond-drill program in a joint venture with Esso Resources in 1987–88 while exploring for the down plunge extension of the M–1 Zone. Gold mineralization occurs in irregular brecciated, smoky, quartz-carbonate veins along the sheared contact between the sericitized and carbonatized tholeiitic rocks to the north, and the carbonatized komatiites to the south. This is similar to the M–2 Gold Zone in the upper levels. Gold also occurs within a “north” lens, which is characterized by irregular quartz-carbonate veins within the altered tholeiites. This is similar to the M–1 Gold Zone mined in the upper levels. The veins in the West Zone area are characterized by containing a minor amount of disseminated pyrite and a very minor amount of chalcopyrite, but abundant specks of visible gold. The larger veins contain the high-grade gold values and the stringer areas contain lower grade (subeconomic) values. The grade of the ore at the contact mined thus far has been very high, with the average grade being over 0.35 ounces Au per ton (as compared to the N–2 Zone, which so far has produced an average grade of 0.188 ounces Au per ton). The “north” lens in the tholeiites averages just less than 0.15 ounces Au per ton, but is considered...
a bonus zone. Interestingly, the best surface drill intersection obtained in this area was 0.16 ounces Au per ton over 8 feet. The komatiites in the West Zone area are brown to green in colour, carbonatized and increase in talc and chlorite content southward towards the South Fault. The tholeiites are bleached greenish-yellow in colour with variolites and pillows evident.

The production history for the Stock Township Mine to October 31, 1992, is summarized below.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Tons</th>
<th>Grade (ounces Au/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-1</td>
<td>77 720</td>
<td>0.128</td>
</tr>
<tr>
<td>M-2</td>
<td>40 388</td>
<td>0.122</td>
</tr>
<tr>
<td>N-1</td>
<td>9780</td>
<td>0.121</td>
</tr>
<tr>
<td>N-2</td>
<td>335 282</td>
<td>0.188</td>
</tr>
<tr>
<td>Satellite</td>
<td>29 690</td>
<td>0.139</td>
</tr>
<tr>
<td>West Zone</td>
<td>30 845</td>
<td>0.366</td>
</tr>
</tbody>
</table>


MINING AND DEVELOPMENT

The shaft reaches a depth of 880 feet below surface; however, the bottom level at the mine is the fourth level, 575 feet below surface. The shaft is not used below the fourth level due to ground problems in the talc-chlorite schist. A ramp has been driven down from the fourth level to access ore in the N-2 Zone above the sixth level (850 feet). This ramp was extended further to the seventh level (975 feet) in the N-2 Zone. A branch of this ramp was also driven to reach the West Zone on the seventh level.

Most of the mine’s production at the end of 1992 was coming from the N-2 Zone between the sixth and seventh levels. Pillar recovery will be taking place in the N-2 Zone just below the fifth level, at the fourth level and above the second level. A ramp will be driven below the seventh level to access ore below. Underground diamond drilling in 1992 indicated that gold mineralization in the N-2 Zone exists for at least 200 feet below the seventh level.

In the West Zone, drifting in ore on the seventh level took place in 1992. A subdrift was driven in ore 50 feet above the level and raising from this subdrift was started. To obtain quick high-grade mill feed, benches took place on the seventh level. Also at the end of 1992, an exploration drift on the seventh level was started westward, north of the ore to accommodate delineation diamond drilling. The fourth level was extended westward to meet a ventilation raise which started from the seventh level in the West Zone. Ramping will be done to access below the seventh level.

Mining in the N-2 Zone and the Satellite zones was conducted mostly by mechanized cut-and-fill with pillar recovery done by longhole methods. The M-1 Zone was mined by longhole and a few small longhole slopes were developed in the other zones. Fill was obtained by waste development muck, classified mill tailings and sand from a surface pit. The West Zone is presently being developed for longhole mining by sublevel retreat and using a remote load, haul, dump machine for mucking.

A gradual decline is being driven eastward from the sixth level towards the shaft bottom. The shaft will be cleaned out, inspected up to the fourth level and an engineering study done to see if the shaft can be made operational down to the sixth level. If the study is positive, the shaft may be rehabilitated by using concrete and may be sunk a further 80 feet to the seventh level.

The history of the Stock Township Mine has been a history of determination and perseverance. The original decision to develop the deposit was based on a gold grade of under 0.15 ounces per ton. The price of gold was higher in constant dollars at the time. Underground development was almost completed in the areas south of the "Minor" break when the rich N-2 Zone was discovered. This discovery resulted in the mine being brought into production. As the ore was being depleted, a decision to drive towards the West Zone was made, which recently resulted in finding the highest grade Au mineralization yet within the mine area. The exploration potential is still excellent to find additional reserves (St. Andrew Goldfields Limited, personal communication, 1992; personal observation, 1992).

Industrial Minerals

LUZENAC INCORPORATED,
REEVES MINE

Production of talc from the Penhorwood Township open pit mine was begun in 1978 by Steetley Talc Incorporated. In 1988, Luzenac Incorporated purchased the Steetley operations. Talc is obtained from the mining and beneficiation of a talc-magnesite altered komatiite. Mining is conducted by a contractor in January and February with the ore being stockpiled. Beneficiation is done throughout the year. The talc is concentrated at the mine site and processed at a fine-grind plant in Timmins. Most of the talc is sold to the paint and plastics industry, with 20 to 30% sold to the pulp and paper industry, and a small amount sold to the cosmetics and rubber industries. Previously, the largest proportion of talc was sold to the pulp and paper industry.

In 1992, the company produced and marketed about 30 000 tons of talc from 12 000 tons of ore mined and milled. The produced tonnage is lower than the 1991 amounts due to the necessary increase in milling times to accommodate the change in product type. This has resulted in an increase of 25% in the average value per ton of product. At present capacity, proven ore reserves are good for another 10 years or more of production.

In 1992, 40 to 45 people were employed at Luzenac Incorporated's Timmins operations, down slightly from 1991 (Luzenac Incorporated, personal communication, 1992).
ADVANCED EXPLORATION AND DEVELOPMENT

Claude Rundle Gold Mines Limited, Rundle Property

The Rundle property is an Archean lode gold deposit consisting of fracture-controlled gold mineralization in felsic intrusive and mafic volcanic rocks. There is no record of gold production from the deposit which was originally discovered in 1940 by C. Rundle, an employee of Hollinger Gold Mines Ltd.

In 1941, Hollinger sunk a shaft and completed underground development on the property. Proven and probable reserves were 91,000 t at 9.49 g/t Au when operations were suspended due to wartime conditions. In 1981, Sulpetro Minerals Ltd. completed an access road to the mine and continued to explore the deposit until 1986, when Sulpetro was succeeded by Novamin Resources. Novamin actively explored the property from 1986 to 1987, and updated reserves of 500,000 t at 7 g/t Au were published at the conclusion of its surface program. Further underground exploration by Novamin resulted in revised reserves of 534,820 t at 6.53 g/t Au (Luhta 1992).

In 1991, the property was acquired by Claude Rundle Gold Mines Ltd., a private company. In 1992, after upgrading the road and bringing milling equipment to the property, all activity on the Rundle gold deposit ceased. Extensive stripping, surface mapping and sampling were carried out in 1991 and, in 1991 and 1992, the underground workings developed in 1986 and 1987 by Novamin Resources Limited were dewatered and underground mapping and sampling was done (Claude Rundle Gold Mines Limited, personal communication, 1991, 1992; personal observations by the Timmins Resident Geologist, 1991 and 1992).

Great White Minerals Ltd., Fripp—Price Townships

This silica property straddles the east-west township boundary between north-central Fripp Township and south-central Price Township, approximately 20 km south of Timmins.

GENERAL GEOLOGY

The property comprises rocks of the upper sequence of the Deloro group including north-northwest-trending calc-alkaline mafic to felsic volcanic rocks, pyroclastic rocks and iron formation. The northeast corner of the property is cut by the granodioritic Adams pluton causing stratigraphic deformation by contact metamorphism of the surrounding rocks. Diabase dikes intrude the area in a northerly direction, but rarely crosscut the Adams pluton.

The silica-rich body is hosted by the calc-alkaline volcanic rocks in proximity to the granodiorites and is divided into 3 areas of "silica pulses" based on the silica content and the concentration of fragments and xenoliths. The richest zone, known as the "A Zone", is surrounded on the north, west and south by volcanic rocks and on the east by a probable fault. It is defined as having less than 10% xenoliths and assays have yielded extremely high silica values. The "B Zone" is surrounded by the "A Zone" to the west and south, the "C Zone" to the east and volcanic rocks to the north. It is defined as having greater than 10%, but less than 20%, xenoliths and assays have yielded high silica values. The "C Zone" is defined as having greater than 20% xenoliths and is surrounded by the "B Zone" to the west and partially by volcanic rocks to the north, east and south. The xenoliths range in composition from felsic intrusive to ultramafic extrusive.

A quartz-chlorite rich area has been found to the south of the main silica showing and samples have yielded assay values up to 2.67 g/t Au, 1.0 g/t Ag, 2.42% Cu, 57 ppm Ni and 60 ppm Zn (Great White Minerals, personal communication, 1992; Great White Minerals OMIP Summary Report, November 1, 1992).

Activity in 1992

Bulk samples totalling 2500 tons were taken during the year, 1500 tons early in the year and another 1000 tons in the late fall. More than 100 samples were sent to various potential clients for testing. The material is being examined for the production of various products, including architectural aggregate, custom aggregate, high purity quartz, crucibles, fibre optics and silicon metal.

A NORTC Grant of $38,800 was received for road work to be conducted in the area. With this grant, a total of 5 km of the Fripp Road was upgraded and a further 3 km was constructed.

During the year, the following work was completed on the property: 25 definition percussion drill holes; 4 diamond-drill holes; and a detailed mapping project. Results were favourable, although no details were made public. Engineering work on pit design, site planning and surface layout was also conducted. A feasibility and market study is presently being done and will continue into next year. The property is also being considered for its gold and copper potential (Great White Minerals, personal communication, 1992; Great White Minerals OMIP Summary Report, November 1, 1992).

Great Lakes Kaolin Inc. (Mineral Research Canada), Kipling Township

In February 1992, Mineral Research Canada (now Great Lakes Kaolin Inc.) began the extraction of a 13,000-tonne bulk sample of kaolin-silica sand and ball clay from its property in Kipling Township (NTS 42J/01NE). A total of 93,000 m³ of material initially had to be removed to produce this sample. Extraction ceased the first week of April. The sample was shipped to the Mineral Research Canada pilot plant and laboratory in Parry Sound. In March, 15 roto-sonic holes were drilled to a depth of 250 feet to further delineate the deposit. This was a continuation of the 168 roto-sonic drill-hole program totalling 1000 m drilled by the company in 1988–89.
Product and customer evaluation have taken place since the bulk sampling was done. Tests of the kaolin at several paper mills have returned encouraging results. Further ceramic test work has established that there is a demand for the product in northeastern Ontario, and that it meets market acceptance standards. Test work to evaluate the unconsolidated silicas and co-product has not yet been completed.

Mineral Research Canada is operating a 1.5 to 2 tpd test plant in the Parry Sound district. Plans have been made for a 30 tonnes per hour plant to be completed when the operation is in production. Plans have also been made to upgrade the existing winter road into the Kipling site to a semi-permanent road to provide year-round access. The completion of the road will allow the company to extract the remaining 137,000 t allowed on the 150,000 t limit aggregate permit issued by the Ministry of Natural Resources.

The deposit has been known for a number of years and has been subject to prior examination including upwards of 9000 m of exploration drilling. Mineralization includes kaolin, ball clay, refractory clay and silica sand (M. Martin, Mineral Research Canada, personal communication, 1992).

EXPLORATION ACTIVITY

Introduction

Exploration activity continued to decrease from the levels attained in the late 1980s. However, claim staking increased compared to 1991, mostly due to the staking of large tracts of land in the James Bay area for diamond exploration and staking in the Smooth Rock Falls area staked in early 1992 following reports of zinc mineralization being intersected.

Exploration budgets for many companies working in the area were down in 1992 from previous years. Between 1990 and the beginning of 1992, there were a total of 85 companies (both major and junior) working in the Timmins Resident Geologist’s District. At the end of 1992, there were 23.

Between 1990 and the end of 1992, 6 local exploration offices were closed in Timmins. This, combined with staff reductions and lay offs in other offices, has resulted in the total loss, in technical employment, of approximately 125 jobs.

The bulk of the exploration work completed during the year was done mainly by major companies, with only a few junior companies operating in the District.

Highlights from the year’s exploration activity follow. For a detailed summary of all exploration in the district, please refer to Tables 12.6 and 12.7 and Figures 12.1 and 12.2.

Asarco Exploration Co. of Canada Ltd.

At the end of February 1992, Asarco Exploration completed 4 surface diamond-drill holes, totalling approximately 2000 feet, on a property in Garnet Township optioned from Mingold Resources Limited. A volcanogenic massive sulphide zone was the exploration target as follow-up to a previously intersected five-foot section grading 2.5% Zn.

Eighty feet of oxide-facies iron formation was intersected in the recent drilling with several feet of sulphides. The best base metal intersection was 3 feet of 1.5% Zn. A follow-up surface stripping program was conducted during the summer with washing, mapping and sampling of the stripped area. The iron formation was noted to be quite complicated structurally, displaying tight, isoclinal folding.

Seven surface diamond-drill holes were completed in the spring and early summer in the northeast corner of Macklem Township near the company’s Aquarius gold deposit. IP anomalies within felsic body were the drill targets. Some drilling was also done for stratigraphic mapping purposes. Two of the holes were on the former Pominex property now owned by Asarco. Minor amounts of gold were intersected in the felsic rocks, as well as some narrow, localized gold in the surrounding carbonatized ultramafic rocks.

One, 1000-foot, surface diamond-drill hole drilled in Nova Township for base metal exploration purposes intersected highly metamorphosed felsic schists. Nothing of economic significance was intersected.

Asarco completed geophysical surveys, mapping and sampling over recently staked claims in Deloro Township just south of the Buffalo Ankerite Mine and just immediately south of the Porcupine–Destor deformation zone. Felsic volcanic rocks are exposed on surface with abundant carbonate alteration and some ankerite veining, as well as intrusive porphyry rocks of varying composition (Asarco Exploration, personal communication, 1992).

BHP Minerals Canada Ltd.

BHP Minerals Canada Ltd. concentrated on nickel and base metal exploration projects in the Timmins area in 1992. The company drilled 4 surface diamond-drill holes, totalling 700 m, on volcanogenic massive sulphide targets in Hutt Township, but intersected nothing of significance.

In McArthur Township, BHP Minerals conducted mapping projects just west and south of McArthur Lake. Three surface diamond-drill holes, totalling 800 m, were drilled in felsic volcanic rocks intersecting a sulphide-facies iron formation with some remobilized chloropyrite and sphalerite within quartz-filled fractures. An extensive belt of komatiites was mapped and sampled for geochemical analysis. Some samples returned values of over 40% MgO. At the end of 1992, a seven-hole, 1400 m surface diamond-drill project was being conducted on targets obtained from mapping, geochemistry and geophysics.

BHP Minerals staked 60 claims in Carscallen Township over an airborne geophysical response. Line cutting on these claims was done in 1992 (BHP Minerals Canada Ltd., personal communication, 1992).

**Abbreviations**

- AEM: Airborne electromagnetic survey
- AMag: Airborne magnetic survey
- ARes: Airborne resistivity survey
- AVLF: Airborne very low frequency survey
- DD: Diamond drilling
- DEEPEM: Deep electromagnetic
-Expl.AcL: see “Exploration Activity”, this chapter
-GC: Geochemical survey
-Gl: Geological survey
-GP: Geophysical survey
-HLEM: Horizontal loop electromagnetic survey
-IP: Induced polarization
-Le: Line cutting
-Mag: Ground magnetic survey
-Prop.Exam: see “Property Examinations”, this chapter
-RCD: Reverse circulation drilling
-Samp: Sampling
-Tr: Stripping
-UTEM: University of Toronto electromagnetic
-VLF-EM: Very low frequency electromagnetic survey

<table>
<thead>
<tr>
<th>Company/Property</th>
<th>Township</th>
<th>Activity</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
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<td>5. R.Burt–C.Morgan</td>
<td>Massey Tp.</td>
<td>DD-10, 2200 m, GlGC, Mag, HLEM, VLF-EM</td>
<td>also during 1990–91 exploration program</td>
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<td>Fripp, Musgrove tps.</td>
<td>AMag, AVLF, AEM, ARes, GlGC</td>
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<td>Robb, Jamieson tps.</td>
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<td>Gl, Samp, assays</td>
<td>1990 OPAP work; further prospecting in Zavitz only in 1992</td>
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<td>1911 base metal exploration</td>
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<td>23. J. Landers</td>
<td>Horwood Tp.</td>
<td>Mag, HLEM, DD-1, 152m</td>
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<td>Str, Tr, assays, GI</td>
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<td>28. C. Mortimer</td>
<td>Dore Tp.</td>
<td>Str, Tr, Samp</td>
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</tr>
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<td>37. Tri Origin Ltd.</td>
<td>Murphy, Wark tps.</td>
<td></td>
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<tr>
<td>38. Turnbull Staking Syndicate</td>
<td>Penhorwood, Reeves, Kenogaming, Sewell tps.</td>
<td>DD-5, 1060m</td>
<td>Expl.Act.; property optioned from Glen Auden Resources</td>
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<td>DDHs, over 1700m</td>
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<td>Poulett, Watson tps.</td>
<td>DD-4, 418m, Mag, HLEM</td>
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<td>42. Roseval Silica</td>
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### Table 12.7. Previously unlisted exploration data received, in 1992, by the Timmins Resident Geologist’s Office.

#### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
<th>Township(s)</th>
<th>Company/Property</th>
<th>Activity</th>
<th>Year</th>
<th>File Number</th>
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<td>Str, DD, 80 ft</td>
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### Table 12.7. Continued.

<table>
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<th>Township(s)</th>
<th>Company/Property</th>
<th>Activity</th>
<th>Year</th>
<th>File Number</th>
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<tbody>
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<td>Mann, Duff, Reaume, Hanna tps.</td>
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<tr>
<td>Pharand, Childerhose tps.</td>
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<td>Gl, Samp, assays</td>
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<td>T-3086</td>
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<td>A. D’Aigle</td>
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<td>Tisdale, Deloro tps.</td>
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<td>OMP 90</td>
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<td>Turnbull Tp.</td>
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</table>

### Cominco Limited

Cominco Ltd., in a base metal exploration program, drilled 2 surface diamond-drill holes, totalling 386 m, to test a geophysical target in Nova Township. Nothing of economic significance was found.

Cominco also conducted a humus geochemical sampling program in Foleyet Township and drilled 2 surface diamond-drill holes on base metal targets. Nothing of significance was intersected.

UTEM® surveys were conducted on a property optioned from Comstate Resources in Reid and Mahaffy townships. No new conductors were located and the option was dropped (Cominco Ltd., personal communication, 1992).

### Cree Lake Resources

Incorporated in 1990, Cree Lake Resources was formed to explore the former Quinterra Resources gold property on the south side of Cree Lake in Swayze and Cunningham townships. Quinterra discovered a large brecciated iron formation boulder on the property, which reportedly returned 0.878 ounces Au per ton over a 10 foot sample. Subsequent exploration by Quinterra involved mapping, geophysical surveying and diamond drilling. The source of the boulder was never located. The Quinterra drilling disclosed a number of highly anomalous gold values in a variety of lithologic and structural settings, for example, 600 ppb Au over 20 feet, including 1200 ppb over 5 feet, in a hornfelsed zone at a granitic contact (hole 12); 608 ppb Au over 31.5 feet, including 2000 ppb over 3 feet, in chert-pyrite iron formation (hole 14); 0.052 ounces Au per ton over 12.5 feet in brecciated...
In the fall of 1992, Cree Lake Resources commissioned MPH Consulting Limited of Toronto to carry out a program of geological mapping and prospecting, overburden stripping and trenching and bedrock sampling on the property. A soil geochemistry survey was conducted over specific geophysical targets to prioritize them for stripping and blasting. Twelve areas were stripped or trenches, exposing sulphide- and oxide-facies iron formations, carbonate alteration zones and a large quartz stockwork zone within a felsic intrusive body. The results of the program are in the process of being compiled and released (MPH Consulting Limited, personal communication, 1992).

**Falconbridge Limited**

Falconbridge Exploration worked on 2 large base metal exploration projects in 1992. The first was exploration within a 5 km radius around the Kidd Creek Mine and the second was exploration in the Kamiskotia area.

Surrounding the Kidd Creek Mine and mostly to the north, 13 surface diamond-drill holes were completed, totalling approximately 7000 m, on 5 wholly owned and optioned properties. As well, an additional 13 holes, totalling approximately 8000 m, were drilled on the recently optioned 160 acre White Star Copper Mines property adjacent to and on the western boundary of the Kidd Creek Mine property. Drilling here was confined to an area above a vertical depth of 1000 m. A favourable rhyolite horizon, which hosts the small base metal deposit on the Chance Mining and Exploration Company Ltd. ground to the west, is the target. Whether this is the same stratigraphic horizon on which the Kidd Creek deposit occurs is not yet known. Every hole has undergone down-hole electromagnetic testing. Deeper drill testing below 1000 m will be done next year on the property.

An input survey was flown over the claims surrounding the Kam-Kotia Mine on which Falconbridge has an exploratory licence of occupation. As well, a high-powered deep EM ground survey was completed on the property. This EM survey is reported to be able to obtain information to a depth of 250 m below surface. Six surface diamond-drill holes were completed, totalling approximately 4000 m, on the property in non-environmentally sensitive areas. The mine stratigraphy was tested at depth and along strike. Down-hole electro-magnetic surveys were done on every hole. Lithogeochemistry is being done on the drill core. Next year, the drill testing of geophysical targets will be done. An environmental monitoring program, financed by Falconbridge and the Ministry of Northern Development and Mines and managed by a provincial intergovernmental steering committee, is being conducted in the area covered by the exploratory licence of occupation.

In other programs, Falconbridge completed 8 surface diamond-drill holes, totalling approximately 3000 m, on an old reactivated base metal property in Genoa Township. Three surface diamond-drill holes, totalling approximately 1000 m, were completed in Wilkie Township to test geophysical responses in the Kirkland Lake Resident Geologist's area. A large regional compilation program is continuing at the Timmins Office (Falconbridge Exploration, personal communication, 1992).

**Homestake Canada Ltd.**

During 1992, Homestake concentrated on data compilation and research of key advanced prospects in the Timmins area. All field work conducted was targeted towards potential property acquisitions. Exploration activities were curtailed at the end of the summer after the merger of Homestake Mining with Corona Corporation. All Homestake offices are being closed with the exception of a reorganized office in Reno, Nevada, and an office in Vancouver, which will control the company's interests in British Columbia. The Timmins Resident Geologist's Office is in the process of acquiring as much previously unsubmitted data from the local office as is possible before it closes on December 31, 1992 (Homestake Canada Ltd., personal communication, 1992).

**Inco Exploration and Technical Services Limited**

Inco Exploration and Technical Services Limited completed line cutting and geophysical surveys during the winter of 1992 in Agate Township. A reverse circulation drill program, totalling 41 holes, was also completed. The objective of the program is to explore for zinc mineralization in a similar geological setting as that worked on by Noront Resources Ltd. in Hurdman Township to the south. Surface diamond drilling is planned here for 1993.

As part of a base metal program in Hutt Township, further line cutting and geological mapping were done on the company's property as a follow-up to similar work done in 1991. Geophysical surveying will be done in 1993.

Line cutting and geological mapping were done on Inco property in Nova Township and reconnaissance geological work was done in Tooms and Greenlaw townships in the Swayze area (Inco Exploration and Technical Services Limited, personal communication, 1992).
KWG Resources Incorporated—
Blue Falcon Mines Limited

In the summer of 1992, KWG Resources and Blue Falcon Mines Ltd. entered into a joint venture agreement to conduct a diamond exploration program in the Attawapiskat River area. During the summer and fall, over 58 720 ha (146 800 acres) were staked for the “Spider #1” project to the west and south of the community of Attawapiskat. This program was initiated after assessment files were examined which reported that a surface diamond drilling project conducted by Monopros Ltd. in 1988 and 1989 reported that 9 holes on various claims had intersected kimberlitic rock.

In 1988, BP Resources Canada Ltd. conducted geophysical surveys in the Attawapiskat area to outline potential kimberlitic intrusions. Although no diamond drilling was reported in the reports submitted for assessment work, recommendations to drill test magnetic anomalies were made.

The property surrounds the Monopros claim group and airborne magnetic surveys conducted by the joint venture partners, KWG Resources and Blue Falcon Mines, have identified various airborne geophysical targets thought to indicate diatremes. Plans have been announced for a 30 000-foot surface diamond-drill program to test these targets (Blue Falcon Mines, personal communication, 1992; KWG Resources—Blue Falcon Mines news conference, August 24, 1992; Timmins Resident Geologist’s files).

Kennecott Canada Incorporated

In 1992, Kennecott Canada Inc. conducted a nickel exploration program on a large property centred south of Betty Lake in Tooms and Greenlaw townships in the Swayze greenstone belt. MPH Consulting Limited conducted the work on the project on behalf of Kennecott. The property encompasses a number of known nickel occurrences in surface showing and previous drill holes.

One hundred and fifty miles of line were cut and ground geophysics (magnetic, MaxMin II, EM) were completed during the winter. This was followed by an extensive program of prospecting, geological mapping and sampling during the early summer. A stripping and trenching program was conducted on the old Tooms Syndicate nickel showing in August.

Kennecott’s primary exploration target is a high-grade, volcanic peridotite-associated nickel sulphide deposit.

The Tooms Syndicate showing has been described as occurring in tuffaceous rocks with “greenstone” to the south and peridotite in the north. The greenstone is now felt to be part of a thick gabbroic body and the peridotite probably represents komatiitic volcanic rocks. Previous surface channel sampling had returned values of 0.85% Ni over 2.13 m and up to 0.67% Cu over 4.88 m. Previous shallow X-ray type drill holes under the trenches returned nickel values of up to 1.22% over 1.95 m (hole 1), 0.37% over 3.05 m (hole 2) and 0.48% over 7.62 m (hole 4), and copper values up to 0.52% over 10.36 m. Subsequent larger diameter core drilling in the showing area in 1967 returned values up to 0.36% Ni over 5.49 m (including 0.85% over 1.52 m [hole 8]) and up to 0.45% Cu over 3.57 m (hole 8).

Grab samples in the area of the old Tooms Syndicate trenches have returned values as high as 1.82% Ni and 1.02% Cu. These values were encountered in tuffaceous rocks containing pyrite-pyrrhotite content of 20% or less. The nickel-rich zone occurs closer to the ultramafic rocks separate and distinct from the copper zone which occurs further to the south towards the gabbroic rocks. Drilling by Granges Exploration in the late 1970s, some 1200 m west of the above, returned nickel values to 0.50% over 4.82 m and 0.53% over 2.80 m (including 1.02% over 0.88 m [hole SW–62]) and 0.44% over 3.66 m (hole SW–63).

A major corridor of deformation and alteration located north of the nickel-associated ultramafic belt was extensively explored for its gold potential by Quinterra in the 1980s. They reported intersections of up to 0.113 ounces Au per ton over 7.47 m, although the gold mineralization is indicated to be quite erratic.

The 1992 exploration work located a total of 11 high priority geophysical-geological targets which have been recommended for diamond drill testing (3000 m±). This work is expected to be completed during 1993 (MPH Consulting Limited, personal communication, 1992; Assessment File Summary, 1992).

Kirkton Resources Corporation

Located in the south portion of the Swayze greenstone belt some 130 km southwest of Timmins, the Shunsby Cu-Zn-Pb-Ag property of Kirkton Resources Corp. has a history of exploration dating back to the early 1900s when the area was first examined for its iron potential. In excess of 200 diamond-drill holes have been completed on the property to date. This work has been focussed on 2 small Cu-Zn (+ Pb, Ag) deposits, the so-called “Main” and “South” zones.

Various reserve estimates have been prepared for the property by previous workers. Placer Developments Limited in 1980, for example, calculated a reserve of 2.4 million tons grading 0.4% Cu and 2.4% Zn. Calculation by M.W. Resources Ltd., in 1981, indicated a local, higher grade pod in the Main Zone containing 80 000 tons at 3.90% Cu, 6.29% Zn, 1.2 ounces Ag per ton, 0.03 ounces Au per ton along with an estimate of reserves in the South Zone of 970 000 tons at 1.2% Cu and 5.0% Zn. Subsequent calculations, prepared for M.W. Resources Ltd. in 1989, indicated a total geological reserve of approximately 1.0 million t grading 1.0% Cu and 1.5% Zn.

Relative to earlier years when most of the above work was carried out, there is now excellent access into the property via good-quality logging roads. Kirkton’s original interest in the property focussed on the potential to develop a large tonnage, open pit Cu-Zn deposit. It was recognized by Kirkton that the greatly improved access into the area would
play a significant role in the economics of the property and might permit the mining of lower grades.

By agreement dated June 30, 1989, as amended February 28, 1990, with M.W. Resources Ltd. and Chelsea Resources Ltd., Kirkton was granted an option to acquire up to a 100% undivided interest in the Shunsby property subject to the reservation of a 12.5% net profits royalty to the above companies.

In order to complete the option, Kirkton must complete a cumulative amount of $2,750,000 of exploration work by April 12, 1994, and make payments totalling $250,000.

Kirkton subsequently entered into an agreement dated October 23, 1992, as amended October 30, 1992, with Phelps Dodge Corporation of Canada, Limited, pursuant to which Phelps Dodge may fund exploration and development work and earn into Kirkton's rights and obligations with respect to the Shunsby property. Phelps Dodge is expected to commence an exploration program on the Shunsby property in late 1992.

A major OMIP-supported exploration effort has been ongoing on the Shunsby property since 1989. The work has been managed by MPH Consulting Limited of Toronto on behalf of Kirkton.

The 1989 work comprised a major line cutting and ground geophysical program. An extensive computer-aided drill-hole compilation exercise was also carried out. This was followed in 1990 with a large stripping and trenching exercise aimed at locating some of the drill-indicated mineralization at surface. The 1991 program again had a large stripping, trenching and sampling component in follow-up to previous work, but also included comprehensive geological mapping both on a property-wide scale and of a very detailed nature in the area of the deposits. Extensive petrographic and computer-supported lithogeochemical processing work was also carried out to assist in the classification of various rock types in the mineralized areas and the identification of hydrothermal alteration signatures associated with mineralization. The stripping and trenching work, in 1991 particularly, indicates some attractive copper (± zinc) grades and widths associated with the known structurally controlled mineralization. A trench across a portion of the Copper Breccia showing, for example, averaged 3.53% Cu over 5.0 m. Similarly, a 3.0 m sample across the Copper Knob structure averaged 2.59% Cu. Some of the more significant surface sampling results are summarized below (Timmins Resident Geologist’s personal observations, 1992; Kirkton Resources Corporation, Annual Reports, 1991, 1992 and news release, November 2, 1992).

<table>
<thead>
<tr>
<th>Showing/Area</th>
<th>Inferred Zone Width (m/ft)</th>
<th>Cu (%)</th>
<th>Pb (%)</th>
<th>Zn (%)</th>
<th>Ag (oz/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;4 + 25N&quot;</td>
<td>8.0/26.2</td>
<td>0.67</td>
<td>1.15</td>
<td>4.30</td>
<td>0.12</td>
</tr>
<tr>
<td>&quot;Cu Knob&quot;</td>
<td>3.0/9.8</td>
<td>2.59</td>
<td>0.02</td>
<td>0.32</td>
<td>0.41</td>
</tr>
<tr>
<td>&quot;4 + 00N&quot;</td>
<td>7.4/24.3</td>
<td>2.87</td>
<td>0.78</td>
<td>2.97</td>
<td>0.38</td>
</tr>
<tr>
<td>&quot;2 + 75N&quot;</td>
<td>1.0/3.3</td>
<td>0.69</td>
<td>1.30</td>
<td>5.97</td>
<td>0.20</td>
</tr>
<tr>
<td>&quot;Cu Breccia&quot;</td>
<td>5.0/16.4</td>
<td>3.53</td>
<td>0.02</td>
<td>0.52</td>
<td>0.54</td>
</tr>
<tr>
<td>&quot;1 + 00S&quot;</td>
<td>4.8/15.7</td>
<td>0.75</td>
<td>2.76</td>
<td>10.77</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Moneta Porcupine Mines Incorporated

It was announced early in 1992 that Falconbridge Ltd., while surface drilling to test an electromagnetic anomaly during a base metal exploration program on property optioned from Moneta Porcupine Mines Inc. in Godfrey Township, intersected a narrow, gold-bearing, quartz-carbonate vein. The anomaly was found to be a 35 m thick graphitic argillite horizon. The gold was within a 10 cm quartz-carbonate vein with arsenopyrite. Core sampling returned assays of 306 g Au over 0.4 m. The hole was drilled in July of 1991 and follow-up drilling has yet to be done.

Moneta Porcupine Mines Inc. conducted a large staking program in early 1992 in Loveland and Macdiarmid townships after re-evaluating core obtained by surface diamond drilling conducted in 1966. Some of the core examined forms part of the Ministry of Northern Development and Mines Timmins Drill Core Library collection. Geological interpretation by the company suggests that the area could represent an environment in which a volcanogenic massive sulphide deposit could be hosted. Line cutting was done over a portion of these claims in 1992.

Control of Moneta Porcupine Mines Inc. was acquired by J. Larche, a native of Timmins, in August, 1992 (Moneta Porcupine Mines Inc., personal communication, 1992; The Northern Miner, January 13, February 3, August 24, 1992).

Noble Peak Resources Ltd.

In 1992, Noble Peak Resources actively explored a number of Timmins area properties.

Noble Peak Resources entered into a joint venture with Outpost Resources and its contracting arm, Target Resources, for Noble Peak Resources' main property in Halcrow Township. A gold exploration program was carried out during the year, consisting of overburden stripping, washing and sampling.

A second, smaller program consisted of humus sampling on ground in Halcrow and Denyes townships.

In the Reeves-Muskego area, additional ground was staked and a geological mapping and geochemical sampling program were undertaken.

A program of lake sediment and humus sampling was conducted over relatively untested airborne anomalies in the Horwood Lake area.

Samples were collected from all the above-mentioned properties to be processed for diamond indicator minerals.

Although no work was done on the company’s Cunningham Township property in 1992, drill core from 1991 drilling was submitted to the Timmins Drill Core Library (Noble Peak Resources Limited, personal communication, 1992).
Noranda Exploration Company Limited

As a result of the Ontario government airborne survey, which was flown over the North Swayze–Montcalm area and issued in 1990, Noranda Exploration conducted base metal exploration programs in Nova and Belford Townships in 1992. The company drilled 4 surface diamond-drill holes totalling 1050 m. This drilling tested electromagnetic targets and followed up on diamond drilling done in the previous year.

In Cunningham Township, Noranda drilled 9 holes, totalling 1600 m, at the end of 1992 on claims near the Shunsby base metal occurrence. This followed prospecting, geological mapping and geophysical surveys done by the company to trace the stratigraphy which hosts the Shunsby occurrence. Encouraging results of the above work were reported and interesting geology not previously known was found to occur in the area.

In Thorburn Township, one 424 m diamond-drill hole was drilled in 1992 during an extensive base metal drilling program initiated in late 1991. A thick sequence of highly siliceous rhyolites with sulphides was traced. One hole intersected approximately 100 m of up to 20% sulphides (mostly pyrite with minor chalcopyrite and sphalerite). However, no intersections of economic significance were obtained. Exploration in this area has terminated except for attempting to generate new ideas.

As a follow-up to a base metal intersection obtained by Falconbridge Ltd. on adjacent claims in 1990 (10.1 m of 1.37% Cu, 7.53% Zn, 0.14% Co, 29 g/t Ag, 1.1 g/t Au), Noranda completed a geophysical program on its Alexo property in Dundonald Township.

Four surface diamond-drill holes, totalling 420 m, were drilled on conductors in the north part of Murphy Township. Graphitic argillites were intersected. Instead of rhyolitic rocks which were reportedly intersected in previous drilling in the area, carbonatized, ultramafic rocks were obtained. The option on the property was dropped.

In the southwest part of Jessop Township, Noranda completed 3 surface diamond-drill holes, totalling 820 m, in 1992, in a base metal exploration program.

Preliminary base metal exploration work was done by Noranda in Foleyet, Reid and Hong Kong townships.

Noranda Exploration managed 3 gold exploration projects in 1992 in the Timmins Resident Geologist’s area on behalf of Hemlo Gold Mines Ltd. On the West Porcupine Group optioned from Glen Auden Resources, 5 surface diamond-drill holes were completed totalling 1060 m. Preliminary work which included geophysics, mapping and prospecting was done on the Sylvanite project in Denyes Township. Drilling is to be started in late 1992. On property, on which a letter of intent has been signed with Gowest Amalgamated Resources, in Denton Township, Noranda has completed line cutting, geophysical surveys and geological mapping. This property includes the old Halpenny gold showing on which Gowest completed a stripping and surface diamond drilling in 1981. Surface sampling outlined a zone 80 by 14 feet grading 0.127 ounces Au per ton.

In a joint venture with JonPol Exploration in 1987–88, Gowest intersected a section with anomalous gold values during a diamond-drill hole program as follow-up to an overburden drill program in silicified and sericitized basalts with pyrite and arsenopyrite.

Noranda Exploration has announced it will be closing its regional exploration office in Timmins, effective April 1993. Although the company’s exploration budget will remain the same for the Timmins area, it will be managed from the exploration office in Noranda, Quebec. A small field office may be maintained in Timmins. In October 1991, Noranda Exploration employed 39 people in Timmins and, at the time of writing, the company employed 19. Of these, 10 will be transferred and the others laid off (Noranda Exploration Company, personal communication, 1992; Resident Geologist’s files).

Noront Resources Limited–Galico Resources Incorporated, Hurdman Township

In November 1991, Noront Resources acquired a large claim group in Hurdman Township from McKinnon Prospecting Limited. The property had previously been diamond drilled by Mattagami Lake Exploration in 1981, and zinc was intersected in highly metamorphosed (granulite facies) rock. Surface diamond drilling began in late 1991 with 4 holes being completed and, in early 1992, the results were announced, which included 2.41% Zn over 44.3 feet in the first hole in the vicinity of previously known mineralization and 1.91% Zn over 127.5 feet in hole No. 3, 400 feet west of hole No. 1. Also reported were values up to 1.2 ounces Ag per ton, up to 0.03 ounces Au per ton and up to 0.07% Cu. Holes No. 2 and 4 were drilled to test separate ground geophysical anomalies and returned from assay scattered zinc, silver and gold.

In February 1992, it was announced that Galico Resources Inc. entered into an agreement with Noront Resources to fund further exploration on the property for an earned interest. Five surface diamond-drill holes were completed in April, 1992, with intersections grading 1.24% Zn over 64 feet and 1.09% Zn over 353 feet being reported. It was announced in July, 1992, that the 2 companies’ option agreement had been terminated.

All diamond drill core from the 1991–1992 drilling on the property has been donated to the Timmins Drill Core Library (Noront Resources Limited, press release, January 9, February 3, 1992; The Northern Miner, July 20, 1992).
Placer Dome Incorporated

In 1992, Placer Dome Exploration completed 2 surface deep diamond drilling programs, the first early in the year and the second late in the year, to explore for the western extension of ore in the Main Zone of the Detour Lake Mine. A total of 7 holes and 1 wedged hole, totalling 687.5 m, were completed. The drilling was reported to be successful as the Main Zone mineralization was extended a further 800 m westward. One of the holes intersected a new structure, called the “C-Zone”, early in the hole in the hanging wall at the 150 m elevation and 300 m north of the Main Zone structure. Values grading 1.2 ounces Au per ton over 20 feet were reported. The closest mine workings at that elevation are 1000 m to the east. Four shorter, widely spaced (100 m) diamond-drill holes, totalling 1510 m, were drilled to follow up this intersection. Some positive results were obtained. The gold mineralization occurs within basalts which are pillowed and contain flow top breccia. Calcite occurs as replacement material around the pillows and clasts. Disseminated pyrite and pyrrhotite and quartz stringers occur throughout the zone.

Placer Dome Exploration also drilled 3 surface diamond-drill holes into weak IP anomalies on property optioned from Pelangio–Larder Mines Ltd., 4.5 km northwest of the Detour Lake Mine. Anomalous gold values were reported to have been intersected.

On the Dome Mine property, mapping, trenching and sampling programs were conducted by the exploration department to the northeast of No. 8 shaft. Surface diamond drilling will be done in this area next year.

A base metal, surface diamond-drill program was done in Poulett Township. Four holes, totalling 418 m, were drilled to follow up on geophysical surveys. No results of economic significance were obtained.

Geophysical surveys for base metal exploration were done in Mann, Loveland and Mahaffy townships. A geophysical survey (IP) was also completed in 1992 for gold exploration on Placer Dome’s Border Group located 20 km southeast of the Detour Lake Mine (Placer Dome Exploration, personal communication, 1992).

Rio Algom Exploration Inc.

In 1992, Rio Algom continued exploration north of Timmins on property optioned from Abitibi Price Incorporated. Detailed horizontal loop electromagnetic and magnetic surveys on a grid straddling Macbe and Kingsmill townships were conducted in December, 1991. Fifty-two reverse circulation holes, totalling 1796 m, were drilled in January, 1992, in Aubin, Nesbitt and Lucas townships. By mid-February, 7 surface diamond-drill holes, totalling 1014 m, had been drilled with 1 hole in each of Carnegie, Macbe and Crawford townships and 2 holes each in Aubin and Kingsmill townships. An IP survey was conducted in Nesbitt township in August and additional surface diamond-drill hole, totalling 268 m, was drilled in the same township in October. Results from the work conducted thus far have not been encouraging, however, plans for future work are under review. Rio Algom continues to hold the options on the properties at the end of 1992.

The company’s Timmins project office was closed on June 25, 1992. Work conducted on the project after this date was completed by staff from the company’s Toronto office.

The company has donated a substantial amount of data not previously submitted to the Timmins Resident Geologist’s Office and the Timmins Drill Core Library (Rio Algom Exploration Inc., personal communication, 1992).

Royal Oak Mines Incorporated

Royal Oak Mines Inc., with the assistance of flow-through funding and an Ontario government OMIP program, spent 75% of its total exploration budget of $2.5 million in the Timmins area. Most of the work was in the vicinity of the Pamour No. 1 Mine, in an area stretching from the Broulan property to the west, to and including the Hoyle Property in the east, which extends to the eastern boundary of Whitney Township. A total of 77,292 feet of surface diamond drilling was completed here in 1992. The objective was to find gold ore amenable to open pit mining. Although the program did not meet this objective, 2 significant gold zones out of 9 target areas were found to have the possibility of becoming underground programs.

On the Hoyle property east of Pamour No. 1, Royal Oak made 2 different agreements in 1989 with the owner Falconbridge Gold Corporation. On the southern portion, where Royal Oak is presently mining the Hoyle gold deposit, the agreement is on a production royalty basis. On the northern portion, Royal Oak is earning into a 50% joint venture agreement with Falconbridge Gold. This agreement expires in 1994. In the southern part, 2 areas in sedimentary rocks were targeted for surface diamond drilling. One was south of the No. 2 pit, where a few low erratic gold values were intersected, but nothing of economic significance was found. As a follow-up on previous Falconbridge drilling, which intersected gold values in greywackes at the east end of the Hoyle property, 6 surface diamond-drill holes were completed by Royal Oak. The ore hosting conglomerate mined at the Pamour No. 1 and the Hoyle Mines thins out to the east and gold mineralization continues in zones within the greywacke. The best intersection returned values of 0.247 ounces Au per ton over 14.8 feet. This zone may have the potential of becoming a possible underground operation.

Royal Oak conducted approximately 60% of its Pamour No. 1 vicinity surface diamond drilling over a strike length of 8000 feet in the northern portion of the Hoyle property in the volcanic rocks and an enclosed sedimentary unit. A zone called the “A.K” Zone located in the volcanic rocks north of the No. 2 pit was delineated on 200-foot spacings down to a depth of 400 feet over a strike length of 2000 feet. Multiple gold-bearing quartz veins were intersected. The best intersection obtained was 0.29 ounces Au per ton over 29 feet. The
"A.K" zone may also have potential of becoming an underground operation. The only other good drill results apart from the "A.K" zone in the northern area came from a quartz vein at the contact between ultramafic and mafic volcanic rocks, which recorded a value of 1.46 ounces Au per ton over 6 feet.

Also on the Hoyle property, a stripping program was carried out near the east boundary around an old twenty-feet-deep shaft. Narrow gold-bearing quartz veins in mafic volcanic rocks were uncovered. Nothing of economic significance was found. The best chip sample was 0.171 ounces Au per ton over 5 feet.

On the company's wholly-owned Pamour No. 1 property, 16 surface diamond-drill holes were completed south of No. 4 pit, with sub-economic results being obtained. A few deep surface diamond-drill holes were drilled east of 51 vein north of the Pamour No. 1 Mine. The best intersection here was 0.22 ounces Au per ton over 3 feet. Drilling into crown pillars on the west side of the Pamour No. 1 Mine for possible open pit ore did not locate any significant continuous zones. Drilling east of the No. 5 pit and south of the pit on the wholly owned Broulan property returned low grade gold values.

Royal Oak Mines Inc. purchased the Broulan property in 1991. Presently, the company is carrying out a shaft inspection at the Hallnor Mine between the Broulan and Pamour properties. Plans are to access and establish underground exploratory drilling stations on the twenty-second level (3300 feet below surface), from which to explore for targets on the Broulan property adjacent to the Hallnor Mine to the east and the Pamour property boundary to the west.

Nine surface diamond-drill holes totalling 7421 feet were drilled in 1992 on various targets in an attempt to extend the known mineralized horizons at Royal Oak's Night Hawk Lake North Peninsula property in Cody Township.

Royal Oak Mines Inc. completed a stripping program in the north part of Lot 7, Conc. II, Tisdale Township, over an area of old trenches. Erratic quartz veins with disseminated pyrite mineralization occurs in carbonatized mafic volcanic rocks containing pillows and pillow breccia located 300 feet west of the Krist Fragmental at the nose of the Porcupine Syncline. The best chip sample result is from a seventeen-feet section grading 0.098 ounces Au per ton.

One surface diamond-drill hole, 866 feet in length, was drilled into a target consisting of possible gold-bearing shear zones in a felsic intrusive in Newmarket Township. No significant results were obtained.

The company also completed a geological mapping project on a base metal property in Semple and Hutt townships (Royal Oak Mines Inc., personal communication, 1992).

**Tri Origin Exploration Limited**

Tri Origin Exploration Limited has 67 claims in English Township and in the north part of Semple Township. Previous work has identified anomalous gold values in disseminated sulphide zones along a felsic-ultramafic contact within carbonatized ultramafic rocks and within porphyritic zones. In late 1992, 30 km of line cutting and IP surveys were completed on the claims (Tri Origin Exploration Limited, personal communication, 1992).

**RESIDENT GEOLOGIST STAFF ACTIVITIES**

The Timmins Resident Geologist Office is staffed by L.E. Luhta, Resident Geologist; P.J. Sangster, Staff Geologist; D.M. Draper, Data Geologist and D.C. Egerland, Secretary. The Timmins Drill Core Library is staffed by C.D. Hamblin, Drill Core Library Geologist and M.L. Leroux, Drill Core Library Geologist Assistant.

In spite of the decline in the exploration and development activity in the district, client use of the Resident Geologist's facilities remained high, with over 2800 office consultations recorded from January to the end of November. This figure does not include field trip participants or the 955 visits recorded to the Timmins Drill Core Library. Over 7500 telephone inquiries were received by the Resident Geologist's Office and Drill Core Library from January to December 1, 1992.

The Resident Geologist's Assessment File and Technical Library continued to expand with 114 assessment files and 43 OPAP and/or OMIP submissions being incorporated into the database. Additional information from Rio Algom and Homestake not previously submitted for assessment was donated when these companies closed their Timmins offices. The updated version of the provincial Mineral Deposit Inventory (MDI), including 1:50 000 base maps showing locations for all known mineral occurrences in the Timmins Resident Geologist's District has also been added to the Technical Library.

In 1992, the office saw an increasing number of projects related to public relations and to public education. Timmins hosted the Northeastern Ontario Mines and Minerals Symposium and staff of the Timmins Resident Geologist's Office played a significant role in its organization and presentation. S. Lomas, a local geologist, was hired on a short-term contract to assist in the preparation of the Symposium. Over 300 people attended the two-day event with the highlight being a keynote address presented by Ms. M. Witte, President, Royal Oak Mines Ltd. In conjunction with the Symposium, the Timmins Office prepared several booklets and/or brochures for public distribution including: "Summary: Northwestern Ontario Mining and Development Activity, 1992" and "Properties Available for Sale, Option, or Joint Venture in the Timmins Resident Geologist's District".

The Resident's Staff also co-ordinated a full week of activities emphasizing the importance of Ontario's Mineral Industry during Ontario Mining Awareness Week in June. Two weekends of activities were presented at Kettle Lakes Provincial Park over the course of the summer and a day
program was provided to the Timmins Museum Young explorers group. A poster session was provided in conjunction with the Porcupine Branch Prospectors and Developers Association (PBPD A) Northern College Career Day. A poster session titled, "Northeastern Ontario Clays", was also presented at the Ontario Clay and Glass Association annual conference.

As part of the MNDM PEP (Public Education Project), the Timmins Resident Geologist's Office co-ordinated the collection of rocks and minerals for 50 teaching kits. The kits are to be assembled in early 1993 and will be distributed to each Resident Geologist's Office, where the kits will be kept available for loan to local schools.

During the late spring and early summer, a five-week Basic Prospecting Course was presented in Timmins to 25 student prospectors.

Staff of the Timmins Resident Geologist's Office made 44 property visits including at least 1 visit to each operating mine and development project in the area. Eighteen field trips were given including a comprehensive tour of the Porcupine camp to a delegation of geologists from China.

The Resident Geologist's office and staff assisted by providing technical support for other agencies and branches with field components. M. Leroux, Drill Core Library Geologist Assistant served as field assistant to S. Fumerton, NODA Geologist, Swayze Mineral Deposits Study. K. Heather, a Geological Survey of Canada Geologist, also working with funding provided under NODA, was provided with office space and occasional logistical support. H. Veldhuysen, NODA Geologist working on an evaluation of the Shawmere anorthosite complex, was provided with office space, technical support and orientation tours of the complex. L. Lafleche, a local ACAD specialist, was hired on a short-term contract to instruct D. Draper in the use of computer-assisted drafting hardware and software.

Staff of the Timmins Resident Geologist's Office spent considerable time in assisting local explorationists with OPAP and/or OMIP applications and submissions. Additional time was spent in follow-up field examinations of properties funded by these programs.

L. Luhta and C. Hamblin continued as members of the Provincial Drill Core Library Committee. L. Luhta also served on the Kam-Kotia Committee; acted as MNDM liaison with the Attawapiskat Community and represented MNDM at the Cordilleran Round-Up in Vancouver. P. Sangster continued to serve on the MNDM Communication, Marketing and Education Steering Committee, on the PBPD A Education Committee and on the PBPD A Benny Hollinger Trail Committee. M. Leroux retained his position as Secretary for the Porcupine Geological Discussion Group.

**PROPERTY EXAMINATIONS**

**Cogema Canada Limited—Moneta Porcupine Mines Incorporated, Tisdale Township**

**INTRODUCTION**

On October 3, 1992, the Timmins Resident Geologist was invited to examine diamond-drill core from a drill program recently conducted by Cogema Canada Limited on property optioned from Moneta Porcupine Mines Inc. in the southwest part of Tisdale Township (NTS 42A/6NW). In the fall of 1990, 45 claims in the area were optioned by Moneta to Cogema. Under the agreement, to earn a 50% interest in the claims, Cogema was to make annual cash payments to Moneta and commit expenditures to a work program by December 1, 1994. Cogema was to be the operator during this exploration phase. In 1991, line cutting, geophysical and geological surveys were conducted on the claims. Surface diamond drilling began in July and ended in September of 1992.

**LOCATION AND ACCESS**

The surface diamond-drill program took place on a part of the former August Porcupine Mines Limited property, which comprises 4 patented claims, P.13300, P.13038, P.13039 and P.13040 in the north half of Lots 8 and 9, Conc. I and the south half of Lots 8 and 9, Conc. II, Tisdale Township, and an adjacent leased claim, P.577598, located in the south half of Lot 9, Conc. II. The claims are located one-half mile due south of the town of Schumacher. Access to the property is eastward for one-half mile along the natural gas pipeline from a point just east of the Vipond road turnoff on the back highway which joins Timmins and South Porcupine.

**HISTORY**

The 4 patented mining claims are a part of 4 claims which Moneta Porcupine Mines Inc. purchased from August Porcupine Mines Incorporated in 1989. Ferguson (1968) described the history as follows:

Development by previous operators had been chiefly confined to the vicinity of the Alma vein, which outcrops on the northwest claim, about 250 feet south of the Hollinger boundary. In 1916 the Triumph Shaft, inclined 62° N, was sunk by Triumph Mines Limited in the vicinity of the vein (OBM 1916, p.103); and about 150 feet of drifting and crosscutting was done on the 100-foot level. Later, the shaft was deepened to 315 feet, and 310 feet of lateral work was completed on the 300-foot level. Some underground drilling was done, but no record of the work is available.

During 1923 and 1924, 4 holes were drilled on the north claims, and 3 holes on the southeast claim, the total
footage being 8300 (OBM 1924, p.63). A shaft, said to be 35 feet deep, was sunk midway between the southwest and southeast claims on a lens of quartz in rust-weathering carbonatized lava. About 250 feet south of the shaft, there is a 60-foot trench, which intersects a pyritic zone 15 to 20 feet wide. The northwest claim was prospected by a grid of trenches at 100-foot intervals laid out in a north-south and east-west pattern.

Exploration in the vicinity of the Alma vein was resumed in 1945. The former surface workings were cleaned out, and stripping and test-pitting was done at intervals for a total distance of 1000 feet along strike. Three diamond-drill holes, totalling 1069 feet of drilling, were completed along the vein zone. An additional 3870 feet of drilling was done in four holes in an effort to cross-section the property along the north-south centre line. In 1952 the property was geologically mapped, bulldozer stripping was done, and all the main vein occurrences were channel-sampled.

In 1975, Northern Mines, which had optioned the 4 claims from August Porcupine Mines Ltd., sampled old trenches on the property. A 1237-pound bulk sample was reported to have been taken on June 9, 1975, from the “Alma vein” which assayed 0.534 ounces Au per ton (The Northern Miner, Aug 21, 1975). Follow-up surface diamond drilling at the site “showed that the economically interesting Au values present at the Alma vein do not extend to any appreciable distance along strike or to depth”.

In 1988, Peter Island Resources Incorporated optioned the property from August Porcupine Mines Limited and drilled 3 surface diamond-drill holes, totalling 3504 feet. No significant results were obtained. Drill core from all 3 holes was donated to the Timmins Drill Core Library.

Leased claim P.577598 was purchased by Moneta Porcupine Mines Inc., in 1992, from local prospectors D. Meunier and A. Ristamaki, who had staked the claims on June 1, 1980, when the former patented claims owned by Porcupine Gold Top Mines Limited came open for staking. Known as the Porcupine Goldtop north claims, Ferguson (1968) described its history as follows: “On the north claim, the early work consisted of trenching and some drilling done many years ago. A shaft was sunk and from the size of the dump, it is estimated to be 100 feet in depth and may have some lateral workings. Material on the dump consists of carbonatized lavas with some quartz and a little pyrite”.

In 1984, a stripping and trenching program was carried out by D. Meunier. In 1987, J.P. Sheridan, who optioned the property from the owners, had a magnetometer survey done. A total of 37 samples were also taken from an old trench and assayed, 3 of which returned gold assays of economic significance.

GENERAL GEOLOGY

The early Precambrian metavolcanics in the Timmins area are divided into 2 groups, the Deloro and Tisdale groups. The volcanic stratigraphy is further divided into 6 formations; numbers I to III are within the Deloro group and numbers IV to VI are within the younger Tisdale group. The Deloro group is largely a calc-alkalic sequence composed mostly of andesite and basalt in the lower part and dactitic flows and dactitic and rhyolitic pyroclastic rocks toward the top. Iron formation is common at the top. Most of the Deloro group is confined to a domal structure. The basal formation of the younger Tisdale group consists of komatiitic flows. This, in turn, is overlain by tholeiitic basalts and then by volcanoclastic rocks of a calc-alkalic dactite composition. Metasedimentary rocks of the Porcupine group, which is mainly a turbidite sequence overlain in part by fluviatile sedimentary rocks, overlie the latest volcanic formation of the Tisdale group. At the contact between the Deloro group and the Tisdale group in the north, a major structural break called the Porcupine–Destor deformation zone trends north-east.

Two periods of folding north of the deformation zone took place. An original north-trending series of folds were subsequently refolded about an east-northeast axis. A dominant structure the Porcupine Syncline the axial trace of which trends across most of the south half of Tisdale Township resulted from this second period of folding (Pyke 1982).

PROPERTY GEOLOGY

The property is located on the north limb of the South Tisdale anticline. The rock types are within a tightly folded package and belong to “Formation V”, the middle volcanic formation of the Tisdale group, and are composed dominantly of iron-rich tholeiitic basalt. This “Formation V” corresponds to the Vipond Subgroup of previous workers (Ferguson et al. 1968). On the property, 3 bands of a variolitic flow are shown to occur striking generally in a west-northwest direction. Locally known as the V10B horizon, the flow is a variolitic pillow lava with the varioles broken up in many places. The V10B flow occurs at the top of “Formation V” and is intercalated with a massive basalt, called the “99 flow”, which forms the lowermost unit in “Formation V”. This flow is generally uniform with interflow argillite occurring at both its upper and lower contacts. These occur within a complex synclinal structure with a west to northwest axis.

RECENT PROGRAM

Eleven surface diamond-drill holes, totalling 4369 m, were drilled on the property by Cogema during the summer and the fall of 1992. Seven of the holes were drilled in a southwest direction across the strike of the volcanic rocks, 3 in a northwest direction, drilling downdip and 1 in a northeast direction. Only 1 economically significant intersection was obtained; 6.17 g/t Au over 3 m (Moneta Porcupine Mines
The predominant rock types are massive mafic metavolcanic rocks in the south with mafic tuffs to the north that contain a few narrow east-trending pyritic chert bands. An east-striking sulphide-facies iron formation up to 10 feet wide occurs in the extreme northern part of the area.
It is siliceous, banded and contains up to 10% disseminated pyrite, as well as irregular, secondary, crosscutting quartz stringers.

Narrow, east-trending shear zones, up to 10 feet wide, cut the mafic volcanic rocks. These shear zones exhibit carbonate and minor sericite alteration, as well as irregular quartz-carbonate veinlets and stringers which contain minor tourmaline and varying amounts of coarse euhedral pyrite (0 to 5%).

An old pit is located within the sheared mafic metavolcanic rocks in the centre of the exposed area. Four selected grab samples containing quartz veining and up to 5% disseminated pyrite mineralized, taken by the writer from this area, were assayed at 0.021, 0.091, 0.064 and 0.031 ounces Au per ton.

Two grab samples were taken from the 100 foot-long trench. One sample, which assayed 0.008 ounces Au per ton, was taken from a 1 foot wide zone of banded pyrite at the contact between massive and tuffaceous mafic volcanic rocks at the south end of the trench. The other sample was taken 7 feet south of the first sample from a chert zone, 1.5 feet wide, containing minor pyrite and a few stringers of secondary quartz. This sample assayed 0.002 ounces Au per ton.

The writer had examined the showing previously on November 1, 1986, before the major stripping was done. At that time, 3 samples, taken adjacent to the pit, returned assay values of 0.018, 0.029 and 0.008 ounces Au per ton. The highest assays from 6 samples taken from the iron formation to the north returned 0.002 ounces Au per ton.

Kaltwasser–Demarchi Occurrence, Sheraton Township

INTRODUCTION

On August 17, 1992, the Timmins Resident Geologist, accompanied by D. Korpela, Mining Lands Technician, Porcupine Mining Division and R. Kaltwasser, the property holder, visited a surface gold occurrence in Sheraton Township. The property consists of 15 unpatented claims (16 sixteen-hectare units) and is held jointly by R. Kaltwasser of Matheson and D. Demarchi of South Porcupine. Thirteen units are in the southeast corner of Sheraton Township, 2 adjoining units on the east side are in Egan Township and 1 remaining unit on the south side in Timmins Township.

LOCATION AND ACCESS

The gold occurrence is located on the east side of claim P.115614. This claim is at the southeast corner of Sheraton Township approximately 50 km east southeast of the City of Timmins (NTS 42A/7SE).

To access to the property, Highway 101 is taken east from the City of Timmins to the Gibson Lake road, a distance of 38 km. The Gibson Lake road, a gravel road leading south of Highway 101, is followed to the Lipsett Lake road 23 km south of Highway 101. The occurrence is accessed by driving along a sand road 8 km north from Lipsett Lake and walking 1.5 km eastward along a trail.

GENERAL GEOLOGY

The occurrence is mapped as being within Archean mafic volcanic rocks adjacent to a felsic stock which lies in proximity to the south and to the east. North-trending Matachewan diabase dikes are common throughout the area.

The claims are underlain mostly by mafic volcanic rocks with a northwest-trending gabbro intrusive located in the west. Numerous north-striking diabase dikes transect the property. Feldspar porphyry dikes occur intruding the mafic volcanic rocks and gabbro. Some are cut by fine, quartz-filled fractures containing fine cubic pyrite.

HISTORY

The staked claims and surrounding properties have been worked by a number of individuals and companies in the past.

A shallow shaft was sunk prior to 1922 on 1 of 2 adjacent patented claims in Timmins Township to the south. Narrow quartz veins containing pyrite occurring within mafic volcanic rocks and porphyry intrusions were reported to contain gold values (Berry 1940).

Nine surface diamond-drill holes were drilled in 1947 in Timmins Township on the above mentioned claim. Andesite, porphyry and diabase were intersected.

In 1974, stripping and trenching were reported by L. Dolan on claims covering the south part of the Kaltwasser–Demarchi claims and also on claims further to the south and east. Gold values were reported.

Johns–Manville Canada Inc. conducted geological and geophysical surveys, stripping and trenching on the property in 1981 to 1984. Au values were obtained from sampling quartz fractures in feldspar porphyry dikes which intrude mafic volcanics.

T. McAllister completed various geophysical surveys on a property covering the southeast corner of the Kaltwasser–Demarchi claims and also further to the east and south.

Kimex Resources Incorporated conducted geophysical surveys on a property over the west end of the Kaltwasser–Demarchi claims as well as to the north, west and south.

INVESTIGATION

An area 175 by 45 feet, striking north along a ridge sloping west, was stripped and cleaned under the direction of the prospectors R. Kaltwasser and D. Demarchi. An old trench, 15 feet long by 3 to 4 feet wide by 6 to 9 feet deep, is located in the northeast part of the stripped area. This was blasted out.
268

many years ago since trees 8 inches in diameter were found growing in it before the stripping began. A north-striking diabase dike is exposed along the total length of the stripped area. This dike dips vertically and has a maximum width of 9 feet. On the west side of the dike, uniform mafic volcanic rocks occur with interflow chert bands up to a few feet in width. These bands strike in a direction just west of north. On the east side of the dike, pillowed mafic volcanic rocks occur. In 1 location to the southeast part of the stripped area, variolites were observed. An east-trending massive porphyry dike averaging 5 feet in width occurs in the north part of the stripped area. This porphyry is composed of white feldspar phenocrysts in a light pink coloured groundmass.

A few narrow, discontinuous lamprophyre (hornblende-biotite rich) dikes up to 10 inches wide and striking just west of north were observed in the stripped area. On the north side of the stripped area, epidote alteration was observed in the mafic volcanic rocks at the contact of 1 dike. These dikes are cut by the younger diabase.

A few narrow, widely spaced quartz stringers, up to 1 inch wide, occur within the mafic volcanic rocks. These generally strike at 127° and contain cubic pyrite within the quartz and within the adjacent mafic volcanic rocks. A minor amount of carbonate alteration occurs in the mafic volcanic rocks along the contact with these stringers. Most of the quartz stringers occur on the west side of the stripped area. A few occur within the pillowed rocks on the east side.

Two faults striking 110° and dipping vertically cross the stripped area. Horizontal displacement on both sides is just a few feet. One fault is in the north, the other is in the south of the stripped area. There are a few minor shears parallel to these faults crossing the exposure as well.

A total of 25 chip samples were taken across the quartz stringers by the claim holders during the summer of 1992. Gold values of economic significance were obtained in the majority of these samples with the best assay being 0.668 ounces Au per ton over 4 feet. The writer, with D. Korpela of the Timmins Mining Recorder's Office, took 12 selected grab samples of quartz and pyrite mineralization in various locations within the stripped area. Assays in ounces Au per ton obtained from these samples were: 0.151, 0.056, 0.004, 0.201, 0.127, 0.073, 0.111, 1.839, 0.179, 0.061, 0.255 and 0.758.

The Kaltwasser-Demarchi occurrence contains narrow quartz stringers which contain gold. Assays of economic significance were obtained by the claim holders and the writer. However, the quartz stringers on the stripped area are very narrow and widely spaced and this immediate area may not have potential for mining. The whole area warrants further exploration since gold values were also obtained in other locations by previous workers. The intrusion of the batholith which occurs to the south and east may have been associated with the deposition of gold in the surrounding rocks. Gold-bearing quartz veins may also occur within the batholith and at its contact (personal observation, 1992 Assessment Files).

Keefer Lake Resources, Denton Township

INTRODUCTION

On May 26, 1992, the writer visited a gold occurrence on claims held by Keefer Lake Resources southwest of Godin Lake in the southwest corner of Denton Township.

LOCATION AND ACCESS

The gold occurrence is located on claim P.949908 in Denton Township close to the west shore of a creek draining into south end of Godin Lake (NTS 42A/5SE). Access was by vehicle along a bush road south of Highway 101 located approximately 1.5 km west of Cripple Creek. A right intersection on the road is taken at a point 5.6 km from Highway 101 and the road is followed for a further 2.8 km to a point close to the east shore of Godin Lake. A trail was then walked along for approximately 1 km westward, crossing the creek flowing into the south end of Godin Lake (see MDI C548, C550).

GENERAL GEOLOGY

The occurrence lies on the east side of a narrow east-trending band of metavolcanic and metasedimentary rocks on which the Mosher Lake occurrence previously described is located. This band is surrounded by felsic intrusive rocks and is offset 2.5 km to the north by a north-trending fault which passes through Godin Lake. The metavolcanic rocks which occur within the band are both massive and tuffaceous and are mafic to intermediate in composition. Intruding these metavolcanic rocks are north-trending diabase dikes. Several northeast-trending shear zones are located to the south and west of Godin Lake.

HISTORY

In 1946, A. Phillip held a group of 23 claims over the area. Stripping and trenching exposed shear zones in metavolcanic rocks, some of which contained quartz-carbonate veins with pyrite and minor chalcopyrite mineralization. Samples from the trenches are reported to have assayed up to 0.03 ounces Au per ton. In 1947, 2 diamond-drill holes intersected sheared chlorite carbonate schist containing quartz-carbonate veins.

In 1971, Texas Gulf Sulphur Company Incorporated and Conwest Exploration Company participated in joint ventures on this property, which was optioned from the Galata brothers. An airborne geophysical survey was conducted over the area. In 1972, Falconbridge Nickel Mines conducted a magnetic survey over the area. In the 1980s, F. Galata trenched many areas in Keefer and Denton townships. In 1988 and 1989, Keefer Lake Resources conducted geological and geophysical surveys and prospecting in the area. The occurrence was stripped, washed and sampled in 1988.
INVESTIGATION

Bedrock was exposed for a length of 270 feet and a width of 50 feet by stripping and washing in 1988. Old pits occur on the exposure which were possibly excavated by A. Phillip in 1946. The exposed area consists mainly of sheared mafic volcanic rocks. The shearing strikes at 030° and dips at 075° to 080° to the east. Varying intensities of carbonate and sericite alteration exist. Quartz flooding is common within dilation zones formed by shearing. Some of this primary shearing and quartz veining has been isoclinally folded by a second parallel period of deformation. Secondary quartz veining crosscuts the primary quartz and foliation at irregular angles. Pyrite is a common accessory mineral throughout. No chalcopyrite was observed by the writer, even though it has been reported in previous work. Seven selected grab samples taken from throughout the exposure assayed the following in ounces Au per ton: 0.009, 0.002, tr, 0.002, 0.014, 0.003, nil (Chowdry 1989).

DRILL CORE LIBRARY PROGRAM

The Timmins Drill Core Library serves the mining and exploration community of the Timmins Resident Geologist’s area. During the past year, representatives of the exploration industry, universities and government made 955 visits to the Drill Core Library facilities. A total of 21729.6 m of drill core was collected by the staff or delivered by the public (Table 12.8). The Core Library is now storing 156 108.4 m of drill core from 4173 individual holes, representing 589 442.2 m of actual drilling. A small offsite storage location continued to allow for the storage of overflow material. The Core Library staff removed 10 763.7 m of core to the offsite location from the Drill Core Library during the year. A total of 28 280.4 m of core is currently stored offsite. Advance notice may be required to access this material.

A permanent offsite storage facility is planned for Timmins as part of the jobsOntario Capital Fund and will utilize approximately 2 acres of land. Site preparation is scheduled to begin in the spring of 1993 and fencing and the transfer of drill core from the temporary offsite location is planned for the summer of 1993. Accessibility to the offsite core by the public will be greatly improved once the new site is operational. Most of the core and all the drill hole data will continue to be stored in the existing Drill Core Library building.

RECOMMENDATIONS FOR EXPLORATION

Potential for Nickel Discoveries in the Shaw Dome Area

Five known nickel deposits in the Timmins area are associated with peridotite-komatiites at the southern periphery of the Shaw Dome in Langmuir and Eldorado townships (NTS 42A/06NE). Three of the 5 known deposits have been mined. The Langmuir #2 deposit was mined between between 1973 and 1977. The Langmuir #1 deposit was mined in 1991 and

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<td>19.5</td>
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</table>

Persons requiring further information or wishing to examine or donate drill core should telephone (705) 360-3870 or write to:

The formation of nickel-sulphide ores is controlled by the availability of sulphur. Komatiitic-hosted nickel deposits form when the ultramafic silicate lava becomes sulphur saturated, resulting in the separation of an immiscible sulphide melt. Because of its chalcophile nature, nickel partitions preferentially into a sulphide melt phase. If gravitational or flow segregation takes place, ore grade concentration of Ni can form typically toward the base of a flow (Eckstrand and Naldrett 1990).

Archean komatiitic nickel deposits may have acquired sulphur from local sources, as sulphur isotope studies have shown that the bulk of the sulphur in these deposits is of supracrustal origin.

Sulphide iron formation, a possible source for the sulphur is very predominant in the southern periphery of the Shaw Dome and occurs in the stratigraphic footwall in proximity to the ore at the Redstone and Langmuir #2 deposits and the nickel mineralization at the Hart deposit (Robinson 1982). Sulphide iron formation is also predominant in the Deloro group in the northern periphery of the Shaw Dome. Just to the west of Goose Lake, exposed sulphide iron formation is conformably overlain by a spinifex textured komatiitic flow.

This area covering the northern periphery of the Shaw Dome, from Whitney Township in the west to Carman Township to the southeast, appears to be suitable for hosting komatiitic nickel deposits.

ONTARIO GEOLOGICAL SURVEY—GEOSCIENCE BRANCH ACTIVITIES

A detailed description of work done by the Geoscience Branch in the Timmins Resident Geologist District is provided in Summary of Field Work and Other Activities 1992 (Ontario Geological Survey, Miscellaneous Paper 160). Publications released by the Geoscience Branch in 1992 are listed in Table 12.9.

Geology of Keith and Muskego Townships, Northern Swayze Greenstone Belt

J.A. Ayer and R. Theriault (Ayer and Thierault 1992) completed the second year of a three-year program designed to upgrade the geological database of the northern Swayze greenstone belt. Keith and Muskego townships were mapped at a scale of 1:13 840. Funding for the project is supplied by NODA.
Quaternary Geology of the Foleyet Area, Northern Ontario

C.A. Kaszycki (Kaszycki 1992) began field mapping in the Foleyet area as part of a four-year regional till sampling and surficial geologic mapping program covering the Swayze greenstone belt. The objective of the program is to provide a regional Quaternary framework for mineral exploration using glacial drift. Funding for the project is supplied by NODA.

Gold Mineralization in the Northern Night Hawk Lake Area of the Abitibi Greenstone Belt

G.M. Siragusa (Siragusa 1992) began a multi-year program of detailed investigations of recently discovered gold occurrences in the Timmins area. Field investigations will be combined with assessment file information and unpublished exploration data. The 1992 program concentrated on the northern Night Hawk Lake area.

RESEARCH BY OTHER AGENCIES

Western Abitibi Mineral Deposit Study

S.L. Fumerton, Field Services Section, Ontario Geological Survey—Information Services Branch, Timmins, began a three-year program to document, in detail, all known mineral occurrences in the Swayze greenstone belt. The work done to date has been concentrated on the northern part of the belt (Fumerton 1992). Funding for the project is supplied by NODA.

Regional Geology and Structure of the Archean Swayze Greenstone Belt and Surrounding Granitoid Terranes: Implications for Mineralization

K.B. Heather, Continental Geoscience Division, Geological Survey of Canada, completed the first year of a multi-year program designed to provide a better understanding of the complex tectonic history of the region (Heather 1992). The program will include reconnaissance, synoptic-style, lithological and structural mapping augmented by geochemical and geochronological studies. Funding for the project is supplied by NODA.


H. Veldhuyzen, a contract geologist with the Mineral Development and Rehabilitation Branch, Ontario Ministry of Northern Development and Mines, began an evaluation program of the Shawmere anorthosite body near Foleyet as a potential source of raw materials for the chemical industry (Veldhuyzen 1992). Mapping and sampling of the complex began in the fall of 1992. Further testing including acid leaching of selected samples is underway. Funding for the project was supplied by NODA.

SELECTED PUBLICATIONS RECEIVED


*These publications are part of a collection of geoscience texts acquired from the Timmins Public Library by the Resident Geologist's Office.

Also acquired during 1992 were various periodical donations which were incorporated into the office collection. These include sets of The Canadian Mining and Metallurgical Bulletin, Canadian Mining Journal and Canadian Journal of Earth Sciences. The Timmins Resident Geologist’s office gratefully acknowledges these donations and, in particular, Dr. R.A. Cameron.

REFERENCES


Jensen, K.A. and MacRae, W.E. 1986. Surface hazard location at the Kam Kotia Mine in Robb Township, District of Cochrane; for the Ministry of Natural Resources, Timmins, Ontario.


272
INTRODUCTION

The announcement by Sudbury Contact Mines Ltd. of the discovery of 2 kimberlite pipes, one of which tested diamondiferous; the advanced exploration and development of the Lightning gold deposit by Hemlo Gold Mines Inc. and joint venture partners; the increased production of green carbonate blocks for dimension stone; the increase in the number of OPAP and OMIP recipients working in the district; and several other promising exploration projects contributed towards the overall increased exploration activity in the Kirkland Lake Resident Geologist’s District as compared with 1991.

MINING ACTIVITY

During 1992, there were 6 producing mines, 2 active quarries and 1 tailings recovery operation in the Kirkland Lake Resident Geologist’s District (Figure 13.1). Gold was the primary resource in 4 of the 6 mines in production and in the tailings recovery operation. Table 13.1 summarizes the gold production data for 1992 and lists the corresponding figures for 1991.

Barite and hedmanite, a lizardite filler, were extracted from the 2 remaining mines. The 2 operating quarries, 1 in Teck Township and 1 in McGarry Township, removed blocks of green carbonate decorative stone for export to European markets.

Historic gold production and documented gold reserves are summarized in Table 13.2 and Table 13.3, respectively. Properties listed in these tables can be found in Figure 13.2.

American Barrick Resources Corporation

The Holt–McDermott Mine, situated in the northwest corner of Holloway Township (see Figure 13.1), produced 46,325 ounces of gold from 453,348 tons of ore in 1992, for a recovered grade of 0.102 ounces Au per ton (see Table 13.1; J. Haflidson, American Barrick Resources Corporation, personal communication, 1993).

Late in the year, a diamond drill hole was completed to explore the down-dip potential of the Matawasaga Zone. The drill hole intersected what appears to be an active mineralized zone located some 2500 feet south of the shaft at a depth of 2900 feet below surface. Additional drilling has been planned to determine the full extent and significance of this zone (J. Haflidson, American Barrick Resources Corporation, personal communication, 1993).

Fifteen employees were laid off in September, 1992, reducing employment at the mine from 175 to 160. The layoff was attributed to a reduced level of development work taking place (Mines and Minerals Weekly Bulletin, September 8, 1992, p.1).

Deak Resources Corporation–GSR Mining Ltd.

The Kerr Mine in Virginiatown, located in McGarry Township near the Ontario–Quebec border (see Figure 13.1), produced 28,000 ounces of gold from 292,000 tons of ore in 1992 (see Table 13.1; G. McDonald, Deak Resources Corporation, personal communication, 1993).

The Northern Ontario Heritage Fund Corporation (NOHFC) agreed to loan Deak Resources Corporation an additional $800,000 to modify its mill. The funds were used to complete a tailings treatment system, install a flotation/regrind circuit for harder ores and to produce concentrates from carbonaceous ores (The Northern Miner, February 17, 1992, p.19). In 1991, the mine received $2.1 million from NOHFC for expansion of the mill to its current 2000 tonnes per day capacity.

In 1992, the Kerr mill processed ore from the Kerr Mine and custom milled ore from both the Cheminis Mine in McVittie Township and the Astoria Mine in Rouyn, Quebec (Mines and Minerals Weekly Bulletin, February 17, 1992, p.1).

During the summer months, the Kerr Mine, in conjunction with the local tourist bureau, offered underground tours of its mining operations to the general public. As of Septem-
Figure 13.1. Kirkland Lake Resident Geologist's District.
EXPLANATION

Producing Mines, 1992
1. American Barrick Resources Corp.
   Holt-McDermott Mine ................................................................. Au, Ag
2. Deak Resources Corp. - GSR Mining Ltd.
   Kerr Mine ..................................................................................... Au, Ag
3. Extender Minerals of Canada Ltd. .................................................. barite
4. Hedman Resources Ltd. .............................................................. serpentine filler
5. Lac Minerals Ltd.
   Macassa Mine .............................................................................. Au, Ag
6. Lac Minerals Ltd.
   Lake Shore Tailings Project ...................................................... Au, Ag
7. Northfield Minerals Inc.
   Cheminis Mine ............................................................................ Au

Advanced Exploration Projects
1. Hemlo Gold Mines Inc. - Freewest Resources Inc. - Teddy Bear Valley Mines Ltd. - Newmont Mining Corp. (Lightning Zone) ................................................................. Au

Producing Quarries
1. Tundra Granite and Marble
   Teck Tp. project ................................................................. marble (“green carbonate”)
2. Tundra Granite and Marble
   Kerr option .............................................................................. marble (“green carbonate”)

Exploration Activity
1. Kingswood Exploration 1985 Ltd. (Thunder Zone) .............................. Au
2. Hemlo Gold Mines Inc. - Glimmer Resources Inc. (Glimmer) ................. Au
3. Royal Oak Mines - Queenston Mining Inc. (Upper Beaver) ..................... Au
4. American Barrick Resources Corp. (Holt-McDermott Mine) .................. Au
5. Sudbury Contact Mines Ltd. (Diamond Lake) ....................................... diamond
6. Glencairn Explorations Ltd. (Goodfish) ................................................ Au
7. Greater Lenora Resources Corp. ....................................................... Cu, Zn
8. Battle Mountain (Canada) Inc. - Queenston Mining Inc.
    (Amalgamated Kirkland) ............................................................... Au

Property Visits
1. Chartre – Dustfresne Cairo property
2. Cook – Gamble property
3. Kidston Gauthier property
4. Tundra Green Carbonate pit
5. Layered basaltic komatiite flow

Location of OGS Field Party
1. Geology of McNeil and Robertson townships (L.S. Jensen)
2. A geochemical traverse along the 80th meridian west
   (J.A.C. Fortescue, R.D. Dyer and C.R. Fouts)

<table>
<thead>
<tr>
<th>Mine Owner</th>
<th>Township</th>
<th>Tons Milled</th>
<th>Production (oz Au)</th>
<th>Recovered Grade (oz Au/t)</th>
</tr>
</thead>
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<td>Buffonta</td>
<td>Garrison</td>
<td>26643</td>
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<td>Perrex Resources Inc.</td>
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<td>McVitie</td>
<td>8950</td>
<td>40115</td>
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<td>Northfield Minerals Inc.</td>
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<td>453348</td>
<td>60728</td>
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<td>McGarry</td>
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<td>35424</td>
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<td>GSR Mining Ltd.</td>
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<td>Macassa</td>
<td>Teck</td>
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<td>146839</td>
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<td>Lakeshore Tailings</td>
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Table 13.2. Past gold production in the Kirkland Lake Resident Geologist’s District.

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<th>Tons Milled</th>
<th>Production (oz Au)</th>
<th>Production (oz Ag)</th>
<th>Grade (oz Au/t)</th>
<th>Years of Production</th>
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<td>1</td>
<td>Aljo</td>
<td>Beatty</td>
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<td>Ashley</td>
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<td>43</td>
<td>81</td>
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<td>Centre Hill **</td>
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<th>Production (oz Ag)</th>
<th>Grade (oz Au/t)</th>
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<td>Miller Independence</td>
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<td>1054</td>
<td>177</td>
<td>2380</td>
<td>0.168</td>
<td>1941</td>
</tr>
<tr>
<td>Ross</td>
<td>Hislop</td>
<td>6714482</td>
<td>995832</td>
<td>1544795</td>
<td>0.148</td>
<td>1936–89</td>
</tr>
<tr>
<td>Ryan Lake **</td>
<td>Powell</td>
<td>184790</td>
<td>1352</td>
<td>36141</td>
<td>0.007</td>
<td>1948–57,62–64</td>
</tr>
<tr>
<td>Stairs</td>
<td>Midlothian</td>
<td>15835</td>
<td>3573</td>
<td>1767</td>
<td>0.226</td>
<td>1965–66</td>
</tr>
<tr>
<td>Sylvanite</td>
<td>Teck</td>
<td>5049536</td>
<td>1674808</td>
<td>337956</td>
<td>0.332</td>
<td>1927–61</td>
</tr>
<tr>
<td>Teck Hughes</td>
<td>Teck</td>
<td>9565302</td>
<td>3709005</td>
<td>501657</td>
<td>0.388</td>
<td>1917–68</td>
</tr>
<tr>
<td>Toburn ***</td>
<td>Teck</td>
<td>1186316</td>
<td>570659</td>
<td>135238</td>
<td>0.481</td>
<td>1912–53</td>
</tr>
<tr>
<td>Upper Beaver ***</td>
<td>Gauthier</td>
<td>580562</td>
<td>140709</td>
<td>59167</td>
<td>0.242</td>
<td>1913–72</td>
</tr>
<tr>
<td>Upper Canada</td>
<td>Gauthier</td>
<td>4648984</td>
<td>1398291</td>
<td>589696</td>
<td>0.301</td>
<td>1938–71</td>
</tr>
<tr>
<td>White–Guyatt</td>
<td>Munro</td>
<td>50</td>
<td>10</td>
<td>nil</td>
<td>0.200</td>
<td>1911</td>
</tr>
<tr>
<td>Wright Hargreaves</td>
<td>Teck</td>
<td>9934327</td>
<td>4821296</td>
<td>853643</td>
<td>0.485</td>
<td>1912–65</td>
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<tr>
<td>Young–Davidson</td>
<td>Powell</td>
<td>6213272</td>
<td>585690</td>
<td>131393</td>
<td>0.094</td>
<td>1934–57</td>
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<tr>
<td>Total Gold Ore:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Tailings:</td>
<td></td>
<td>3647298</td>
<td>118358</td>
<td>0.032</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: * Producer in 1992; ** Base metal mine; *** Intermittent production; Production figures to the end of December 1992; refer to Figure 13.2 for property locations.

### Table 13.3. Gold reserves in the Kirkland Lake Resident Geologist’s District.

<table>
<thead>
<tr>
<th>Mine/Property</th>
<th>Township</th>
<th>Reserves (tons)</th>
<th>Grade (oz Au/ton)</th>
<th>Ounces of Gold</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Anoki</td>
<td>Gauthier</td>
<td>650000</td>
<td>0.136</td>
<td>88400</td>
</tr>
<tr>
<td>5 Armistice</td>
<td>McGarry</td>
<td>242224</td>
<td>0.175</td>
<td>42389</td>
</tr>
<tr>
<td>8 Barber Larder</td>
<td>McGarry</td>
<td>60000</td>
<td>0.161</td>
<td>9660</td>
</tr>
<tr>
<td>11 Blue Quartz</td>
<td>Beatty</td>
<td>128000</td>
<td>0.861</td>
<td>110208</td>
</tr>
<tr>
<td>13 Buffonta</td>
<td>Garrison</td>
<td>452000</td>
<td>0.175</td>
<td>79100</td>
</tr>
<tr>
<td>18 Cheminis</td>
<td>McVittie</td>
<td>256661</td>
<td>0.156</td>
<td>40039</td>
</tr>
<tr>
<td>20 Creek Zone</td>
<td>Hislop</td>
<td>1118000</td>
<td>0.184</td>
<td>205712</td>
</tr>
<tr>
<td>22 Eastmaque Tailings</td>
<td>Teck</td>
<td>840000</td>
<td>0.033</td>
<td>277200</td>
</tr>
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<td>23 Garrcon</td>
<td>Garrison</td>
<td>513000</td>
<td>0.281</td>
<td>144153</td>
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<td>25 Glimmer</td>
<td>Beatty</td>
<td>1084373</td>
<td>0.338</td>
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<td>26 Golden Harker</td>
<td>Harker</td>
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<td>0.161</td>
<td>80500</td>
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<td>835544</td>
<td>0.170</td>
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<td>31 Hislop West</td>
<td>Beatty</td>
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<td>32 Holt–McDermott *</td>
<td>Holloway</td>
<td>4650000</td>
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<td>697500</td>
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<td>34 Iris</td>
<td>Harker</td>
<td>769756</td>
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<td>54653</td>
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<td>35 Kerr *</td>
<td>McGarry</td>
<td>2175000</td>
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<td>40 Lighting</td>
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<td>0.270</td>
<td>1485000</td>
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<td>41 Ludgate</td>
<td>Michaud</td>
<td>650000</td>
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<td>111150</td>
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<tr>
<td>42 Macassa *</td>
<td>Teck</td>
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<td>Macassa (Lakeshore Tailings) *</td>
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<td>246000</td>
</tr>
<tr>
<td>Matachewan Consolidated</td>
<td>Hislop</td>
<td>200000</td>
<td>0.090</td>
<td>18000</td>
</tr>
<tr>
<td>Maud Lake</td>
<td>Beatty</td>
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<td>0.158</td>
<td>205400</td>
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<td>Newfield</td>
<td>Garrison</td>
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<td>48000</td>
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<td>Phryp</td>
<td>Taylor</td>
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<td>0.080</td>
<td>25346</td>
</tr>
<tr>
<td>Ross</td>
<td>Hislop</td>
<td>1055000</td>
<td>0.125</td>
<td>131875</td>
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<tr>
<td>Shoot Zone</td>
<td>Taylor</td>
<td>2100000</td>
<td>0.111</td>
<td>233100</td>
</tr>
<tr>
<td>Teck–Hughes</td>
<td>Teck</td>
<td>400000</td>
<td>0.250</td>
<td>100000</td>
</tr>
<tr>
<td>Upper Canada</td>
<td>Gauthier</td>
<td>1780000</td>
<td>0.280</td>
<td>498400</td>
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<tr>
<td>Totals (Mines):</td>
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<td>28722891</td>
<td>0.213</td>
<td>6125000</td>
</tr>
<tr>
<td>Totals (Tailings):</td>
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<td>11420000</td>
<td>0.045</td>
<td>518800</td>
</tr>
</tbody>
</table>

Note: * Producer in 1992 (assuming no additional ore reserves found in 1992).

**Extender Minerals of Canada Ltd.**

Extender Minerals of Canada Ltd. produced approximately 10,000 tons of barite from its underground mine and mill facility in Yarrow Township, west of Matachewan (see Figure 13.1). This figure is virtually identical to the production figures published in 1991.

The final product was shipped to markets primarily within Canada. Barite is used in the manufacture of various products, including brake linings, paints, plastics and mold lubricants at several of the base metal smelters in Canada (R. Hill, Extender Minerals of Canada Ltd., personal communication, 1993).

**Hedman Resources Ltd.**

Hedman Resources Ltd. produced 3720 tons of hedmanite in 1992, up marginally from the 3433 tons produced the previous year. Ore reserves to 300 feet depth remain at approximately 10 million tons, which is sufficient to produce 5 million tons of filler. The open-pit mining operation is located in the south part of Warden Township (see Figure 13.1) and the ore is processed in the company’s milling facility in Matheson.

Hedmanite is a lizardite mineral filler used in the manufacture of many different products including phenolics (a heat resistant plastic used in making toaster/cookware handles, distributor caps, telephones, etc.), brake pads and brake shoes, adhesives and paints.

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**Figure 13.2.** Location of properties with past production and/or gold reserves.
Approximately 60% of their production was exported to Asian markets (Japan, Malaysia, Indonesia, etc.) while the remaining 40% was sold in North America. Hedman Resources is actively searching for new markets for its product (R.F. Bertrand, Hedman Resources Ltd., personal communication, 1993).

**Lac Minerals Ltd.**

The Macassa Mine, situated in the central portion of Teck Township (see Figure 13.1), produced 77,258 ounces of gold from 146,839 tons of ore in 1992, for a recovered grade of 0.526 ounces Au per ton. The Lakeshore Tailings Project recovered 14,846 ounces of gold from 279,130 tons of tailings, for a recovered grade of 0.053 ounces of Au per ton (see Table 13.1; D. Cater, Lac Minerals Ltd., personal communication, 1993).

Underground diamond drilling was conducted throughout the year in order to better define existing ore blocks, as well as to explore for more distant hangingwall and footwall mineralized zones (D. Cater, Lac Minerals Ltd., personal communication, 1993).

In March 19, 1992, a coroner’s inquest was held into the death of a miner in November of 1991. Following the inquest, the jury recommended to prohibit the use of ignition cord and tape (safety) fuse assembly in further blasting operations (Northern Daily News, March 19 and March 26, 1992).

Another coroner’s inquest into the death of a second miner on December 20, 1991, at the 5450-foot level determined that the miner died of asphyxiation after being buried under a rock pile following a rock burst. The inquest found that there was no way to predict the rock burst (Northern Daily News, April 1, 1992, p.1).

Other rock bursts continued to plague the mining operation, although fortunately not resulting in any fatalities. One occurred on July 7, 1992, at the 6400-foot level and another on October 28, 1992, below the 6300-foot level (Northern Daily News, October 29 and October 30, 1992, p.1).

In June, the company announced the layoff of 16 workers at the Macassa Mine, 6 clerical staff and 10 hourly employees. In August, the workers voted in favor of a strike to back their demands and called for a conciliator to mediate the dispute. The workers had been without a contract since July 4, 1992 (Northern Daily News, August 4, 1992, p.1).

**Northfield Minerals Inc.—Deak Resources Corporation**

The Cheminis Mine in McVittie Township (see Figure 13.1), produced 4054 ounces of gold from 40,115 tons of muck during the first 3 months of 1992. The calculated grade of ore was 0.118 ounces Au per ton, compared to the recovered grade of 0.101 ounces Au per ton (see Table 13.1; V. Popov, Northfield Minerals Inc., personal communication, 1993).

The mine discontinued operations in April of 1992 and remained dormant for over 7 months after Dynatec Mining Ltd. had withdrawn their contract to operate the mine (Mines and Minerals Weekly Bulletin, April 6, 1992, p.1).

In September, Deak Resources Corporation and Northfield Minerals Inc. signed a letter of agreement whereby Deak Resources Corp. will acquire an interest in 18 full claims and 2 half claims at the Cheminis Mine. Under the agreement, Deak Resources Corporation will become the mine operator and will mine 500 tons of ore per day over a two-year period. During that period, Deak Resources Corporation will spend $1.75 million in exploration and development and pay Northfield Minerals Inc. a production royalty of $4.50 per ton (Northern Daily News, September 12, 1992; Mines and Minerals Weekly Bulletin, September 21, 1992, p.1). In November, Deak Resources Corporation began dewatering the mine and completed the task on December 31, 1992.

**Tundra Granite and Marble Corporation**

Tundra Granite and Marble Corporation acquired the right to quarry green carbonate (crystal green) south of Kirkland Lake and at the Kerr Mine (see Figure 13.1). At both sites, blocks measuring up to 2.0 by 1.2 by 1.0 m have been extracted and exported to Italy for processing.

The company plans to rent a section of a building at the Adams Mine site and establish a cutting and polishing facility to manufacture finished products, mostly for export. The first 2 pieces of quarrying equipment, percussion machines mounted side by side on railings, have arrived. The rest of the machinery and equipment is expected to arrive this winter.

The green carbonate at the Kerr Mine and south of Kirkland Lake are distinctly different. The Kerr Mine green carbonate has a brighter green color and contains a higher content of quartz veins. Both are considered highly attractive by decorative stone standards, and initial marketing efforts have been successful (J. Palu, Tundra Granite and Marble Corporation, personal communication, 1992).

**ADVANCED EXPLORATION AND DEVELOPMENT**

**Hemlo Gold Mines Inc.—Freewest Resources Inc.—Teddy Bear Valley Mines Limited**

The Holloway Joint Venture was formed by Hemlo Gold Mines Inc., Freewest Resources Inc. and Teddy Bear Valley Mines Limited to fund and manage the Holloway Project, 60 km north of Kirkland Lake (see Figure 13.1). The Holloway Project covers a portion of the Lightning Zone with geological reserves of 5 million tonnes grading 9.2 g/t Au. Hemlo Gold Mines Inc. is the joint venture operator and holds a
50.79% interest. Freewest Resources Inc. holds a 33.86% interest and Teddy Bear Valley Mines Limited holds a 15.35% interest (The Northern Miner, November 16, 1992, p.2).

A $12 million underground exploration and development program was approved by the joint venture partners. The program includes the sinking of a 4.5 m diameter four-compartment circular shaft to a depth of 430 m. At the end of 1992, the shaft reached a depth of 180 m and all the planned surface installations (headframe, hoist-room, dry, kitchen, office and core shack) were in place.

In addition to the shaft sinking, 1100 m of drifting will be completed, of which 300 m will be within the ore zone. The Holloway Joint Venture also plans to complete 25 000 m of underground definition drilling and some raising. A 5000 tonne bulk sample will be stockpiled on site until the scheduled completion of the program. The bulk sample will be treated at a still to be specified mill facility.

The $12 million Holloway Project is scheduled to be completed in the third quarter of 1993 (P. Cooper, Hemlo Gold Mines Inc., personal communication, 1993).

EXPLORATION ACTIVITY

Government Incentive Programs

In 1992, the Ontario Mineral Incentive Program (OMIP) awarded 27 grants valued at over $3.13 million to various companies working in the Kirkland Lake Resident Geologist's District. Although the total number of grants declined from last year's 35, the total value increased by approximately $90 000. The number of grants for the Kirkland Lake Resident Geologist's District represents over one-quarter of the total provincial allocation of $10 million (Table 13.4).

The Ontario Prospectors Assistance Program (OPAP) continued to provide essential funding for grassroots exploration in the Kirkland Lake area. Sixty-eight successful applicants, working in the Kirkland Lake Resident Geologist's District, received grants totalling $673 000. This figure is down 13% from last year's amount and represents approximately 16% of both the dollar value and number of grants issued throughout Ontario in 1992 (see Table 13.4).

COMPANY ACTIVITIES IN 1992

Based on active claim units (one unit = 16 hectares), exploration activity increased significantly from 1991. In the Kirkland Lake Resident Geologist's District, the number of active units rose to 25 528 in December of 1992, compared with 20 168 units in December of 1991. Table 13.5 summarizes the status of claims and assessment work credits for 1992 as well as the historical figures for the last 20 years. A comparison of the active claim units and the total equivalent assessment dollars filed for the same period is illustrated in Figure 13.3.

Much of this increased activity can be attributed to the recent interest in diamond exploration that followed the announced discovery by Sudbury Contact Mines Limited of diamondiferous kimberlites east of Kirkland Lake. The discovery of several significant diamond-bearing kimberlite pipes in the Lac de Gras area, N.W.T., also had a positive spillover effect on diamond exploration in the Kirkland Lake Resident Geologist's District.

A compilation of the exploration activity in the Kirkland Lake Resident Geologist's District is listed in Table 13.6 and illustrated in Figure 13.4. Table 13.7 lists the significant exploration results published during the year.

Gold exploration accounted for over half the total programs completed in 1992. Diamond exploration was next, making up approximately one-third of the total. Base metal exploration programs constituted about 10% of the total programs completed.

GOLD EXPLORATION

In Teck Township, Lac Minerals Ltd. explored the surface extension of the 05 Zone north of the mine and the strike extension of the 102–103 Zone on the Amalgamated Kirkland property south of the mine. Meanwhile, Battle Mountain (Canada) Inc. and Queenston Mining Inc. continued drilling on the 102–103 Zone at depth and along strike (see Figure 13.1). The zone has now been defined along a 5000-foot strike length between the 1400-foot and 2500-foot levels, and remains open at depth. Some of the better assays reported include 0.17 ounces Au per ton over 100.4 feet (true width of 50.0 feet) and 0.19 ounces Au per ton over 27.9 feet. The 104 Zone, previously unidentified, was intersected during the drilling program. This narrow zone assayed 0.49 ounces Au per ton over 2.0 feet (Northern Daily News, March 18, 1992; The Northern Miner, September 28, 1992; Queenston Mining Inc., News Release, March 27, 1992).

To the northeast in Morrisette Township, Glencairn Explorations Ltd. tested the extension of the A-zone on the Goodfish property, intersecting 0.24 ounces Au per ton over 10.0 feet (see Figure 13.1). Further east in the Gauthier township, Royal Oak Mines Inc., through its subsidiary Beaverhouse Resources Ltd., completed a large drill program on Queenston's Upper Beaver property and outlined a new zone 2500 feet north of the existing mine workings (see Figure 13.1). Selected assays include:

<table>
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<th>Ounces Au per ton</th>
<th>Copper (%)</th>
<th>Core length (feet)</th>
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</thead>
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<tr>
<td>0.16</td>
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</tr>
<tr>
<td>0.15</td>
<td>0.33</td>
<td>27.5</td>
</tr>
<tr>
<td>0.09</td>
<td>1.60</td>
<td>35.2</td>
</tr>
</tbody>
</table>


In McVittie Township, 4 properties were examined during the course of the year. Deak Resources Corporation signed a $1.75 million deal with Northfield Minerals Inc. to mine 300 000 tons of gold ore and to further explore the Cheminis property over a two-year period (Northern Daily...
Table 13.4. Government incentive programs Kirkland Lake Resident Geologist’s District (OMIP, Ontario Mineral Incentive Program; OPAP, Ontario Prospectors Assistance Program).

<table>
<thead>
<tr>
<th>Township 1</th>
<th>Township 2</th>
<th>OMIP No. of Grants</th>
<th>Amount Awarded</th>
<th>OMAP No. of Grants</th>
<th>Amount Awarded</th>
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<td>Coulson</td>
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281
Table 13.5. Summary of claims recorded and assessment work credit.

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<th>Year</th>
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<th>Active Claims</th>
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<th>Physical Surveys ($)</th>
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<th>Claims Recorded</th>
<th>Claims Cancel</th>
<th>Active Claims</th>
<th>Diamond Drilling (man days)</th>
<th>Geophysical Surveys (man days)</th>
<th>Other Work (man days)</th>
<th>Total Filed (man days)</th>
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<td>81 500</td>
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Figure 13.3. Claim staking history of the Kirkland Lake Resident Geologist's District.
Figure 13.4. Exploration activity in the Kirkland Lake Resident Geologist's District.
### Abbreviations

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<tr>
<th>Abbreviations</th>
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<td>Airborne Magnetic Survey</td>
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<td>DD</td>
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<td>Electromagnetic Survey</td>
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<td>Exploration Program</td>
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<td>Stripping</td>
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### Table 13.6. Exploration activity in the Kirkland Lake Resident Geologist's District.

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<th>Exploration Activity</th>
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<td>Abbotsford (Au)</td>
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<td>Bernatchez, G.</td>
<td>Alma (Au)</td>
<td>GL</td>
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<td>3</td>
<td>Trinity Explorations</td>
<td>Argyle (Ni, Cu)</td>
<td>GL, M, EM, SA</td>
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<tr>
<td>4</td>
<td>Kiernicki, F.</td>
<td>Argyle, Bannockburn (Au)</td>
<td>DD(3)(1186 feet)</td>
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<td>5</td>
<td>Glencairn Explorations–Strike Minerals</td>
<td>Arnold (diamonds)</td>
<td>EXP-$100,000 (NM 06/06/92)</td>
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<td>6</td>
<td>Merrick, A.</td>
<td>Arnold (Au)</td>
<td>GL, EM, M</td>
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<td>7</td>
<td>Regal Goldfields (A-4 Alfie Cr. Pipe)</td>
<td>Arnold (diamonds)</td>
<td>50-tonne bulk sample (NDN 10/31/92)</td>
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<td>8</td>
<td>Wheaton River Min–Glencairn Expl–Strike Min</td>
<td>Arnold, Melba, Bernhardt (diamonds)</td>
<td>to DD 14 mag anomalies (NM 03/02/92)</td>
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<td>Kiernicki, F.</td>
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<td>Hemlo Gold Mines–Glimmer Resources (Glimmer)</td>
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<td>Rochon, R. &amp; Rochon, D. (Benoit project)</td>
<td>Benoit, Maisonville (Au)</td>
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<td>Kiazky, J.C., Otto, B.C.</td>
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<tr>
<td>51</td>
<td>Noranda Exploration Co. Ltd.</td>
<td>Harker (Au)</td>
<td>DD(2)(528.2m)</td>
</tr>
<tr>
<td>52</td>
<td>Noranda Exploration Co. Ltd.</td>
<td>Harker (Au)</td>
<td>DD(5)(1180.2m)</td>
</tr>
<tr>
<td>53</td>
<td>MacGregor, R.A. (Group 2 East)</td>
<td>Hearst (Au)</td>
<td>SA</td>
</tr>
<tr>
<td>54</td>
<td>McGregor, R.A. (South Grid A–1)</td>
<td>Hearst (Au)</td>
<td>DD(2)(358 feet)</td>
</tr>
<tr>
<td>55</td>
<td>Sudbury Contact Mines Ltd.</td>
<td>Hearst (Au)</td>
<td>SA</td>
</tr>
<tr>
<td>56</td>
<td>MacGregor, R.A.</td>
<td>Hearst, Skead (Au)</td>
<td>SA</td>
</tr>
<tr>
<td>57</td>
<td>Utah Mines Ltd. (Manor property–MacGregor)</td>
<td>Hearst, Skead (Au)</td>
<td>SA</td>
</tr>
<tr>
<td>58</td>
<td>Raven Resources Inc.</td>
<td>Hinks (Au)</td>
<td>EM, SA</td>
</tr>
<tr>
<td>59</td>
<td>Aurizon Mines Ltd.</td>
<td>Hobbitzell (Au)</td>
<td>DD(6)(4265.1 feet), SA</td>
</tr>
<tr>
<td>60</td>
<td>Cogema Canada Ltd. (Burntbush River project)</td>
<td>Hobbitzell, Noseworthy (Au)</td>
<td>DD(42)(8785.8m), SA, EM, M</td>
</tr>
<tr>
<td>61</td>
<td>American Barrick (Holt–McDermott)</td>
<td>Holloway (Au)</td>
<td>DD (PC: J. Halidson)</td>
</tr>
<tr>
<td>62</td>
<td>Hemlo Gold–Freewest–Teddy Bear (Lightning)</td>
<td>Holloway (Au)</td>
<td>DD (PC: P. Cooper)</td>
</tr>
<tr>
<td>63</td>
<td>Noranda Exploration</td>
<td>Holloway (Au)</td>
<td>DD(10)(11617.1 feet)</td>
</tr>
<tr>
<td>64</td>
<td>Perron Gold Corp. (“Teck–101 Option”)</td>
<td>Holloway, Marriott (Au)</td>
<td>GL, M, IP</td>
</tr>
<tr>
<td>65</td>
<td>Hanson, T.A. (Sutton, M.)</td>
<td>Holmes (Au)</td>
<td>DD(4)(276.9 feet)</td>
</tr>
<tr>
<td>66</td>
<td>Parson, G.E.</td>
<td>Holmes (Au)</td>
<td>GL</td>
</tr>
<tr>
<td>67</td>
<td>Halladay, L.B.</td>
<td>Hutt, Montrose (Au)</td>
<td>G, Pr, SA</td>
</tr>
<tr>
<td>68</td>
<td>Raitanan, L.</td>
<td>Katrine (Au, Cu)</td>
<td>DD(1)(399 feet)</td>
</tr>
<tr>
<td>69</td>
<td>Battle Mountain (Canada) Ltd. (Lebel stock)</td>
<td>Lebel (Au)</td>
<td>GL</td>
</tr>
<tr>
<td>70</td>
<td>Battle Mountain (Canada) Ltd. (Gull Lake property)</td>
<td>Lebel (Au)</td>
<td>GL</td>
</tr>
<tr>
<td>No.</td>
<td>Property Owner</td>
<td>Township (Commodity)</td>
<td>Exploration (Activity)</td>
</tr>
<tr>
<td>-----</td>
<td>-----------------------------------------------------------</td>
<td>------------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>71</td>
<td>Cunningham, L.J. (Bouzane property)</td>
<td>Label (Au)</td>
<td>GL, M, DD(1)(400 feet)</td>
</tr>
<tr>
<td>72</td>
<td>Premier Exploration Inc.</td>
<td>Label (Au)</td>
<td>AEM, AM</td>
</tr>
<tr>
<td>73</td>
<td>Trinity Exploration Ltd. (Murdock Creek fault)</td>
<td>Lebel, Morisette, Arnold (Au)</td>
<td>SA</td>
</tr>
<tr>
<td>74</td>
<td>Dyment, L.M. (Maisonville Pipeline South property)</td>
<td>Maisonville (Cu, Mo, W)</td>
<td>SA</td>
</tr>
<tr>
<td>75</td>
<td>Mullan, G.J.</td>
<td>Maisonville (Au)</td>
<td>Str, SA</td>
</tr>
<tr>
<td>76</td>
<td>Neal, H.E. (Marriott South claims)</td>
<td>Marriott(Au, Cu, Zn, Pb)</td>
<td>SA</td>
</tr>
<tr>
<td>77</td>
<td>Mitchell, T.</td>
<td>Marriott (Au)</td>
<td>Str, SA</td>
</tr>
<tr>
<td>78</td>
<td>Richardson, N.</td>
<td>Marriott (Au)</td>
<td>EM, M, GL, SA</td>
</tr>
<tr>
<td>79</td>
<td>Geoconsuls Jack Stoch Ltd.</td>
<td>McElroy (Au)</td>
<td>EM, IP</td>
</tr>
<tr>
<td>80</td>
<td>MacGregor, R.A. (Moly Hill property)</td>
<td>McElroy (Au)</td>
<td>SA</td>
</tr>
<tr>
<td>81</td>
<td>McGregor, R.A. (McElroy West group)</td>
<td>McElroy (Au)</td>
<td>SA</td>
</tr>
<tr>
<td>82</td>
<td>Geoconsuls Jack Stoch Ltd.</td>
<td>McElroy, Gauthier (Au)</td>
<td>Pr, SA</td>
</tr>
<tr>
<td>83</td>
<td>Parker, D.P.</td>
<td>McEvay (Mari)</td>
<td>SA</td>
</tr>
<tr>
<td>84</td>
<td>Beckett, B.T., Salo, A.</td>
<td>McGarry (Au)</td>
<td>GL, M, EM</td>
</tr>
<tr>
<td>85</td>
<td>Boudreault, B.</td>
<td>McGarry (Au)</td>
<td>GL, SA</td>
</tr>
<tr>
<td>86</td>
<td>Deak Resources–Cyprus Canada (Kerr)</td>
<td>McGarry (Au)</td>
<td>DD(8)(11 000 feet) (PC D. Stevenson)</td>
</tr>
<tr>
<td>87</td>
<td>GSR Mining Corporation</td>
<td>McGarry (Au)</td>
<td>DD(2)(4866 feet), SA</td>
</tr>
<tr>
<td>88</td>
<td>Kennecott Canada–Deak Resources (Kerr)</td>
<td>McGarry (Au)</td>
<td>DD(8)(11 000m) (PC M. Zurowski)</td>
</tr>
<tr>
<td>89</td>
<td>Crighton, R.</td>
<td>McNeil (Au)</td>
<td>GL</td>
</tr>
<tr>
<td>90</td>
<td>Deak Resources–Northfield Min (Cheminis)</td>
<td>McVittie (Au)</td>
<td>EXP, dewatering (NM 09/12/92)</td>
</tr>
<tr>
<td>91</td>
<td>Hemlo Gold Mines–Northfield Min (Swansea)</td>
<td>McVittie (Au)</td>
<td>EXP (NM 07/20/92)</td>
</tr>
<tr>
<td>92</td>
<td>Hemlo Gold Mines–Greater Lenora Res (Omega)</td>
<td>McVittie (Au)</td>
<td>DD(5000 feet) (NM 09/07/92, 10/12/92)</td>
</tr>
<tr>
<td>93</td>
<td>Hemlo Gold Mines–Northfield Min–Towerlands</td>
<td>McVittie, McGarry (Au)</td>
<td>EXP, DD (NDN 05/14/92 PC P. Cooper)</td>
</tr>
<tr>
<td>94</td>
<td>Lac Minerals Ltd.</td>
<td>McVittie (Au)</td>
<td>DD(124.1m)</td>
</tr>
<tr>
<td>95</td>
<td>Royal Oak Mines Inc. (Lac McVittie JV)</td>
<td>McVittie (Cu, Zn, Au)</td>
<td>DD(4)(3432 feet), SA</td>
</tr>
<tr>
<td>96</td>
<td>Sudbury Contact Mines (Diamond Lake)</td>
<td>McVittie, Gauthier (diamonds)</td>
<td>DD, bulk sampling (NDN 04/02/92,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>06/02/92, NM 09/14/92, 10/07/92)</td>
</tr>
<tr>
<td>97</td>
<td>Sudbury Contact Mines–Panthro Res (Mary Ann)</td>
<td>McVittie, Gauthier (diamonds)</td>
<td>DD (NM 11/16/92)</td>
</tr>
<tr>
<td>98</td>
<td>Boone, P., Lauria, J.P.</td>
<td>Melba (Au)</td>
<td>Str, SA</td>
</tr>
<tr>
<td>99</td>
<td>Canamax Resources Inc. (Montrose 1)</td>
<td>Montrose, Hincks (Au)</td>
<td>GL, Str, SA</td>
</tr>
<tr>
<td>100</td>
<td>Glencain Expl. (Goodfish)</td>
<td>Morisette (Au)</td>
<td>DD(4)(2500 feet) (NDN 01/22/92)</td>
</tr>
<tr>
<td>101</td>
<td>Medici Resources Inc.</td>
<td>Morisette (Au)</td>
<td>IP</td>
</tr>
<tr>
<td>102</td>
<td>Pamorex Minerals Inc.</td>
<td>Morisette (Au)</td>
<td>Str, SA</td>
</tr>
<tr>
<td>103</td>
<td>St Denis, R.</td>
<td>Mortimer (Au)</td>
<td>M, Pr, Str, Tr, SA</td>
</tr>
<tr>
<td>104</td>
<td>Ellgring, F., Ward, D., Ward, J.</td>
<td>Mortimer, Newmarket, Steele (Au)</td>
<td>EM</td>
</tr>
<tr>
<td>105</td>
<td>Granges Inc.</td>
<td>Munro</td>
<td>GL, DD</td>
</tr>
<tr>
<td>106</td>
<td>Lalonde, D.</td>
<td>Munro (Au)</td>
<td>DD(4)(2326 feet), SA</td>
</tr>
<tr>
<td>107</td>
<td>Christie, N.</td>
<td>Munro</td>
<td>Str, Tr, SA</td>
</tr>
<tr>
<td>108</td>
<td>Trinity Explorations</td>
<td>Munro (Au)</td>
<td>EM, GL</td>
</tr>
<tr>
<td>109</td>
<td>Christie, C.</td>
<td>Munro, McCool (Au)</td>
<td>SA</td>
</tr>
<tr>
<td>110</td>
<td>Newmont Exploration of Canada Ltd. (Mikwam project)</td>
<td>Noseworthy, Bradette (Au)</td>
<td>DD(9)(2326.3m)</td>
</tr>
<tr>
<td>No.</td>
<td>Property Owner</td>
<td>Township (Commodity)</td>
<td>Exploration (Activity)</td>
</tr>
<tr>
<td>-----</td>
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<td>------------------------</td>
</tr>
<tr>
<td>111</td>
<td>Boudreau, B.</td>
<td>Ossian (Au)</td>
<td>EM, M</td>
</tr>
<tr>
<td>112</td>
<td>Battle Mountain Canada Ltd. (Vigraas Lake)</td>
<td>Otto (Au)</td>
<td>DD(4)(3039.7 feet)</td>
</tr>
<tr>
<td>113</td>
<td>Rivard, F.</td>
<td>Otto (Au)</td>
<td>GL, SA</td>
</tr>
<tr>
<td>114</td>
<td>Walls, J.</td>
<td>Otto (Ind. Min.)</td>
<td>GL</td>
</tr>
<tr>
<td>115</td>
<td>Weller, W.A.</td>
<td>Otto (Au)</td>
<td>Str</td>
</tr>
<tr>
<td>116</td>
<td>Laskowski, H.</td>
<td>Paddock</td>
<td>GL, SA</td>
</tr>
<tr>
<td>117</td>
<td>Mullan, G. (Silver Bar Extension)</td>
<td>Paddock</td>
<td>GL, M</td>
</tr>
<tr>
<td>118</td>
<td>Raven Resources Inc. (“Granite Property”)</td>
<td>Paddock (Au)</td>
<td>DD(2)(473 feet), EM, M</td>
</tr>
<tr>
<td>119</td>
<td>Tagliamont, F.P.</td>
<td>Paddock (Au)</td>
<td>EM, GL, SA</td>
</tr>
<tr>
<td>120</td>
<td>Trinity Exploration</td>
<td>Paucaud, Catharine (Cu)</td>
<td>GL, EM, M, Pr</td>
</tr>
<tr>
<td>121</td>
<td>Orofino Resources Ltd.</td>
<td>Pontiac (Cu, Zn)</td>
<td>GL, Gc, EM</td>
</tr>
<tr>
<td>122</td>
<td>Kiernicki, F., Leahy, M.</td>
<td>Powell, Bannockburn (Au)</td>
<td>Str, SA</td>
</tr>
<tr>
<td>123</td>
<td>Noranda Exploration Co Ltd. (Bowyer 282)</td>
<td>Purvis</td>
<td>DD(1)(706 feet)</td>
</tr>
<tr>
<td>124</td>
<td>Kasner, G.C.</td>
<td>Rickard (Cu, Zn)</td>
<td>DD(6)(1345.5m), SA, EM, M</td>
</tr>
<tr>
<td>125</td>
<td>Greater Lenora Resources</td>
<td>Rickard (Cu, Zn)</td>
<td>EXP (NM 03/16/92)</td>
</tr>
<tr>
<td>126</td>
<td>Orofino Resources Ltd.</td>
<td>Robertson (Cu, Zn)</td>
<td>GL, EM, M, Gc</td>
</tr>
<tr>
<td>127</td>
<td>Queenston Mining Inc.</td>
<td>Robertson (Cu, Zn)</td>
<td>DD(13)(15 931.8 feet), SA, M</td>
</tr>
<tr>
<td>128</td>
<td>MacGregor, R.A. (Group F1)</td>
<td>Skead (Au)</td>
<td>SA</td>
</tr>
<tr>
<td>129</td>
<td>Sudbury Contact Mines Ltd.</td>
<td>Skead, Rattray, Milligan (Au)</td>
<td>EM, M, Gv</td>
</tr>
<tr>
<td>130</td>
<td>Long, G.</td>
<td>Steele (Au)</td>
<td>Pr, SA</td>
</tr>
<tr>
<td>131</td>
<td>Long, G.</td>
<td>Stoughton (Au)</td>
<td>Pr, SA</td>
</tr>
<tr>
<td>132</td>
<td>Golden, W., Obradovich, T.</td>
<td>Tannahill (Au)</td>
<td>Str, SA</td>
</tr>
<tr>
<td>133</td>
<td>Battle Mountain (Canada) Ltd. (Amal Kirkland)</td>
<td>Teck (Au)</td>
<td>DD(10)(37 184m), SA</td>
</tr>
<tr>
<td>134</td>
<td>Battle Mountain (Canada) Ltd. (Teck ‘A’)</td>
<td>Teck (Au)</td>
<td>DD(3)(347.8m), SA DD (CNR 03/27/92, (NDN 01/10/92, 06/18/92, NM 09/28/92)</td>
</tr>
<tr>
<td>135</td>
<td>Lac Minerals Ltd. (Macassa)</td>
<td>Teck (Au)</td>
<td>GL</td>
</tr>
<tr>
<td>136</td>
<td>Mahood–Greer, M. (Perron Group 1&amp;2)</td>
<td>Teck (Au)</td>
<td>DD (20 000 feet) (PC D. Cater)</td>
</tr>
<tr>
<td>137</td>
<td>Moore, H.A. (South gp. West Block)</td>
<td>Teck (Au)</td>
<td>Gc, GL, EM, M</td>
</tr>
<tr>
<td>138</td>
<td>Placer Dome Inc. (South Floodwood River project)</td>
<td>Tweed (Au)</td>
<td>EM, M</td>
</tr>
</tbody>
</table>

Sources: NM (The Northern Miner), NDN (Northern Daily News), PC (Personal Communication), CNR (Company News Release)
Table 13.7. Significant exploration results in 1992 — Kirkland Lake Resident Geologist's District.

<table>
<thead>
<tr>
<th>Owner(s)</th>
<th>Property</th>
<th>Township (Location)</th>
<th>Commodity</th>
<th>Highlights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kingswood Exploration 1985 Limited</td>
<td>Thunder Zone</td>
<td>Beatty–Coulson (1)</td>
<td>Au</td>
<td>3 narrow high-grade zones intersected; reported assays include 2.95 oz/t over 6 feet, 0.14 oz/t over 30.8 feet and 0.11 oz/t over 57.7 feet; other narrow intersections were intersected with grades of up to 0.15 oz/t (NM: 02/10/92, 03/02/92, 05/25/92).</td>
</tr>
<tr>
<td>Hemlo Gold Mines Inc. Glimmer Resources Inc.</td>
<td>Glimmer</td>
<td>Beatty–Hislop (2)</td>
<td>Au</td>
<td>Hole 91–60 intersected a 10 to 15 cm quartz-ankerite vein along a favorable mafic-ultramafic contact running 3.55 oz/t over 1.0 m; a 200-metre step-out hole at a depth of 400 m returned 0.35 oz/t over 4.0 m; further drilling was planned on the 3 known mineralized zones (NM: 01/13/92, 09/28/92, NDN: 10/31/92).</td>
</tr>
<tr>
<td>Royal Oak Mines Inc. Queenston Mining Inc.</td>
<td>Upper Beaver</td>
<td>Gauthier (3)</td>
<td>Au,Cu</td>
<td>New gold zone discovered 2500 feet north of old workings; assays include 0.16 oz/t and 1.01% Cu over 62.0 feet, 0.15 oz/t and 0.33% Cu over 27.5 feet, 0.09 oz/t and 1.60% Cu over 35.2 feet (NDN: 01/20/92).</td>
</tr>
<tr>
<td>American Barrick Resources Corporation</td>
<td>Holt–McDermott</td>
<td>Holloway (4)</td>
<td>Au</td>
<td>New gold zone intersected 900 m below surface between the McKenna and Ghost Mountain faults on strike with the Mattawasaga Zone (J. Haflidson, pers.comm.).</td>
</tr>
<tr>
<td>Sudbury Contact Mines Limited</td>
<td>Diamond Lake</td>
<td>McVittie (5)</td>
<td>D</td>
<td>Two kimberlite pipes discovered; bulk sample from first recovered 8 microdiamonds, 4 of which are considered gem quality; second kimberlite pipe did not contain any diamonds (NDN: 04/02/92, 06/02/92; NM: 09/14/92, 10/07/92).</td>
</tr>
<tr>
<td>Glencairn Explorations Ltd.</td>
<td>Goodfish</td>
<td>Morrisette (6)</td>
<td>Au</td>
<td>4-hole, 2500 feet drill program completed to test extension of A-zone; intersected 0.24 oz/t over 10.0 feet (NDN: 01/22/92; NM: 02/24/92).</td>
</tr>
<tr>
<td>Greater Lenora Resources Corp</td>
<td>Rickard (7)</td>
<td></td>
<td>BM</td>
<td>Option agreement made on 61-claim block where base metals intersected in silicified and chloritized volcanics (NM: 03/16/92).</td>
</tr>
<tr>
<td>Battle Mountain (Canada) Inc. Queenston Mining Inc.</td>
<td>Amalgamated Kirkland</td>
<td>Teck (8)</td>
<td>Au</td>
<td>Drilling to test the “102–103” zone confirms its continuity for a strike length of 5000 feet between 1400 feet deep and 2500 feet deep; assays include 0.17 oz/t over 100.4 feet (true width of 50 feet), 0.29 oz/t over 2.95 feet and 0.19 oz/t over 27.9 feet; hole AK92–42 intersected new “104” zone, assaying 0.49 oz/t over 2.0 feet (CNR: 03/27/92; NDN: 06/18/92; NM: 09/28/92).</td>
</tr>
</tbody>
</table>

Notes: Commodity: Au (gold), Cu (copper), BM (base metals), D (diamonds).  
Highlights: oz/t (ounces Au per ton).  
Source: NM (The Northern Miner), NDN (Northern Daily News), CNR (Company News Release).
Northern Daily News, September 12, 1992). Hemlo Gold Mines Inc. signed a deal with Northfield Minerals Inc. and Towerlands Properties Inc. to earn a 51% interest in their properties over 4 years. Hemlo Gold Mines Inc. agreed to spend $1.1 million on the Swansea property, west of the Omega group, and $2.25 million on the Bear Lake property, a large block of ground which runs from the Omega property to the Barber Larder Pit in McGarry Township (Northern Daily News, May 14, 1992; The Northern Miner, July 20, 1992, p.3). A small 1200 m drill program was completed on the Bear Lake property near the end of the year (P. Cooper, Hemlo Gold Mines Inc., personal communication, 1993). Hemlo Gold Mines Inc. also completed an agreement with Greater Lenora Resources Corp. for an interest in the Omega property. An initial drill program of 5000 feet was planned for the property.

At the Kerr Mine property in McGarry Township, Deak Resources Corporation and Cyprus Canada Inc. announced a $3 million, four-year surface and underground drilling program. In 1992, Cyprus Canada Inc. completed 8 drill holes totalling 11 000 feet from 3 underground levels; 3 holes from the 1300-foot level, 1 hole from the 2050-foot level, and 4 holes from the 2500-foot level. The holes were drilled to test the Mill Zone, the South Zone and the stratigraphy south of the main mine workings (D. Stevenson, Cyprus Canada Inc., personal communication, 1993). Kenneccott Canada Inc., in separate deal with Deak Resources Corporation, drilled 8 deep holes for over 35 000 feet on the property adjoining the Kerr Mine. The purpose of the drill program was to test the Larder Lake Deformation Corridor at depth, using 1000-foot drill centers (M. Zurowski, Kenneccott Canada Inc., personal communication, 1993).

In the Black River–Matheson area, several companies were active in 1992. Kingswood Explorations 1985 Limited continued definition drilling on its Thunder Zone, in Beatty and Coulson townships. Late in the year, Sudbury Contact Mines Limited signed an option agreement with Jonpol Explorations Limited and T&H Resources Ltd. for an interest in their properties over 4 years. Jonpol Explorations Limited and T&H Resources Ltd. completed a 15 000-foot drill program on the Garrison Township property to test the deep extension of the main zone. Drill-indicated reserves to the 1000 foot depth stand at 513 000 tons grading 0.28 ounces Au per ton (The Northern Miner, January 20, 1992).

Exploration work is continuing on Hemlo Gold Mines Inc.’s and Canamax Resources Inc.’s Golden Highway Joint Venture which covers a large block of ground in Harker, Holloway and Marriot townships. Most of Hemlo Gold Mine Inc.’s $6 million 1992 exploration budget for Ontario has been spent on its joint venture properties in the Kirkland Lake Resident Geologist’s District, with a significant portion of that going towards the Golden Highway Joint Venture (Mines and Minerals Weekly Bulletin, February 24, 1992, p.1).

At the Holt–McDermott Mine property in Holloway Township, American Barrick Resources Corporation intersected a new gold zone 900 m below surface (see Figure 13.1). The new drill intersection occurs between the McKenna and Ghost Mountain faults, on strike with the existing Mattawasaga Zone. Further drilling was planned for late in the year (J. Haflidason, American Barrick Resources Corporation, personal communication, 1993).

In addition to the $12 million mine development work that was approved in 1992, Hemlo Gold Mines Inc. and Freewest Resources Inc. continued exploration drilling on the Lightning Zone property in Holloway Township. Two drill rigs were exploring the favourable mafic-ultramafic contact east of the Lightning Zone. Shaft sinking is continuing on the Lightning Zone itself, which has preliminary reserves of 5 million tonnes grading 9.2 g/t Au (S. Conquer, Hemlo Gold Mines Inc., personal communication, 1993).

DIAMOND EXPLORATION

The published discovery of a diamond-bearing kimberlite pipe in McVittie Township by Sudbury Contact Mines Limited early in the year was a major factor in stimulating diamond exploration in the Kirkland Lake area (see Figure 13.1). The Agnico–Eagle Mines Limited affiliate announced it had recovered 14 microdiamonds from the Diamond Lake kimberlite pipe, 6 of which are considered gem quality. The discovery of a second kimberlite pipe, south of the Diamond Lake pipe, was disclosed later in the year. Sudbury Contact Mines Limited planned to spend $600 000 in 1992 to explore between 20 and 30 geophysical anomalies using 2 diamond drill rigs. The drill targets are situated on 9 separate properties, covering 40 000 acres of ground. Some of these magnetic anomalies are found within the Mary Ann property, in McVittie and Gauthier townships. Late in the year, Sudbury Contact Mines Limited signed an option agreement with
Lake Resources Inc. and planned to spend $200,000 to evaluate the diamond potential of the property (Northern Daily News, April 2, 1992, p.3 and June 2, 1992, p.1; The Northern Miner, September 14, 1992, p.6 and November 9, 1992, p.2).

In Arnold Township, 3 separate exploration programs were announced during the course of the year. Glencairn Explorations Ltd. and Strike Minerals Inc. planned a $100,000 program on their joint venture property. Regal Goldfields Limited revealed plans to extract a 50 tonne bulk sample from the A-3 pipe for assaying. Wheaton River Minerals Ltd. signed an option agreement with Glencairn Explorations Ltd. to diamond drill-test 14 magnetic anomalies on 4 separate properties, 5 of which occur in Arnold Township. The joint venture also planned to test 4 magnetic targets in Elliot Township, 3 in Melba Township and 2 in Bernheardi Township (The Northern Miner, June 1, 1992, p.1, July 20, 1992, and October 26, 1992, p.2).

KWG Resources Inc. signed a $3 million two-year option agreement with Regal Goldfields Limited to explore its kimberlite properties. Work planned on the B-30 (Nickila Lake) pipe in Bisley Township included a detailed magnetometer survey and the extraction of a 50 tonne bulk sample. A 300 ton bulk sample from the two separate magnetic phases of the C-3 pipe in Clifford Township was planned as well. The C-14 pipe is a known diamondiferous kimberlite pipe where a previous 8 tonne sample recovered 8 diamonds weighing a combined total of 0.30 carat (The Northern Miner, October 26, 1992, p.2, and November 16, 1992, p.1).

In Eby Township, Greater Lenora Resources Corp. announced the discovery of 2 lamproite boulders on its property. An exploration program designed to locate the source of these boulders was planned (Northern Daily News, July 21, 1992).

In addition to an ongoing evaluation of the Buffonta property’s gold potential in Garrison Township, Gwen Resources Ltd. is also evaluating its diamond potential. A 500 pound bulk sample of 2 Kimberlite-lamproite dikes from the No.6 Zone pit was tested for its diamond potential. Although no pyrope garnets were found in the sample material, other indicator minerals suggest a high diamond potential for the area (Northern Daily News, May 23, 1992, p.3).

**BASE METAL EXPLORATION**

Base metal exploration was carried out in 3 widely separated areas of the Kirkland Lake Resident Geologist’s District. All 3 areas occur within unique tectonic-stratigraphic assemblages as defined by Jackson and Fyon (1991).

In Ben Nevis Township northeast of Kirkland Lake, Minnova Inc. optioned a 175-claim group from Mountain Lake Resources Inc. and planned to spend $200,000 to evaluate the base metal potential of the property (Northern Daily News, March 21, 1992, p.6A).

West of Lake Abitibi, Greater Lenora Resources Corp. announced an option agreement on a 61-claim group in Rickard Township (see Figure 13.1) containing anomalous base metal values (primarily zinc and lead) within silicified and chloritized metavolcanic rocks (drill core exhibiting the mineralization is available for viewing at the Kirkland Lake Core Library). Rickard Township is underlain by komatiitic and tholeitic metavolcanic rocks, cherts, iron formation and felsic pyroclastic rocks of the Stoughton-Rocquemaure assemblage.

In Robertson Township near Matachewan, Falconbridge Limited has optioned a 127-claim group from Queenston Mining Inc. and Strike Minerals Inc. where earlier diamond drilling intersected copper-zinc massive sulphides. Falconbridge Limited can earn a 50% interest by spending $1,675 million over 4 years. A preliminary exploration program was planned for the summer (Mines and Minerals Weekly Bulletin, May 4, 1992, p.1). Robertson Township is underlain by poorly exposed intermediate to felsic metavolcanic rocks of the Watabeag assemblage, considered to be the western equivalent to the Blake River assemblage.

**KIMBERLITES, LAMPROITES AND DIAMONDS IN KIRKLAND LAKE**

**Introduction**

Kimberlite is a “porphyritic alkaline peridotite containing abundant phenocrysts of olivine (commonly serpentinized or carbonated) and phlogopite (commonly chloritized), and possibly geikieite and chromian pyrope, in a fine-grained groundmass of calcite and second-generation olivine and phlogopite and with accessory ilmenite, serpentine, chlorite, magnetite and perovskite.” (Bates and Jackson 1980). The name was derived from Kimberley, South Africa, where a significant portion of commercial diamond-bearing pipes are found.

Lamproites, host to the large Argyle diamond deposit in northwestern Australia, are mineralogically similar, though not identical, to kimberlites. They are generally not serpentinized, and rarely contain pyrope garnets and ilmenite. Glass and, to a lesser degree, amphiboles are typical matrix constituents for lamproites, though not for kimberlites.

Worldwide, kimberlites are found in large Precambrian (greater than 1500 Ma) stable cratons characterized by thick continental crusts and low geothermal gradients. Diamondiferous kimberlites appear to be located in the heart of a shield area, whereas barren kimberlites are generally found at the margins. Even within the same field, kimberlite pipes might have been emplaced during several different episodes rang-
ing from 75 million to 450 million years (Tertiary to Ordovici-
can), much younger than the usual Precambrian host rocks
(Atkinson 1988).

On a regional scale, kimberlite emplacement is generally
associated with distinct structural trends, particularly reac-
tivated structures. Kimberlite pipes occur in clusters along
these structural trends. In the N.W.T., the recent Lac de Gras
discoveries are situated within a north-northwest-trending
deformational zone, appropriately named the "Corridor of
Hope". Virtually all the kimberlite occurrences in the Kirkland
Lake area are situated within a similar 30 km to 40 km wide
north-northwest-trending deformational corridor, called the
Lake Timiskaming Rift Valley (Lovell 1972).

Because of their properties, kimberlite pipes tend to
form bedrock topographical low features, frequently covered
with thick overburden. Assessing the diamond potential of a
kimberlite pipe, once found, can be a very expensive propo-
sition—generally requiring a 5000 to 10000 tonne bulk
sample to accurately assess its grade. Other factors that are
frequently considered in assessing the economic potential of
diamondiferous pipe are 1) pipe size (generally the biggest
pipe in a cluster is the most economic); 2) ratio of payable to
non-payable pipes (varies, 1 in 12 economic at the Premier
field in South Africa); 3) depth of erosion (upper crater zone
usually contains higher grades, but is less homogeneous than
the lower diatreme zone); 4) percentage of gem quality
stones; and 5) the diamond market (The Northern Miner,
Nov.16, 1992, p.16).

EXPLORATION HISTORY—
KIRKLAND LAKE

One of the first published references to kimberlites in the
Kirkland Lake area was made over 40 years ago. In the 1948
Ontario Department of Mines Annual Report (Geology of
Michaud Township), Satterly (1948) described what "may be
termed a kimberlite" — a "striking ultrabasic rock" containing
phenocrysts of olivine, phlogopite and pyrope-rich garnet
as well as "a few small foreign rock fragments" in a
serpentinized, olivine-rich and weakly magnetic matrix. The
kimberlite described above was found in 2 separate holes
drilled by Marchaud Mines on its Ludgate Lake property.
The find was far from spectacular — occurring as very narrow
dikes of "badly crushed" and "crumbled" core — and ap-
ppeared to generate little interest at the time.

Almost 2 decades later, a glacioluvial study of the
Munro esker by Lee (1968) delineated anomalous concentra-
tions of magnesiu-rich pyrope garnets and associated
"kimberlitic rock fragments" in Gauthier Township, south of
Highway 66. Glacial tracing techniques led to the discovery
of another kimberlite dike at the Upper Canada Mine. The
dike, best exposed on the 2750-foot level, trends 340° and
dips vertically. Although only 1 m wide, it is among the wider
kimberlite dikes known worldwide (Lee and Lawrence 1968).
Age dating on the kimberlite indicates a Late Jurassic period
of emplacement (151 ± 8 Ma).

Subsequent discoveries of kimberlite float in the Gauthier
township, including an 11.6 kg float found by Ontario Geo-
logical Survey mapping crews in a gravel pit south of High-
way 66 and 300 m west of the Esker Lakes Provincial Park
Road (Baker 1982a, 1982b) generated some exploration
activity in the early- to mid-1980s. Monopros Ltd., an affili-
ate of De Beers Consolidated Mines Ltd., tested several bulls-
eye magnetic targets during that period and outlined at least
4 kimberlite pipes in Arnold, Belley and Morrisee town-
ships. Hole 84-13–01, drilled on "Anomaly 13" (A-4 pipe)
in Arnold Township, recovered 5 microdiamonds, collect-
ively weighing 0.002 carat (MDI No: T1146; Kirkland Lake
assessment file number: KL1911).

RECENT EXPLORATION
DEVELOPMENTS

Early in 1992, Sudbury Contact Mines Limited announced
the discovery of a new kimberlite pipe in the southwest corner
of Mcvittie Township, north of Diamond Lake. Analysis of
core samples recovered 14 microdiamonds. Six of which are
considered gem quality. In September of 1992, the discovery
of a second kimberlite pipe south of the Diamond Lake find
was announced by the same company.

The almost concurrent discoveries of diamond-bearing
kimberlites near Kirkland Lake and in the Lac de Gras area
in the N.W.T. have increased interest in diamond exploration
considerably. Most of the recent grass-roots activity in
Kirkland Lake has been financed by junior mining and
exploration companies, including Sudbury Contact Mines
Goldfields Limited, Greater Lenora Resources Corp., Pure
Gold Resources Inc., Deak Resources Corporation, Wheaton
River Minerals Ltd., KWG Resources Inc., Goldhunter Ex-
plorations Inc. and Canadian Giant Exploration Ltd. (The
Northern Miner, September 14, 1992, p.1, and November

A preliminary compilation of the kimberlite occurrences
in the Kirkland Lake area is summarized in Table 13.8 and
illustrated in Figure 13.5. To date, 8 kimberlite pipes have
been documented. All occur within a 15 km radius of Victoria
Lake, straddling Morrisee, Arnold, Lebel and Gauthier
townships. Microdiamonds were reported in 2 of the kimberlite
pipes, the A-4 pipe (Arnold Township) and the Diamond
Lake pipe (McVittie Township). Eight macrodiamonds,
weighing a total of 0.30 carat, were recovered from an 8.17-
tonne sample of the C-14 pipe in Clifford Township. One of
the diamonds, considered to be gem quality, weighs 0.17
carat (Dia Met Minerals Ltd. Information Circular, 1990 —
Kirkland Lake publication ref no: 12181).

Surprisingly, only 4 kimberlite or lamproite dikes have
been substantiated. Three are found well to the north of the
existing pipes in Michaud, Garrison and Harker townships,
while the fourth occurs at the Upper Canada Mine in Gauthier
Township. The sparse kimberlite dike population might be
the result of 1 or more of the following reasons: 1) they are

G. MEYER et al.
Table 13.8. Summary of documented kimberlite and/or lamproite occurrences in the Kirkland Lake Resident Geologist’s District.

<table>
<thead>
<tr>
<th>Kimberlite Occurrence</th>
<th>Township</th>
<th>Name</th>
<th>UTM Zone Easting</th>
<th>Northing</th>
<th>MDI No.</th>
<th>Diamonds Found?</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Bisley</td>
<td>Nickila Lake (B-30)</td>
<td>17 580400</td>
<td>5348350</td>
<td>C2299</td>
<td>No</td>
<td>Drilled by Monopros Ltd. (84-06-01, 84-06-03, 84-06-04, 85-6) and Lac Minerals Ltd. (B30A); Monopros hole 85-6 at Kirkland Lake Core Library.</td>
</tr>
<tr>
<td>P2</td>
<td>Clifford</td>
<td>C-14</td>
<td>17 589200</td>
<td>5347800</td>
<td>C2300</td>
<td>Yes</td>
<td>Drilled by Lac Minerals Ltd. (C14L, C14J); Dia Met Minerals Ltd. recovered 8 macrodiamonds weighing 0.30 carat from 8.17 tonne sample (one diamond weighed 0.17 carat).</td>
</tr>
<tr>
<td>P3</td>
<td>Morissette</td>
<td>Morissette Creek</td>
<td>17 580900</td>
<td>5340000</td>
<td>T1144</td>
<td>No</td>
<td>Drilled by Monopros Ltd. (83-20-01, 84-20-01).</td>
</tr>
<tr>
<td>P4</td>
<td>Arnold</td>
<td>Alfie Creek 1</td>
<td>17 583100</td>
<td>5341250</td>
<td>T1146</td>
<td>Yes</td>
<td>Drilled by Monopros Ltd. (83-13-01, 84-13-01) and Lac Minerals Ltd. (A4A, A4B); 5 microdiamonds were recovered from Monopros hole 84-13-01.</td>
</tr>
<tr>
<td>P5</td>
<td>Arnold</td>
<td>Alfie Creek 2</td>
<td>17 582650</td>
<td>5340950</td>
<td>T1145</td>
<td>No</td>
<td>Drilled by Monopros Ltd. (84-13-02, 84-13-03); outlined curved elliptical kimberlite pipe.</td>
</tr>
<tr>
<td>P6</td>
<td>McVittie</td>
<td>Diamond Lake</td>
<td>17 592100</td>
<td>5329800</td>
<td></td>
<td>Yes</td>
<td>Sudbury Contact Mines Limited discovered 2 kimberlite pipes in the vicinity of Diamond Lake, 8 microdiamonds recovered from first pipe, 4 of which are gem quality.</td>
</tr>
<tr>
<td>P7</td>
<td>Arnold</td>
<td>Arnold A1</td>
<td>17 583220</td>
<td>5345050</td>
<td></td>
<td>No</td>
<td>Drilled by Lac Minerals Ltd. (hole A1B).</td>
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<tr>
<th>Dikes</th>
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<th>Indicator Minerals</th>
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<td>I2</td>
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<td>I3</td>
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</table>
Figure 13.5. Kimberlite and/or lamproite occurrences in the Kirkland Lake Resident Geologist's District.

generally quite narrow (less than 1 m wide); 2) they are highly susceptible to weathering, causing poor core recovery and bedrock topographic lows; 3) they have been emplaced within existing fault or fracture zones, again causing poor core recovery; and 4) they have been mis-classified as narrow lamprophyre or basic to ultrabasic dikes.

All currently known kimberlite boulders and indicator minerals have been found in Gauthier, Mcvittie and McGarry townships, east of Kirkland Lake. They occur down-ice from the main kimberlite pipe field centered around Victoria Lake and within the north-northwest trending structural corridor (Lake Timiskaming rift valley) that appears to have defined kimberlite emplacement in the Kirkland Lake area. The only known erratics found outside the favorable corridor are the lamproite boulders discovered by Greater Lenora Resources Corp. in Eby Township, southwest of Kirkland Lake. The source of these boulders has yet to be found.

GOVERNMENT-FUNDED RESEARCH

The Kirkland Lake Kimberlite Project, funded both federally and provincially through Canada-Ontario Northern Ontario Development Agreement (NODA) has 2 main components. The first component will search for kimberlite indicator minerals in the heavy mineral concentrates of approximately 1500 till samples from the Ontario Geological Survey sonic overburden holes drilled during the BRIM (Black River-Matheson) project. This examination will include microprobe analysis of the samples for kimberlite indicator minerals.

The second component will examine the nature of glacial dispersion patterns over and down-ice from 3 known kimberlite pipes; the C–14 pipe in Clifford Township, the B–30 or Nickila Lake pipe in Bisley Township and the Diamond Lake pipe in Mcvittie Township. In addition, vegetation and soil samples over several kimberlite pipes will be analyzed geochemically for indicator minerals. M.B. McIntenaghan and R.N.W. DiLabio of the Geological Survey of Canada are managing the project (M.B. McIntenaghan, Geological Survey of Canada, personal communication, 1993).

Funded by the Ontario Geological Survey Geoscience Research Grant Program, D.J. Schulze, University of Toronto, is studying the petrographic and chemical variations of mantle xenoliths and xenocrysts from 5 kimberlite pipes in the Kirkland Lake area; the C–14 pipe in Clifford Township, the A–1 and A–4 pipes in Arnold Township the AM–47 pipe at the boundary of Arnold and Morrisette townships, and the B–30 or Nickila Lake pipe in Bisley Township. The sample material from these pipes will also be used in P. Vicker's MSc thesis, an investigation of the equilibration conditions of garnet-peridotite xenoliths found in these pipes and a comparison of their stability field with the diamond stability field (D.J. Schulze, University of Toronto, personal communication, 1993).

Electron microprobe work of hand-picked garnets, chromites and ilmenites from heavy mineral concentrates is being completed as well. The heavy mineral concentrates were prepared from the AM–47, B–30 and C–14 pipes, as well as a large kimberlite boulder from the Misema River esker. Preliminary conclusions indicate that the garnet and chromite mineralogy is consistent with diamondiferous kimberlites found elsewhere. Furthermore, the ilmenites are not oxidized, indicating minimal resorption of diamonds during the emplacement of the pipes to surface.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

Permanent staff of the Kirkland Lake Resident Geologist's office include: G. Meyer, Resident Geologist; H. Lovell, Regional Staff Geologist; D. Guindon, Staff Geologist; F.M. Boucher, Administrative Secretary; Z. Madon, Drill Core Library Geologist and M. Gaudreau, Drill Core Library Assistant.

H. Lovell, Regional Staff Geologist, retired on January 31, 1992, following completion of the Matachewan-Kirkland Lake-Larder Lake gold study. A farewell party held in his honour marked the end of almost three decades of a dedicated career with the Ontario Government. Geological assistance was provided by C. Backle and J. Cook in the completion of his final reports.

T. Beckett, Data Geologist, worked on various contracts primarily assisting in the processing of assessment reports.

D. Guindon commenced a secondment as Mineral Deposit Inventory Project Coordinator to oversee the province-wide completion of the MDI database. T. Beckett is providing back-fill for the staff geologist for the duration of his assignment.

J. Kidston and M. Dyment, contract employees, completed approximately 574 Mineral Deposit Inventory records for the Kirkland Lake Resident Geologist office. It is expected that an additional 300 records will be completed this fiscal year.

P. Lenardon worked on the Summer Experience 1992 program as an assistant at the Drill Core Library.

D. Robinson, contract employee, started to provide key words for the technical articles for approximately 7200 records in the library reference computer program.

Futures work placements under the co-ordination of F.M. Boucher, included C. Backle, S. Smith, T. Teeple and D. Jewett. Assignments included clerical assistance, data entry, collection of data resources and geological assistance to the Kirkland Lake Resident Geologist and Core Library offices.

Resident Geologist staff presented a seven-day prospec-
tors course and one-day field trip to 27 participants in April. Mining Lands staff assisted by providing up-dates on claim-staking and assessment work regulations. D. Guindon wrote a manual on report writing to be used in the prospecting course.

As part of Mining Awareness Week, exhibits were presented by: MNDM, the Northern Prospectors Association and the local branch of the Canadian Institute of Mining and Metallurgy and Petroleum at the Kirkland Lake mall.

A crew of 9 Junior Rangers, based at Esker Lakes Provincial Park, spent 3 days upgrading several field trip stops by stripping overburden and bleaching outcrops. A komatiitic flow, that has recently undergone university research, was also cleaned.

The Resident Geologist’s staff organized a field trip and slide show given by W. Mueller, University of Quebec, Chicoutimi, on surge flows.

Several mineral potential evaluations and mine hazard evaluations were reviewed for property re-zoning at the request of the Ministry of Municipal Affairs.

Poster displays were presented at the Northeastern Ontario Regional Geoscience Seminar and the Ontario Mines and Minerals Symposium in Toronto. Z. Madon assisted with the MNDM display at the Quebec Prospector’s Association conference in Val d’Or.

G. Meyer commenced reconnaissance sampling of the hydrothermal alteration zone association with the Holloway Joint Venture Project gold deposit. Lithogeochemical sampling of Gauthier Township volcanic group rocks was also started by the Resident Geologist. Details of this field work are included in this report.

M. Gaudreau designed and built a prototype of a steel pallet that will be used in all off-site drill core storage facilities throughout the province.

The MINEPLAN database and mine closure plans inventory at the Kirkland Lake Drill Core Library was completed by Z. Madon.

D. Guindon conducted a local geological field trip for the Chinese Delegation in October.

Ministry staff conducted a tour of the core library facilities for a thirty-member Russian delegation from the Sakha–Yakutia region, northern Siberia, known for its diamond and gold deposits.

A geologist died of carbon monoxide poisoning August 10, while dewatering an old shaft in Boston Township. Ministry personnel assisted the OPP in finding his body. A subsequent Coroner’s Inquest was attended by D. Guindon.

As an information item, Z. Madon completed French Language accreditation to become the contact person for the Mines and Minerals Division in Kirkland Lake.

This year, the Kirkland Lake Resident Geologist’s office again maintained a high level of activity, providing assistance to 2623 visitors and responding to 2104 phone inquires. In addition, the Core Library provided the same to 970 visitors and handled 1228 phone calls. Staff conducted 31 property visits, 4 field trips, and visited 2 underground mine sites. A total of 240 assessment reports were integrated into the office files.

PROPERTY VISITS

Chartre–Dufresnes Cairo Property (MDI No: T 1078)

The Chartre–Dufresnes Cairo Township property is located approximately 1.5 km east of Matachewan and centred at UTM Zone 17, 528700E 5309350N (see Figure 13.1). The property consists of 7 contiguous claims which are as follows: L1179885, L1179886, L1179887, L1179888, L1179889, L1179890 and L1185634. Access to the property is by boat across the Montreal River, 800 m west of the Pioneer Park boat launch off Highway 66. A total of 10 sites have been stripped and washed with a fire hose, exposing old trenches, pits and fresh rock surfaces along the southeastern bank of the Montreal River, on Claim 1179888.

The general geology of the area prospected is underlain by granodiorite of the Round Lake batholith to the southeast and mafic flows of the Boston assemblage to the northwest. The mafic flows are generally coarse grained and are intruded by the granodiorite. Quartz veins are well developed both in the granodiorite and the mafic flows. Zones of sub-parallel quartz veins up to several metres wide have been exposed with individual veins ranging up to 1 m in width. The quartz veins are more or less parallel to the granodiorite-mafic flow contact and have a general azimuth of 050° dipping mostly near vertical to 65° to the southeast.

The quartz veins and adjacent sheared wall rocks contain disseminated hematite, magnetite, chalcopyrite and pyrite. The northernmost trench (Trench #7) exposed a 1.5 m wide shear zone with disseminated chalcopyrite. The owner analysed a total of 47 grab samples for gold from the trenches and cleaned areas. Two values returned nil and the remainder ranged from 3 to 240 ppb Au. Thirty of these samples were also analyzed for copper and ranged from 0.05% to 2.48% Cu. Homestake Canada Inc. had 6 samples assayed and the highest gold value was 325 ppb.

Cook–Gamble Property (MDI No: T 0412)

The Cook–Gamble property is located in Catharine Township at UTM Zone 17, 587750E 5313150N (see Figure 13.1). The property consists of 4 contiguous claims which are as follows: L532869, L893843, L893844 and L893845. The property can be accessed by taking Highway 624 north for approximately 8 km from Marter, turning west on the main lumber road in Lot 2, Concession 2, following that road for about 2.5 to 3.0 km and then walking west for approximately...
The claim group is underlain by mafic to intermediate iron-rich metavolcanic rocks of the Catharine Formation, which are cut by narrow quartz porphyry dikes and quartz-carbonate veins containing pyrite. The metavolcanic rocks strike north-northwest, with stratigraphic tops to the east. Numerous quartz-carbonate veins occur on the property. The strike of the quartz veins cross-cuts stratigraphy and is generally east trending. Individual quartz veins are up to 4 m wide and zones of quartz veining and associated wall rock carbonate alteration can be as wide as 10 to 15 m. The quartz veins are white to grey in colour and contain minor amounts of pyrite. The most promising quartz-carbonate exposures were further tested by diamond drilling. Extensive sampling of quartz veins in outcrop and diamond-drill core by the owners returned gold values ranging from 0 to 3188 ppb.

An inclined shaft was sunk by Ostrom Gold Mines Limited in 1926–1927 on the present Claim L532869. The shaft has a depth of 525 feet and levels were established at 200, 350 and 500 feet. On the lowest level, 1300 feet of lateral development was performed.

In 1991, a massive magnetite-chalcopyrite zone, parallel to the stratigraphy and up to 30 cm wide was discovered. On the footwall side, a chalcopyrite stringer zone occurs with individual chalcopyrite stringers perpendicular to layering. The whole mineralized zone has the characteristics of a volcanogenic massive sulphide deposit in miniature. Copper values for this zone range up to 8% and the highest gold value is 2702 ppb.

Kidston Gauthier Township Property (MDI No: T 0768, T 0774)

J. Kidston acquired 3 claims (4 units), L1136765, L1136766 and L1186100, in Gauthier Township (see Figure 13.1). The centre of the property is located at approximately UTM Zone 17, 586600E 5335500N. The property can be accessed by taking Highway 672 north off Highway 66, turning east on a lumber road about 300 m after the Ontario Northland railroad crossing, driving east for another 300 m and then north for about 250 m to a walking trail, which leads to the claim group.

The property is underlain by the Gauthier Group which is a thin sequence of potassium-rich, calc-alkalic volcanic rocks. Most of the volcanic units are either tuffs or lapilli volcanic rocks.

Outcrops do not occur on the property. However, the owner detected bedrock in the northeast corner of Claim L1136765 by pounding a rebar steel rod into the sand cover. Trenching at this site exposed intensely sheared and folded, sericitized and carbonatized tuff and lapilli volcanic rocks. This exposure was further tested with Drill Hole G–91–14. The entire hole from 25.5 to 465 feet stayed within similarly strongly hydrothermally altered volcanic rocks as exposed in the trench. The drill core has a beige colour throughout and remnants of remnant fragments are preserved. The surface of the core has turned brown due to oxidation of the carbonate minerals.

The Gauthier Group has undergone widespread sericitization and carbonization. However, this alteration appears to be most intense on the property and its immediate vicinity. The highest gold value obtained in the the drill hole is 8 ppb. Although this value is not anomalous, the sericite-carbonate zone needs to be further evaluated to determine if gold and/or other diagnostic elements increase or decrease along strike or at depth. To the east of the property, a rhyolite unit has been mapped by Norart Uranium and Gold Mines Ltd. (Kirkland Lake Assessment File # 2112). It needs to be determined if this unit represents a true rhyolite or silicification of more mafic material. Unfortunately, overburden coverage is widespread and sampling can only be performed in a few areas.

Tundra Granite and Marble Corp.'s Green Carbonate Pit in Teck Township

Tundra Granite and Marble Corp.'s open pit in Teck Township was visited by the Resident Geologist on several occasions in 1992. The pit located at UTM Zone 17, 572450E 5331450N south of Kirkland Lake is developed in a well exposed green carbonate zone measuring approximately 1000 m by 200 m (see Figure 13.1). Access to the quarry is via Pollock Avenue in Kirkland Lake, south to Harvey Kirkland, and south again on Conroy Street, which leads directly to the pit. On strike, the zone is overburden covered, but a few outcrops suggest that the zone continues both east and west.

The pit, now measuring approximately 25 by 15 m, has reached a depth of about 6 m. The rock near surface tends to be fractured and often strongly oxidized. With increasing depth, the carbonate zone has become more competent and near vertical. Parallel joint planes spaced several metres apart are forming natural breaks for some of the blocks.

The green carbonate zone, south of Kirkland Lake, occurs within the Larder Lake break and is likely the product of hydrothermally altered ultramafic flows. The colour of the green carbonate is due to fuchsite, a green mica mineral. Quartz-veining, usually randomly oriented, comprises approximately 10% of the rock and is substantially less than the green carbonate rock from the Kerr Mine. The lower quartz content makes the rock softer, thus reducing drilling, cutting and polishing costs.

Layered Basaltic Komatiite Flow, Boston Creek Area

A basaltic komatiite flow occurs at the contact of the lower Wawbewawa Group and the stratigraphically overlying
Catherine Group. The flow strikes northwest to southeast for a distance of 5 km and has a width of up to 115 m. The unit occurs approximately 2 km northeast of Boston Creek and is centred at the southeastern shore of O’Donalde Lake at UTM Zone 17, 580740E 5318600N (see Figure 13.1).

Two sites were examined in the field, 1 immediately southeast of O’Donalde Lake, where the entire cross-section of the flow is exposed, and the other, 4 km to the southeast, where exposure is limited to the top half of the flow. Stone et al. recognized 5 distinct layers, which, from base to top, are 1) basal pyroxenite, 2) peridotite, 3) pyroxenite, 4) spinel pyroxenite, and 5) spinifex-textured pyroxenite.

The basal pyroxenite, a 50 cm wide chill zone, is now an amphibolite (clinopyroxene altered to amphibole). The peridotite unit, approximately 30 m thick, consists of completely serpentinized cumulate olivines with intercumulate clinopyroxene. This unit has a sharp contact with the overlying pyroxenite. The pyroxenite unit, 7 m thick, contains several 20 to 30 cm wide interlayered magnetite-rich bands. Near the top of this unit, anorthosite occurs generally as blobs up to 30 cm long and 15 cm wide, with sharp upper contacts and gradational basal contacts. The elongation of the blebs tends to parallel layering and some are cross-cutting. The anorthosite, at both sites, is similar and occurs at the same stratigraphic position. Platinum group minerals (PGMs) occur at the base and the top of the pyroxenite unit. The following PGMs were identified; bismuthian, merenskyite, kotulskite, mertieite or stibiopalladinite, an unnamed palladium-silver sulphide, sperrylite, and an unnamed rhodium-platinum sulpharsenide (Stone et al. 1992). Stone obtained a combined platinum-palladium assay of 100 ppb. A substantially higher value was obtained by a prospector at the southeastern outcrop. The spinel pyroxenite unit, 14 m thick, consists essentially of clinopyroxene. Individual clinopyroxene crystals tend to be coarse grained (pegmatitic) and have a preferred orientation parallel to layering. The uppermost spinifex-textured pyroxenite, up to 30 m wide, is made up of platy pyroxene crystals, generally several metres long and up to 1 cm wide, arranged sub-parallel and perpendicular to layering.

**RESIDENT GEOLOGIST’S RESEARCH PROJECTS**

**Lightning Gold Zone**

The sericite-carbonate alteration zone associated with the Lightning gold zone provides an excellent research opportunity to determine elements and mineralogy diagnostic to the proximity of the gold deposit. Such information could then be applied to other known and yet to be found similar alteration zones. What makes this deposit such an excellent site to study is the uniform nature of the massive mafic volcanic flows which are either intensely hydrothermally altered, slightly altered or completely unaltered. Comparisons of analyses can then be made against background values which are anticipated to be relatively uniform.

At the Lightning zone, the sericite-carbonate alteration zone is best developed adjacent to the upper portion of the gold zone. The alteration zone continues to surface and extends laterally for several kilometres along strike in the plane of the gold zone.

Permission was obtained from Noranda Exploration Company, Ltd. to perform reconnaissance sampling. The company has been very supportive in determining the best drill core sections for this purpose. A total of 36 samples were collected.

The initial sampling program was confined to the zone of carbonate-sericite alteration, and, where possible, to its unaltered equivalent adjacent to the ore zone and at wide-spaced intervals towards surface. In relation to the size of the alteration zone, sampling was confined to only a small section. Depending on the results, sampling may be expanded along the strike of the alteration zone.

Some of the questions the present research project and future follow-up research will attempt to answer are as follows:

- are there systematic geochemical and/or mineralogical variations within the sericite-carbonate alteration as the gold zone is approached in both a lateral and a vertical direction?
- if systematic variations occur, can they be applied to other similar geological settings?
- is the sericite-carbonate alteration zone essentially confined to an area above the gold mineralization?
- are other major sericite-carbonate alteration zones associated with gold deposits? or are some “productive” and others not?
- if there are “productive” and “unproductive” alteration zones, what are the differences between them?

The answer to some of these questions may have a profound impact upon the search for deep “blind” gold deposits.

**Study of Gauthier Group Volcanic Rocks**

Volcanic rocks of the Gauthier group stretch from the northeastern corner of Lebel Township in an east-southeasterly direction to west of Spectacle Lake in McVittie Township, for a total length of 15 km and an approximate width of 2.5 km. The Gauthier group appears to be overlain conformably by mafic volcanic rocks belonging to the Kinojevis group to the north and east. To the south, an unconformity occurs between these volcanic rocks and the younger Timiskaming sediments. Top determinations on presumably Kinojevis group pillow lavas, in McVittie Township, suggest the pres-
ence of a major anticline, the axial plane of which passes more or less through the centre of the Gauthier group volcanic rocks for their entire length (Thompson and Griffis 1941).

The Gauthier group volcanic rocks have been considered somewhat unusual in that they are essentially pyroclastic rocks and occur in an area where one would expect Kinojevis group magnesium-rich and iron-rich mafic volcanic rocks. The Gauthier group pyroclastic rocks are potassium-rich calc-alkalic in composition and have a low magnetic signature similar to the Blake River assemblage.

Following an inspection of drill core with M. Dyment from a drill hole completed on J. Kidston’s property, as well as earlier discussions with L. Cunningham, the Kirkland Lake Resident Geologist conducted a reconnaissance examination and sampling of the Gauthier group (see section on Kidston Gauthier property). The reconnaissance sampling program covered only about 50% of the belt. However, from this study, it was determined that carbonate-sericite alteration is widespread, occurring to varying degrees almost everywhere, and is most intense in the general vicinity of the Kidston Gauthier property.

Strongly carbonatized rocks were also mapped previously in an area between Victoria Lake and McTavish Lake, Map No. 53a (Maclean 1944), and about 600 m west of Spectacle Lake, Map 50b (Thompson 1941). These sites have yet to be examined by the author. The 3 known areas of intense hydrothermal alteration appear to be coincident with the axis of the anticline. To the southwest of the Upper Beaver Mine, this intense alteration zone was not observed where rock exposures are good. It is therefore not known if the intense alteration is continuous along the axial plane of the anticline.

Some of the strongly hydrothermally altered volcanic rocks, collected from the Gauthier group, will be analyzed and compared with those from the Lightning zone.

**DRILL CORE STORAGE PROGRAM**

The Kirkland Lake Core Library is responsible for acquiring and preserving representative drill core for the Kirkland Lake District and the northern part of the Cobalt District.

The facility collects, catalogues and stores donated drill core, sonic drill-holes and rock samples from exploration and mapping programs throughout the area. This material is available for public viewing and, in most cases, sampling.

Clients are permitted to use the facility’s core splitters, rock saws, core saws and rock polishing equipment. In addition, they can examine both rock samples and thin sections in detail with the library’s binocular microscopes. Moreover, certain physical properties of core or rock samples can be verified using the library’s susceptibility meter (magnetism), UV lamp (fluorescence) and scintillometer (radioactivity).

In 1992, the library acquired cores from 72 new drill holes representing 43,039 feet (13,118.2 m) of drilling. The library surpassed the one million feet milestone for representative core with the acquisition of Hole KL2360 (TWL–89-03), on June 3, 1992. Table 13.9 lists all the core donated between November 15, 1991 and November 15, 1992. During 1992, 537 clients used the facility and a further 382 clients made inquiries during the year.

Since its inception, the Kirkland Lake Drill Core Storage Program has accumulated a total of 687,713 feet (209,614.8 m) of core representing 1,033,319 feet (314,955.6 m) of drilling and 2,360 drill holes (Figure 13.6). This total includes 155 sonic holes drilled by the Ontario Geological Survey–Geoscience Branch between 1984 and 1988. At present, 57.5% of the core (395,401 feet from 1,576 holes) is stored inside the facility itself, while the remaining 42.5% of the core (292,312 feet from 937 holes) is located off-site on wooden pallets. Inside core storage is filled to 94.2% of capacity.

A concerted effort by the core library staff to obtain type sections from past and present mines or developing properties has generated significant results. Over the year, core from the following properties has been collected:

2. Upper Canada Mine (Au–Gauthier Township) Queenston Mining Inc.
3. Anoki (Au–Gauthier Township) Queenston Mining Inc.
5. Stairs Mine property (Au–Midlothian Township) Teck Exploration Ltd.

Due to an increased interest in “green carbonate” rock as decorative stone, the core library staff compiled a list of “green carbonate” core that is available for viewing. Anyone who has this type of core and is considering donating it to the facility is encouraged to call the core library staff at Kirkland Lake.

As part of the Ontario Capital Fund, the Drill Core Library Expansion Initiative (DCLEI) was developed to address the overflow problems being experienced at all provincial facilities. The process of telescoping core was discontinued several years ago. In Kirkland Lake, a permanent outside core storage site was selected and is being upgraded for off-site core storage. The DCLEI is also funding the development and production of unitized, maintenance-free, all-steel pallets to minimize handling costs and accidents and maximize core mobility and ease of use for Ministry staff and clients.

A program initiated in 1990 to collect, document and
Table 13.9. Summary of drill core collected (Nov. 15, 1991 to Nov. 15, 1992), Kirkland Lake Resident Geologist’s District.

<table>
<thead>
<tr>
<th>Township</th>
<th>Number of holes</th>
<th>Total Depth (m)</th>
<th>Core Stored (m)</th>
<th>Number of boxes</th>
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<tr>
<td>Ben Nevis</td>
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<td>72.9</td>
<td>72.9</td>
<td>11</td>
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<td>Bernhardt</td>
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<td>44.8</td>
<td>44.8</td>
<td>6</td>
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<tr>
<td>Black</td>
<td>4</td>
<td>210.2</td>
<td>150.9</td>
<td>29</td>
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<tr>
<td>Cairo</td>
<td>3</td>
<td>381.4</td>
<td>313.7</td>
<td>51</td>
</tr>
<tr>
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<td>2489.5</td>
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<tr>
<td>Cleaver</td>
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<td>Guihord</td>
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<td>Ingram</td>
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<tr>
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<td>Munro</td>
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<td>72</td>
<td>11818.2</td>
<td>12075.8</td>
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</tr>
</tbody>
</table>

display representative rock samples from the Kirkland Lake District is continuing. Also, in order to facilitate searches by clients, the core library staff have undertaken to standardize and redraft all the drill hole location maps.

**STEEL PALLET FOR DRILL CORE STORAGE**

The JobsOntario Capital Fund Drill Core Library Expansion Initiative was designed to address the overflow of drill core at most library facilities throughout Ontario. A long-life, low-cost, and minimal maintenance idea was implemented in 1992 to replace strapped core boxes on wooden pallets with steel pallets (Photo 13.1).

Each all-steel pallet will hold 40 to 60 boxes of drill core. The boxes stack in 4 vertical columns 9 inches in width, separated by 1 by 1 inch hollow structural steel. The all-steel pallet can hold up to 2000 pounds and is self contained, eliminating steel strapping. With the use of a jig, the units can be stacked 2 high to save space, if necessary. When compared to the previous outside storage system, the new steel pallets should reduce wooden core box rot by increasing air circulation and thus keeping the boxes drier.

As part of the development of the steel pallet, a lightweight aluminum carriage was designed and built to ease the removal of core boxes from the pallet. With the light weight carriage under a core box, the box can be slid forward easily on rolling wheels and then removed without reaching, thus reducing the risk of injury or spillage.

The new outside drill core storage system will greatly increase access, accelerate core selection and improve safety. The Ministry of Northern Development and Mines is of the opinion that an excellent, inexpensive and effective core storage system has been developed. The steel pallets should be in use at all Drill Core Libraries by the summer of 1993.

**RECOMMENDATIONS FOR EXPLORATION**

**Recommendations for “Blind” Epigenetic Gold Deposit Exploration**

A major sericite-carbonate hydrothermal alteration zone occurs essentially above and in the plane of the Lightning gold zone. Such alteration zones, which are not uncommon within the Kirkland Lake and Larder Lake gold camps in the Kirkland Lake Resident Geologist’s District, may play a key role in finding “blind” epigenetic gold deposits.

Roslyakova and Roslyakov (1975) in their study on endogenic aureoles of gold deposits, discuss the use of a number of indicator elements such as Cu, Pb, As, etc. However, for prospecting purposes, they advocate the use of gold
Figure 13.6. Location of drill holes for which cores are stored at the Kirkland Lake Drill Core Library.

Photo 13.1. Prototype of the steel pallet to be used for off-site drill core storage.
Judging by the mineralogy of the sericite-carbonate alteration zones, it is anticipated that they would show up as resistivity lows. Some test work would be required and the digital data for the Ontario Geological Survey Black River—Matheson (BRIM) airborne survey for Harker and Holloway townships could be manipulated to extract the resistivity results. If this is unsuccessful, it is recommended to have test lines flown in Holloway Township using a system that has excellent resistivity mapping capabilities. In the event of successful manipulation of the existing data for the Harker—Holloway area, the BRIM data should be subjected to the same scrutiny for the entire survey area in order to determine if hydrothermal alteration zones can be identified under the clay-cover in the Matheson area.

Other ground resistivity surveys, such as IP and EM16R surveys, should also be conducted over the Lightning zone. If successful, these surveys could also be applied elsewhere.

Once a hydrothermal alteration zone has been identified for testing, extensive sampling and analyses would be required to identify, on the basis of indicator elements, areas for intensive follow-up exploration. These elements, analyzed in the report by Roslyakova and Roslyakov (1975), would make an excellent suite of elements for test purposes. Results of reconnaissance geochemical work currently performed by the Kirkland Lake Resident Geologist is hoped to provide further guidance in this type of an exploration approach.

If hidden intrusive bodies are responsible for causing hydrothermal activity, they can be detected by seismic surveys. This may provide guidance for deep exploration west of Matheson and east of Harker Township. In the Kirkland Lake—Larder Lake area, a large number of intrusions come to surface and much of the gold is hosted within the intrusions. This may suggest that the intrusions in this area were emplaced at a higher level in the crust than those in the Matheson and Holloway Township areas.

**Epigenetic Gold Deposit Model — Holloway Township to Timmins**

The formation of epigenetic gold deposits by hydrothermal activity was previously discussed (Meyer et al. 1992) and can be paraphrased as follows: Epigenetic gold deposits are formed by hydrothermal activity. Solutions, perhaps in the 300°C range, flowed upwards via permeable mediums and underwent cooling and reduction in pressure. At a favourable temperature-pressure range, silicification, albitionization, pyritization and gold mineralization precipitated from the hot fluids, likely at the boiling point. The temperature-pressure range was perhaps more or less parallel to the Archean surface at the time of the formation of gold deposits. The solutions in the continued upward flow were still hot and caused extensive sericite-carbonate hydrothermal alteration above and in the same plane as epigenetic gold deposits. The Lightning gold zone, now with a shallow plunge to the east, and the occurrence of the Mattawasaga gold zone at greater depth than the other Holt—McDermott gold deposits to the west, perhaps are indicative of the eastward tilting of a previously horizontal zone.

To examine this possibility further, the gold deposits were likely formed along a major subduction zone. With an assumed subsequent greater uplift to the west of the Lightning zone, a deeper cross-section of Archean rocks would be exposed there. Rocks prominent to the west consist of at least 7 felsic intrusive bodies distributed in an 8 km wide zone over an east-trending distance of 30 km. The single largest intrusion measures 6 km in diameter. With less possible uplift in the Lightning zone area and uplift decreasing to the east, it can be further inferred that felsic intrusions might occur beneath the Lightning zone and at increasing depths further to the east. With a possible intrusive body below the Lightning zone, such an intrusion could be the heat source required for the hydrothermal activity to occur. Age determinations in the Timmins area and elsewhere suggests, however, that the formation of gold deposits was considerably younger than the emplacement of proximal or associated felsic intrusions. Therefore, this aspect needs to be further investigated.

At present, only a few small gold deposits occur in the immediate area of felsic intrusions, and the larger deposits such as the Ross Mine—Glimmer deposit and Holt—McDermott—Lightning zone occur at a distance of 6 km both west and east, respectively, from the zone of felsic intrusions. This suggests that the above mentioned larger gold deposit areas are mirror images of each other. In the Lightning zone area, the "favourable" gold deposit Archean temperature-pressure range plunges to the east and, in the Matheson area, this plunge is to the west. Further to the west of Matheson, the "favourable" zone reappears again in the Timmins area.

If the above hypothesis is accepted, the favourable gold-forming zone is cut by the present erosion surface in 3 locations, each with a rather limited east-trending extension. Each site has several major gold deposits. If it is assumed that the density of major gold deposits is the same for the entire length where the zone favourable for gold mineralization does not come to surface, it can be concluded that only a fraction of the gold deposits have been found. Although many of these may be too deep to be economical by today's standards, blind gold deposits close enough to surface to explore for and to mine may occur east of the Lightning zone—Holt—McDermott Mine area, west of the Ross Mine—Glimmer deposit area and east of the Timmins gold camp.

**MATACHEWAN CONSOLIDATED MINES LTD. TAILINGS SPILL**

Following the failure of the tailings dam at the former Matachewan Mine site in October of 1990, several government ministries were mobilized to clean up the resulting spill and to repair a washed out road. The Ministry of the Environment (MOE) subsequently ordered Matachewan Consoli-
dated Mines, Limited, Goldteck Mines Limited and Pamour Inc. (now Royal Oak Mines Inc.) to pay for the clean-up and road reparation costs, which amounted to over $2 million.

In January of 1992, Goldteck Mines Limited agreed to pay the province $40,000 to be released from the clean-up order. Matachewan Consolidated Mines, Limited later reached a similar agreement, paying the province $12,000 and putting a $400,000 lien against the property. Pamour Inc. decided to appeal the order.

In June of 1992, 3 members of the Environmental Appeal Board heard testimony from several witnesses in Kirkland Lake. The 2 main issues argued during the tribunal were 1) whether Pamour Inc. caused or permitted the discharge of tailings at the Matachewan Mine property, and 2) whether Pamour Inc. owned or had management and control of the tailings at the time of the spill.

Shortly after all testimony was presented and closing arguments completed, the chairman of the Environmental Appeal Board absolved Pamour Inc. from all responsibility in the incident. A complete copy of the decision is available for viewing at the Kirkland Lake Resident Geologist’s Office and at the Kirkland Lake Core Library.

In July of 1992, Judge R. Carr convicted Matachewan Consolidated Mines, Limited and Goldteck Mines Limited of violating the Water Resources Act. R. McCloskey, director of Matachewan Consolidated Mines, Limited was also convicted of “failing to take all reasonable care to ensure the company did not harm the environment” under the Environmental Protection Act.

Both companies pleaded not guilty to a total of 7 charges laid; 3 under the Water Resources Act and 4 under the Environmental Protection Act. A decision whether to continue with the sentencing is expected early in 1993.

HEALTH AND SAFETY HAZARD

A lone prospector, pumping an old shaft in the Boston Creek area, died of carbon monoxide poisoning on or about August 11, 1992. Initially, the prospector had his gas-powered pump set up at the collar of the shaft. When the depth of the shaft exceeded the length of the intake hose, the prospector lowered the pump into the shaft.

Testimony at the subsequent Coroner’s Inquest suggested that the pump stopped running due to oxygen depletion in the confined space of the shaft. The prospector climbed down a ladder into the shaft and filled the pump with gas. The time required to fill the pump would have been sufficiently long to allow his body to absorb enough carbon monoxide that he would have lost his balance upon standing and quickly lost consciousness. Death would have followed.

The prospector was pumping without notifying the Ministry of Labour and was in violation of a number of Ministry of Labour requirements for shaft pumping: a ventilation system, air quality testing equipment, direct communications to someone on surface, a combustion engine within 100 feet of the shaft, and measurement of the amount of water being pumped.

Some of the recommendations of the Coroner’s Jury include that safety courses be taught by the Ministry of Northern Development and Mines, that the courses should be a prerequisite to obtain or renew a prospector’s licence, that all hazards found by prospectors be reported to Ministry of Northern Development and Mines, and that Ministry of Northern Development and Mines require proof from OMIP and/or OPAP applicants that the Ministry of Labour has been contacted in the case of shaft dewatering, prior to issuing a grant. The Coroner’s Jury recommendations are non-binding on the Ministry of Northern Development and Mines, but are being considered for future policy changes.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

Precambrian Geoscience Section

L. Jensen (1992) mapped McNeil and Robertson townships. Open File Map 204 (see Figure 13.1).

Canada–Ontario Northern Ontario Development Agreement (NODA)

1. J.A.C. Fortescue, R. Dyer and C. Fouts sampled a narrow strip along the 80th meridian west. Lake bottom and stream sediments were collected with the aid of a helicopter. The program of low density sampling will be used to determine the feasibility of low density geochemical mapping of Ontario.

2. A five-year program including till studies using heavy mineral concentrates and overburden drilling in a heavily drift covered area bounded by Beatty and Stoughton townships in the north and Ossian and Maisonville townships to the south. The aim of the study is to evaluate the potential for locating various economic mineral deposits and kimberlite pipes.

3. Geoterrrex Ltd. of Ottawa carried out an airborne geophysical survey under contract for the Geological Survey of Canada. The project involved systematic airborne coverage of the Blake River Syncline, an area bounded by the townships of Benoit and Maisonville to the west and Pontiac and Ossian to the east.

4. A project to construct a Geographic Information System (GIS) database for the Kirkland Lake–Cobalt–Temagami area that will be integrated with a pilot land-use information system.

RESEARCH BY OTHER AGENCIES

Universities

More detailed information on some of the following projects can be found in Geoscience Research Grant Program Summary of Research 1991–1992 (OGS 1992) or in the Abstracts, Ontario Mines and Minerals Symposium, December 9 to 11, 1992.
McMASTER UNIVERSITY
W.E. Stone is researching exploration criteria for platinum metals in layered mafic-ultramafic flows.

QUEEN’S UNIVERSITY
R.M. Harrap and H. Helmstaedt are studying the structure and emplacement mechanics of the Round Lake batholith, south of Kirkland Lake (Geoscience Research Grant 399).

UNIVERSITY OF OTTAWA
A.E. Lalonde is studying the composition and pleochroic colour of biotite associated with gold deposits at Kirkland Lake (Geoscience Research Grant 411).

M. Legault and A.E. Lalonde are studying the petrology and geochemistry of the Temiskaming sediments.

UNIVERSITY OF QUEBEC–CHICOUTIMI
W. Mueller and others are studying the sedimentology and volcanology of the Kirkland Lake Basin.

UNIVERSITY OF SASKATCHEWAN
Q. Xie and R. Kerrich are studying the geochemistry of zoned ultramafic intrusions in the Kirkland Lake area.

UNIVERSITY OF TORONTO
D.J. Schulze is studying the petrographic and chemical variations of mantle xenoliths from 5 kimberlite pipes in the Kirkland Lake area.

UNIVERSITY OF WESTERN ONTARIO
M. Collison, M. Clegg, A.D. Edgar and R.H. Sutcliffe are studying the mineralogy, petrology and geochemistry of alkaline metavolcanic rocks and their relationship to gold mineralization in the Kirkland Lake area (Geoscience Research Grant 409).

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QMinEx Associates and Queen’s University. 1992. Giant ore deposits: Proceedings of the giant ore deposits workshop; QMinEx Associates and Queen’s University, 599p.


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Maclean, A. 1944. Township of Lebel, NTS 32D/4W, 42A/1E, Timiskaming District, Ontario; Ontario Department of Mines Color Map 53A, scale 1:12 000, Accompanying Bulletin 150.


Thompson, J.E. 1941. Map No. 50B — Township of McVittie, Timiskaming District, Ontario, Ontario Department of Mines Color Map 50B.

Thompson, J.E. and Griffis, A.T. 1941. Map No. 50C — Township of Gauthier, District of Timiskaming, Ontario, 1 inch to 1000 feet; in Geology of Gauthier Township, east Kirkland Lake area, Ontario Department of Mines, v.50, pt.8.

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³Staff Geologist, Cobalt, Field Services Section, Ontario Geological Survey—Information Services Branch

INTRODUCTION

The re-opening for staking of Best, Cassels and Strathy townships near Temagami, and James Township near Elk Lake on January 7, 1992, had a significant impact on the number of exploration activities documented during 1992 in the Cobalt Resident Geologist’s District. These 4 townships were released from the Temagami Land Caution by the Teme-Augama Anishnabai band late in 1991. Land acquisition and exploration activities were most evident in the 3 townships located near Temagami, where Fyon and Crocket (1986) indicated that the Archean metavolcanics had an elevated potential for hosting volcanic-associated zinc-copper-silver massive sulphide mineralization. They also identified 3 deformation zones in the area as having high gold potential.

Although the Fort Knox Gold Resources Inc. nickel-copper discovery in Fawcett Township has not lived up to initial expectations, its significance within the Shining Tree greenstone belt has not been lost on many of the junior and senior exploration companies still active in the area. The area warrants further evaluation for its precious and base metal potential.

Diamond fever hit the Cobalt–Haileybury–New Liskeard area with the revelation that Monopros Limited had discovered at least 1 kimberlite pipe in Bucke Township, just west of Haileybury, during the early 1970s. Currently, diamond exploration in the Cobalt Resident Geologist’s area is focussed on a 50 km wide corridor centred on the Temiskaming rift structure, which stretches from Temagami in the south to Larder Lake in the north.

Base metal potential in the Cobalt area continues to interest explorationists. Several companies and individuals have begun studies of the Archean greenstone assemblages in the Cobalt and Silver Center areas. They are attempting to solve the long-standing riddle about the origin of base metal concentrations at depth, below the productive silver-bearing cobalt arsenide veins in the Cobalt camp.

Interest in industrial minerals and building stone resources appears to be on the upswing. Kyanite Mining Corporation continues to evaluate a kyanite resource in Butler and Antoine townships. Local building and landscaping stone suppliers have reported an increase in sales for 1992. One company is in the process of evaluating specific limestone beds within the Paleozoic outlier between Haileybury and Englehart. The target rock types are a fine-grained to aphanitic, buff coloured micritic dolostone and a variably coloured shelly limestone. Another company has shown interest in crushed rocks of different colours for use in manufacturing Terrazzo Stone facing stones, tiles and counter tops.

Almost all of the exploration activities documented during 1992 were “grass roots” oriented and preliminary in nature. This is due in part to the limited available exploration dollars, and to the fact that much of the ground under current exploration had been withdrawn from staking prior to April 1990, or prior to January 1992.

A near-record total of 48 companies and individuals were actively exploring for minerals in the Cobalt Resident Geologist’s District in 1992, an increase of 23% over 1991. This compares favourably with a record 50 companies active in 1987, during the height of flow-through funding. Claim staking reached record levels in 1992, with 2452 units staked and 135 units cancelled, for a net change of 2317 units added to the exploration land base. Approximately 60 diamond drill holes totalling 9636 m were completed during 1992 in the Cobalt Resident Geologist’s District, an increase of 162% from 1991 surface diamond drilling activities (Figures 14.1, 14.2, 14.3, 14.4 and 14.5).

As in 1991, Ontario Prospectors Assistance Program (OPAP) and Ontario Mineral Incentive Program (OMIP) awards made a significant impact on the total number of reported exploration activities during 1992. In the Cobalt Resident Geologist’s area, 36 OPAP grants valued at $352 945, and 5 OMIP grants valued at $193 503 were awarded.

MINING ACTIVITY

Dymond Clay Products Limited, Bucke and Breault Quarries

Early in 1992, Dymond Clay Products Limited (DCPL) completed the sale of 50% of its shares to Miller Paving Limited of Markham, Ontario. Funds generated by the sale were used to repair the lime kiln again (Ireland et al. 1992). Following repair of the kiln, CANMET was contracted to carry out a detailed evaluation of the entire system to determine optimum operating parameters. The combination of using suitable refractory brick for the kiln lining and following CANMET’s recommended operating parameters appears to have solved the technical problems that had plagued the operation since its start-up in 1990. Due to the time
Figure 14.1. Cobalt Resident Geologist’s District.
Figure 14.2. Claim-staking activity in the Cobalt Resident Geologist's District.

Figure 14.3. Exploration diamond drilling in the Cobalt Resident Geologist's District.

Figure 14.4. Exploration activity in the Cobalt Resident Geologist's District.

Figure 14.5. Client services—number of visitors to the Cobalt Resident Geologist's office.
required to complete repair work and fine-tune the kiln, only limited lime production was reported in 1992.

DCPL produces a variety of products—including agricultural limestone and lime, crushed limestone and aggregate and industrial lime—from the Bucke and Dymond Township quarries in the New Liskeard area (UTM 600000E 5256400N; NTS 31 M/5NE; MDI T735). DCPL produced 61,000 t of limestone in 1992. Much of this material was used by Falconbridge Gold Corp. to neutralize acid-generating waste rock from its Owl Creek open pit in Timmins. Falconbridge Gold Corp. is placing the waste rock and limestone back into the pit in alternating layers, a design to neutralize any acid leach generated. Total crushed aggregate production this year was 33,000 t, mostly Granular “A” road surfacing material (T. Overton, Dymond Clay Products Limited, personal communication, 1992).

**McLaren’s Bay Mica Stone Quarries**

For much of 1992, McLaren’s Bay Mica Stone sales were flat, but during the third quarter all the stockpiled slab and stone product was purchased for the United States market. There was a strong demand for large stone blocks weighing several tonnes, also destined for U.S. markets. Total estimated material sold in 1992 was 3,000 t. Demand for the material was still strong when operations were suspended for the winter, and there are already several orders to be filled in the spring.

The McLaren’s Bay Mica Stone quarry (UTM 627100E 5174700N; NTS 31 L/11NW; MDI N0096) is located in central McAuslan Township, just north of Reynolds Lake. Access is via the McLaren’s Bay road north from Highway 63. The product is a white, high-silica metaquartzite with coarse green or red (hematite-rich) muscovite gneissic bands. Folding and local in situ pegmatite development produces unusual textures associated with intense muscovite development, and the visual effect is striking (G. Boughner, McLaren’s Bay Mica Stone, personal communication, 1992).

**Thorne Brilliant Stone Quarry**

The Thorne Brilliant Stone Quarry (UTM 643450E 5171300N; NTS 31 L/11NE; MDI N0166) is located in Poitras Township at the top of the ski hill, 1 km south of Thorne, Ontario. Production totalled 68 tons of variably sized flagstone in 1992. Approximately 35 tons were shipped to Quebec to be used for facing stone on a newly built church. Another 100 tons is ready for shipment to Quebec in the spring. The remainder of the 1992 production went to numerous locations in Ontario and Quebec.

Thorne Brilliant Stone Quarry produces a white and red flagstone derived from quartz-rich gneiss containing bands of fine- to medium-grained muscovite mica. Splitting along the micaceous bands produces a flagstone 3 to 10 cm thick that exhibits a highly reflective, mottled facing. The red colour is due to hematite within the mica flakes. A black, biotitic gneiss that exhibits good flagstone splitting characteristics was recently discovered on the quarry property. The owners believe the stone is marketable, and production is planned for 1993 (P. Pharand, Thorne Brilliant Stone Quarry, personal communications, 1992).

**ADVANCED EXPLORATION AND DEVELOPMENT**

**Gwen Resources Limited–Perrex Resources Inc., Strathy Township**

Early in 1992, Gwen Resources Limited completed a seven-hole, 1000 m diamond drilling program on its Clenor gold property in Strathy Township (UTM 589100E 5215800N; NTS 31 M/4SW; MDI N0063). All of the holes were collared in the immediate vicinity of the main vein zone to test for continuity of width and grade for a proposed bulk sample.

Gwen Resources subsequently removed a 3250-ton bulk sample from the property, which included approximately 700 tons of development ore stockpiled on surface by previous operators. The bulk sample was trucked approximately 160 km to the Deak Resources Corp. mill in Virginatown for custom milling. Gwen Resources also cut a grid and completed magnetometer and very-low-frequency electromagnetic (VLF-EM) surveys over the entire property.

The Clenor property consists of 4 contiguous patented claims in central Strathy Township, approximately 3.6 km northwest of the town of Temagami. Originally staked by S. Beanland in 1929, the main showing was discovered by P.D. Hermiston and R. McCauley in 1934. During 1934–1935, while the property was under option to Consolidated Mining and Smelting Co. of Canada, extensive surface exploration was carried out.

The property was subsequently optioned to Goodfish Mining Co. in 1936, which formed Beanland Mining Co. Ltd. to operate it. During 1937–1938 and 1946, Beanland Mining sank a 505-foot deep, three-compartment vertical shaft with working levels established at the 175-foot, 325-foot and 475-foot levels. A raise was driven on the main vein from the 325-foot level to surface, and 2508 feet of lateral work was completed on the 3 working levels. In 1946, the company’s name was changed to Clenor Mining Co. Ltd. No further work was recorded until Gwen Resources Limited acquired the property in 1991.

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The property straddles the northeast-trending, steeply south-dipping Vermilion–Net Lake Deformation Zone (V–NLDZ) (Fyon and Crocket 1986) (now referred to as Net–Vermilion deformation zone), a regional structure trending through the northeast part of the Temagami greenstone belt. The V–NLDZ separates the older volcanic complex to the northwest from the younger Arsenic Lake Formation to the southeast.
The Clenor deposit is hosted by the Arsenic Lake Formation which consists of a series of west-striking, steeply south dipping, iron-rich, massive and pillowved tholeiitic basalt flows. The rocks have developed a moderate to strong penetrative foliation that is parallel to the V–NLDZ. The limited outcropping within the V–NLDZ are of chlorite-biotite-magnetite schist (iron formation), intercalated with clastic or tectonic ultramafic fragmental units and mafic flows. Northwest of the break, the older sequence of metavolcanics is represented by thin bedded, northeast-trending, feldspathic, calc-alkaline felsic to intermediate tuffs.

Gwen Resources plans to drive a decline down to the 50-foot level and collect a 4000-ton bulk sample from the main vein during 1993 (A. Perron, Gwen Resources Limited, personal communications, 1992; Kirkland Lake Northern Daily News, December 19, 1991; February 5 and March 21, 1992).

Fort Knox Gold Resources Inc., Fawcett Township

Encouraged by initial diamond drilling results, Fort Knox Gold Resources Inc. continued to explore its Fawcett Township base metals property in 1992 (UTM 492250E 5263700N; NTS 41 P/115E). Fort Knox holds a large number of claim units centred on Fawcett Lake in Fawcett Township. Access to the property is via several new forest access roads south from Highway 560 in MacMurchy and Churchill townships. Through a Management Services Agreement, management of the exploration was passed over to Inco Exploration and Technical Services Inc. late in 1991.

On the North Grid, a total of 3 diamond drill holes were completed, totalling 942 m. Values were reported up to 0.33% Zn and 1.74% Pb over 1.6 m, and 0.23% Zn and 0.59% Pb over 8.3 m within a sequence of felsic tuff and feldspar porphyry from the North Grid drilling. Bore hole geophysics from the last hole drilled indicated the presence of an off-hole conductor that warrants testing.

The copper-nickel discovery is located on the South Grid, just east of Granite Lake in Fawcett Township. A total of 4909 m of diamond drilling in 13 holes delineated the deposit over a strike length of 122 m and to a vertical depth of 500 m. No grade and/or tonnage estimate is available.

A third grid, the 307 Grid, was established to the southeast, between the 2 existing grids and Fawcett Lake, covering airborne electromagnetic anomalies not indicated on the maps published in 1990 as part of the MNDM Shining Tree Area Airborne Electromagnetic Survey. A ground magnetometer survey was completed over all 3 grids. A pulse electromagnetic survey was completed over the North and South Grids, and an EM37 electromagnetic survey was completed over the 307 Grid.


EXPLORATION ACTIVITIES

A summary of 1992 exploration activities in the Cobalt Resident Geologist’s District is available in Table 14.1. Some of the more significant, unusual and/or advanced exploration activities have been summarized below.

Cobalt Area

CHITARONI, A.L.

A.L. Chitaroni holds 18 claim units east of Oxbow Lake, in South Lorrain Township (UTM 615500E 5225500N; NTS 31 M/3NW) (see Table 14.1, no.7). Access is via the Lorrain Valley road south from Haileybury to Maiden’s Lake, then southwest via the powerline to an old trail leading west to Oxbow Lake. Exploration work was funded by an OPAP grant. A combined magnetometer and VLF–EM airborne survey was flown over the property, followed by a trenching and bedrock sampling program. The property is being evaluated for its base metal potential. A short, 275-foot, five-hole stratigraphic diamond drilling program tested a metadiabase unit and a “quartz-eye” schist horizon. Only minor sulphide mineralization was encountered by this drilling (G. Chitaroni, Prospector, personal communications, 1992).

CYPRUS CANADA INC.

A property generative review of base metal mineralization in the Cobalt camp (UTM 604100E 5259090N; NTS 31 M/5NE; MDI T736) was initiated by Cyprus Canada Inc. (see Table 14.1, no.13). A compilation program was in progress at the end of 1992. A letter of intent had been signed with Starmin Mining Inc. for the Helens–Eplett Mine property in Bucke and Lorrain townships, but this agreement was not exercised (S. Parry, Cyprus Canada Inc., personal communications, 1992).

GORE, J.A.

J.A. Gore continued exploration for silver-cobalt mineralization on his South Lorrain property (UTM 616750E 5227800N; NTS 31 M/3NW; MDI T0081) during 1992 (see Table 14.1, no.27). The property is accessible via the Lorrain Valley road to Maiden’s Lake, then east along a trail 1 km to the old Mining Corp. shaft. The work was funded by an OPAP grant. A two-phase work program was completed.
### Abbreviations

- AEM: Airborne electromagnetic survey
- AMG: Airborne magnetometer survey
- AVLF: Airborne VLF-EM survey
- Comp: Compilation
- DDH: Diamond drill hole
- EM: Electromagnetic survey
- Geochem: Geochemical survey
- Grav: Gravity survey
- HLEM: Horizontal loop electromagnetic survey
- IP: Induced polarization survey
- Mag: Magnetometer survey
- Map: Geological Mapping
- OMIP: Ontario Mining Incentive Program
- OPAP: Ontario Prospectors Assistance Program
- PEM: Pulse electromagnetic survey
- Prosp: Prospecting
- St: Stripping
- Tr: Trenching
- VLEM: Vertical loop electromagnetic survey
- VLF-EM: Very low frequency electromagnetic survey

### Exploration Activity in 1992

<table>
<thead>
<tr>
<th>Company/Individual</th>
<th>Township/Area</th>
<th>Exploration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Annett, R.</td>
<td>Asquith</td>
<td>1 DDH (175 feet), Mag, VLF-EM, HLEM, Str (OPAP)</td>
</tr>
<tr>
<td>2. Asarco Expl. Canada Ltd.</td>
<td>Kemp</td>
<td>1 DDH (377 feet)</td>
</tr>
<tr>
<td>3. Asarco Expl. Canada Ltd.</td>
<td>Connaught</td>
<td>Str, Tr, sampling</td>
</tr>
<tr>
<td>4. Atkinson, D.H.</td>
<td>MacMurchy</td>
<td>Mag (6.2 km), VLF-EM (6.2 km), HLEM (10.2 km)</td>
</tr>
<tr>
<td>5. Beecham, A.</td>
<td>Best</td>
<td>Line cutting (5 km), Map, Comp, Geochem (OPAP)</td>
</tr>
<tr>
<td>6. Bortnick, S.</td>
<td>Natal, MacMurchy</td>
<td>Line cutting (10 km), Mag (10 km), VLF-EM (10 km), Prosp, sampling (OPAP)</td>
</tr>
<tr>
<td>7. Chitaroni, A.</td>
<td>South Lorrain</td>
<td>5 DDH (275 feet), AMG, AVLF, Tr, Str (OPAP)</td>
</tr>
<tr>
<td>8. Chitaroni, G.</td>
<td>Best</td>
<td>AMG, AVLF, Str, sampling, Geochem, Comp, Prosp (OPAP)</td>
</tr>
<tr>
<td>9. Chitaroni, G.</td>
<td>Best</td>
<td>AMG, AVLF, Prosp (OPAP)</td>
</tr>
<tr>
<td>10. Chitaroni, G.</td>
<td>Beauchamp</td>
<td>AMG, AVLF (OPAP)</td>
</tr>
<tr>
<td>11. Claw Lake Partnership</td>
<td>Cabot</td>
<td>Prosp, Map, Str, sampling (OPAP)</td>
</tr>
<tr>
<td>12. Claw Lake Partnership</td>
<td>Kelvin</td>
<td>Prosp, Mag, VLF-EM, Map (OPAP)</td>
</tr>
<tr>
<td>13. Cyorus Canada Inc.</td>
<td>Cobalt area</td>
<td>Comp</td>
</tr>
<tr>
<td>14. Donovan, P.</td>
<td>Leonard</td>
<td>Mag, VLF-EM, Map, sampling (OPAP)</td>
</tr>
<tr>
<td>15. Dunn and Korba</td>
<td>Tudhope</td>
<td>Mag, Prosp, Str, Map (OPAP)</td>
</tr>
<tr>
<td>16. Ellgring, F.</td>
<td>Pense</td>
<td>VLEM, Prosp (OPAP)</td>
</tr>
<tr>
<td>17. Ewanchuck, Morris and Swanson</td>
<td>Tushope, Bryce</td>
<td>Line cutting, Mag, VLF-EM, 5 DDH (236 m), soil sampling, Tr, Str, Map (OPAP)</td>
</tr>
<tr>
<td>18. Extender Minerals of Canada Ltd.</td>
<td>North Williams</td>
<td>Tr, Str, bulk sampling (700 tons) (OMIP)</td>
</tr>
<tr>
<td>19. Falconbridge Expl. Ltd.</td>
<td>Cobalt area</td>
<td>Reconnaissance geology, Geochem, Comp</td>
</tr>
<tr>
<td>20. Falconbridge Expl. Ltd.</td>
<td>Temagami area</td>
<td>Deep EM, reconnaissance and detailed mapping, Comp, Geochem</td>
</tr>
<tr>
<td>21. Ferguson, R.</td>
<td>North Williams, Ogilvie</td>
<td>Prosp</td>
</tr>
<tr>
<td>22. Filo and Jones</td>
<td>Strathy</td>
<td>Prosp (OPAP)</td>
</tr>
<tr>
<td>23. Fischer and Webster</td>
<td>Strathy</td>
<td>Map, Mag, VLF-EM, IP (OPAP)</td>
</tr>
<tr>
<td>24. Fort Knox Resources Inc. Inco Ltd</td>
<td>Fawcett</td>
<td>DDH, Line cutting, Mag, EM, PEM, IP, Map</td>
</tr>
<tr>
<td>25. Gereghy, G.</td>
<td>Bryce</td>
<td>Grav (14.5 km), sampling (OPAP)</td>
</tr>
<tr>
<td>26. Gondor and Atkins</td>
<td>Tudhope</td>
<td>AMG (200 km), AEM (200 km), Prosp, sampling (OPAP)</td>
</tr>
<tr>
<td>27. Gore, J.</td>
<td>South Lorrain</td>
<td>1 DDH (307 feet), Tr, Str (OPAP)</td>
</tr>
<tr>
<td>28. Gwen Resources Ltd.</td>
<td>Strathy</td>
<td>Line cutting, DDH, VLF-EM, Mag, Tr, bulk sampling</td>
</tr>
<tr>
<td>29. Haileybury School of Mines Alumni</td>
<td>Coleman</td>
<td>Adit, DDH (current)</td>
</tr>
<tr>
<td>30. Halliday, L.</td>
<td>Burrows</td>
<td>Prosp (OPAP)</td>
</tr>
<tr>
<td>31. Henriksen, G.</td>
<td>Kelvin</td>
<td>(OPAP)</td>
</tr>
<tr>
<td>32. Inco Ltd.</td>
<td>Strathy, Cassels</td>
<td>Reconnaissance Map, Geochem</td>
</tr>
<tr>
<td>33. Ingham, E.</td>
<td>Fawcett</td>
<td>(OPAP)</td>
</tr>
</tbody>
</table>

312
The first phase consisted of trenching and stripping of a recently discovered brittle fault zone in the Nipissing Diabase. This work, termed the East Trench, concentrated on a quartz-carbonate vein located near the base of Diabase Hill, on claim 118861. Trenching revealed traces of copper and iron staining in a rubbly fault gouge which strikes 060° and dips 60°S. Grab samples taken from this structure are reported to have returned anomalous concentrations of mineralization, ranging up to 0.26% Co, 0.72% Ni and 0.47 ounces Ag per ton.

The second phase consisted of re-entering a 1991 diamond drill hole and completing an additional 307 feet of diamond drilling. The drill hole was collared in Huronian-age Coleman Member conglomerates to test a possible cobalt-mineralized structure. The 1992 deepening was designed to penetrate the unconformity between the Huronian sedimentary rocks and the underlying Archean metavolcanic rocks. No economic mineralization was encountered, but an encouraging amount of calcite vein stringering was noted at the base of this hole near the unconformity (J. Gore, Prospector, personal communications, 1992; writer’s personal observations, 1992).

The O.E. Walli Adit extends eastward from the base of Diabase Mountain on the former Teck–Silverfields property in Coleman Township. Access is via the Ragged Chutes road east from Highway 11B at Cobalt. At the suggestion of H. Moore, former Mine Geologist at Silverfields and a director of the HSM Alumni Association, a 700- to 800-foot diamond drill hole is being completed from underground to test for the on-strike continuation of a high-grade silver-cobalt vein system mined previously at the Teck–Silverfields Mine. Benefits from any discovered mineral resource would belong to the HSM Alumni Association and would be used to assist the school with ongoing and future projects (H. Moore, personal communications, 1992).

<table>
<thead>
<tr>
<th>Company/Individual</th>
<th>Township/Area</th>
<th>Exploration</th>
</tr>
</thead>
<tbody>
<tr>
<td>34. KRL Resources Corp.–Cross Lake Minerals</td>
<td>Knight, Natal</td>
<td>Line cutting, Mag (65 km), HLEM (65 km), 6 DDH (887 m) (OMIP)</td>
</tr>
<tr>
<td>35. KWG Resources–Blue Falcon Mines Ltd.</td>
<td>Bucke</td>
<td>AMG</td>
</tr>
<tr>
<td>36. Kyanite Mining Corp.</td>
<td>Butler, Antoine</td>
<td>Environmental assessment</td>
</tr>
<tr>
<td>37. LaCarte, A.</td>
<td>Tyrrell</td>
<td>Prosp, Str</td>
</tr>
<tr>
<td>38. LaCarte and MacCallum</td>
<td>Tyrrell</td>
<td>Str, Tr, sampling, 2 DDH (800 feet)</td>
</tr>
<tr>
<td>39. Ladouceur, J.</td>
<td>Asquith</td>
<td>Prosp, 4 DDH (264 feet), Geochem (OPAP)</td>
</tr>
<tr>
<td>40. Laronde, D.</td>
<td>Best</td>
<td>Line cutting (30 km), Mag, Geochem (OPAP)</td>
</tr>
<tr>
<td>41. Legacy Expl. Ltd.</td>
<td>Coleman</td>
<td>1 DDH wedge (1623 feet), downhole geophysics OMIP)</td>
</tr>
<tr>
<td>42. Marshall, F.</td>
<td>Ingram</td>
<td>2 DDH (899 feet), VLEM (OPAP)</td>
</tr>
<tr>
<td>43. McClemens, A.</td>
<td>Best, Cassels</td>
<td>Line cutting, Mag, VLF–EM, soil sampling, Tr (OPAP)</td>
</tr>
<tr>
<td>44. Morris, Pinkerton</td>
<td>Farr</td>
<td>Prosp, Mag, VLF–EM (OPAP)</td>
</tr>
<tr>
<td>45. Noranda Inc.</td>
<td>Connaught</td>
<td>Str, Map, sampling (OPAP)</td>
</tr>
<tr>
<td>46. Rapski, J.</td>
<td>Fawcett</td>
<td>Str (9000 square feet), Tr (OMIP)</td>
</tr>
<tr>
<td>47. Suchanek, C.</td>
<td>Churchill</td>
<td></td>
</tr>
<tr>
<td>48. Tindale, Annett and Ferguson</td>
<td>Dufferin</td>
<td></td>
</tr>
<tr>
<td>49. Tindale, J.</td>
<td>Kelvin</td>
<td>Line cutting (2 miles), HLEM (2 miles), Map (2 miles) (OPAP)</td>
</tr>
<tr>
<td>50. Tindale, Annett and Ferguson</td>
<td>MacMurchy</td>
<td>Line cutting (16 km), Map, Mag, VLF, HLEM, sampling (OMIP)</td>
</tr>
<tr>
<td>51. Tittley, H.</td>
<td>Burrows</td>
<td>IP, Prosp</td>
</tr>
<tr>
<td>52. Tyranex Gold Inc.</td>
<td>Pense</td>
<td>AEM (200 km), AMG (200 km)</td>
</tr>
<tr>
<td>53. Tyranex Gold Inc.</td>
<td>Tyrrell, Knight</td>
<td>DDH, bulk sampling (OMIP) (OPAP)</td>
</tr>
<tr>
<td>54. Watts, H.</td>
<td>Kittson</td>
<td>Line cutting, soil sampling, Prosp, geophysics (OPAP)</td>
</tr>
<tr>
<td>55. Westin, B.</td>
<td>Strathy</td>
<td>Line cutting, Map, sampling</td>
</tr>
<tr>
<td>56. 1886 Holdings Ltd.</td>
<td>Stewart</td>
<td>INACTIVE (property visit and description)</td>
</tr>
<tr>
<td>57. A. Decker property</td>
<td>Knight</td>
<td></td>
</tr>
</tbody>
</table>

HAILEYBURY SCHOOL OF MINES

Under the guidance of the Haileybury School of Mines (HSM) Alumni Association, the Northern College Haileybury School of Mines rehabilitated the former Meteor Adit (UTM 615500E 5247550N; NTS 31 M/3NW) in Coleman Township for use by the Diamond Drilling School (see Table 14.1, no.29). The adit was renamed the O.E. Walli Adit after a former Principal of the Haileybury School of Mines.

The O.E. Walli Adit extends eastward from the base of Diabase Mountain on the former Teck–Silverfields property in Coleman Township. Access is via the Ragged Chutes road east from Highway 11B at Cobalt. At the suggestion of H. Moore, former Mine Geologist at Silverfields and a director of the HSM Alumni Association, a 700- to 800-foot diamond drill hole is being completed from underground to test for the on-strike continuation of a high-grade silver-cobalt vein system mined previously at the Teck–Silverfields Mine. Benefits from any discovered mineral resource would belong to the HSM Alumni Association and would be used to assist the school with ongoing and future projects (H. Moore, personal communications, 1992).
KWG RESOURCES INC.

As part of its regional diamond exploration program, KWG Resources Inc. acquired a significant land package (UTM 596950E 5258900N; NTS 31 M/SNE; MDI T1501) in the Cobalt–Haileybury–New Liskeard area during 1992 (see Table 14.1, no.35). A detailed airborne magnetometer survey is in progress over a large portion of the Temiskaming rift structure in both Ontario and Quebec, extending from Latchford in the south to Larder Lake in the north. These activities have created a small staking rush in the area.

KWG Resources' land acquisition was predicated on the presence of a kimberlite pipe in northwest Bucke Township, just west of the town of Haileybury. Access to the property is by road, east from Highway 11 along the Fifth Concession (Seed's Road). The kimberlite was discovered initially by Monopros Limited in the late 1970s, which drill-tested the west part of the pipe in the mid-1980s. Lac Minerals Ltd. restaked the ground and drill-tested the east part of the kimberlite pipe in the late 1980s. The 2 drill hole collars are 550 m apart, and an intervening magnetic low response suggests there may be 2 separate kimberlite bodies present on the property.

In 1992, the claims came open and were acquired by an independent explorationist who vended the property to KWG Resources. Bulk sampling of the original kimberlite occurrence, using a modified reverse circulation drill, had begun at the time of writing (December 1992). Evaluation of other geophysical targets is planned for early 1993 (N. Novak, KWG Resources Inc., personal communication, 1992; The Northern Miner, August 10, 24, 31, 1992).

Englehart Area

DUNN, G.C. AND KORBA, E.

The G.C. Dunn and E. Korba property (see Table 14.1, no.15) consists of 6 unpatented claims located in east-central Tudhope Township (UTM 566700E 5281600N; NTS 41 P/9NE; MDI T1463). Access to the property is by trail north from Highway 65 along the Tudhope–Bryce townships boundary. A winter magnetometer survey early in 1992 was followed by prospecting, hydraulic stripping and geological mapping in the spring. This work investigated a fault structure in the northern half of claim 990957 which trends 070°, termed the DK zone, and a parallel structure in claim 1134103 termed the Moosehorn.

The DK zone has been traced for 300 m along trend and is reported to contain green mica, quartz flooding and variable amounts of iron, copper and zinc sulphides carrying erratic gold values. Two grab samples, reportedly obtained from an old pit (Pit 3) located at sub-baseline 0+00, line 209+00W, were analyzed by the Cobalt Resident Geologist. Values of 0.109 ounces Au per ton, 0.34 ounces Ag per ton and 623 ppm Cu were returned from sample 3116, while sample 3118 assayed 0.041 ounces Au per ton, trace Ag and 1935 ppm Cu.

The Moosehorn zone consists of a 30 m wide zone of sheared tuffs and rhyolite on claim 1134103. The best reported assay from this zone was from sample 3149, which returned a value of 0.108 ounces Au per ton and 1290 ppm Cu (G. Dunn, Prospector, personal communications, 1992).

ELLGRING, F.H.

F.H. Ellgring completed a 300-Hz vertical loop electromagnetic (VLEM) survey and prospecting on a property located at the western boundary of Pense Township (UTM 6030000E 5298000N; NTS 31 M/13NW) (see Table 14.1, no.16). Access is via Highway 569 east from Tomstown. The VLEM program was designed to screen a series of 1000-Hz conductors which had been located in 1991. No conductors were found with this lower frequency survey, so the earlier results were attributed to conductive overburden. This exploration was funded by an OPAP grant (F. Ellgring, Prospector, personal communications, 1992).

EWANCHUCK, J., MORRIS, J. AND SWANSON, F.

Partners J.R. Ewanchuck, J. Morris and F. Swanson continued their exploration efforts on their claims held in Tudhope and Bryce townships (UTM 566400E 5286100N; NTS 41 P/9NE; MDI T1543) through funding provided primarily by OPAP grants (see Table 14.1, no.17). Access to the property is by secondary road south from Highway 560 in Robillard Township, past the Hill Lake fish hatchery to the old Britcanna mine, then by trail west to the Tudhope–Bryce townships boundary.

A comprehensive program of ground magnetometer and VLF–EM surveying, soil sampling and geological mapping was completed on 2 newly acquired claims in Tudhope Township. Five diamond drill holes totalling 236 m were completed on the Tudhope claim block. This drilling tested a 200 m long strike extension of an auriferous, shear-hosted quartz vein system. The drilling was conducted immediately northeast of the 1991 drill program (Ireland et al. 1992).

Work in Bryce Township concentrated on investigating a section of the claim block located north of the Britcanna Porphyry intrusive (Johns 1986), referred to as the Nielson claims. Work done included a VLF–EM survey, soil sampling and stripping and sampling of a quartz vein structure. This structure may represent the eastward extension of the vein system drilled in Tudhope Township. It is located north of and parallel to the Estival Break. Time was also spent prospecting and cleaning out old pits and trenches on the remaining Bryce Township claims (J. Ewanchuck, Prospector; J. Morris, Prospector; B. Westin, Geologist, personal communications, 1992).

North Bay Area

KYANITE MINING CORPORATION

As part of the long-term evaluation of its kyanite deposit in Butler and Antoine townships (UTM 654250E 5153200N; NTS 31 L/10SW), Kyanite Mining Corporation completed a
baseline aquatic resources assessment of the local watershed (see Table 14.1, no.36). The deposit is located within 1 km of the Ottawa River, and is accessible via Highway 533 south from Highway 63, east of North Bay. The focus of the study was to evaluate a suitable site for a pump house.

Local lakes and streams were examined and a suitable site was recommended by the consultants, Environmental Applications Group Limited of Toronto. The consultants also recommended further baseline studies, and an environmental impact assessment to support site location approval and the Liquid Industrial Waste Application (tailings disposal site).

The environmental impact assessment addresses such issues as fisheries, wildlife, vegetation, archeology, soils, land use, recreation, short- and long-term impacts (construction, operation, site layout) and the development of mitigation strategy development.

Kyanite Mining intends to take a bulk sample for metallurgical evaluation in 1993 (R. Blais, Geological Consulting Inc., personal communication, 1992; Assessment Files, Cobalt).

1886 HOLDINGS LIMITED

Following the release of Building Stone Opportunities in Central Ontario—1991 Supplement (Marmont 1992a), 1886 Holdings Limited acquired ground in Stewart Township, approximately 50 km north of North Bay, Ontario (UTM 617800E 5169900N; NTS 31 L/11SW) (see Table 14.1, no.56). Access to the property is via the Tomiko road, east from Highway 11 in northwest Merrick Township. The property covers a portion of the Mulock Batholith, a gneissic to foliated, Late Precambrian quartz monzonite to granodiorite intrusive. It was described by Marmont (1992a) as a pink, foliated to gneissic rock exhibiting uniform composition and texture over a wide area. Only 1 set of joints was reportedly apparent in most outcrops.

The property was mapped in detail in 1992, and an area was inferred, exhibiting the potential to provide large stone blocks. Additional work is planned for 1993, including stripping and sampling (Cobalt Resident Geologist’s office, Assessment Files, 1992).

Shining Tree Area

CLAW LAKE PARTNERSHIP

Participants R. Ferderber, H. Ferderber and T. Obradovich pooled their 1992 OPAP grants to evaluate several properties in Cabot and Kelvin townships (see Table 14.1, nos.11, 12).

Access to the Cabot Township claims (UTM 470300E 5283800N; NTS 41 P/11NW; MDI S2916) is via the Cabot road, west off the Grassy Lake road in Kelvin Township. On the seventy-unit property held in partnership with G. Mullin, extensive prospecting, geological mapping, stripping and sampling resulted in the discovery of a significant gold-bearing shear structure and a separate base metal occurrence. The property was recently optioned to Jonpol Explorations Ltd. which plans a major evaluation of it in 1993.

The Kelvin Township property (UTM 476900E 5280650N; NTS 41 P/11NW) is located in the southwest part of Kelvin Township and is accessible by air from Shining Tree. The partners completed ground geophysical surveys, geological mapping and detailed prospecting over a series of airborne electromagnetic anomalies. The property is underlain by a sequence of rhyolitic flows, fragmentals and tuffs. Additional work is planned (T. Obradovich, personal communications, 1992).

DONOVAN, P.

A combined geophysical (magnetometer, VLF–EM) survey, geological mapping and bedrock sampling program (see Table 14.1, no.14) was completed by P. Donovan with the assistance of OPAP funding, in the vicinity of Fournier Lake, Leonard Township (UTM 499050E 3264300N; NTS 41 P/11SE; MDI T1484). Access to the property is by road along the hydroelectric transmission line south from Highway 560 in Tyrrell Township. Several carbonate vein structures were identified carrying up to 4% cobalt (P. Donovan, Prospector, personal communication, 1992).

EXTENDER MINERALS OF CANADA LTD.

In 1992, Extender Minerals of Canada Ltd. completed an OMIP-assisted work program (see Table 14.1, no.18) begun late in 1991 on its North Williams Township barite property (UTM 498200E 5251150N; NTS 41 P/6SE; MDI T1487). The property is accessible by secondary road, 35.8 km south of Highway 560 via the Bay Lumber road. During 1991 and 1992, stripping, trenching, diamond drilling and bulk sampling were completed to further evaluate the economic potential of the high grade barite deposit. Only 1600 feet of a planned 2000-foot diamond drilling program were drilled due to poor core recoveries. Four holes were lost when the drill encountered 6- to 8-feet wide vugs adjacent to the barite vein.

An approximately 700-ton bulk sample was taken from 2 locations on the “B” vein (see “Property Examinations” section). The bulk sample was trucked to Extender Minerals’ mill in Matachewan for evaluation (R. Hill, Extender Minerals of Canada Ltd., personal communication, 1992).

KRL RESOURCES CORP.—CROSS LAKE MINERALS INC.

Joint venture partners KRL Resources Corp. and Cross Lake Minerals Inc. completed a 65 line-kilometre ground geophysical program (see Table 14.1, no.34) consisting of magnetometer and horizontal loop electromagnetic (HELM) surveys on the Arthur Lake property in Knight and Natal townships (UTM 494500E 5283350N; NTS 41 P/11NE). The property is accessible by secondary road 5 km north from Highway 560 along the hydroelectric transmission line in Tyrrell Township. A six-hole, 887 m diamond drilling program was subsequently carried out to test specific targets on
the property. The 1992 program was completed with OMIP assistance.

One hole was drilled to test a known gold-bearing structure, the Courageous Lake vein, that dips onto the property from surface exposures located just north of the property boundary. Two mineralized green carbonate alteration zones separated by a 37 m wide (core length) diabase dike were encountered at depth over core lengths of 25 m and 17 m, respectively. The green carbonate zone carries consistently anomalous gold values in the 0.01 to 0.05 ounces Au per ton range, with individual analyses up to 0.1 ounce Au per ton over narrow widths. The partners are encouraged by the width and persistently anomalous nature of the alteration envelope, and additional work is planned away from the diabase dike.

Five holes were collared to test specific conductive targets on the property. Surface outcrop exposures indicated the area of interest was underlain by extensive komatiitic flows in contact with felsic flows and pyroclastic units, a favourable host for Kambalda-type copper-nickel sulphide deposits. The 5 holes encountered graphitic horizons at the contact between the ultramafic and felsic sequences, or within the felsic package. Additional geophysical targets are scheduled to be tested (K. Filo, KRL Resources Corp., personal communication, 1992; Northern Daily News, February 5, 20; March 6, 21, 1992; The Northern Miner, December 30, 1991; January 27; February 5, 1992).

LACARTE, A.

A limited program of prospecting and stripping (see Table 14.1, no.37) was completed on A. LaCarte's Porphyry Lake property in Tyrrell Township (UTM 498000E 5275950N; NTS 41 P/11NE). A rough road was recently cut from Highway 560 just west of Porphyry Lake, 1 km southward to the property. There are a number of poorly documented gold-copper occurrences in the vicinity. Washing and sampling of the stripped areas is planned for 1993 (A. LaCarte, personal communication, 1992).

LACARTE, A. AND MacCALLUM, R.

A. LaCarte and R. MacCallum are partners on a gold property located in central Tyrrell Township (UTM 496450E 5275350N; NTS 41 P/11NE; MDI T1544) (see Table 14.1, no.38). Access to the property is by a road 1.5 km east of the Tyrrell–MacMurchy townships boundary on Highway 560, 4.5 km southward to Hydro Creek. Work completed in 1992 included 2 diamond drill holes totalling approximately 800 feet to test a green carbonate alteration zone and associated auriferous graphitic sedimentary rocks located on the west part of the property, near Hydro Creek. On the east part of the property, additional stripping, trenching and sampling were completed on the porphyry-hosted gold zone. A detailed description of the LaCarte–MacCallum property is included in the "Property Examinations" section (A. LaCarte, R. MacCallum, personal communications, 1992; writer's personal observations, 1992).

SUCHANECK, C.

C. Suchaneck continued exploration for gold (see Table 14.1, no.47) on his claims in Churchill Township (UTM 476400E 5271600N; NTS 41 P/11SW), funded by an OPAP grant. The claims are located at the northwest end of Jonson Lake. Access to the property is by boat from Shining Tree village, up to the north end of the West Arm, Shining Tree Lake, and then 1 km northwest by trail. Stripping on a previously defined gold anomaly revealed 2 narrow quartz veins hosted in a volcanic fragmental tuff unit. Anomalous values which range from 0.1 to 0.3 ounces Au per ton over widths of a few inches were delineated. A reconnaissance geological mapping program was also completed (C. Suchaneck, Prospector, personal communication, 1992).

TINDALE, J., ANNETT, R. AND FERGUSON, R.

Partners J. Tindale, R. Annett and R. Ferguson completed 2 OMIP-funded exploration programs in the Shining Tree area this year (see Table 14.1, nos.48, 50).

The Dufferin Township project (UTM 498500E 5247650N; NTS 41 P/6NE) consisted of trenching a copper showing hosted in Lorrain Formation quartzites. Access to the property is via the Bay Lumber road south from Highway 560 in MacMurchy Township to the hydroelectric transmission line access road in North Williams Township, then south to the Dufferin Township property on Wren Creek. Mineralization consists of disseminated chalcopyrite, bornite and pyrite. A 150- by 60-feet stripped area is reported to average 0.3% Cu. An option agreement with a major company is pending.

An exploration program consisting of 16 km of line cutting, geological mapping and geophysical surveying (magnetometer, VLF-EM and HLEM) was completed north of Houston Lake in MacMurchy Township (UTM 489450E 5277950N; NTS 41 P/11NE). Access is by boat on Houston Lake from Highway 560. Some anomalous nickel values are reported to have been returned by this work (J. Tindale, personal communications, 1992).
and geochemical surveys on properties in Cassels and Strathy townships as well as reconnaissance mapping in the area.

Additional compilation work and evaluation of the past year’s work is ongoing (J. Cecchetto, Falconbridge Limited, personal communications, 1992).

FILO, K. AND JONES, D.

As a result of the re-opening for staking of Strathy Township early in 1992, K. Filo and D. Jones staked several claim blocks near the east end of Net Lake, west of the village of North Temagami (UTM 589950E 5218800N; NTS 31 M/4SW). Access to the property is by road via Highway 11, which passes through the northeast part of the property, just north of the turn-off to North Temagami. Initial OPAP-funded prospecting on the property (see Table 14.1, no.22) revealed the presence of several old trenches in felsic metavolcanic rocks mineralized with chalcopyrite and sphalerite. The partners subsequently optioned the property to a major company which intends to conduct a major work program in 1993. OPAP funding slated for work on the property was diverted to other properties held by the partners (D. Jones, K. Filo, personal communications, 1992).

RESIDENT GEOLOGIST’S STAFF ACTIVITIES

During the year, the Cobalt Resident Geologist’s office was staffed by: J. Ireland, Resident Geologist; E. Baša, Staff Geologist; R. Zalnieriunas, contract Staff Geologist; J. Price, contract Secretary; C. Pickard, contract Secretary; B. Westin, contract geologist; G. Chitaroni, contract geologist and G. Ryan, Junior Geological Assistant.

J. Ireland continued to pull double duty as Acting Manager, Temiskaming Testing Laboratories for most of 1992. E. Baša gave birth to a vibrant, healthy young fellow named Aurelian shortly after beginning maternity leave last November, and returned to her duties in September 1992. R. Zalnieriunas assumed the Staff Geologist’s position during E. Baša’s maternity leave and then assumed the position of Assistant to the Manager of Temiskaming Testing Laboratories – Resident Geologist, Cobalt, in October. B. Westin and G. Chitaroni were hired on contract for 3 months to assist the regular staff with special projects. G. Ryan was hired on contract to organize, catalogue and create a publicly accessible database of rock and mineral specimens, to sort and document diamond drill core stored in Cobalt, and to assist staff in the field and office. J. Price continued as contract Secretary until October, when C. Pickard took over the contract position.

A major task completed by G. Ryan was sorting, cataloguing and entering into database over 3600 plans and maps pertaining to the numerous mines that once operated in the Cobalt, Temagami, Shining Tree, Gowganda, Elk Lake and Englehart areas. This database proved invaluable to Mindecom Associates of Sudbury, which was contracted to complete the Abandoned Mines Inventory Site Investigations program for those parts of the Cobalt Resident Geologist’s area excluding the Cobalt silver camp proper and the Shining Tree–Gowganda–Elk Lake areas. This program was a follow-up to the initial Abandoned Mines Hazards compilation contract completed by Pearson, Hoffman and Associates early in 1992.

Office use by clients in 1992 reached an all-time high of 1268 visitors, a 27% increase from 1991’s previous record level of 923 visitors. The increased activity is directly attributable to the re-opening of a portion of the Temagami Land Caution in 1992, and the activities surrounding the Fort Knox base metals play in the Shining Tree area.

Regular staff activities included reviewing and commenting on land use issues (Timber Management Plans, Temagami Comprehensive Planning Council, Wendaban Stewardship Committee, etc.), and presenting a poster display at the Mines and Minerals Geoscience Symposium in Toronto and the Regional Symposium in Timmins, which featured a four-township geological compilation of the Shining Tree area in the vicinity of the Fort Knox Gold Resources Inc. copper-nickel discovery. As part of the Mining Awareness Week promotions, a hands-on poster display was presented at the Temiskaming Mall in New Liskeard, and a tour of the Resident Geologist and Temiskaming Testing Laboratories building in Cobalt was offered to local schools.

Field tours were provided for representatives from the mining industry, as well as elementary, secondary and post-secondary students, the general public, other ministries and other branches of MNDM. In the office, work continued on the creation of a newspaper-clippings index file database and the reorganization and typing of field notes written by former Cobalt Resident Geologist R. Thompson. Acquisition and compilation of property submissions for the “Properties for Sale, Option and/or Joint Venture” file continued during 1992.

With the assistance of Temiskaming Testing Laboratories, the Cobalt Resident Geologist’s office is currently preparing rock and mineral specimen kits to be used as teaching aids for prospectors’ courses and in elementary schools across the province.

A presentation and information session describing mineral exploration methods and the mining cycle was given to members of the Tama-Augama Anishnabai band in Temagami. The presentation was well received by most in attendance.

“Discover ’92, an Introduction to Prospecting” was the theme of the 1992 prospectors’ course given over a six-week period in Temagami, Ontario. Temagami was chosen as the site because of the renewed interest in the mineral potential of the area, brought about by the re-opening for staking early in 1992, of the 3 townships near Temagami. There were 33 registrants for the course, with participants from as far away as North Bay, Powassan and Englehart.
Staff were requested to assist the Abandoned Mines section of Mineral Development and Rehabilitation Branch, MNDM, in establishing a Crown Pillar monitoring pilot project in Cobalt. The project involved diamond drilling through several Crown Pillars in Cobalt and installing special cable sensors that, when measured electronically using time domain reflectometry instruments, provide readouts showing in-hole distortions of the cable. The readings are interpreted to determine the type of stress (shear, compressional, extensional, etc.) exerted on the cable, and the amount of movement that caused the stress. Ten sensors at 3 sites in Cobalt are monitored weekly. The pilot project immediately paid dividends as 1 of the sites, located under a parrkette in Cobalt, returned movement responses on a weekly basis. Remedial work on the site was completed using special funding provided by MNDM.

Staff assisted Haileybury School of Mines to establish a geophysical test site in Coleman Township by obtaining permission to use the site and completing much of the line cutting.

On the recommendation of A. Beecham ("Recommendations for Exploration" section in Ireland et al. 1992), whole rock geochemical data collected in the Cobalt silver camp by G. Patterson in 1979 was entered into an electronic database together with data collected by J. Wood in 1978 and T. Andrews in 1982. R. Zalnieriunas carried out a review of the data utilizing the NEWPET® shareware software package. The study was preliminary in nature, but results indicate further evaluation of the data is warranted. A complete summary of the results is included in the "Special Projects" section of this report.

At the request of A. Kraus, research scientist at Inco's Sheridan Park Research Centre in Mississauga, Ontario, staff visited several local mine dumps and collected 25 kg of high-grade cobalt ore, which will be used by A. Kraus in developing separation technology that may solve the arsenic problem associated with cobalt ores.

The staff submitted for approval a Canada-Ontario Northern Ontario Development Agreement (NODA) project proposal for the development of a Land Use Planning electronic database management prototype, using Geographical Information Systems (GIS) technology. This NODA project is scheduled to commence in 1993 under the supervision of the Cobalt Resident Geologist.

Staff attended several professional seminars and training sessions during the year, including the Mines and Minerals Geoscience Symposium in Toronto and the Regional Symposium in Timmins, the Annual Prospectors and Developers Association of Canada Convention in Toronto, the British Columbia Geological Survey Land Use Planning Workshop in Victoria, and the Ministry of Natural Resources' GIS Symposium in Toronto.

PROPERTY EXAMINATIONS

Chitaroni Granite Lake–James Lake Property, Best Township

BACKGROUND INFORMATION

Striping results of copper-nickel sulphide showings on claims 1165505, 118862 and 118864, Best Township (UTM 596101E 5224394N; NTS 31 M/4NE; MDI N0098) were examined on June 26 and August 20, 1992 (see Table 14.1, no.8). At the time of examination, the ground was held by G. Chitaroni. Access to the property is by Highway 11 which passes through the central section of the claim group. During June and July 1992, G. Chitaroni completed stripping, washing and sampling on 3 narrow, semimassive to massive pyrrhotite-chalcopyrite-pentlandite mineralized showings in the eastern part of his claim group.

Strip zone 1 (north showing) revealed a pit and an area previously tested by diamond drill hole KM1, Quebec Metallurgical Industries Ltd., 1954 (Thompson 1968). Strip zone 2 (middle showing) revealed the Acana No.1 (Thompson 1968) zone, while strip zone 3 (south showing) revealed the immediate shaft area of the Acana No.2 (Thompson 1968) zone. All 3 strip zones were examined by J.C. Ireland and R.V. Zalnieriunas in the company of G. Chitaroni and G. McBride on June 26, 1992. Strip zone 3 was mapped and sampled by R.V. Zalnieriunas and G. Ryan on August 20, 1992.

REGIONAL GEOLOGY

All 3 mineralized showings are hosted within a north-trending band of Archean metavolcanic rocks. Archean granitoids of the Chambers–Strathy batholith occur to the west, while Paleoproterozoic sedimentary rocks of the Huronian Supergroup and Mesoproterozoic intrusive Nipissing Diabase overlie the metavolcanic rocks to the east.

The metavolcanic sequence is composed predominantly of north-trending and subvertically dipping mafic flows and minor pyroclastic rocks. They are intruded by minor cross-cutting dikes of felsite, feldspar porphyry and lamprophyre. A north-trending hornblende gabbro intrusive occurs at the east boundary of the sequence. This gabbro is similar to that described immediately to the west in Banting Township and the west part of Best Township (Smyk et al. 1991).

GEOLOGY

Strip Zone 1 (North Zone)

Stripping exposed a 30 by 20 m area of massive, medium-bedded mafic flows and intercalated volcaniclastic sedimentary rocks. An old shallow pit, approximately 3.0 by 1.8 m, occurs in the centre of the stripped area. This pit had been sunk on a 1 to 3 m wide band of schistose, cherty interflow...
sediiments or reworked tuff hosting 3 subparallel, 5 to 10 cm wide bands of stringer and disseminated sulphides (pyrite and/or chalcopyrite). This zone strikes 028° to 040° and dips 80° to 85° to the west. A 1 to 3 m thick mafic breccia unit forms the western wall rock, while a thick sequence of pillowed mafic flows forms the eastern wall. Bedding is overturned, with stratigraphic tops facing east, based on pillow tops and sedimentary grading.

In addition to previous surface work of an unknown age, this zone was tested by drill hole KM1 (85 feet) of Quebec Metallurgical Industries Ltd. in 1954 (Thompson 1968). No significant sulphide values were noted and no assays were reported.

Strip Zone 2 (Centre Zone)

Stripping for geological information was conducted on thinly covered outcrop ridges in the vicinity of the Acana No.1 and 3 zones (Assessment Files, Cobalt).

A narrow, 10 to 20 cm wide, sulphide-mineralized fault appears to form the Acana No.3 zone. Two pits, 4.6 m and 3.6 m deep respectively, had been sunk on this structure, which strikes 030° to 040° and dips steeply west. Massive pyrrhotite stringers were noted in the No.1 pit along with extensive chlorite alteration. Country rock in the immediate area consists of weakly sheared, pillowed mafic flows containing minor, variable disseminated iron sulphides and occasional quartz-epidote alteration balls.

The Acana No.1 zone is exposed in Pit 3, a shallow historical trench located 15 m northeast of Pit 2. The time of visit this zone was poorly exposed. Massive sulphide stringers (pyrrhotite-pyrite-chalcopyrite) were noted in a highly strained zone, over an apparent width of 1.5 m. This zone appears to lie parallel to the Acana No.3, along an average strike of 035°, and is located approximately 10 m to the northwest.

Strip Zone 3 (South Zone)

Mineralization of the Acana No.2 zone is hosted by the western, basal contact of a differentiated gabbro sill or dike found intruding mafic massive and pillowed flows. The average strike of this contact is 010°. Mineralization exposed within the examined stripped area is located at an inflection in this contact which strikes approximately 042° (Figure 14.6). The mineralization occurs as a diffuse, gossan weathering lens of disseminated and stringer sulphides (pyrrhotite-chalcopyrite-pyrite), approximately 25 by 10 m in size, hosted by an irregular lens of massive, fine- to medium-grained, dark green to black pyroxenite. The pyroxenite has been partly altered to secondary amphiboles. The main body of the intrusive consists of a fine- to medium-grained, massive, medium green-grey, diabasic to xenomorphic textured gabbro. This gabbro grades into a more leucocratic and coarse-grained phase to the east. A coarse-grained, rusty weathering, gabbro pegmatoid phase occurs as 3 small lenses within the main gabbro body at this location.

A 10.7 m deep exploration pit was sunk on the north edge of this mineralized lens prior to 1952. In addition, this area of the zone has been tested by 2 rock trenches and several campaigns of shallow diamond drilling. Work to date, including geophysical surveys and geological mapping, has failed to prove up an economic deposit of mineable size.

A number of samples collected at this site returned the values shown in Table 14.2.

E-M-S Partnership Claims, Tudhope Township

The partnership of Ewanchuck, Morris and Swanson holds a series of claim blocks in eastern Tudhope and western Bryce townships (UTM 564900E 5286100N; NTS 41 P/9NE; MDI T1543) (see Table 14.1, no.17). Access to the various claim blocks is reached by trails which stem from a westward trending secondary road which originates near the Hill Lake fish hatchery in Bryce Township.

The partnership's claims cover a substantial part of an east-northeast-trending shear structure. This is a brittle, Archean structure which extends northeast from the northern tip of the Hope Lake stock, located in Tudhope Township, to the northwest-trending Cross Lake fault, located in the northeast corner of Bryce Township. Johns (1986) considered compressive forces associated with emplacement of the Round Lake batholith, located immediately to the north, have been the primary cause for the formation of this and other related structures. The shear is drift-covered and is entirely contained within the upper section of the Catarine group of tholeitic mafic metavolcanic rocks. It is parallel to, and lies within 600 m of the contact with the overlying calc-alkalic Skead group metavolcanic rocks.

In addition to the main structure, the partners have outlined a number of secondary, parallel fault structures. At present, the most important of these has been traced intermittently from the northwest corner of lot 1, concession IV, Tudhope Township to the southern boundary of lot 8, concession VI, Bryce Township. This was referred to by Moorehouse (1944) as the Palmer–Vaughan–Estival Break. Diamond drilling of this secondary structure was carried out by the partners in 1991 and 1992 in the vicinity of the Taylor showing, with limited success.

The Taylor showing is located in the extreme northwest corner of lot 1, concession IV, Tudhope Township. Various individuals and companies have carried out surface and diamond drilling work on this zone. Erratic, high grade gold assays of up to a few ounces gold per ton have been reported from surface trenches, but all drilling campaigns to date have failed to prove up mineable reserves at depth.

319
Figure 14.6. Granite Lake–James Lake property, strip zone 3.
Table 14.2. Sampling results from strip zone 3 of the Acana No.2 zone.

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Au (ppb)</th>
<th>Ag (ppm)</th>
<th>Cu (ppm)</th>
<th>Ni (ppm)</th>
<th>Co (ppm)</th>
<th>Pd (ppb)</th>
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<td>357</td>
<td>293</td>
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<td>41</td>
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<td>3580</td>
<td>1295</td>
<td>201</td>
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<tr>
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<tr>
<td>92-17</td>
<td>&lt;25</td>
<td>nil</td>
<td>2570</td>
<td>3360</td>
<td>196</td>
<td>47</td>
</tr>
</tbody>
</table>

At the time of the visit, the 5 principal pits which comprise the Taylor showing were poorly exposed. All pits had been blasted the previous year and were not yet cleaned out. The pits are currently labelled from east to west, "A" to "E" consecutively. Quartz veining is hosted by a shear zone trending 065° and dipping 65°SE.

Only 1 moderately good exposure of the vein occurs, located on the western wall of pit "A". Here, a 2 m thick zone of quartz stringer veining is exposed. The zone averages 15% pyrite and trace chalcopyrite. The sulphides occur as small semimassive lenses and disseminated bands. Footwall rocks in the "A" pit exhibit a narrow zone of chlorite alteration which shows a developed shear fabric and minor parasitic drag fold structures. The best selected grab sample assay reported by the partners from this pit has been 4.35 ounces Au per ton. Four other grab samples from the same vein returned assay values ranging from 1.12 to 0.22 ounces Au per ton.

Examination of a slabbed semimassive pyrite sample from the "A" pit reveals the presence of fine visible gold grains which are preferentially aligned along en échelon microfractures. The microfractures cross obliquely, at an approximate angle of 60° to the main schistosity direction.

A. Decker Gold Occurrence
(Temiskaming Nickel Ltd.),
Knight Township

The A. Decker gold occurrence is located in southwest Knight Township, approximately 500 m west of the north end of Moon Lake, on leased claim MR 37627 (UTM 494791E 5279928N; NTS 41 P/11NE; MDI T0314) (see Table 14.1, no.57). The property is accessible via the Arthur Lake road, 2 km north from Highway 560 in Tyrrell Township.

The property was initially worked in 1939 by Hollinger Consolidated Gold Mines Limited under an option agreement with A. Decker. Since that time, several companies have held options on the property and considerable work has been reported. Very little technical information is available in the public record. There are apparently 4 separate gold-bearing structures on the property. Two of the structures comprising the "East Break" are documented in this report, as they were better exposed at surface. The 2 structures making up the "West Break" were not examined.

The 2 trenched and stripped areas representing the "East Break" are situated on the east side of a regional northeast-trending valley lineament. The area is underlain by a series of northeast-trending, steeply northwest-dipping alkalic Archean metavolcanic flows and fragmental units, and at least 1 thick komatitic flow unit. The relationship between the 2 volcanic rock types is unclear but they appear to be conformable. The komatitic unit occupies the axis of a tight antiform isoclinal fold that plunges steeply to the northeast. The axis of the fold is roughly equivalent to the trace of the valley lineament.

TRENCH NO. 1 (EAST VEIN)

A series of recently cleaned-out old pits and trenches intermittently expose a 0.4 to 1.5 m wide carbonatized shear, trending 021° to 025° and dipping steeply northwest, for 40 m along trend. The shear hosts a carbonatized felsic dike and quartz-carbonate veins and stringers erratically mineralized with 1 to 3% disseminated pyrite.

The southwest end of the shear is exposed in a 12 m long cross-trench and pit on the vein zone. Hanging wall rocks up to 2 m west of the shear are characterized by intense green carbonate alteration with associated quartz stockwork, and are probably ultramafic in origin. A large exposure of komatiitic flows is located immediately southwest of the trenched area.

The west limit of the shear is marked by a 30 cm wide barren quartz vein followed by 90 cm of green carbonate rock sparsely mineralized with disseminated pyrite and cut by a stockwork of quartz stringers. The east limit of the shear is similarly marked by a 6 cm wide barren quartz vein in sheared contact with a 1 m wide, carbonatized, sericitized, siliceous felsite dike containing irregular carbonate blebs and 0.1 to 3% disseminated pyrite.

Footwall rocks are extensively chloritized, variably brecciated and carbonatized, possibly alkalic basaltic rocks. Up to 1% pyrite associated with localized green carbonate alteration occurs in the brecciated sections of the exposure proximal to the felsite dike.
## Sample Assay Length

<table>
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<th>Sample No.</th>
<th>Gold (oz/T)</th>
<th>Length (m)</th>
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<td>3.00</td>
</tr>
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<td>2</td>
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</tr>
<tr>
<td>12</td>
<td>0.171</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Figure 14.7. A. Decker gold occurrence, Knight Township.
Chip sampling across the structure and along the trend of the quartz-veined shear returned anomalous gold values ranging from 0.002 to 0.039 ounces Au per ton (Figure 14.7).

**TRENCH NOS. 2 THROUGH 5 (WEST VEIN)**

The West Vein (see Figure 14.7), located 60 m further west along the face of the northeast-trending lineament, trends 020° to 025° with a steep northwest dip. A series of 4 cross-trenches were excavated on the structure exposing it intermittently for 50 m along trend. A narrow, pyrite-mineralized, quartz-carbonate vein was exposed in trenches No. 2 and 5, which are located at the north and south ends of the defined trend. Trenches No. 3 and 4 were mud-filled, and no veining or mineralization was observed.

At the No. 2 trench (see Figure 14.7), a 7 to 8 cm wide quartz vein stringer zone is exposed, mineralized with 15 to 20% pyrite as small, isolated blebs. The vein is hosted in a minor shear which cuts schistose, carbonatized, possibly alkalic mafic metavolcanic rocks. The host rocks are extensively bleached and weathered. A composite sample of the vein and wall rock material returned 0.604 ounces Au per ton across 15 cm.

Trench No. 4 has no vein exposure due to mud at the bottom of the pit. A narrow, carbonatized felsite dike trending 025° is poorly exposed on the west end of the trench. A second felsite dike of undetermined thickness is exposed in the east wall of the trench. All intervening rocks were removed. No samples were taken from this trench.

Trench No. 5 marks the southernmost exposure of the West Vein. It is actually an old blast pit blown out of the side of a prominent ridge trending parallel to the vein structure. The vein is exposed in section on the north side of the pit. Two 20 cm wide veins exposed near the top of the pit join together into a single 30 cm wide vein near the bottom of the pit. Erratic massive pyrite pods up to 30 cm long by 15 cm wide occur within the vein structure. As the vein continues southward along the pit back, it pinches to 3 to 5 cm and becomes boudinaged. The footwall rock is a felsite or feldspar porphyry of undetermined thickness, and the hanging wall rock is a schistose alkaline basalt cut by narrow felsite dikes. All rock types are carbonatized.

A 30 cm chip sample taken across the widest part of the West Vein in trench No. 5 returned 0.171 ounces Au per ton.

**Extender Minerals of Canada Ltd. Barite Prospect, North Williams Township**

The Extender Minerals of Canada Ltd. barite prospect (see Table 14.1, no.18) is located in southwest North Williams Township, approximately 300 m west of the south end of Tracey Lake (UTM 498200E 5251150N; NTS 41 P/6SE; MDI T1487). The property is accessible by secondary road, 35.8 km south of Highway 560 via the Bay Lumber road. The main showings are situated on unpatented mining claims L. 441509 and L. 441510.

The barite occurrence was first discovered in the 1960s by local prospectors R. Annett and R. Ferguson during initial construction of the H.E.P.C. electric transmission line. Two veins were found, designated “A” and “B” (Figure 14.8). In 1977, Extender Minerals excavated a series of trenches and completed 6 diamond drill holes totalling 1032 feet on the 2 vein zones.

The “A” vein strikes roughly 050° and dips vertically to steeply southeast and is the southernmost vein discovered to date on the property. It has been traced for 750 feet along strike, of which 450 feet attained thicknesses of more than 3 feet on surface. The “B” vein is located 800 feet northwest of the “A” vein, and trends parallel to it. The “B” vein was traced for over 1500 feet along strike, attaining thicknesses of more than 3 feet over an interval of 250 feet.

A third, narrow barite vein (“C” vein) was recently discovered approximately half way between the “A” and “B” veins, exhibiting the same strike and dip. Its average width and strike extent are unknown. Where exposed, the vein is 6 to 8 inches wide.

In 1992, Extender Minerals completed a bulk sampling program on the “A” vein (see Figure 14.8). Two trenches were excavated and approximately 620 tons of material removed and shipped to Extender’s mill in Matachewan for processing. The results of the evaluation were not available at the time of writing.

Trench 1 measured 6 feet wide by 33 feet long and varied in depth from 10 to 13 feet. The vein was 3.2 feet wide on surface and widened to 5 feet at the base of the cut. An estimated 2350 cubic feet of material averaging 50% BaSO₄ was removed. The vein is zoned, with a central core of pure white barite and a marginal phase consisting of mixed barite and yellowish calcite. Fluorite and minor chalcopryte are present in the calcite-rich marginal phase of the vein. The vein is hosted in a very unusual pink to red, trachytic textured, aphanitic to fine-grained hornblende-porphyritic rock of possible intrusive origin. The rock exhibits pervasive chlorite alteration immediately adjacent to the vein.

Trench 2 measured 6 to 7 feet wide by 120 feet long and averaged 6.5 feet in depth. The vein is poorly exposed in the bottom of the trench, but is approximately 2.5 to 3 feet wide where it could be observed. Approximately 5100 cubic feet of material was removed, averaging an estimated 40% BaSO₄. Vein composition and zonation, host rock type and alteration are identical to trench 1. Structural control is more evident in trench 2, as the vein doglegs significantly and considerable brecciation is evident adjacent to the vein. Shearing and slickenside structures are evident in the altered wall rocks.
The "B" vein is exposed by stripping near the base of a prominent north-trending ridge, approximately 800 feet north of the "A" vein bulk sample site. To the west, near the top of the ridge, the vein bifurcates and pinches to the southwest while the other branch trends due south. Vein widths here are minimal—1 to 4 inches wide. To the northeast, the single vein approaches 3 feet in width over 30 feet of strike length before disappearing in overburden. The host rock is the same pink, aphanitic to fine-grained trachytic rock common to the "A" vein area. Chloritic wall rock alteration is not pronounced and only minor calcite was observed. There is no record of diamond drilling on this portion of the "B" vein.

**Hare Lake Gold Occurrence, Tyrrell Township**

The Hare Lake gold occurrence was discovered in 1990 by R. MacCallum and A. LaCarte, who hold 7 unpatented mining claims in west central Tyrrell Township, just west of Hare Lake (UTM 496450, 5275350N; NTS 41 P/11E; MDI T1544) (see Table 14.1 no.38). The claims were staked following the re-opening of the peripheral lands adjacent to the Temagami Land Caution in April 1990. Access to the property is by a road 1.5 km east of the Tyrrell–MacMurchy townships boundary on Highway 560, 4.5 km southward to Hydro Creek.

Much of the initial work completed by MacCallum and LaCarte was directed at a folded sequence of "green carbonate rock" trending northwest through the west half of the property. Several large, 3 to 10 feet wide quartz carbonate veins and associated quartz stockworks within the green carbonate rocks were evaluated for their gold potential. Relict spinnifex texture suggests the green carbonate rocks were originally komatiitic flows. Erratic gold values were reported from pyritic, graphitic sedimentary rock units immediately adjacent to the carbonate rocks. A three-hole diamond drilling program was in progress late in 1992 to further evaluate this zone.

On the northeast part of the property, near the east boundary of claim L.1146157, a well-mineralized feldspar porphyry intrusive with coarse blebs and stringers of pyrite was discovered (Figure 14.9). Graphitic interflow sedimentary rocks containing semimassive to massive bands of pyrite are partially exposed at the east contact of the porphyry, and much of the sulphide in the porphyry appears to have been derived from this unit. To the northeast, a sequence of thin, mafic pillowed flows and cherty interflow sedimentary rocks is exposed. The pillow selvages have been partially altered to magnetite, and the chert beds partially recrystallized. A broad anticlinal fold nose with a northerly axial trend is evident in the exposure.

Subsequent stripping revealed the presence of a stacked series of 2 to 35 mm wide quartz-carbonate veins trending 010° to 030° and dipping gently at 10° to 30° to the west. The veins are bounded on the east by a fault trending 010° and dipping 55° west. They are open in all other directions. A distinct alteration assemblage consisting of extensive sericitization and pyritization (up to 15% disseminated pyrite locally) is associated with the veining, and appears to overprint the coarser blebs and stringers of pyrite in the porphyry. The quartz-carbonate veins are only sparsely mineralized with pyrite. Coarse free gold in nuggets 10 mm in diameter are erratically distributed within the quartz-carbonate veins. The occurrence of coarse-grained gold is rare.

Samples collected failed to return any high-grade gold assays, but several analyses returned anomalous values in the 0.01 to 0.04 ounces Au per ton range.

To date, evaluation of the gold-bearing structure within the porphyritic intrusive has been restricted to a small blast pit. The host structure appears quite strong and possibly marks the axial trace of an anticlinal fold within the volcano-sedimentary package that hosts the feldspar porphyry intrusive. The partners plan to investigate the strike extension of the gold-bearing structure. They are currently considering an offer to option the property.

**SPECIAL PROJECTS**

**Cobalt Silver Camp Whole Rock Data Review**

A review of the available PETROCH geochemical data for the immediate Cobalt silver camp was performed in November 1992 by R.V. Zalnieriunas. This exercise was initiated when apparently anomalously high barium values were noted in the lithological database for the Cobalt Geologist's District. A summary of this review was presented at the annual OGS Mines and Minerals Geoscience Symposium held in Toronto in December 1992.

The PETROCH database is a collection of 27,000 multielement geochemical analyses of rock samples that have been collected by the OGS from throughout the province, and analyzed by the OGS Geoscience Laboratories.

A subset of 120 records—representing all available Cobalt camp samples of extrusive metavolcanics—was extracted and converted to ASCII-based *.ROC files to be used by NEWPET® (1987–1991) software. This program is available as shareware from Memorial University of Newfoundland, Department of Earth Sciences. The database subset represents samples collected by J. Wood during his preliminary reconnaissance of the area in 1978 (78W.. samples), G. Patterson's 1979 area field sampling (GPCO.. samples) and A.J. Andrews' 1982 results (82AJA.. samples).

The distribution frequency patterns of selected major oxides and some metals indicated the presence of multiple sample populations. This is best illustrated by the cumulative frequency distribution plot for Na2O (Figures 14.10a, 14.10b and 14.10c). To alleviate this multipopulation effect, the database was further subdivided into apparent calc-alkalic and tholeitic fields and their respective apparent alkalic and
subalkalic subsets using Irvine and Baragar (1971) plot definitions (Figures 14.11 and 14.12), with data recalculated for an anhydrous option and total iron expressed as FeO*. (Note that no attempt was made to correlate this classification with hand sample or thin section descriptions. See also discussion on alteration below.)

ALTERATION

A proportion of the samples plot in the alkaline field (see Figure 14.12), and this is especially true for the calc-alkaline population. A high degree of alkali metasomatism is indicated by this plot. Check plots of SiO₂, Na₂O, K₂O, MgO, FeO*, Ba, Cu and Zn versus Zr show a high degree of scatter, with identified highly alkaline samples seemingly randomly distributed. Samples plotting in the tholeiitic field show a better preserved trend line. A high degree of hydrothermal alteration is indicated throughout the total population, with all checked elements showing varying degrees of mobility.

Of the samples, 83 were classified as calc-alkaline and 37 as tholeiitic. Similar SiO₂ modes—in the range of 49 to 52 weight %—occur for both the calc-alkaline and tholeiitic suites (Figures 14.13a and 14.13b). This suggests that the majority of samples lying in the calc-alkaline field probably do so because of alteration effects. This illustrates the inherent problems of classifying altered samples using standard major element discrimination plots. Further study using relatively immobile elements and rare earth elements is needed to determine probable unaltered protoliths.

Two-thirds of the apparent calc-alkaline rocks fall outside the field of fresh volcanic rocks and close to that of known high-sodium keratophyre and/or spilite fields (Figure 14.14). Most of the tholeiitic samples appear to be relatively unaltered (fresh) volcanic rocks, with a few samples plotting in the high-soda spilite field. This general pattern was noted by Patterson and Andrews (1980), who attributed it “to a reflection of metasomatism, rather than an original igneous character.”

It is interesting to note that while there is a spatially well-defined alkali enrichment throughout the camp, only 3 samples show soda depletion. This occurs at an elevated level of less
Figure 14.9. Geology of the Hare Lake gold occurrence, Tyrrell Township.
than 2.0% Na$_2$O determined statistically.

As expected, the element Ba shows a log-normal distribution, with 90% of the samples occurring below a threshold of 601 ppm Ba (Figures 14.15a and 14.15b). A few samples show maximum barium values up to a few thousand parts per million. A wide degree of scatter is noted when Ba is plotted against total alkalis, SiO$_2$ and/or Zr, indicating a wide degree of mobility and probable hydrothermal additions. A lesser degree of scatter is present for the base metals Cu and Zn.

**IMPPLICATIONS FOR VOLCANOGENIC MASSIVE SULPHIDE BASE METALS MINERALIZATION**

Volcanogenic massive sulphide (VMS) deposits are not restricted to any particular host rock within a volcano-sedimentary sequence. Since the Archean metavolcanic rocks which form the local camp basement are complexly folded, a VMS-style deposit may occur anywhere within the Cobalt camp.

The area immediately east of North Pickerel Lake in Coleman Township shows a moderate degree of soda depletion. This may mark the locus of an alteration pipe. Erratic sodium-, potassium- and barium-enrichment occurs in a broad arc to the south and east of the North Pickerel Lake area. It is possible that the zones of enrichment and depletion are related to a hydrothermal alteration event. The area warrants follow-up ground investigation.

**CONCLUSION**

This review of major elements and base metal background values in volcanic extrusive lithologies has found elevated base metal and barium values within the sample population. It confirms the alkaline alteration of local stratigraphy reported by Patterson and Andrews (1980). The source of these anomalies is enigmatic. It may be due solely to hydrothermal processes associated with cobalt-silver style of mineralization. The possibility of economically important VMS-style deposition cannot be ruled out, in light of the known base metal occurrences in the sedimentary exhalites that cap many of the volcanic flows in the Cobalt camp.

**CANADA–ONTARIO NORTHERN ONTARIO DEVELOPMENT AGREEMENT ACTIVITIES**

**Industrial Minerals and Building Stone in the Districts of Nipissing, Parry Sound and Sudbury (Ontario)**

C. Marmont continued field work in the second year of a three-year program to evaluate the economic potential of industrial minerals and building stones in central Ontario. This study is concentrating on the districts of Parry Sound and parts of the districts of Nipissing and Sudbury. Results of the work so far have been reported by Marmont (1991, 1992a, 1992b).
Figure 14.11. AFM plot (after Irvine and Baragar 1971).

Figure 14.12. Total alkali versus silica plot (after Irvine and Baragar 1971).
Minor field work was performed in the Cobalt Resident Geologist's District during 1992, directed toward anorthosite. Anorthositic feldspar is: a possible source of alumina; a feedstock for the ceramics, glass, filler and insulation industries; and dimensional stone (Dolan et al. 1991). Dolan et al. (1991) also reported that anorthosite containing feldspar having a Si:Al ratio lower than 1.5 is suitable for certain chemical applications. Such feldspars have anorthite contents greater than about An₉₀, and occur in "layered" anorthositic bodies, commonly of Archean age. Less anorthitic plagioclase feldspars (An⁵⁰-⁶⁰) occur in "massif-type" intrusions which are typical of the Canadian Grenville Province.

In light of the report by Dolan et al. (1991), a coordinated provincial program was initiated to evaluate anorthositic feldspar resources. As part of this effort, C. Marmont conducted field evaluation of anorthosites in the Sudbury-North Bay-Mattawa region. In due course, beneficiation tests will be commissioned, and laboratory evaluation undertaken of the suitability of Ontario anorthosites for chemical, ceramic, glass and filler applications.

In the Cobalt Resident Geologist's District, there are anorthosites of both massif and layered types. The Fall Lake meta-anorthosite is probably of the layered type, and the Tilden Lake anorthosite appears to be massif type. The affinity of the Eau Claire meta-anorthosite is uncertain at present.

Airphoto interpretation of all bodies was undertaken to identify large outcrops. The bodies were then traversed to identify significant areas of clean anorthosite. True anorthosite (Buddington 1939) is defined as containing more than 90% plagioclase feldspar, the balance commonly being pyroxene or hornblende (possibly with olivine and/or biotite). For an anorthosite to have potential commercial applications, it would likely need to be purer than 95% plagioclase. Because plagioclase weathers to a white colour, the composition of anorthositic rocks can usually be measured on clean outcrop surfaces, and expressed as colour index.

No significant volumes of anorthosite were observed during the summer's work. Clean meta-anorthosite was observed in the Eau Claire meta-anorthosite (Calvine, Lauder and Papineau townships), but exposures are so poor that an estimate of the anorthosite resource is not practicable. The body is sheared, and the anorthosite is likely interlayered with gabbroic anorthosite and gabbro.

The Tilden Lake anorthosite contains some clean anorthosite, but it appears to be too thin and poorly exposed to be of interest.

Anorthositic gneiss was also recorded by Lumbers (1969) in the northern part of Mattawan Township. Exposure is very poor, and only a small amount of anorthosite was observed along the Ottawa River.

The Fall Lake meta-anorthosite is not readily accessible, and was not visited.

Both the Fall Lake and Eau Claire meta-anorthosites have been evaluated in the past for their iron-titanium contents.

On the basis of field observations during the summer of 1992, it appears that none of the anorthosites studied is a suitable source of plagioclase feldspar. However, petrographic and geochemical studies will be completed over the winter, and further work may follow, depending on these results.

Metal and Cyanide Recovery from Foul Barren Solution (Canada-–Agnico–Eagle partnership)

Presently there is only a single economic method for the recovery of silver from concentrates produced in the Cobalt camp. It involves intense batch cyanide leaching, which produces foul barren solutions that can be expensive to treat. A partnership project has been developed with Agnico–Eagle
Mines Ltd. to use laboratory and pilot plant testing of the barren solutions to investigate potential ways of recovering metals and cyanide.

GIS Model Management Database (Canada)
This project will construct a Geographic Information System (GIS) database for the Kirkland Lake-Cobalt-Temagami area that will be integrated with a pilot land-use information system being designed by the provincial survey.

Geoscience data—including information on bedrock and surficial geology, geochemical and geophysical survey data, mineral showings and deposit descriptions—have been gathered in the area for almost 100 years, and can be used for such diverse purposes as mineral exploration and land use planning. A GIS database will maximize the retrievability and usefulness of the large volume of information, and assist in enhancing exploration in the area.

Temagami Land Use Planning GIS System (Ontario)
A revised initial proposal for this project has been submitted for approval to the planning board.

DIAMOND DRILL CORE STORAGE PROGRAM
Diamond drill core offered to the Cobalt Resident Geologist’s office during 1992 totalled 840 m representing 8 holes. Only 670 m of core from 3 holes was received and processed. This core is being stored offsite at the Kirkland Lake and Timmins Drill Core Library facilities or at offsite storage sites. The remainder was held back pending completion of logging and sampling.

A total of 244.19 m of diamond drill core representing 10 diamond drill holes was stored at the Cobalt Core Storage facility in 1992 for Golder Associates Limited. This core was collected as part of the Hazardous Lands Abatement Program in Cobalt, financed by MNDM.

At the end of 1992, 21 216.09 m of drill core from the Cobalt Resident Geologist’s District was in storage at the Cobalt Core Storage facility (Table 14.3).

RECOMMENDATIONS FOR EXPLORATION
Current exploration efforts in the Cobalt Resident Geologist’s area are directed primarily towards base metals and diamonds. This year’s recommendations will therefore focus on these diverse commodities.

Base Metals
Various styles of base metal mineralization have been documented in the Cobalt, Temagami, Shining Tree and Englehart areas. Recent exploration efforts in these areas have been directed towards volcanogenic massive sulphide (VMS) and magmatic copper-nickel (MCN) styles of mineralization, with some preliminary success. Opportunities are excellent for the discovery of economically significant VMS and MCN concentrations, and should be pursued in these areas.
Table 14.3. Summary of drill core stored at the Cobalt Core Storage facility.

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*Total number is different from total of column due to rounding-off of figures.

The Temagami, Cobalt, Shining Tree and Englehart areas are underlain by Archean volcanic assemblages which have the best potential for hosting VMS deposits. Detailed geological mapping is required to subdivide felsic volcanic assemblages and better define high-silica rhyolites (quartz latites); this rock type characterizes volcanic centres, the cores of which act as heat engines for hydrothermal processes. Additional whole rock analyses are required to determine if the volcanic rocks have been altered, and whether the alteration is consistent with other known base metal deposits. Work by Fyon and Crocket (1986) in the Temagami area indicates that the rock types are favourably altered. No such government study has been attempted for the Cobalt, Shining Tree or Englehart greenstone belts.

There are documented MCN occurrences and deposits in the Temagami and Shining Tree areas, including the Kanichee copper-nickel-platinum group elements and Copperfields copper mines near Temagami, and the Fawcett Township copper-nickel occurrence near Shining Tree. The possibility is excellent of discovering additional MCN deposits in these areas.

In the Temagami and Shining Tree areas, numerous small, remnant Archean volcanic assemblages have been recognized outside the main Temagami greenstone belt (TGB). They share the same geological, structural and geochemical characteristics as the TGB, and many of these “volcanic outliers” are host to base metal occurrences. Most are poorly documented or unexplored. The Temagami and Shining Tree outliers share many of the attributes of other, more famous “volcanic outliers” such as at Manitouwadge and Hemlo.

In the Englehart area, a significant accumulation of intrusive and extrusive ultramafic rocks marks the boundary between the Skead and Catherine volcanic sequences. These
rocks have high potential for hosting Kambalda-type copper-nickel deposits as well as MCN deposits. They are poorly exposed and poorly explored, yet readily accessible.

In Bryce Township in the Englehart area, the large Britcanna Porphyry intrusion has been extensively altered to a sericite-carbonate schist. This suggests that voluminous gases were retained in the intrusion during crystallization. Erratic concentrations of gold and copper are common both within the intrusion and in the peripheral rocks, associated with late fractures and shears. A possible source for the copper-gold mineralization could be hosted within the porphyry body. The presence of significant copper-gold concentrations within a porphyry host would not be detectable by conventional airborne geophysical surveys due to the disseminated nature of the mineralization.

Another source of potentially economic base metal mineralization is in the younger Proterozoic rocks of the Huronian. These rocks occupy a large regional basin structure and are composed of older, Archean rocks that were weathered and deposited in the basin. Base metal-bearing sediments could have been deposited in economic concentrations. Metamorphic processes could have acted to remobilize subeconomic base metal concentrations and redeposit them in economic concentrations within fold noses and other structural traps. These processes are also valid for gold recombination, although the physical and chemical requirements for gold remobilization and precipitation are much more restricted. Paleoplacer gold deposits have been sought in the Huronian sediments for many years; sulphide concentrations within specific Huronian strata are invariably enriched in gold. Basin margins offer the best prospective areas since the sedimentary beds are steeper dipping and more structurally disturbed than those inside the basin. The margins should reveal better exposed stratigraphic sections and possible windows into the older rocks.

Significant concentrations of copper and/or zinc-lead have been documented within the Proterozoic Lorrain Formation quartzites south of Shining Tree in Dufferin and Browning townships, on the northwest margin of the basin. A possible source for these sulphide accumulations would be the Archean volcanic assemblages peripheral to the Huronian basin. Disseminated copper, zinc and lead sulphides occur in a basal pebble conglomerate at Drummond Cairn within the Gowganda Formation in Cobalt, near the Proterozoic–Archean unconformity.

As part of the ongoing evaluation of the base metal potential of the Cobalt silver camp, whole rock geochemical data obtained from the provincial PETROCH database was reviewed by staff from the Resident Geologist's office in Cobalt. The procedure and results of this special study are presented in the "Special Projects" section of this report.

**Diamonds**

Canadian explorationists have learned that you cannot say with certainty that diamonds do not occur in Canada. Kimberlitic pipes and dikes have been documented in several provinces and territories over the last few decades, but explorationists have not found economic concentrations of diamonds within these rocks. Recent developments in the Lac De Gras area of the Northwest Territories may yet prove that the Canadian Shield is a good prospective place for diamonds. At the same time, kimberlite pipes and dikes are being evaluated in northeast Ontario and Quebec, within the Lake Timiskaming "failed rift structure".

There is ample evidence that the Lake Timiskaming "failed rift structure" has been active since the Paleozoic. Unusual "lamprophyric" dikes have been documented in Ordovician limestones in Casey and Harris townships. At the Breault quarry in Dymond Township, late faults offset limestone and dolomite units of Silurian age. The entire Paleozoic Lake Timiskaming outlier is a down-faulted block within the Lake Timiskaming "failed rift structure", indicating substantial vertical movement during or subsequent to the Silurian.

If, as suspected, emplacement of the known kimberlite pipes is controlled by the Lake Timiskaming "failed rift structure", then the corridor along that structure from Mattawa to the James Bay lowlands is prime diamond-hunting ground.

In the Cobalt area, kimberlite pipe occurrence has been documented to date, in Bucke Township just west of Highway 11. If the general rule holds that kimberlite pipes tend to occur in clusters, then additional pipes should be expected in the area.

Specific areas to prospect for diamond host rocks fall within a 50 km wide corridor along both sides of Lake Temiskaming, and at fault junctions within that corridor.

The town of Mattawa is at the junction of 2 failed rift structures, the Lake Temiskaming and the Lake Nipissing. This junction marks a distinct zone of weakness within the continental crust, and should be a good area for diamond exploration.

Johns (1986) describes "pebbly lamprophyres" up to 6 m wide cutting the Britcanna Porphyry in Bryce Township. All such unusual dikes and diatremes described in literature require ground evaluation in light of the recent kimberlite discoveries within the Lake Timiskaming "failed rift structure".

**SELECTED PUBLICATIONS RECEIVED**


Nichols, R.S. 1985. Recent observations on Keewatin stratigraphy and geological controls of silver mineralization at Cobalt, Ontario; unpublished draft paper, 27p.


INTRODUCTION

In an article in *The Globe and Mail* on November 14, 1992, science writer S. Strauss called the Sudbury formation "... the sphinx of geology. There is nothing else quite like it on the face of the planet." This is evident from the many visitors who continue to come to Sudbury each year from all over the world. As one visitor put it: "Sudbury is a veritable geological pilgrimage site".

Interest in the geology of the Sudbury area has indeed reached new heights. Much university, company, Ontario Geological Survey and Geological Survey of Canada sponsored, recent and ongoing, geological research work has produced a wealth of new data. The meteorite impact theory remains intact, but its foundation begins to show some cracks. Interpretation in coming years appears to be headed for another scientific revolution in the sense of Thomas Kuhn, another paradigm shift. This is to be welcomed, as radical shifts in thinking are vital to periodically redirect exploration efforts.

If R. Grieve of the Geological Survey of Canada is right, Sudbury is an impact structure and the Sudbury Igneous Complex is not an igneous complex but an impact melt (Grieve 1992).

Yet, the reflection profiles from the 1990 LITHOPROBE seismic survey may tell a different story. The results of this survey were published in 1992 and, to no ones' surprise, the survey data contained several surprises, which may begin to question the meteorite impact hypothesis a little (Milkereit and Green 1992).

The exciting scientific activities notwithstanding, mining and exploration activity continued at a brisk, if reduced pace.

Seven Ontario Mineral Incentive Program (OMIP) grants and 25 Ontario Prospectors Assistance Program (OPAP) grants were awarded in the Sudbury district in 1992. Four recipients used their grants exploring for dimension stone, 14 for gold, and 14 for base metals.

Inco Limited and Falconbridge Limited continued to mine copper, nickel and precious metals from their mines in the Sudbury area. The nickel price declined during the year from approximately US$3.70 per pound early in 1992, to US$2.39 in November. This caused Inco Limited and Falconbridge Limited to take measures toward the end of the year to protect their local interests and profitability.

Silica extraction continued on Badgeley Island near Killarney, and at Alban in Delamere Township. Quarrying of dolomite continued at the west end of Manitoulin Island. The possible development of a silica quarry in the Wavy Lake area for smelter flux remains questionable due to strong opposition from local residents supported by local politicians.

Prospecting in the Sudbury District continued at a brisk pace, and exploration for building stone continued. Dimension stone samples from the Sudbury area were displayed at international exhibitions in Seattle, Washington, and Verona, Italy, where they created considerable interest.

Jarvis Resources Limited took delivery of equipment purchased in Germany and Italy for a dimension stone processing plant to be built in Lively. It should be ready for production early in 1993.

The success of Ontario Trap Rock Limited, an operation near Bruce Mines that ships crushed Nipissing diabase ("trap rock") by boat to southern Ontario markets, created some interest in diabase in the Sudbury area. This interest was fuelled, in part, by speculation that the Ontario Ministry of the Environment may change the definition of "inert", and place restrictions on the use of some types of crushed smelter slags generally used as railway ballast.

In September, the Geoscience and Information Services Branch of the Ontario Geological Survey, along with the Mining Lands Branch and Mineral Development and Rehabilitation Branch of the Ministry of Northern Development and Mines, moved into the Willet Green Miller Centre on the campus of Laurentian University. The new facility is to be officially opened in 1993.

Two large international conferences, sponsored in whole or in part by the Ontario Geological Survey, took place in September in the new Willet Green Miller Centre. One focussed on large meteorite impact structures, and the other on Sudbury and Noril'sk nickel-copper and precious metals deposits.

Funding through the Canada-Ontario Northern Ontario Development Agreement (NODA) to conduct a three-year study of the industrial mineral potential of Manitoulin Island
commenced in June. The focus of this study is primarily on the identification of high-quality carbonate deposits.

Some work on building stone and industrial mineral potential was done in the district under another NODA funded project operating from the Dorset Resident Geologist's office.

MINING ACTIVITY

Introduction

The Mineral Sector Analysis Branch of the Mines and Minerals Division has estimated the total production from the Sudbury camp in the past 100 years to be in the neighbourhood of 768 million tons of ore mined to produce 19 billion pounds of nickel and similar amounts of copper. These numbers, based on Ontario government statistics, and estimates by Falconbridge Limited and Inco Limited, are considered as nothing more than best estimates.

The price for nickel on the London Metal Exchange (LME) in February was in the range $US3.60 to 3.70 per pound. In March, April and May, it traded between $US3.50 to 3.40 per pound; in June, it dropped to $US3.20 to 3.30 per pound and, in July and early August, it rose slightly back to $US3.30 to 3.50 per pound. By September 30, however, it had slipped to $US3.04 per pound and reached a low point of $US2.39 per pound on November 17, much below the price of a pound of butter, a point belaboured in the Sudbury press.

Inco Limited estimated that worldwide consumption of refined nickel in 1992 would be 1.4 billion pounds, or about 8.5% less than the 1.53 billion pounds demand in 1991. Toward the end of the year, nickel inventories stood at about 180 000 t, up about 80 000 from 1991, and at about the same level as in 1982, considered to have been a "dark year" in nickel mining.

The oversupply of nickel for 1992 was thought to be due in part to the Russians' being unable to absorb their own production because of problems with consumer goods manufacturing, resulting in the dumping of nickel on world markets.

Although Inco Limited and Falconbridge Limited operate worldwide, their main operations are located in Sudbury (Figure 15.1). Much of the information the 2 companies publish is consolidated for all operations. Consequently, it is not always easy to obtain numbers that are Sudbury specific. The company profiles given below reflect this.

Figure 15.1. Producing mines in the Sudbury area.

Inco Limited (Ni, Cu, Co, Au, Ag, PGM, Se, Te, SO₂, H₂SO₄)
1 Lower Coleman
2 Little Stobie
3 Stobie
4 Frood
5 Copper Cliff North
6 Copper Cliff South
7 Creighton
8 Crean Hill
9 McCreedy West
10 Levack
11 Garson

Falconbridge Limited (Ni, Cu, Co, Au, Ag, PGM, H₂SO₄)
12 Lockerby
13 Onaping-Craig
14 Fraser
15 Strathcona
16 Thayer Lindsley
Inco Limited

Within the Sudbury area during 1992, Inco Limited operated 11 underground mines, 1 smelter, 2 refineries, 3 sulphuric acid plants, 1 liquid sulphur dioxide plant and 1 strip rolling mill for coinage blanks.

The operating mines and their rated daily capacities (Giancola 1992) are as follows: Copper Cliff North, 3000 tonnes per day (tpd); Copper Cliff South, 4300 tpd; Crean Hill, 2500 tpd; Creighton, unavailable; Frood, 5500 tpd; Garson; Levack, 3400 tpd; Little Stobie, 3800 tpd; Lower Coleman, 2700 tpd; McCready West, 2800 tpd; Stobie Mine, 12 000 tpd.

All of Inco Limited’s Sudbury ore was milled at the much enlarged Clarabelle Mill, which operates at a current capacity of approximately 45 000 tons of ore per day (Inco Limited Annual Report 1991). Their operating costs at a breakeven point are reported to be approximately SUS3.30 a pound (The Northern Miner, November 23, 1992).

At the beginning of the year, Inco Limited reported Canadian ore reserves of 401 million short tons grading 1.44% Ni and 0.85% Cu. The percentage of this that is relevant to its Sudbury operations is not publicly known (Inco Limited Annual Report 1991).

On March 29, Inco Limited celebrated its 90th birthday. The company was formed in 1902 as The International Nickel Company Limited through the amalgamation of the Orford Copper Company of New Jersey and the Canadian Copper Company of Ohio. The company was renamed Inco Limited in 1976 (The Sudbury Star, March 29, 1992).

Inco Limited employs about 18 000 persons in 19 countries, over one-third of them in the Sudbury area. The Sudbury workforce stood at about 6940 employees through the year.

In January, the company had to briefly declare force majeure, when a furnace failed in the copper refinery at Copper Cliff. This resulted in a 70% copper production loss for about 10 weeks. This also affected precious metals, which mostly report to the copper circuit.

In April, Dr. M. Sopko took over as Chairman and Chief Executive Officer. He had previously been head of the company’s Ontario Division.

During the year, the company spends approximately $600 000 on its environmental improvement programs covering approximately 2000 acres of land in the Sudbury and Copper Cliff areas (The Northern Miner, February 17, 1992).

Inco Limited’s sulphur dioxide abatement program, a $600 million expenditure over several years, was slightly ahead of schedule. Sulphur dioxide aerial discharge in 1991 was 572 000 t (The Sudbury Star, March 31, 1992, September 1, 1992). By January 1994, this will be reduced to 265 000 t, representing 90% containment of all sulphur.

During the summer, all operations shut down for 5 weeks. Another shutdown of 3 weeks was announced in October for over the Christmas period.

Construction of the Sudbury Neutrino Observatory (SNO) was on target. Scheduled to be operational in 1995, the surface buildings were officially opened in August, and excavation of the large chamber on the 6800-foot level of Creighton No. 9 Shaft was progressing well. The chamber will house 1000 tons of heavy water in an acrylic vessel which forms the main detector for this international venture.

Earnings for the year to September 30 were US$11.3 million, compared to US$88.4 million in the same period in 1991 (The Northern Miner, November 9, 1992).


The precipitous drop in the price of nickel forced the company and its union in the last quarter to discuss ways to bring down costs, yet avoid layoffs. On October 5, the company announced production cutbacks of 40 million pounds of nickel over the next 12 months, a three-week Christmas shutdown, cuts of 10% in salaries for staff and directors’ fees, and reduction in capital expenditures in 1993 to US$230 million, US$50 million below the planned expenditures for 1992 (The Globe and Mail, October 6, 1992; The Northern Miner, October 12, 1992).

In November, Inco Limited offered early retirement to 400 employees in Canada and the United States. By early December, the company had met its objectives, with 260 Sudbury employees having accepted the offer.

On a more positive note, also in November, Inco Limited announced it will re-open the lower levels of the Garson Mine at an estimated cost of US$50 million.

Falconbridge Limited

Falconbridge Limited produced nickel-copper-precious metals from 5 operating mines in the Sudbury District. Production in 1991 was 2.6 million tons of ore (Falconbridge Review 1991). All ore is concentrated at the Strathcona Mine mill, which has a milling capacity of approximately 10 000 tpd. The concentrate is trucked to the company’s smelter at Falconbridge. Copper-nickel matte is shipped from the Falconbridge smelter to the company’s refinery in Norway.

In 1992, Falconbridge Limited operated the following mines in the Sudbury district: Fraser Mine, production capacity 1.0 million tons per year; Lockerby Mine, capacity 400 000 tons per year; Onaping/Craig Mine, production capacity 1.1 million tons per year; Strathcona Mine, production capacity 300 000 tons per year; and the Thayer Lindsley Mine, production capacity 120 000 tons per year (The Sudbury Star, April 6, 1992).
During 1992, Falconbridge Limited employed about 2225 persons in its Sudbury operations.

Early in the year, Falconbridge Limited completed its access shaft at the Craig Mine. The shaft has a depth of 1512 m, a diameter of 6.25 m, and cost about $30 million to complete. Previously, access to the mine had been via underground from the Onaping Mine.

The Thayer Lindsley Mine was opened in May, after preproduction costs of $40 million. The shaft has a depth of 1640 m, with production currently from the 1310 m level at 500 tpd. Ore is being trucked to the Strathcona Mill, with no tailings accumulating at the mine site (The Northern Miner, June 8, 1992).

The Lockerby Mine celebrated 20 years of production on May 30. To date, 7 million tons of ore have been produced (Falcon, June 2). The mine had been scheduled for closure at the end of 1994, but may have a new lease on life with the recent discovery of 2 new ore zones.

Falconbridge Limited was disrupted by a ten-day strike by 367 office, clerical, and technical workers of Local 6855, United Steel Workers of America. The strike affected production, even though there was an agreement between the 2 unions allowing Mine Mill Local 598 workers access to their workplaces. The strike was settled on June 13 with a new three-year contract.

On June 23, a contractor's barge with a diamond drill aboard overturned on Vermilion Lake. The company had been conducting lake-surface exploratory drilling on the Vermilion deposit. Only a small amount of diesel fuel entered the water, thus no major environmental problems resulted from the accident as was first feared.

Falconbridge Limited's Sudbury operations shutdown for 5 weeks in summer and, late in the year, the company announced a further shutdown of 2 weeks over Christmas.

Consolidated net earnings for the first 9 months of 1992 amounted to $50.1 million, compared to $38.0 million for the same period in 1991 (The Globe and Mail, November 5, 1992).

The company does not publish a breakeven point of production cost. Company official R. Laine stated: “the price we have to receive to justify continued investment is $4.50 a pound” (The Sudbury Star, January 31, 1992).

Towards the end of November, the company announced further measures to counter the low nickel prices. This included an offer of early retirement to 251 employees, hoping for acceptance by at least 200, and a further shutdown of operations for 4 weeks in January of 1993.

**Industrial Minerals**

Unimin Canada Limited operated the Badgeley Island high-grade silica quarry, 4 km west of the village of Killarney.

Annual production is approximately 430 000 tons. The coarse silica is shipped to Midland, Ontario and Ashtabula, Ohio, for further processing into silica sand for the glass industry.

Standard Aggregates Incorporated operated its Meldrum Bay quarry at the west end of Manitoulin Island during the Great Lakes shipping season. The company produces high-grade dolomite from a 50-foot face in the Silurian Amabel Formation. Production during 1992 was approximately 2 million tons. Reserves are estimated at 100 million tons.

Carman Construction Incorporated produced 120 000 tons of silica from a quarry they operate on a seasonal basis near Alban in Delamere Township. The material is used as smelter flux at Inco Limited’s Copper Cliff smelter. Carman Construction Incorporated also operated a small silica quarry near Lake Panache in Roosevelt Township, the material from which is sold as exposed aggregate by custom order only.

Hercules Stone Limited extracted approximately 500 tons of Silurian Manitoulin Formation limestone from the Foxey Quarry in Gordon Township on Manitoulin Island. The rock is used for curbing, walkways and landscaping.

Crea-Mac Contracting Company Limited operated a small, pink-feldspar quarrying and crushing operation near Warren. The material is used for decorative landscape aggregate with production on an “as required” basis.

Multigranitics Incorporated began to stockpile pink, grey, brown, and black igneous and metasedimentary rocks from various quarry sites throughout the district, in order to produce coloured landscape aggregate by the spring of 1993.

Geological evaluations and feasibility studies were conducted on silica properties owned by A. Leblanc in Janes Township, L. Alarie and Sons Limited in Eden Township, J. Rolston in Howland Township, and Norwin Geological Limited in May and Salter townships.

Considerable quantities of sand and gravel were also extracted by numerous companies throughout the Sudbury district.

**ADVANCED EXPLORATION**

Underground exploration and development continued at most producing mines in the Sudbury area throughout the year. Development properties of notable interest are mentioned below.

**Inco Limited**

Inco Limited completed development at the Copper Cliff South Mine of the A-10 orebody, from the 2400-foot to the 4000-foot levels. A new muck handling and crushing system has also been installed on the 4000-foot level (L. Cochrane, Inco Limited, personal communication, 1992).
The re-evaluation of the lower levels of the Garson Mine has led to a production decision to mine high-grade ore between the 3800-foot and 4200-foot levels. Production was halted there in 1987 after a fatal accident due to poor ground conditions. The company is confident that with new mining techniques the mine can be safely operated. Grades are 1.8% Ni and 1.3% Cu. Production of this zone is scheduled to commence in the last quarter of 1993, employing approximately 100 persons (L. Cochrane, Inco Limited, personal communication, 1992).

At the McCreedy East Mine, development of an orebody discovered in 1991 was suspended in September of that year (Cosec and Gates 1992). Subsequent development work has focussed on a new zone located 1 km west of the mine site. Proven and probable reserves are 5.9 million short tons grading 8.83% Cu and 0.63% Ni. This orebody may enter production in 1994, depending upon market conditions (Inco Limited Annual Report 1991).

Falconbridge Limited

At the Craig Mine, reserves of 13.5 million t containing 2.00% Ni and 0.74% Cu have been outlined within 9 zones over a strike length of 1000 m lying between 650 and 1700 m below surface (Moore and Nikolic 1992). Shaft sinking, begun in 1990, has been completed to a depth of 1512 m. Commissioning of the mine, originally to have been in August 1993, has been postponed until further notice due the recent low price of nickel.

Exploration and development work continued at Strathcona Mine in order to access the Copper Zone containing 976 000 t grading 9.3% Cu and 0.5% Ni, and the Deep Copper Zone containing 7.63 million t grading 4.5% Cu and 0.6% Ni (Naldrett et al. 1992). The ore of the Copper Zone is composed of very rich stringers of massive chalcopyrite with minor magnetite, pyrite, pentlandite and sphalerite occurring 100 to 200 m into the footwall (Archean Levack Gneiss) of the Sudbury Igneous Complex approximately 900 m vertically below surface. The Deep Copper Zone is composed of a series of complex, fracture-filled arcuate veins of massive chalcopyrite and cubanite with accessory pentlandite, magnetite and pyrrhotite. The veins range in size from 1 cm to 6 m wide and are located up to 500 m from the contact zone of the footwall and sublayer norite, 1000 to 1400 m below surface (Li et al. 1992).

A $2 million underground diamond drilling program at the Lockerby Mine, from the 4200-foot level, has outlined the Lockerby Depth Zone from 5300 to 7200 feet, and open at depth. Access will require an internal shaft from 3650 to 7200 feet. Another new zone, The Lockerby East Zone, can be reached by drifts from the present workings.

EXPLORATION ACTIVITY

The Sudbury Resident Geologist's district encompasses 27 500 km² (Figure 15.2). Geologically, the area is underlain by rocks of Archean, Proterozoic and Paleozoic age. The Grenville Front runs diagonally across the district from southwest to northeast, dividing it into geologically dissimilar parts.

The area is famous for its large, world-class nickel-copper-precious metal mines associated with the Sudbury Igneous Complex and, to a lesser extent, for its many precious and base metal occurrences outside the Sudbury Igneous Complex.

Exploration activity by major mining companies outside the Sudbury Igneous Complex declined somewhat from 1991, as efforts concentrated on advanced nickel-copper-platinum group metals (PGM) projects associated with the complex.

Prospecting and grass-roots exploration by individuals increased modestly, particularly in the Benny Greenstone Belt and associated metavolcanic inliers, as well as potential gold-bearing soda-metasomatized areas east of Wanapitei Lake. Significant diamond drilling programs were undertaken by Inco Exploration and Technical Services Incorporated, Falconbridge Limited, Flag Resources (1985) Limited, and Stralak Resources Limited. Exploration interest in dimension stone and silica prospects continued at approximately the 1991 levels (Table 15.1).

Several exploration projects are highlighted below. For a detailed summary of exploration in the district, please refer to Table 15.2 and Figure 15.2 (the size of a mining claim mentioned in this report is a single forty-acre unit).

L. Barry

L. Barry completed manual stripping, trenching, and lithogeochemical sampling on her quartz diorite-hosted chalcopyrite occurrence, located on the northeast periphery of the Sudbury Igneous Complex.

Bharti Laamenen Mining Incorporated

Bharti Laamenen Mining Incorporated continued its long-term exploration programs on several base metal properties in the Benny Greenstone Belt. Geological mapping, stripping, trenching, lithogeochemical sampling and diamond drilling were conducted on the Richardson Lake (T. Holmstrom) sulphide occurrence in Rhodes Township. The geology is described in the "Property Examinations" section of this report.

N. Bond and D. Scott

N. Bond and D. Scott completed mechanical stripping, trenching and bulk sampling at the R.J. Jowsey gold and copper occurrence in Frechette Township. The property is underlain by intercalated arkose and argillite of the Gowganda Formation, intruded by medium- to coarse-grained Nipissing diabase. Massive to finely disseminated pyrite with minor chal-
Table 15.1. Summary of claims recorded and assessment work credit.

<table>
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<tr>
<th>Year</th>
<th>Claims Recorded</th>
<th>Claims Cancelled</th>
<th>Claims Active</th>
<th>Diamond Drilling (Man Days)</th>
<th>Geophysical Surveys (Man Days)</th>
<th>Geological Survey (Man Days)</th>
<th>Total Survey (Dollars)</th>
<th>Geotechnical Survey (Dollars)</th>
<th>Physical Survey (Dollars)</th>
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<td>6852</td>
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<td>34 691</td>
<td>80 168</td>
<td>1960</td>
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<td>255 824</td>
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<td>304 792</td>
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</table>

*with the new Mining Act in effect June, 1991, assessment work requirements changed to dollar value

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Figure 15.2. Sudbury Resident Geologist's District exploration activity, 1992 (keyed to Table 15.2).
Table 15.2. Exploration activity in the Sudbury Resident Geologist’s District, 1992 (keyed to Figure 5.2).

Abbreviations

<table>
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<tr>
<th>DD</th>
<th>Diamond Drilling</th>
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<td>Tr</td>
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<td>Ground Magnetic Survey</td>
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<td>GL</td>
<td>Geological Survey</td>
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<tr>
<td>VLF-EM</td>
<td>Very Low Frequency Electromagnetic Survey</td>
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<td>IP</td>
<td>Induced Polarization</td>
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<th>Township</th>
<th>Exploration Activity</th>
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<td>724031 Ontario Incorporated</td>
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<td>Dimension Stone Evaluation</td>
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<td>Ontario Quarries Incorporated (749574 Ontario Limited) (Harama marble)</td>
<td>Parkin Tp. (Dimension stone)</td>
<td>Str, bulk sampling</td>
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<td>Tr, GC</td>
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<td>Bharti Laamenen Mining Incorporated (Richardson Lake)</td>
<td>Broder Tp.</td>
<td>Tr, GC</td>
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<tr>
<td>9</td>
<td>Blue, P.G.</td>
<td>Caen Tp. (Ni, Cu)</td>
<td>Str, Tr, GC</td>
</tr>
<tr>
<td>10</td>
<td>Blue, P.G.</td>
<td>Shakespeare Tp. (Ni, Cu, PGM)</td>
<td>Tr</td>
</tr>
<tr>
<td>12</td>
<td>Brady, J. [OMIP funded]</td>
<td>Frechette Tp. (Au)</td>
<td>GC, Prospecting</td>
</tr>
<tr>
<td>14</td>
<td>Brady, J. [OPAP funded]</td>
<td>Muldrew, Hart tps. (Cu, Pb, Zn)</td>
<td>Prospecting, GC</td>
</tr>
<tr>
<td>15</td>
<td>Brady, J. [OPAP funded]</td>
<td>Parkin Tp. (Au, Ag, Ni, Cu, Zn, PGM)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>16</td>
<td>Brady, M. [OPAP funded]</td>
<td>Parkin Tp. (Dimension stone)</td>
<td>GL</td>
</tr>
<tr>
<td>17</td>
<td>Brisson, A.</td>
<td>Parkin, Hutton tps.</td>
<td>Str</td>
</tr>
<tr>
<td>19</td>
<td>Burns, I. (Major Leckie’s Shaft)</td>
<td>McNish, MacBeth tps.</td>
<td>Str, GL, GC, GP</td>
</tr>
<tr>
<td>20</td>
<td>Burns, I. (Pumphouse Creek)</td>
<td>Leask Tp. (Co, Cu)</td>
<td>Str, Tr</td>
</tr>
<tr>
<td>22</td>
<td>Clement, D.</td>
<td>Rathbun Tp.</td>
<td>Prospecting, Str</td>
</tr>
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<td>23</td>
<td>Clement, D.</td>
<td>Lorne Tp. (Zn)</td>
<td>Prospecting, Tr, GC</td>
</tr>
<tr>
<td>24</td>
<td>Clement, Y., and Pilkey, D.</td>
<td>Dublin, Scadding tps. (Cu, Pb, Zn)</td>
<td>GL, GC</td>
</tr>
<tr>
<td>25</td>
<td>Dekeyser, M.</td>
<td>Curtin Tp. (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>27</td>
<td>Falconbridge Limited (Muldrew Lake property) [OPAP funded]</td>
<td>Sheppard, MacBeth tps.</td>
<td>Tr, DD</td>
</tr>
<tr>
<td>28</td>
<td>Falconbridge Limited (Mirage Project)</td>
<td>Fairbank Tp. (Cu, Pb, Zn)</td>
<td>DD</td>
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<tr>
<td>29</td>
<td>Fielding, R. (Eagle’s Nest) [OPAP funded]</td>
<td>Scadding, Rathbun, Kelly tps. (Au)</td>
<td>Downhole Geophys pulse EM, DD</td>
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<td>31</td>
<td>Flag Resources (1985) Ltd. (Wolf Lake/Cobalt Hill) [OMIP funded]</td>
<td>Mackelcan Tp. (Au)</td>
<td>DD</td>
</tr>
<tr>
<td>33</td>
<td>Forster, J. (Ella Lake)</td>
<td>Allen Tp. (Dimension stone)</td>
<td>Dimension Stone Evaluation</td>
</tr>
<tr>
<td>34</td>
<td>Gervais, R. (Moose Mountain Mine)</td>
<td>Hutton Tp. (Zn)</td>
<td>DD</td>
</tr>
<tr>
<td>35</td>
<td>Gervais, R., Miron, T. and Shank, M. (Miron Galena)</td>
<td>Roberts Tp. (Zn)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>36</td>
<td>Graham, R. [OPAP funded]</td>
<td>Scadding Tp. (Au)</td>
<td>IP</td>
</tr>
<tr>
<td>37</td>
<td>Haminen, T. and Maki, A. (Chief Lake)</td>
<td>Tilton Tp. (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>38</td>
<td>Haminen, T. and Maki, A. (Battersby Creek) [OPAP funded]</td>
<td>Marquette Tp. (Au, Cu, PGM)</td>
<td>GL, GC, Str, Tr</td>
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<tr>
<td>39</td>
<td>Hinds, R.S.</td>
<td>McConnell Tp. (Au?)</td>
<td>Prospecting</td>
</tr>
<tr>
<td>40</td>
<td>Huycke, J.G. [OPAP funded]</td>
<td>Moncrieff Tp. (Au, Pb, Zn, Cu)</td>
<td>Str, Tr</td>
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<tr>
<td>No. on Map</td>
<td>Company/Individual (Property Name)</td>
<td>Township (Commodity)</td>
<td>Exploration Activity</td>
</tr>
<tr>
<td>-----------</td>
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<td>----------------------</td>
</tr>
<tr>
<td>31</td>
<td>Inco Exploration and Technical Services Incorporated</td>
<td>Boon, Gerow tps.</td>
<td>GP, GC, GL</td>
</tr>
<tr>
<td>31</td>
<td>Inco Exploration and Technical Services Incorporated</td>
<td>Sudbury Basin area</td>
<td>DD</td>
</tr>
<tr>
<td>32</td>
<td>Komareckha, R. [OPAP funded]</td>
<td>Eden, Cherrian tps. (Si, Dimension stone)</td>
<td>Percussion drilling, GL, ATSM testing</td>
</tr>
<tr>
<td>33</td>
<td>Maki, O.T.</td>
<td>Hutton, Parkin tps. (Au)</td>
<td>GL, GC, placer</td>
</tr>
<tr>
<td>35</td>
<td>Manitou Stone (Canada) Incorporated</td>
<td>Shibananing Tp. (Dimension stone)</td>
<td>Dimension Stone Evaluation, Str, Prospecting</td>
</tr>
<tr>
<td>36</td>
<td>Miron, T. and Shank, M.</td>
<td>Roberts Tp. (Au, base metals)</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Moss, R. [OPAP funded]</td>
<td>Raimbault, Craig tps.</td>
<td>Prospecting, GL, GC, GP</td>
</tr>
<tr>
<td>38</td>
<td>Naples, K. [OMIP funded]</td>
<td>Foster Tp.</td>
<td>Prospecting</td>
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<tr>
<td>39</td>
<td>Nipissing Industrial Quarries Incorporated</td>
<td>Gibbons, McWilliams tps. (Dimension stone)</td>
<td>Dimension Stone Evaluation</td>
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<tr>
<td>40</td>
<td>Norwin Geological Limited (Pilkey, D. and Patrie, D.)</td>
<td>May, Salter tps. (Si)</td>
<td>GL, GC, DD</td>
</tr>
<tr>
<td>41</td>
<td>Palkovits, R., Palkovits, M., Palkovits, F. [OPAP funded]</td>
<td>Davis Tp. (Au, Cu)</td>
<td>DD</td>
</tr>
<tr>
<td>42</td>
<td>Poutano Granite</td>
<td>Henry Tp.</td>
<td>Str</td>
</tr>
<tr>
<td>43</td>
<td>Poupore, T. [OPAP funded]</td>
<td>Grigg, Scadding tps. (Dimension stone)</td>
<td>Str, Tr, Dimension Stone Evaluation</td>
</tr>
<tr>
<td>44</td>
<td>Prior, D. [OPAP funded]</td>
<td>Lockeyer, Mandamin tps. (Dimension stone)</td>
<td>Prospecting, GL, GP</td>
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<tr>
<td>45</td>
<td>Racicot, F.</td>
<td>Frechette Tp. (Cu, Au)</td>
<td>Prospecting</td>
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<td>46</td>
<td>Racicot, F. [OPAP funded]</td>
<td>Hoskin, Delamere tps. (Dimension stone)</td>
<td>Dimension Stone Evaluation</td>
</tr>
<tr>
<td>47</td>
<td>Rauhala, J. (Black Lake)</td>
<td>Botha, Rhodes tps. (base metals)</td>
<td>Tr</td>
</tr>
<tr>
<td>48</td>
<td>Rice, M. (Sandfly Lake Iron Occurrence) [OPAP funded]</td>
<td>Dieppe Tp. (Cu, Ni)</td>
<td>Tr, GC, VLF-EM, GM</td>
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<td>49</td>
<td>Salo, G. [OPAP funded]</td>
<td>Dublin Tp.</td>
<td>Prospecting</td>
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<td>50</td>
<td>Sawitzky, E. [OPAP funded]</td>
<td>Davis, Janes tps.</td>
<td>GP-horizontal loop EM, GL, GC</td>
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<td>51</td>
<td>Simms, W.</td>
<td>Craig, Ulster tps. (Pb, Zn, Cu)</td>
<td>Tr, prospecting</td>
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<tr>
<td>52</td>
<td>Stralak Resources Limited [OMIP funded]</td>
<td>McKinnon Tp.</td>
<td>DD, downhole GP</td>
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<tr>
<td>53</td>
<td>Stringer, R. (Carson Lake)</td>
<td>Curtin Tp. (Cu, Ni, PGM)</td>
<td>GL, GC</td>
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<tr>
<td>54</td>
<td>Suchanek, C. [OPAP funded]</td>
<td>Craig Tp.</td>
<td>Str, Tr, GC</td>
</tr>
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<td>55</td>
<td>Teck Explorations Limited</td>
<td>Sheppard, McCarthy tps.</td>
<td>Prospecting, GC, GP</td>
</tr>
<tr>
<td>56</td>
<td>Weiss, M.</td>
<td>Street Tp.</td>
<td>GL, GC</td>
</tr>
<tr>
<td>57</td>
<td>Weiss, W.</td>
<td>Gilbert Tp.</td>
<td>Str, Tr, DD</td>
</tr>
<tr>
<td>58</td>
<td>Williams, D.J. [OPAP funded]</td>
<td>Street Tp.</td>
<td>Prospecting</td>
</tr>
</tbody>
</table>

Coppyrite and bornite was found to be associated with quartz veining in the diabase. Carbonate veinlets and brecciation are also present with the quartz. One grab sample (MC–92–53) of fine-grained, moderately disseminated pyrite in quartz from a caved trench assayed 0.778 ounces Au per ton, while a similar sample (MC–92–54) from a recent excavation 150 feet to the northwest, assayed 0.022 ounces Au per ton (Temiskaming Testing Laboratories, Cobalt). A one-ton bulk sample was taken from the latter trench and processed by Erana Mines Limited, but results have yet to be released. Previous diamond drilling in 1985 failed to intersect any significant gold values down dip of the quartz structures. However, 2 VLF-EM geophysical anomalies discovered in the 1985 exploration program remain untested (Cheriton 1985).

**D. Bradley**

D. Bradley conducted a reconnaissance geological survey and lithogeochemical sampling on his claims adjacent to the Alkins gold occurrence in central Scadding Township. The property is underlain by Quirke Lake Group metasedimentary rocks intruded by a coarse-grained Nipissing diabase dike, approximately 200 m wide. In the centre of the dike, on claim 1118371 and immediately south of a large pond, Bradley located 4 old trenches containing coarse-grained magnetite and pyrrhotite. Subsequent assays revealed anomalous nickel mineralization.
D. Brunne and M. Turcott

D. Brunne and M. Turcott completed lithogeochmical sampling on their Big Swan gold-nickel-copper skarn in Porter Township. The geology of this new showing is described in the "Property Examinations" section of this report.

I. Clement, D. Pilkey and E. Sawitzky

Line cutting, geological mapping, and lithogeochmical sampling were completed on a 46 claim unit property in Dublin Township, held by Clement and Pilkey, early in 1992. Subsequently, E. Sawitzky completed a horizontal loop electromagnetic (HLEM) geophysical survey, detailed geological mapping, and a lithogeochmical survey during the remainder of the year. The area had experienced little exploration prior to a lead-zinc-copper discovery by A. Jerome in 1970, in what previously had been mapped as Superior Province. Archean felsic intrusive rocks with numerous, relatively small, detached mafic metavolcanic inliers. The recent exploration activity has outlined a zone of felsic metavolcanic rocks of rhyolitic to dacitic composition, 300 to 500 m wide, rimmed by a peripheral zone of mafic metavolcanic rocks, basaltic to andesitic in composition, up to 400 m wide. The trend of the metavolcanic units is 060°. Sulphide mineralization consisting of sphalerite, galena, pyrite, and pyrrhotite was found within the felsic metavolcanic units, along the same 060° trend. Further detailed geological mapping has been recommended (Pilkey and Clement 1992) [OPAP funded].

Falconbridge Limited

Falconbridge Limited conducted exploration on several properties in the Sudbury area in 1992. Much of this work was done on long-held patented and leased land, thus, detailed information is considered proprietary and confidential.

On the Sudbury Igneous Complex, Falconbridge Limited conducted diamond drilling concentrating in the East Range, particularly near the Norduna Mine and deep diamond drilling at the Nickel Rim Mine.

Substantial diamond drilling continued at the Errington and Vermilion lead-copper-zinc properties in the Sudbury Basin. The origin of this ore is considered to be sedimentary exhalative, and is hosted in the Vermilion Member of the Onwater Formation. Through a joint venture agreement with Royal Oak Mines Incorporated, Falconbridge Limited has earned a 52% interest in the property. Drilling is expected to continue in 1993.

On the "Mirage Project" over the Wanapitei magnetic anomaly, ground geophysical surveys were completed over selected airborne magnetometer (AM) and electromagnetic (AEM) geophysical targets. Results were not as promising as expected (P. Severin, Falconbridge Limited, personal communication, 1992). The company also completed a borehole pulse electromagnetic (PEM) geophysical survey on its 2200 m hole in Sheppard Township. The survey revealed 2 weak anomalies. The first, off-hole, centred at 1130 m in Nipissing diabase close to its lower contact; and the second, in-hole, at 1875 m representing a weakly conductive bed in McKim Formation. Both anomalies represent weak conductors with a low sulphide content (Snajdr and Ravenhurst 1992).

Flag Resources (1985) Limited

Flag Resources (1985) Limited holds 26 000 acres in the area east of Wanapitei Lake. The company currently is the third largest claim holder in the Sudbury District, a position it has held on and off for several years. Some of its land straddles the southwestern parts of the Wanapitei magnetic anomaly.

Flag Resources (1985) Limited completed diamond drilling at 3 separate targets on its holdings over the west end of the Wanapitei magnetic anomaly. Three holes, totalling 1621 m were drilled in 1992. A discussion of 2 of the holes is provided in the "Property Examinations" section of this report [OMIP funded].

R. Graham

Geological mapping, stripping, trenching and a self-potential (SP) geophysical survey were completed by R. Graham on his five-claim property in western Scadding Township. Located approximately 3 km west of the past-producing Scadding Gold Mine, the claims are underlain by Quirke Lake Group metasedimentary rocks intruded by Nipissing diabase. Sudbury breccia, sulphide-bearing and soda-metasomatized diatreme breccia and quartz veins are pervasive throughout all the rock units. Pyrite- and chalcopyrite-bearing samples of diatreme breccia and quartz vein material assayed from 0.19 to 0.46 ounces Au per ton. Stripping and trenching the SP geophysical targets are expected to continue in 1993 (Graham 1990)[OPAP funded].

T. Hanninen and A. Maki

In late 1991, A. Maki discovered auriferous pyrite mineralization in a zone of epidotized Archean (?) gabbro in Marquette Township in an area previously mapped as Archean felsic intrusive rocks of the Superior Province. Subsequent examination revealed a larger gabbroic stock with several sulphide-bearing alteration zones. Results of the exploration program are discussed in the "Property Examinations" section of this report [OPAP funded].

Inco Exploration and Technical Services Incorporated

Inco Exploration and Technical Services Incorporated conducted mineral exploration in several townships underlain by the Sudbury Structure, the majority of work being concentrated on long-held patented ground. Exploration consisted of stripping, trenching, geophysical and geochemical surveys, and diamond drilling.
Deep diamond drilling programs from surface were completed at the McCreedy East Mine, where further exploration continued underground; and at the Victor deposit, where a $40 million shaft sinking program to a depth of 6000 feet has been deferred due to the low price of nickel. Deep diamond drilling was also conducted on the Trillabelle occurrence for copper-rich footwall ore, and in the vicinity of the Crean Hill Mine.

Ground geophysical surveys (GM, IP) were conducted over claims underlain by the East Bull Lake differentiated mafic intrusion, testing for Ni-Cu-PGM sulphide mineralization.

An option agreement covering the formerly producing Nickel Offsets Mine with co-owners United Reef Petroleums Limited and Canhorn Mining Corporation, was terminated after recent ground geophysical surveys failed to determine the downdip expression of the Foy Offset dike. Inco would have been able to earn 55% ownership in the property by spending $2 million by 1992.

Manitou Stone (Canada) Incorporated

Manitou Stone (Canada) Incorporated conducted stripping and bulk sampling of their “Coral Stone” dimension stone prospect in Shabinaning Township. The rock is a leuco-gabbro-norite with abundant plagioclase cumulate texture (Photo 15.1). This is the basal unit of the East Bull Lake–Shakespeare–Dunlop gabbro-anorthosite intrusion, with an approximate age of 2.5 Ga (D. Peck, Laurentian University, personal communication, 1992). Test quarrying of the “Coral Stone” site proved disappointing due to high fracture density. Another site, termed “Galaxy Stone”, also in Shabinaning Township, will be assessed in 1993.

R. Palkovits, M. Palkovits and F. Palkovits

A three-hole diamond drilling program, totalling 335.3 m, was completed on the Palkovits property in Davis Township. Drill core intersected brecciated and soda-metasomatized Gowganda Formation argillite containing fracture-filled pyrite and chalcopyrite. Diamond drill hole P92002 intersected a pyritiferous zone bearing 6.78 g/t Au over 0.94 m at a depth of 38.64 to 39.58 m, and hole P92003 revealed anomalous gold mineralization throughout its length of 80.0 m (Activation Laboratories Limited). The property is located immediately south of the Norstar gold-copper mine, which produced 10,600 ounces Au and 990,000 pounds Cu (Graham 1990)[OPAP funded].

Stralak Resources Limited

This Sudbury-based junior mineral exploration company continued its long-term exploration commitment at its Stralak Pb-Zn-Cu deposit in northeast Craig Township. According to Shklanka (1969), the property had reserves in the East Zone estimated at 363,680 tons grading 3.18% Zn, 0.32% Cu, and 0.68 ounces Ag per ton over an average width of 8.6 feet to a depth of 157 feet. Since then, substantial diamond drilling has increased reserves to 800,000 tons in 3 zones, averaging 4% Zn, 0.3% Cu, 0.5% Pb, and 2 ounces Ag per ton, according to company press releases in 1992. The company completed a downhole pulse EM survey and encountered two conductors that were the subject of the 1992 diamond drilling program. The results are presented in Table 15.3 [OMIP funded].

T. Poupore

T. Poupore continued to evaluate several Espanola Formation limestone (“marble”) prospects in Grigg and Scadding townships that were acquired in 1991. Road construction and minor stripping were completed this year, and crushed decorative aggregate may be produced in 1993 [OPAP funded].

Teck Explorations Limited

Teck Explorations Limited completed a reconnaissance geological survey, lithogeochemical sampling, and petrographic studies on its 233-claim unit property in eastern Sheppard and McCarthy townships, underlain by part of the Emerald Lake magnetic anomaly, also referred to as the Wanapitei magnetic anomaly. The dominant rock unit on the property is massive wacke, mudstone, and siltstone of the Gowganda Formation. This unit has been intruded by grey to grey-black, medium-grained Nipissing diabase. Both units have in turn been intruded by olivine diabase dikes. Extensive, long-term faulting (pre-Huronian, post-Huronian, post-Nipissing, and post olivine diabase) has produced a series of horsts and grabens in the region. Despite this faulting, no areas of intense soda-metasomatism were observed in hand specimens or from geochemical results. However, subsequent thin-section analyses revealed partial albitionization and hematization of 14 samples. This may suggest that these samples may be proximal to more extensively altered and possibly mineralized rocks in the area (Schandl 1992). Sudbury Breccia was noted in the Gowganda Formation and Nipissing diabase. The only significant mineralization discovered on the claims to date has been the Sirola showing, which hosts...
irregular pods of disseminated and blebby pyrrhotite and chalcopyrite in Nipissing diabase over a strike length of 240 feet. The best intersection from drilling was 17.2 feet assaying 0.28 to 0.85% Cu and 0.04 to 0.20% Ni (Shklanka et al. 1992).

PROPERTY EXAMINATIONS

Battersby Creek (Boot Lake) Gold Occurrence

The Battersby Creek or Boot Lake gold occurrence was discovered by A. Maki, in November 1991, while prospecting blasted outcrops along a recently upgraded logging road constructed by E. B. Eddy Forest Products Limited. The occurrence is located in southwest Marquette Township, at UTM co-ordinates 440010E 5223550N or lat. 47°05'N and long. 81°47'W. It can be reached by travelling approximately 120 km north from Sudbury on Highway 144, then west for 10 km on the logging road. It is located on the north and south sides of the road, in a small rock cut atop a relatively steep hill.

The area has moderate relief, dominated by rock knobs, minor scarps and long, narrow, north trending lakes. Lower, swampy ground is predominant in the northern part of the township. Outcrop exposure varies from 5 to 25%. Forest species are primarily jack pine, black and white spruce, and some balsam.

No detailed geological maps or reports exist for Marquette Township or the surrounding area. There are no existing records of exploration on file at the Sudbury Resident Geologist's office. Ontario Geological Survey Map 2361 (Card and Lumbers 1977) indicates the area is underlain by Archean granitic and migmatitic rocks of the Superior Province. Upon the discovery of sulphide mineralization in freshly exposed outcrop, a 16 claim unit was staked and recorded in the names of A. Maki and T. Hanninen.

Card (1979) described these rocks as being part of the Algoma plutonic domain, a series of large, coarse-grained, granitic to monzonitic intrusions emplaced some 2.5 Ga or more ago. Foliated and gneissic rocks of felsic composition are also present, and may represent an older intrusive event deformed by regional metamorphism of the Kenoran Orogeny.

On the Maki–Hanninen property, the felsic unit is granodioritic in composition, massive, coarse-grained equigranular, and weather light grey to pink. The pink unit tends to be porphyritic locally and contains biotite in the range of 5% to 10%, whereas the grey unit lacks appreciable biotite. The felsic unit appears to be intruded by a massive, elliptical metagabbro stock, approximately 1 by 2 km in size, trending north-northeast. The metagabbro is composed primarily of coarse-grained amphibole pseudomorphing after pyroxene with saussuritized plagioclase, quartz, epidote, and accessory opaque minerals (iron oxides and sulphides). This unit may be similar to late Archean mafic plutons 40 km south in Gilbert and Ouellette townships, described by Card and Innes (1981). Nodular plagioclase similar to that observed in the Paleoproterozoic East Bull Lake and Shakespeare–Dunlop differentiated mafic intrusions is exposed on the east shore of Boot Lake, in the northern part of the metagabbro. These intrusions have been related to the Matachewan dike swarm, which have a given age of approximately 2.5 ± 0.1 Ga (Peck et al. 1992; Card and Innes 1981).

The eastern contact of the metagabbro with the felsic intrusive rocks is gradational and approximately 200 m wide. It may represent a zone of assimilation of the country rock or possibly a magmatic differentiate. To the west, the metagabbro lies in fault-contact with the felsic intrusive rocks and to the south the contact has been obscured by a 1 to 5 m wide lamprophyre breccia. Van Schmus (1965) has indicated lamprophyre breccias in the Blind River area are approximately 1.4 Ga. The metagabbro has also been intruded by at least two, 1 to 3 m wide, northwest-trending olivine diabase dikes. These late mafic dikes are approximately 1.2 Ga (Card and Innes 1981).

A north-trending zone of intense epidote alteration 0.3 to 1 m wide, and containing minor medium-grained pyrite and chalcopyrite, was observed within the metagabbro in late 1991. Subsequent grab samples of this zone consistently assayed 0.08 to 0.12 ounces Au per ton (Temiskaming
Testing Laboratories, Cobalt). The epidote alteration zone lacking pyrite mineralization, failed to reveal the presence of gold. Adjacent to this zone and within the metagabbro, moderately disseminated pyrrhotite and chalcopyrite were noted. A grab sample from this location reportedly assayed 4% Cu (Inco Limited, Copper Cliff).

During the year, Maki and Hanninen conducted manual and mechanical stripping and lithogeochemical sampling in the area of the epidote alteration zone. Prospecting on the remainder of the claim unit was conducted, but with limited results, as no new mineralized zones were located. However, massive epidote-bearing float was common north of the main showing. The origin of the sulphides is currently undetermined, but may be the result of remobilization and concentration of sulphides by a heat source such as a late mafic olivine diabase dike.

The northern and western extent of the metagabbro stock has yet to be defined and there is high potential for other such stocks locally, possibly containing Ni-Cu-PGM mineralization. The rock could also provide a target for dimension stone or crushed landscape aggregate, due to its dark greenish-black colour. A similar stock may exist 15 km west in Bazett Township, as indicated by a strong geophysical expression interpreted on OGS Map 2419 (Giblin 1979). Future exploration work will consist of detailed mapping of the mafic stock, expanded trenching of the epidote alteration zone, lithogeochemical sampling for PGM, and reconnaissance mapping for similar structures. The 1992 exploration program was funded by OPAP.

**Big Swan Copper-Gold Skarn**

The Big Swan Cu-Au occurrence was discovered by M. Turcott and D. Brunne while prospecting along a power transmission line, south of Big Swan Lake, Porter Township, in 1991. The occurrence is located at UTM co-ordinates 440200E 5138000N, or lat. 46°24'N and long. 81°46'W, MDI S1216, approximately 15 km north of the town of Espanola. Road access to the property is limited, and it is best reached by float plane from Agnew Lake to O'Brien Lake, then by foot approximately 1 km northeast on the power transmission line. The main occurrence is located approximately 200 m north of the line.

The area has moderate to high relief, dominated by steep ridges and plateaus underlain by quartzite and mafic intrusive rocks. It is generally well-drained, and small pothole lakes are common. Outcrop exposure is highly variable. Forest growth includes mixed hardwoods with minor pine and spruce.

Porter Township was mapped by the Ontario Department of Mines during the years 1956–58 at 1:12 000 (Ginn 1961), but little other published material exists. The Falconbridge Limited Shakespeare prospect is located 5 km southwest of the Big Swan occurrence, where exploration in 1951 outlined 3 to 4 millions tons of rock averaging 0.34% Ni and 0.40% Cu with minor amounts of PGM hosted in highly sheared Nipissing (?) gabbro (Card and Palonen 1976). The Big Swan property consists of 2 twelve-claim contiguous blocks currently held by M. Turcott and D. Brunne.

The surrounding area is underlain by Huronian Supergroup metasedimentary rocks, primarily units of the Quirke Lake Group. These units have been intruded by discordant sills of medium- to coarse-grained gabbro interpreted to be Nipissing diabase. Both the metasedimentary and intrusive units have in turn been folded about an axis trending approximately 060° and plunging northeast in the structure known as the Porter Syncline. Northeast-trending faults are numerous, and often terminate and significantly displace the units they intersect (Ginn 1961).

The Big Swan copper-gold occurrence is located at the contact of the south flank of a gabbro with an argillaceous carbonate unit of the Espanola Formation. Contact metamorphism by the gabbro has resulted in what appears to be a skarn-type mineralization, common in similar units between Sudbury and Elliot Lake. For the most part, the mineralization is controlled by relict bedding planes within the carbonate unit. At the contact, the carbonate unit has been metamorphosed over a 3 to 5 m wide section to hornfels (exoskarn) and hosts massive to strongly disseminated pyrrhotite and chalcopyrite. Grab samples of this material have indicated values of 1% Cu, 0.26 ounces Au per ton, and anomalous nickel, zinc, and cobalt (Accurassay Laboratories, Kirkland Lake). Mineralized beds tend to be undeformed, while unmineralized beds display strongly contorted folding. Gangue minerals of the exoskarn include epidote, axinite, chlorite, andradite, calcite and vesuvianite (idocrase). The altered gabbroic unit (endoskarn) is moderately silicified and hosts massive to finely disseminated pyrrhotite, chalcopyrite, arsenopyrite and pyrite. The gabbro becomes unmineralized 10 to 15 m from the contact, but again becomes enriched in a zone 25 m from the contact. This endoskarn zone contains finely disseminated pyrite, pyrrhotite and chalcopyrite. A grab sample from this rock assayed 0.17 ounces Au per ton (Temiskaming Testing Laboratories, Cobalt).

This mineralized zone is exposed for 90 m and over a width of at least 15 m along the contact between the 2 rock units. Similar mineralization was observed in small shallow outcrops 1500 m to the east. The strike and dip of the contact at the main zone are 040°/55°S, although the strike varies locally and the dip becomes shallower to the east. Fault structures through the property may control mineralization not directly associated with the main zone.

Turcott and Brunne completed stripping and sampling much of the main zone in late 1991 and early 1992. Further work should include detailed mapping and mineralogical studies of the contact zone intrusive, which may be correlated with other mafic intrusive units in the area. Channel sampling on the main zone will also provide better information on the control on gold mineralization. The potential strike length for similar mineral occurrences in the area is great, and all contact zones of Espanola Formation with mafic intrusive rocks should be investigated. Base and precious metals potential within the mafic intrusive rocks should also be given consideration. The 1991 exploration program was funded by OPAP.
Richardson Lake (T. Holmstrom)

This Pb-Zn occurrence, originally discovered in the 1930s, was the subject of intensive exploration by Bharti Laamanen Mining Incorporated in 1992, after a company geologist located old trenches on the property 2 years previous. Interest in the area was sparked by a copper-silver discovery in the area by T. Miron, prospector, earlier that same year.

The property is located on the west side of Richardson Lake, central Rhodes Township, at UTM co-ordinates 478000E 5196900N, or lat. 46°55'N and long. 81°24'W. Access is by Hwy. 144 north from Sudbury for a distance of approximately 75 km, then east on the Dunbar Road of E. B. Eddy Forest Products Limited for 31.5 km where a well-marked trail leads to the occurrence approximately 1.2 km from the Dunbar Road. Access may also be gained by float plane to Richardson Lake. The physiography of the area is of generally low to moderate relief with numerous lakes and swamps. Outcrop exposure is usually less than 5%.

The property consists of 4 contiguous claim units currently held by H. Tracanelli, with outstanding rights entitled to Bharti Laamanen Mining Incorporated for providing exploration funding.

Past exploration history and a detailed description of the regional geology and geology of the original occurrence is described in Cosec and Gates (1992) and Dressler (1980).

In 1992, the company completed an evaluation of detailed soil geochemical and geophysical surveys initiated the previous year. Subsequently, stripping and trenching revealed the presence of several interconnected, sulphide-bearing gossan zones west of the original occurrence. The best exposure of the geology is revealed in the No.1, or westernmost trench (Figure 15.3).

The geology of the No.1 trench reveals a silicified rhyolite breccia hosting a sheared and strongly epidotized massive felsic metavolcanic unit. Within this latter unit is a zone of massive pyrite with moderately to finely disseminated galena and sphalerite. Dendritic psilomelane was commonly observed on fracture surfaces. The mineralized unit is approximately 5 m wide. Grab sample assays from this zone revealed anomalous lead and zinc values, but failed to detect any precious metal mineralization. Also of interest is a silty, carbonaceous unit located on the southern periphery of the mineralized zone, yet contained within the rhyolite. The silt beds within this unit are extremely contorted whereas no such structures are observed in the host rhyolite (Photo 15.2). The carbonaceous unit is less than 1 m wide at this location, but thickens to the southeast to a minimum observed width of 3 m. Analysis of this rock indicates the presence of 9.58% Ca, or ideally calculated, 23.9% calcite (Temiskaming Testing Laboratories, Cobalt). This unit was not previously observed by Dressler during field mapping of the area, and its origin remains enigmatic.

Overlying the rhyolite is a moderately foliated, medium-grained intermediate to mafic metavolcanic unit, metamorphosed to amphibolite facies. Intruding the amphibolite is a 1 m wide medium- to coarse-grained quartz-feldspar porphyry dike, possibly emanating from an unmapped granitic stock located approximately 600 m north of the trench. Foliation in the amphibolite unit becomes stronger at the south end of the trench, and assumes a gneissic appearance. This unit appears to grade into a fine- to medium-grained mafic metavolcanic unit, with little or no foliation. Several metres to the south, the unaltered mafic metavolcanic unit contains rounded to subrounded felsic clasts in what appears to resemble sequences of graded bedding. Three such sequences were observed, each approximately 0.5 m thick. The clasts are up to 3 cm in diameter and slightly elongated with the long axis parallel to the bedding and/or foliation, indicating some degree of strain. The bedding and/or foliation of all the above units strikes from 100° to 110° and dips 70°S to 50°S.

The trenching program was followed by a program of diamond drilling into the known mineralized structure. Four holes, totalling 628 m, were drilled. Two holes intersected the mineralization, but results were not available at the time of writing. Much of the core from all holes appears to be highly silicified and the individual units seem to thicken at depth.

It appears the mineralization is confined to a sheared and silicified contact between the rhyolite breccia and overlying intermediate to mafic metavolcanic units. Future exploration should include detailed geological mapping in order to obtain better understanding on the geometry of this structure and determine its possible continuation along strike, as well as its association with other base metal occurrences in the immediate area. Downhole and additional ground geophysical surveys may also prove valuable in delineating the mineralized zone.

Flag Resources (1985) Limited

Early in 1992, Flag Resources drilled a deep vertical hole at Jones Lake in MacKelan Township, located at UTM co-ordinates 528000E 5187000N or lat. 46°50'N and long. 80°38'W, MDI S1287. The hole was collared on "Cobalt..."
Hill", a prominent breccia zone in Lorrain Formation quartzites, altered through soda metasomatism, and mineralized with sulphides and secondary cobalt minerals (Gates 1991).

The hole was drilled to 2500 feet, with a continual intersection from top to bottom of breccia and soda metasomatized rock. Few sulphide minerals were observed at depth. The company reported concentrations of up to 0.08% cobalt and up to 0.06% nickel in the upper 1500 feet. The lower 1000 feet contained green, chromium-bearing micas, as determined by Falconbridge Limited in their laboratories. The chromium is another unexplained wrinkle in the ongoing saga of Sudbury geology and soda metasomatism in particular.

In October, the company drilled an 807-foot hole at Doon Lake in the northeastern corner of Rathbun Township to test a closed 3000 foot long airborne and ground magnetic and VLF anomaly.

Having been collared near a mapped contact with Lorrain Formation, the hole drilled through argillites and small
amounts of conglomerate, thought to belong to the uppermost Gowganda Formation. Almost the entire section of core is magnetic.

Massive magnetite occurs in up to 2 cm wide veins which can be traced on surface for tens of metres (F. Toews, personal communication, 1992). It also occurs as coarsely, jagged, needle-like grains with pyrite in steeply dipping veins up to 5 mm wide within the drill core. Thin sections of drill core show it to occur as extremely fine, disseminated grains throughout the rock as well.

The distribution of iron in the Huronian Supergroup shows some interesting broad variations from bottom to top, similar to those within the Witwatersrand.

From the base of the lowest stratigraphic horizon, the Livingstone Creek Formation, to the top of the Serpent Formation, magnetite occurs almost exclusively as sulphides, mostly pyrite. An abrupt change takes place at the base of the Gowganda Formation. Iron in the lowermost Gowganda Formation occurs most commonly as magnetite. Towards the middle of the Gowganda Formation hematite becomes common, giving rise to the earliest red beds, and becomes the most abundant iron mineral in the Lorrain Formation.

The source of the magnetite in Flag Resources' drill hole at Doon Lake is an odd situation that currently remains unexplained. The narrowly defined magnetic anomaly suggests that the magnetite has limited lateral continuity in the upper Gowganda Formation argillites, but the drilling indicates it has several hundred feet of vertical continuity.

This, and the magnetite occurring as veins, points to the magnetite being secondary in origin, not detrital. The core shows few other signs of alteration.

Perhaps the anomalous metal concentrations in the Jones Lake hole, and the secondary magnetite under the small magnetic anomaly at Doon Lake, are manifestations of a mafic intrusion at depth which may explain the Wanapitei magnetic anomaly.

RECOMMENDATIONS FOR EXPLORATION

The Sudbury area, being a mature mining camp, offers many exploration opportunities for prospectors and junior and senior mining companies. Some of these, because of their cost, are only within reach of well-financed companies, but every year new surface workings worth further investigation are being found. These, and new ideas which are being developed, continue to offer the prospector opportunities to find that promising showing which he can stake, upgrade, and offer for option.

Wanapitei magnetic anomaly

This is an area of an intense anomalous magnetic signature northeast of Wanapitei Lake. Its size (60 by 30 km) and oval shape makes it similar to that which accompanies the Sudbury Structure. However, its intensity is several times greater than that of the Sudbury Structure.

Due to extensive Huronian metasedimentary rock cover, the anomaly cannot be explained by the rocks at surface, and drilling to date suggests that its source must lie at considerable depth. Being so similar in size and shape, and proximal to the Sudbury Igneous Complex, suggests that there may be a mafic intrusion at depth which is genetically related to the Sudbury event, and which, similarly, may host Cu-Ni-PGM sulphide deposits. The anomaly has intrigued exploration geologists and the scientific community for several decades.

The exploration target thus becomes a hypothetical, post-Huronian intrusion, similar in size and age, to that of the Sudbury Structure. It, in all likelihood, has an irregular upper surface, so that at any one point the top may lie within Huronian rocks, or below Huronian rocks deep within underlying Archean granites and greenstones.

The point to be made is that the top of this hypothetical intrusion is the first order exploration target, and not the Huronian–Archean unconformity. Questions such as "How thick is the Huronian cover at this point?" are often asked, but may not be relevant.

The eastern half of the anomaly lies within the Bear Island Indian Band land caution, and is currently not available for staking. Three companies, Falconbridge Limited, Teck Corporation, and Flag Resources (1985) Limited have staked most of the western half.

In 1991, Falconbridge Limited drilled a hole to 2200 m in Sheppard Township on the north flank of the anomaly. The hole bottomed in rocks of the Huronian Supergroup. A 762 m hole drilled by Flag Resources (1985) Limited (see above) in central MacKeland Township, was drilled on the south flank of the anomaly. It was collared on a sulphide-rich soda alteration zone with secondary cobalt minerals at surface. This hole too bottomed in rocks of the Huronian Supergroup. The lower 300 m of the hole are interesting in that the core contains green chromium-rich micas.

Drilling to date clearly indicates that the source of the Wanapitei magnetic anomaly may lie at considerable depth below surface. It can only be hoped that one of the companies that now holds ground, or a consortium of companies, will soon drill the decisive hole which will explain the anomaly, and in the process possibly find a "second Sudbury camp".

Soda Metasomatic Alteration Zones

These have formed part of an ongoing study by staff of the Sudbury Resident Geologist's Office for several years, although little progress in unravelling their mystery was made in 1992.

Zones of intense albite alteration are found in an area broadly coincident with that part of the Sudbury Structure
which lies outside the Sudbury Igneous Complex, and which is characterized by areas of intense brecciation. Rocks most commonly affected are sedimentary rocks of the Huronian Supergroup and Nipissing diabase.

The soda alteration zones have been dated at about 1.7 Ga (Schandl et al. 1992), and thus are younger than the Sudbury Structure by about 150 million years. Whether or not there is a genetic link between the 2 events remains to be established.

The alteration zones are mostly fine-grained and pink or tan coloured, and are easily recognized visually. They are variably associated with brecciation, further alteration characterized by coarsely crystalline calcium-magnesium-iron carbonates, chlorite, sulphides, and magnetite. Anomalous metal concentrations most commonly found are gold, copper, cobalt and nickel. A deep hole drilled in 1992 intersected about 300 m of albitized rock with green chromium-rich micas. Lead and zinc do not appear to be associated with these alteration zones, and platinum group metals have not been detected either.

Two small past producers, the Scadding Gold Mine in Scadding Township, and the Norstar Au-Cu Mine in Davis Township, were closely associated with soda alteration zones. Remapping of many old showings east of Wanapitei Lake (Gates 1991) has shown that most old showings are associated with ubiquitous albite alteration, a phenomenon not appreciated years ago.

These alteration zones continue to be an easily recognizable and attractive exploration target for prospectors and exploration companies.

**Footwall of the Sudbury Igneous Complex**

In 1985, Falconbridge Limited discovered a small, but rich, Ni-Cu-PGM orebody in the footwall of the Sudbury Igneous Complex at the Lindsay property. Inco Limited continued to explore a Ni-Cu footwall zone at the Victor deposit about 2440 m below surface. At the Strathcona Mine, Falconbridge Limited mines footwall ore about 600 m from the contact zone. Strictly speaking, the Frood-Stobie orebody, which lies about 1000 m from the contact, must be regarded as a footwall orebody.

This begs the question how deep into the footwall can these deposits be found, 600 m, 6000 m, 60 000 m? If an answer is known to this question, it is not known to this office. Footwall deposits appear to be injection phenomena coming off the main contact ore and penetrating into breccia zones below. Sudbury breccias have been found up to 80 km from the contact. Systematic exploration of the footwall thus opens up a new dimension.

Life was simple when the base of the Sudbury Igneous Complex was the sole exploration target. In essence, it was a case of intersecting the contact, drill a few metres into the footwall, and stop drilling. With more footwall ore being found, the footwall becomes an exploration target in its own right. However, the problem shifts from being planar and two-dimensional to being a three-dimensional volume problem, with perhaps an exponential increase in cost.

**Building Stone**

In 1988 and 1989, K. Lacey completed a field study funded under COMDA, of the building stone potential in the Sudbury District. He found that granites and gneisses south of the Grenville Front are generally less fractured than the more variable rock types of the Superior and Southern provinces north of the front. From a tectonic point of view, these observations make much sense. The rocks to the north are older, and have experienced several more periods of tectonic deformation.

Subsequent field investigations have mostly supported Lacey's observations. However, we now find that 1 sedimentary formation within the Huronian Supergroup north of the front, may run counter to Lacey's general findings for granites and gneisses.

Several promising building stone prospects have been found in the past 2 years in the Espanola Formation north and east of Sudbury. The Espanola Formation, can be traced from near Sault Ste. Marie to the area north and east of the Sudbury Igneous Complex, a distance of approximately 300 km. It is mostly drab grey, well-bedded limestone, siltstone, or dolostone.

In an area around the Sudbury Igneous Complex, which appears to be coincident with the area of Sudbury brecciation, areas may be found where the Espanola Formation is highly altered.

Examples of this are soda metasomatic alteration with associated metallic minerals, described above, skarn development as evidenced by a large scheelite deposit east of Espanola, replacement by magnetite as at Cartier, or simple brecciation and recrystallization, as now found in Parkin, Grigg and Scadding townships.

These latter areas of brecciation and recrystallization have yielded some attractive and very solid appearing sample tiles which should become of interest to the building trade.

More investigation of the Espanola Formation around the Sudbury Igneous Complex is warranted in areas of alteration for a) their metallic minerals, and b) for their building stone potential.
Formation are excavated in a single lift of about 17 m. The marine quarry in Canada at the western end of the island in Dawson Township. Massive bedded dolostones of the Amabel reported. They have identified 9 recurring rock types, which Amabel Formation to be more complex than previously 3 active quarries on Manitoulin Island.

The study area encompasses the mainland mass of Manitoulin Island which is bounded by the shorelines of the North Channel, Georgian Bay, Lake Huron, and Mississagi Straight. It is covered by the following 1:50 000 NTS sheets: Meldrum Bay (41G/14), Silver Water (41G/15), Providence Bay (41G/9), Kagawong (41G/16), Manitowaning (41H/12 and 41H/11), and Little Current (41H/13).

Project objectives are to test for high quality carbonates and other potentially economic industrial mineral deposits by compiling, analyzing and re-interpreting existing data. Areas identified as having potential will be further tested by mapping, sampling and chemical analysis.

Through this study, a comprehensive database will be developed for use in land use planning. Areas exhibiting potential for selected commodities will be identified with the anticipated benefit for diversification of the economic base of Manitoulin Island. The project was recently described by Gates (1992).

Manitoulin Island is underlain by Paleozoic rocks that range in age from the Middle Ordovician Verulam Formation to the Middle Silurian Amabel Formation. Several small Precambrian quartzite inliers, belonging to the Huronian Supergroup, occur in the Sheguiandah area.

Located on the northern edge of the Michigan Basin, the Paleozoic units dip gently southward at about 6 m per km. Ordovician strata consisting of limestones, dolostones, and shales occur on the north side of the island and account for about 25% of the land area. Silurian strata, consisting of mostly dolostones and some shales, occupy the remainder of the island. Mapping by Johnson and Telford (1985) found the Amabel Formation to be more complex than previously reported. They have identified 9 recurring rock types, which they grouped into 4 facies associations. At present, there are 3 active quarries on Manitoulin Island.

Standard Aggregates Incorporated operates the largest marine quarry in Canada at the western end of the island in Dawson Township. Massive bedded dolostones of the Amabel Formation are excavated in a single lift of about 17 m. The quarry has been operating since 1980 and supplies chemical grade stone (30%) and construction grade aggregates (70%). The stone is shipped by lake freighter, from a dock adjacent to the quarry, to United States and Canadian markets over an eight-month shipping season. A total of 94 boats arrived at the quarry in 1992 and shipped approximately 2.0 million t.

Hercules Stone Limited supplies both natural jointed blocks of Amabel Formation and glacially polished, thin bedded dolostone of the Manitoulin Formation for use as landscaping stone in the Sudbury–Manitoulin area. Production is intermittent, on an as required basis.

CURRENT PROGRAM
A review is being made of geological reports concerning Manitoulin Island. Included in this review are reports outlining the physical and chemical requirements for the many uses of carbonates and shales.

Chemical analyses for 2449 surface samples plus selected core samples from 29 diamond drill holes on Manitoulin Island are contained in 2 open file reports (Johnson and Telford 1981; Johnson 1983).

To outline potential areas for high purity—chemical grade dolostone, sample locations with SiO₂ less than 1.0% and SiO₂ less than 2.0% were plotted along with analyses of total impurities. Several potential areas of high purity stone, associated with 2 facies of the Amabel Formation, have been outlined. Other criteria such as topography, potential harbour sites, depth of overburden, formation thickness, will be considered prior to the selection of sites requiring detailed sampling in 1993.

The criteria for high-purity limestone, to be used in the manufacture of lime, are a CaO content greater than 52% and a MgO content less than 1.75%. No previous samples have met this standard.

The requirements for cement are 1) to use high-purity limestone and blend in clay or shale, silica, gypsum, and iron oxide to produce a mixture of the proper chemical composition or, 2) to use an argillaceous limestone (cement rock) which contains the ingredients for cement manufacture near the required amount. No samples of high-purity limestone were reported. The requirement for cement rock is a limestone with MgO less than 2.5%, SiO₂ less than 13%, and Al₂O₃ less than 3.7%. A total of 112 Ordovician samples representing surface and drill core samples were analyzed by Johnson. Only 1 sample contained less than the maximum allowable 2.5% MgO content. Five other samples contained MgO in the range 2.86 to 4.17% and met the other criteria. Surface samples were collected for analysis in 1992, in the
area of the previous samples, to confirm the chemistry and to determine the areal extent of the possible "cement rock". Ten samples were also collected from OGS Hole M79–10. This hole is located near 1 of the earlier samples and represents a typical section of the Georgian Bay Formation that would be encountered in quarrying.

Outcrops are also being evaluated for their building stone potential.

**Industrial Minerals and Building Stone in the Districts of Nipissing, Parry Sound and Sudbury**

C. Marmont, Geologist, Algonquin Resident Geologist's office, Dorset, continued field work in the second year of a programme to evaluate the economic potential of industrial minerals and building stone in the district of Parry Sound and parts of the districts of Nipissing and Sudbury. Results of the first and second year's work have been reported by Marmont (1991b, 1992). Five weeks of field work were completed in the Sudbury Resident Geologist's District during 1992, evaluating anorthosite as a potential source offeldspar.

Anorthositic feldspar is a possible source of alumina; a potential feedstock for the ceramics, glass, filler and insulation industries; and a potential dimensional stone (Dolan et al. 1991). Dolan et al. (1991) also reported that anorthosite containing feldspar having a Si:Al ratio lower than 1.5 is suitable for certain chemical applications. Such feldspars have anorthite contents greater than about An70, and occur in layered anorthositic bodies, commonly of Archean age. Less anorhtitic plagioclase feldspars (An40–60) occur in massive-type intrusion which are typical of the Canadian Grenville Province.

In light of the report by Dolan et al. (1991), a coordinated provincial programme was initiated to evaluate anorthositic feldspar resources. As part of this effort, C. Marmont conducted field evaluation of anorthosites in the Sudbury–North Bay–Mattawa region. In due course, beneficiation tests will be commissioned, and laboratory evaluation of the suitability of Ontario anorthosites for chemical, ceramic, glass and filler applications undertaken.

In the Sudbury Resident Geologist's District, anorthosites of both massive and layered type occur. The River Valley and Red Deer anorthosites are probably of the layered type, while the St. Charles, Mercer and Pickerel River anorthosites are of massive type. The affinity of a small body on the east side of the Wahnapitei complex is uncertain at present.

Aerial photograph interpretation of all bodies was undertaken in order to identify large outcrops. The bodies were then traversed in an attempt to identify significant areas of clean anorthosite. True anorthosite (Buddington 1939) is defined as that containing more than 90% plagioclase feldspar; the balance commonly being pyroxene or hornblende (± olivine, ± biotite). For an anorthosite to have potential commercial applications, it would likely need to be purer than 95% plagioclase. Because plagioclase weathers to a white colour, the composition of anorthositic rocks can usually be measured on clean outcrop surfaces, and expressed as colour index.

No significant volumes of anorthosite were observed during the summer's work. The River Valley and Red Deer bodies are mainly anorthositic gabbro, with substantial amounts of gabbroic anorthosite. Nothing could be mapped as anorthosite on an outcrop scale: only as erratic patches within a more mafic host. Thin (1 or 2 m) layers thick occur within shear zones which transect the River Valley body.

The St. Charles anorthosite is fairly consistent in composition, being predominantly a gabbroic anorthosite with a colour index around 15. Locally the colour index is as low as 7 or 8, but no substantial volumes of such material appear to be present.

The Pickerel River anorthosite is also a fairly uniform gabbroic anorthosite with a colour index of 15. Locally anorthositic layers a few centimetres thick occur in recrystallized zones. Gabbroic phases are locally present.

The Mercer anorthosite is essentially a gabbroic anorthosite, but several areas, well exposed in prominent white outcrops, have colour indices of 10 to 12, approaching anorthosite, *sensu stricto*.

On the basis of field observations during the summer of 1992, it appears that none of the anorthosites studied is a suitable source of plagioclase feldspar. However, petrographic and geochemical studies will be completed over the winter, and further work will be predicated on these results.

**RESIDENT GEOLOGIST'S STAFF AND ACTIVITIES**

**Staff**

The following staff were assigned to the Sudbury Resident Geologist's Office in 1992.

1. W. Meyer, Resident Geologist.
2. M. Cosec, Staff Geologist.
3. T. Livingstone, Secretary.
4. B.I. Gates, Staff Geologist–Industrial Minerals Geologist. B.I. Gates was on contract from January to March working as a Staff Geologist and from June through December as an Industrial Minerals Geologist in the NODA program.
5. R. Komarechka, Geological Assistant. R. Komarechka was on contract from January to March as a geological assistant to complete the Geoscience Exploration Database program.
6. M. Nurmikivi, Experience '92. M. Nurmikivi, hired under the Experience '92 program from June to September, was a field assistant to W. Meyer and M. Cosec.
Activities

Staff of the Resident Geologist’s Office responded to approximately 4100 telephone and 1900 office inquiries regarding sample identification, assessment work, mineral occurrences, mineral potential, geology of the area, government programs, land use planning, and a host of other topics. Staff offered advice and assistance to property owners both in the office and in the field.

R. Komarechka completed the Sudbury portion of the Geoscience Exploration Database (Mineral Deposit Inventory) project by the end of March. The program was released for sale through our ministry in both DOS and ASCII versions in August.

In March, a talk to staff and the public by Italian consulting geologist Dr. G. Porro injected a healthy sense of realism into what we can expect from our venture into building stone.

In April, staff participated in the Northeastern Region Mineral Resources Symposium in Timmins. The poster display was entitled “Exploration, Development and Mining Activity in the Sudbury District”.

In late April and early May, staff presented the annual 18 hours of prospector classes. Ministry staff included M. Cosec, R. Denomme, W. Meyer, and E. Solonyka. Facilities were provided free of charge by Cambrian College. R. Junnila, D. Potvin, and T. Insinna from Cambrian College, J. Cecchetto, Falconbridge Limited (Exploration), and E. Pattison, Inco Exploration and Technical Services Incorporated volunteered time to instruct the class. We wish to thank everyone who helped to contribute to the success of the course. A one-day field trip was also given to the participants of the prospectors classes.

Early in summer, the Resident Geologist had 2 accidents within 1 month, both of which resulted in personal injuries, but no lost time. However, he had to curtail activities in the field.

Through the summer, we had several contacts with visiting Ecuadorean visitors. Mr. J.R. Nicolalde, from the Ecuadorean Ministry of Mines and Energy, and a student for 1 year at Cambrian College, spent 1 week in May in this office, participating in a variety of office and field activities. Other Ecuadorean visitors, including 3 teachers, spent several hours with us to get a broad overview of the functions of a Resident Geologist’s Office.

In June, during Mining Awareness Week, we co-hosted an Open House with the Mining Recorder’s Office. Our display highlighted how minerals make our lives better. We planned to give office tours and answer questions; however, only a few people ventured in, perhaps due to a restricted amount of advertising.

Completing any field work in the summer of 1992 was quite a challenge; June alone had 21 rain days. In spite of the rain, staff still managed to give many tours across the Sudbury Structure. A few of the groups and individuals are listed below: Dr. T. Akada from the Geological Survey of Japan; 33 mining engineering students and 6 faculty members from the University of Turin, Italy; T. Lane of Teck Corp., St. John’s, Newfoundland; second-year geology and mining engineering technology students from Cambrian College; students and faculty from the University of Pittsburgh; senior students of Upper Canada College and Bishop Strachan School; a Chinese delegation; faculty from the University of Waterloo; and about 20 geologists and geophysicists from BHP Minerals’ worldwide operations, who had chosen Sudbury for their annual one-week program review meeting, and some field and mine tours. As well, several dimension stone tours were conducted for various groups.

Staff set up and tended a three-day display at the Sudbury Gem and Mineral show in July at the Carmichael Arena. This involved answering questions, mineral indentification, providing MNDM handouts, distributing free mineral samples from Inco’s Frood Mine for children, as well as conducting free raffles for publications, including “The Geology and Ore Deposits of the Sudbury Structure”, and English and French versions of “A Vast and Magnificent Land”.

A forest fire in Roberts Township offered a geological puzzle in July. Ministry of Natural Resources (MNR) fire crews found a lump of rock “the size of a football” (probably nearer in size of a coconut) in a hollow on top of a smoldering yellow birch trunk, 3 m above ground. This turned out to be friable carbonate precipitate, looking somewhat like travertine, with charcoal and evergreen needles embedded in it. Similar carbonate precipitate was also found in unburned peat moss at the base of the tree. The tree stands in a swamp, away from any rock outcrops. We still do not have a satisfactory explanation for this strange phenomenon. One explanation may be that the swamp covers a carbonatite. Humic acids dissolved carbonate, and this then precipitated in the peat moss near surface. But this cannot explain how it also got on top of the tree stump, 3 m above ground. Some laboratory work is to be done on the carbonate in 1993. The use of carbonate precipitate in peat moss over swamps as a possible guide to carbonatites below needs to be further evaluated.

In July, staff gave a one-hour talk on general geology to campers at the Half Way Lake Provincial Park. About 80 persons attended.

Also in July, staff accompanied representatives from the Ministry of Labor and officials from the Town of Walden on an inspection of the former Kidd Copper Mine in Denison Township. Cleanup work has since started.

In August, we were invited to accompany MNR staff to inspect and comment on an area of kettle lakes located in an area of intense gravel extraction near the Sudbury airport. MNR had to decide on an application to extend a gravel extraction permit which would encroach on one of the lakes with exceptionally steep and high walls. Past gravel operations had already severely impacted on this rather striking feature, so that full rehabilitation did not look feasible. More care will be taken with the remaining kettle lakes.
In late summer, a group of faculty from the University of North Carolina visited the office at the end of a university-sponsored field trip. They were pleasantly surprised by the quantity and quality of information available in an Ontario Resident Geologist's office.

For the first time since 1982, we did not host an aerial tour for high school teachers, and this we found to be regrettable. Due to financial constraints, for the first time in about 15 years, the Ontario Mining Association was not able to offer southern Ontario high school geography teachers a chance to view first hand the value of the mineral industry to Ontario by offering them a tour of northern Ontario mining camps. The one-hour flight over Sudbury area wilderness, mines, open pits, old open air roast beds, mills, and smelters in MNR Twin Otters and Turbo Beavers was proclaimed by many teachers in the past as the highlight of their week-long tour. Over the years, the Ontario Mining Association had noticed a marked change for the better in the teachers' perception of the industry and of the North (Bruce Campbell, Ontario Mining Association, written communication, 1987). We hope that in September of 1993 we may once again take teachers on this highly acclaimed tour, so that they can better convey to their students the value of the mineral industry.

Staff participated in the organization of the Large Meteorite Impact and Planetary Evolution (LIMPE) Conference and attended all functions when this event was held in late August and early September. It marked the first major event in the Ministry's newly available facilities in the Willet Green Miller Centre on the campus of Laurentian University. This international conference was attended by 153 delegates from 16 different countries and had presentations on impacts structures from Earth, Venus, and Mars. Although most delegates embraced an impact origin for the Sudbury Structure, the origin of the Cu-Ni-PGMs remains debatable.

In early October, staff attended all functions at the Sudbury–Noril'sk Symposium, the second major international conference to be held within 1 month at the Willet Green Miller Centre. Listening to 8 Russian scientists describe the Noril'sk camp was very interesting. The simultaneous Russian–English–English–Russian translations were a novel experience.

We also attended other events which were part of the Sudbury–Noril'sk symposium, such as an Inco Limited sponsored reception and dinner for the Russian geologists, a discussion evening sponsored by the Sudbury Geological Discussion Group and a field trip to the East Bull Lake Intrusion led by staff and students of Laurentian University.

Throughout the year, we worked with staff from other branches of our ministry and from other ministries on a variety of land use issues. Some of the more significant ones included the Temagami Caution, the McGregor Subdivision at the northeast end of Wanapitei Lake, the Sudbury East Official Plan, the proposed Maley Drive golf course, and issues in the Killarney area. We also worked with staff members from other branches of our ministry on NORFUND, NORT, OPAP and OMIP applications.

B.I. Gates participated, with a poster entitled “Industrial Minerals on Manitoulin Island”, in the Ontario Mines and Minerals Symposium in Toronto in December. The office poster at the symposium was entitled “Mining, Development and Exploration Activity in the Sudbury District, 1992”.

ONTARIO GEOLOGICAL SURVEY–GEOSCIENCE BRANCH ACTIVITIES

A.J. Bajc, Sedimentary and Environmental Geoscience Section, initiated a multi-year study along the North and East ranges of the Sudbury Igneous Complex during 1992 to evaluate the effectiveness of overburden geochemistry for mineral exploration and provide information on the geochemical behaviour of Ni, Cu, PGM, Zn, Pb, and associated elements in the surficial environment. The study area encompasses approximately 1300 km².

Humus, soil, and till samples were collected regionally throughout the study area to obtain background geochemical signatures for materials collected on different bedrock units and evaluate the dispersal pattern. Detailed, property-scale mapping was also conducted at several sites known to contain Ni-Cu-PGM mineralization.

The project is a joint undertaking with the Mineral Resources Division of the Geological Survey of Canada, whose portion is being funded by NODA.

A detailed overview of the project is presented in Bajc (1992).

RESEARCH BY OTHER AGENCIES

The main LITHOPROBE Seismic Reflection Survey was conducted in the fall of 1990. It is an ongoing joint venture between the Government of Canada, the Ontario Government, Inco Limited, Falconbridge Limited, and several universities. About 100 km of low resolution and 40 km of high resolution surveys were carried out.

The results of the 1990 seismic reflection survey were finally published in the September 1992 issue of Geology (Figure 15.4). The profiles show reflectors dipping uniformly south from the North Range of the Sudbury Igneous Complex and the Levack gneisses to a point 10 to 12 km below the South Range. There is no sign of a funnel, no sign of a central or a ring uplift, as might have been expected from a meteorite impact. There may be no central feeder structure at depth.

Reflectors below the South Range are thought to represent southeast-dipping thrust faults. The structure can still be interpreted as a filled meteorite impact crater, but one which has been deformed by upturning of its southern margin and pushing it an unknown distance towards the North Range. If this is correct, the LITHOPROBE profiles will make the original crater much bigger than previously thought. The centre of the original crater must then lie somewhere south of the present South Range. One nagging problem with such undertaking...
severe deformation and lateral translation is the near continuity of rock units at surface.

More reflection surveys are planned. Funding is in place for at least one 20 km section along the northwest bypass from Chelmsford to Highway 17 West. This will be a generally better placed profile than the 1990 north-south section from Dowling past the Lockerby Mine. Being nearer the centre of the structure, it should better define the centre and what goes on at depth below the South Range.

Several spinoff research projects were in progress at the end of the year, and these will continue in 1993.

The results of the LITHOPROBE seismic reflection survey and all spinoff projects can be expected to have quite an impact on future planning for a deep borehole into the Sudbury Structure which is still being considered for the second phase of the Canadian Continental Drilling Program.

The next LITHOPROBE Working Group session is planned to coincide with the Mines and Minerals Division Symposium in December 1993 in Toronto.

R. Mereu of The University of Western Ontario, 4 other universities, the Geological Survey of Canada, the United States Geological Survey, and Geophysics GPR International Incorporated completed seismic refraction surveys, 1 across the Grenville Front, the Sudbury Structure, and into the Superior Province; and another perpendicular across the Sudbury Basin as part of LITHOPROBE. Described as the largest survey of its kind in Canada to date, 415 stations recorded data from 43 shot-points. The data will be incorporated with previous seismic reflection data and presented in early 1993.

A.P. Dickin and M.A. Artan, McMaster University, conducted Os–Pb isotope data investigations in order to identify an origin of the Sudbury ores.

C. Farrow, Carlton University, commenced studying alteration zones related to high-grade copper footwall ores at the Strathcona Mine, in the North Range of the Sudbury Igneous Complex.

G.C. Finn, Brock University, initiated a petrographic and lithogeochemical study of the granophyre phase of the Sudbury Igneous Complex to determine its origin with respect to an impact generated melt and its relationships to the lower part of the Sudbury Igneous Complex.

W.S. Fyfe, The University of Western Ontario, initiated a study of the fluid chemistry in zones of intense deformation shear zones, to test the potential of surface analysis techniques for tracking the nature of fluids involved in major deformation-mineralization processes, and to assess the potential of such measurements in mineral exploration.

H.L. Gibson, Laurentian University, continued investigation into the characteristics and origin of the Errington and Vermilion Zn-Cu-Pb deposits in the lower member of the Onwatin Formation, as well as alteration assemblages in the Onaping Formation.

M.P. Gorton and E.S. Schandl, University of Toronto and D.W. Davis, Royal Ontario Museum, continued with
their efforts to place a time constraint on soda-metasomatism and chlorite alteration associated with gold mineralization in the Huronian Supergroup using hydrothermal monzonite for U-Pb geochronology.

R.S. James, D.C. Peck and R.R. Keays, Laurentian University, continued their study of the characteristics of PGM mineralization at the East Bull Lake and Shakespeare–Dunlop differentiated mafic intrusions, and their relationship to other Paleoproterozoic mafic intrusions in the Huronian–Nipissing magmatic belt.

B.S. Lollar, University of Toronto, attempted to define the role of N₂ and H₂ in inorganic methanogenesis, their transport mechanisms, and interaction with the crystalline rocks of the Canadian Shield. The project will increase the mining industry’s ability to deal with gaseous hazards safely.

A.J. Naldrett and A. Pessaran, University of Toronto, continued their study of the variation between PGM, Ni, Cu, Co, and Au in the Sudbury Igneous Complex North Range footwall ore shoots along a 10 km strike length.

W.M. Schwerdtner and U. Riller, University of Toronto, continued work on the regional structural deformation of the Wanapitei–Cutler Belt and its relationship to the emplacement of the Sudbury Structure.

D.H. Watkinson, Carlton University, initiated work on the geology and lithogeochemistry of breccias around the Sudbury Igneous Complex in order to establish a model for the remobilization of Ni, Cu, and PGM.

R.E. Whitehead and J.F. Davies, Laurentian University, continued their efforts to quantify the geochemical, mineralogical, and isotopic variations in sedimentary units at the base of the Onwatin Formation, that host conformable Zn-Cu-Pb deposits. This will also test the hypothesis that a proposed convective-exhalative system responsible for the mineralization was linked to the underlying Sudbury Igneous Complex.

Detailed descriptions of some of these projects are outlined in Milne (1992).

Several other bachelors’ and post-graduate theses were undertaken within the district during the year.

ACKNOWLEDGMENTS

The authors once again wish to thank T. Livingstone for assistance in preparing this manuscript, for her help with all office activities throughout the year, often over and above what the job description calls for, and for her ever cheerful nature toward staff and the public.

The authors would also like to thank K. Lacey for drafting several figures.

SELECTED PUBLICATIONS RECEIVED

The Sudbury Resident Geologist’s office has available the most recent issues of the following periodicals: The Northern Miner, Northern Miner Magazine, Dimensional Stone Magazine, CIM Bulletin, Economic Geology and Nickel.

Listed below are books received by the office in 1992. Other books and periodicals are available to the interested reader for viewing at the office.


Carmichael, R.S. ed. 1989. Practical handbook of physical properties of rocks and minerals; Geophysics Program, Department of Geology, University of Iowa, Iowa City, Iowa, 741p.


REFERENCES


Graham, R.J. 1990. Prospecting for gold in the Huronian, Scadding Township, Sudbury Mining Division, Ontario; Resident Geologist's files, Sudbury District, Sudbury, 38p.


16. Field Services Section, Southern Ontario: Introduction

A.E. Pitts
Manager, Field Services Section (Southern Ontario), Ontario Geological Survey—Information Services Branch

The Southern Ontario Region is the main source of Ontario's structural materials such as sand, gravel, crushed stone, clay, shale, calcined lime and building stone; and industrial minerals such as salt, gypsum, nepheline syenite, talc, silica, and gemstones. Mineral production values remain at a reduced level due to lower demands in the construction industry. Exploration activity continued at a reduced level. The total assessment work credit was $486 304 (to November 1, 1992). Much of the grass-roots exploration activity that did take place, was funded under the Ontario Prospectors Assistance Program and the Ontario Mineral Incentives Program. There was an active interest in graphite, building stone, flagstone, wollastonite, gold, base metals, quartz and high-purity limestone.

Cal Graphite Corporation, which has a mining operation in Butt Township, continued working toward full production which should be achieved in 1993. Central Ontario Natural Stone Company Limited, of Orillia, opened up a new flagstone quarry in McClintock Township, planning to extract flagstone, and larger stone suitable for guillotining. Pacific Coast Mines Inc. is beginning advanced stage exploration on a wollastonite prospect near Sisleys Bay in Pittsburgh, Leeds, and Landsdowne townships. The company hopes to determine the feasibility of an open pit mining and milling operation on its site, by the end of 1993. Ram Petroleum Limited continued beneficiation tests on a wollastonite prospect in Olden Township. Canadian Mono Mines Inc. will commence the underground mining of a 10 000 tonne bulk sample from the company's Bannockburn Township gold prospect. Belrose Minerals Co. is in the process of setting up a stone processing plant at its Belmont Granite Quarry. The company intends to produce a variety of stone products, primarily for landscaping applications. The Zinc Corporation of America, a subsidiary of St. Joseph Minerals, have outlined a proposal to perform advanced exploration on the Renprior Zinc prospect in Admaston Township, near Renfrew.

The Southern Ontario Region has 3 Resident Geologists' offices. These offices are located in London, Dorset and Tweed. Resident Geologists provide a professional advisory service on the geology and mining activity in their districts. They also offer assistance in local resource development and provide advice on land hazards and land-use planning.

The Region also has an office in Bancroft, which is managed by H. Meyn, a regional specialist. In 1992, he carried out geological mapping in the Belmont Lake area near Marmora. The Bancroft office provides advice on local geology, mineral collecting and mining activities.

The Region has 2 drill core libraries which are located in Tweed and Bancroft. Relevant drill-core reference materials are obtained from mineral exploration programs in the area and are logged and indexed for ready access by clients. There were 48 visitors to these facilities this year.

Field staff were involved in a number of projects during 1992. R. Keevil conducted a building stone evaluation project in the District of Muskoka and parts of Haliburton, Simcoe and Victoria counties. Emphasis was placed on locating and evaluating sites which have potential for extracting large blocks. C. Marmont continued work in the second year of a program to investigate the economic potential of industrial minerals and building stone in Central Ontario. The project is supported under the Canada-Ontario Northern Ontario Development Agreement. D. Villard investigated the distribution of mercury and associated elements in rocks in the Huntsville area. P.W. Kingston, and W.F. Caley (Technical University of Nova Scotia) continued their research on the application of industrial minerals in ceramic and metal matrix composites. Four areas of research which were carried out in 1992 were the preparation of mullite-wollastonite aqueous suspensions; the preparation of alumina-wollastonite aqueous suspensions; the experimental production of wollastonite-zinc/alumina metalmatrix composites; and the experimental production of wollastonite-mullite ceramic matrix composites.
INTRODUCTION

Exploration in the Algonquin District continued at levels similar to those of the past few years, with 52 claims or 198 claim units recorded in 1992. Exploration for base and precious metals continued throughout the district, while activity for building stone was concentrated in the western part of the district. Interest in flagstone has increased over the past several years, which is a little surprising considering the downturn in the construction industry.

Cal Graphite Corporation continued production from its graphite property northeast of Huntsville. The company anticipates achieving full production during 1993. It has also initiated an exploration program on the Sheehan option located several kilometres from the present operation.

The project to evaluate the economic potential of industrial minerals in Central Ontario, that originated in 1991, continued in 1992. This program falls under the Canada-Ontario Northern Ontario Development Agreement (NODA).

Public education continues to be an important function of the Dorset office. As well as providing outreach educational activities throughout the district, the office is responsible for delivering geoscience education programs at the Leslie M. Frost Natural Resources Centre at Dorset.

MINING ACTIVITY

Mining activity for the Algonquin Resident Geologist’s District for 1992 is summarized in both Figure 17.1 and Table 17.1.

Cal Graphite Corporation

Cal Graphite Corporation continued working towards full production. It is anticipated that this goal will be achieved sometime in 1993, once modifications to the mill are completed. The company is extremely pleased with the quality of the flake that it is producing, with carbon contents being maintained in the 94 to 96% range. The company has leased a facility in Brocton, New York State, that is currently being utilized as a warehouse for distribution of products to consumers. Plans call for renovations to the warehouse to facilitate the packaging and blending of products which are designed to customers’ specifications.

Exploration on the Sheehan option located several kilometres from the mine, commenced in November. Detailed diamond drilling is scheduled to be carried out early in 1993 to outline ore reserves. As this deposit is situated immediately adjacent to Algonquin Provincial Park, the company has been working closely with the Ministry of Natural Resources (MNR) in addressing any concerns that the Ministry might have.

Stone Quarries

Throughout the district, 33 quarries produce stone for either the aggregate or construction industry. Of these, 18 produce stone for an assortment of products such as flagstone, landscaping stone and masonry stone. Several new quarries were opened in 1992.

The most notable of the flagstone producers is the Mill Lake Quarry located in Parry Sound. The stone is quarried during the non-winter months and a selection of flagstone products, with thicknesses ranging from 0.5 to 4 inches, is produced. Splitting of the stone continues during the winter. Colours are in the pink to grey range. The quarry employs 6 full-time employees plus a few seasonal workers.

Other Quarries

The Blue Star Mine in Chapman Township closed down in 1992. This mineral occurrence had offered tourists and mineral collectors an opportunity to collect amazonite, smoky quartz, and garnet from a pegmatite vein on the property. The future status of this occurrence as a collecting site is unknown, but it is quite possible that Ontario has lost a superior collecting site for amazonite.

In McClintock Township, a quartz quarry is worked on an intermittent basis, to produce white quartz that is used primarily in landscaping. The deposit occurs in a quartz-rich zoned pegmatite, which is characteristic of many of the pegmatites in the area. The holder of the aggregate permit has plans for expanding the operation and increasing production.

ADVANCED EXPLORATION AND DEVELOPMENT

To the knowledge of the writers, no advanced exploration (as defined in the Mining Act) occurred in the district in 1992.
Several new flagstone quarries were opened under the authority of the Aggregate Resources Act.

EXPLORATION ACTIVITY

Exploration activity is shown in Figure 17.2 and is listed in Table 17.2.

As of December 31, 1992, a total of 52 claims or 198 claim units have been staked in the Algonquin Resident Geologist's District. This represents an increase of 51 claim units over what was staked in 1991, although exploration activity remained at levels similar to the past several years. Table 17.3 shows the record of claim staking and assessment work credits for the past 11 years. Activity concentrated on interests in building stone, flagstone, graphite, marble, precious and platinum group metals and base metals.

Industrial Minerals

BUILDING STONE

There has been continued interest in dimensional granite and gneissic flagstone in the district. Flagstone in particular, has continued to see significant activity during 1992, in spite of the recession.

Central Ontario Natural Stone Company Limited, of Orillia, opened up a new flagstone quarry in McClintock Township. It plans to extract flagstone and larger stone suitable for guillotining. The company had previously staked the ground, as the MNR had refused to issue an Aggregate Permit because of the proximity to Algonquin Park. The Dorset office advised the company and the MNR that issuing an Aggregate Permit was a better alternative for all concerned than having development proceed under the Mining Act. Development then proceeded under the Aggregates Act.

Another potential quarry in the same general area could not be opened because the Ministry of Transportation denied the would-be operators access to Highway 60.

E. and B. Wickern have stripped an area of potential dimensional granite in Ryerson Township. Tiles cut from this site are an attractive dark grey to black gneiss with cross-cutting red and white veinlets. Several blocks were extracted from which tiles were cut and polished.

A company took out several blocks from a very promising site in Burton Township and had plans for the cutting and polishing of slabs from these blocks.

Several companies are continuing to explore in the western part of the district for good sources of dimensional granite. It is felt that some of the gneisses have good potential on the world market. The release of information by Marmont (1992) has resulted in staking activity during the latter half of December.
Table 17.1. Mining activity 1992, Algonquin Resident Geologist’s District.

<table>
<thead>
<tr>
<th>Number on Figure 17.1</th>
<th>Company/Mine</th>
<th>Township</th>
<th>Commodities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Blue Star Mine</td>
<td>Chapman</td>
<td>pegmatite, amazonite, quartz, garnet</td>
</tr>
<tr>
<td>2</td>
<td>Cal Graphite</td>
<td>Butt</td>
<td>graphite</td>
</tr>
<tr>
<td>3</td>
<td>M.T.O.</td>
<td>Mowat</td>
<td>crushed stone</td>
</tr>
<tr>
<td>4</td>
<td>M.T.O.</td>
<td>Henvey</td>
<td>crushed stone</td>
</tr>
<tr>
<td>5</td>
<td>M.T.O.</td>
<td>Blair</td>
<td>crushed stone</td>
</tr>
<tr>
<td>6</td>
<td>M.T.O.</td>
<td>Blair</td>
<td>crushed stone</td>
</tr>
<tr>
<td>7</td>
<td>M.T.O.</td>
<td>East Mills</td>
<td>crushed stone</td>
</tr>
<tr>
<td>8</td>
<td>M.T.O.</td>
<td>Strong</td>
<td>crushed stone</td>
</tr>
<tr>
<td>9</td>
<td>Fowler Construction</td>
<td>McCauley</td>
<td>crushed stone</td>
</tr>
<tr>
<td>10</td>
<td>M.T.O.</td>
<td>Harrison</td>
<td>crushed stone</td>
</tr>
<tr>
<td>11</td>
<td>M.T.O.</td>
<td>Shawanaga</td>
<td>crushed stone</td>
</tr>
<tr>
<td>12</td>
<td>M.T.O.</td>
<td>Carling</td>
<td>crushed stone</td>
</tr>
<tr>
<td>13</td>
<td>Maclain</td>
<td>McDougall</td>
<td>crushed granite</td>
</tr>
<tr>
<td>14</td>
<td>M.T.O.</td>
<td>Foley</td>
<td>crushed granite</td>
</tr>
<tr>
<td>15</td>
<td>M.T.O.</td>
<td>Gibson</td>
<td>crushed granite</td>
</tr>
<tr>
<td>16</td>
<td>M.T.O.</td>
<td>Gibson</td>
<td>crushed granite</td>
</tr>
<tr>
<td>17</td>
<td>M.T.O.</td>
<td>Medora</td>
<td>crushed granite</td>
</tr>
<tr>
<td>18</td>
<td>R. Fleming</td>
<td>Rama</td>
<td>crushed granite</td>
</tr>
<tr>
<td>19</td>
<td>Fowler Construction</td>
<td>Rama</td>
<td>crushed limestone</td>
</tr>
<tr>
<td>20</td>
<td>Tasso Lake Stone</td>
<td>Rama</td>
<td>granite gneiss, white quartz</td>
</tr>
<tr>
<td>21</td>
<td>Rock Lake Granite</td>
<td>Proudfoot</td>
<td>granite gneiss, flagstone, landscaping stone</td>
</tr>
<tr>
<td>22</td>
<td>John Bacher Construction</td>
<td>McClintock</td>
<td>granite gneiss, flagstone, landscaping stone</td>
</tr>
<tr>
<td>23</td>
<td>McDonald Quarry</td>
<td>Finlayson</td>
<td>granite gneiss, flagstone</td>
</tr>
<tr>
<td>24</td>
<td>Frazer Quarry</td>
<td>Finlayson</td>
<td>granite gneiss, flagstone</td>
</tr>
<tr>
<td>25</td>
<td>Huntsville Quarry</td>
<td>Franklin</td>
<td>granite gneiss, flagstone, building stone</td>
</tr>
<tr>
<td>26</td>
<td>Lehman Quarry</td>
<td>Sinclair</td>
<td>granite gneiss, flagstone</td>
</tr>
<tr>
<td>27</td>
<td>Int’l. Quartz Ltd.</td>
<td>McClintock</td>
<td>white quartz</td>
</tr>
<tr>
<td>28</td>
<td>Mill Lake Stone</td>
<td>McDougall</td>
<td>gneiss</td>
</tr>
<tr>
<td>29</td>
<td>Rama Stone Quarries</td>
<td>Rama</td>
<td>red gneiss</td>
</tr>
<tr>
<td>30</td>
<td>A.R. Jeffery</td>
<td>Ryerson</td>
<td>granite gneiss, flagstone</td>
</tr>
<tr>
<td>31</td>
<td>T. Boyes &amp; Sons</td>
<td>Ryerson</td>
<td>granite gneiss, flagstone, building stone</td>
</tr>
<tr>
<td>32</td>
<td>Sirius Landscaping</td>
<td>McClintock</td>
<td>granite gneiss, flagstone, building stone</td>
</tr>
<tr>
<td>33</td>
<td>Northern Excavating Novar</td>
<td>Perry</td>
<td>crushed stone</td>
</tr>
</tbody>
</table>

Note: the abbreviation M.T.O. refers to Ontario Ministry of Transportation
Figure 17.2. Exploration activity during 1992 in the Algonquin Resident Geologist's District.

Table 17.2. Exploration activity 1992, Algonquin Resident Geologist's office.

<table>
<thead>
<tr>
<th>Abbreviations</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BS</td>
<td>Bulk sampling</td>
</tr>
<tr>
<td>DD</td>
<td>Diamond drilling</td>
</tr>
<tr>
<td>GC</td>
<td>Geochemical survey</td>
</tr>
<tr>
<td>GEM</td>
<td>Ground electromagnetic survey</td>
</tr>
<tr>
<td>GL</td>
<td>Geological survey</td>
</tr>
<tr>
<td>GM</td>
<td>Ground magnetometer survey</td>
</tr>
<tr>
<td>SP</td>
<td>Self-potential survey</td>
</tr>
<tr>
<td>Str</td>
<td>Stripping</td>
</tr>
<tr>
<td>VLF-EM</td>
<td>Very low frequency electromagnetic survey</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number on Figure 17.2</th>
<th>Company/Individual</th>
<th>Township Activity</th>
<th>Exploration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>W. Ellerington</td>
<td>McClintock</td>
<td>DD, GL, GM, GEM</td>
</tr>
<tr>
<td>2</td>
<td>R. Tougas</td>
<td>McClintock</td>
<td>prospecting</td>
</tr>
<tr>
<td>3</td>
<td>Fr. &amp; S. Swain</td>
<td>McClintock</td>
<td>prospecting, GC</td>
</tr>
<tr>
<td>4</td>
<td>F. Jones</td>
<td>McClintock</td>
<td>sampling</td>
</tr>
<tr>
<td>5</td>
<td>E. McNaughton</td>
<td>McClintock</td>
<td>prospecting</td>
</tr>
<tr>
<td>6</td>
<td>R. Lashbrook</td>
<td>several</td>
<td>prospecting</td>
</tr>
<tr>
<td>7</td>
<td>W. Ellerington Jr.</td>
<td>McClintock</td>
<td>prospecting, DD, GL</td>
</tr>
<tr>
<td>8</td>
<td>F. Atkinson</td>
<td>Baxter</td>
<td>prospecting, GC</td>
</tr>
<tr>
<td>9</td>
<td>J. Lee</td>
<td>Frazer</td>
<td>prospecting</td>
</tr>
<tr>
<td>10</td>
<td>B. &amp; A. Wickern</td>
<td>Ryerson</td>
<td>prospecting, BS, Str</td>
</tr>
<tr>
<td>11</td>
<td>B. Manella</td>
<td>Laurier</td>
<td>prospecting</td>
</tr>
<tr>
<td>12</td>
<td>D. Jennings</td>
<td>Hindon</td>
<td>prospecting</td>
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</tbody>
</table>
Table 17.2. Continued.

<table>
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<th>Number on Figure 17.2</th>
<th>Company/Individual</th>
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<th>Exploration</th>
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<td>Maria</td>
<td>prospecting</td>
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<td>14</td>
<td>J. Irving</td>
<td>Brunel</td>
<td>prospecting</td>
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<td>D. Rose</td>
<td>Calvin</td>
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<tr>
<td>17</td>
<td>V. Sheehan</td>
<td>Butt</td>
<td>prospecting</td>
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<td>R. Charron</td>
<td>Monck</td>
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Table 17.3. Summary of claims recorded and assessment work credit.

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<tr>
<th>Year</th>
<th>Claims Recorded</th>
<th>Claims Cancelled</th>
<th>Claims Active</th>
<th>Diamond Drilling (Man Days)</th>
<th>Geophysical Surveys (Man Days)</th>
<th>Geological Surveys (Man Days)</th>
<th>Other Work (Man Days)</th>
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<td>354</td>
<td>617</td>
<td>1115</td>
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<td>613</td>
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<td>7690</td>
<td>9980</td>
<td>2112</td>
<td>11 528</td>
<td>31 310</td>
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<td>432</td>
<td>1980</td>
<td>1629</td>
<td>5376</td>
<td>9417</td>
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(+$2233) (+$14 447) (+$13 338) (+$30 018)

<table>
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<tr>
<th>Year</th>
<th>Geotechnical Work</th>
<th>Physical Work</th>
<th>Assays</th>
<th>Total</th>
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<td>1992</td>
<td>52 (198 units)</td>
<td>430*</td>
<td>$39 068</td>
<td>$57 710</td>
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</table>

*For 1981–91, the claims active column represents all of Southern Ontario
Some interest has been expressed by prospectors, in exploring the quartz-rich pegmatites scattered throughout the district, as possible sources of high grade silica. To date, the quartz has been used mainly in landscaping.

**GRAPHITE**

An on-going interest in finding and developing a high quality graphite deposit is evident by the continued exploration activity in Baxter and Laurier townships.

**PRECIOUS AND PLATINUM GROUP METALS AND BASE METALS**

Exploration for base and precious metals was scattered throughout the district in 1992. Most of the work was carried out by local prospectors who tended to concentrate on 1 or 2 properties at a time.

McClintock Township, with 201 current claims, is the most active area in the district. Four prospectors (W.E. Ellerington, S. Swain, F. Swain and R. Tougas) continue to evaluate the copper, nickel and gold potential of the mafic and ultramafic intrusions on their respective claim groups. Work on these various claim groups included geological mapping, diamond drilling, ground magnetometer and electromagnetic surveying, stripping, trenching and prospecting.

Exploration for gold remains limited, with activity in the townships of McClintock, Ryerson, Laurier, Brunel and Baxter.

There were 4 Ontario Prospectors Assistance Program (OPAP) grants awarded in 1992 for a total value of $36,900 and 2 Ontario Mineral Incentive Program (OMIP) designations awarded for a value of $8543.

**RESIDENT GEOLOGIST'S STAFF ACTIVITIES**

The office is currently staffed by D. Villard, Resident Geologist and J. Reed, Secretary. M. Garland, the Staff Geologist, has gone from Thunder Bay to London as the Acting Staff Geologist until such time as the move is approved on a permanent basis. R. Keevil continues in his role as the Acting Staff Geologist. C. Marmont continued in his position as a NODA Geologist hired to undertake an industrial mineral assessment of parts of Central Ontario under NODA. J. Jones did an admirable job during the last 4 months of the year, while filling in for J. Reed, who was on sick leave. Y. Renes was hired under the Environmental Youth Corps program to assist in the minerals program presentations at the Frost Centre.

D. Villard continued his project to examine the distribution of mercury and associated elements in the area immediately northwest of Huntsville. This area is characterized by anomalously high mercury levels in the sport fish in many of the area lakes. A rock geochemical study was initiated in 1992 and will continue in 1993. This work should complement the deep sediment sampling of 8 lakes carried out in 1991. Early in 1993, a similar sampling program on an additional 17 lakes will be undertaken as part of a joint Geological Survey of Canada (GSC), Ontario Hydro and Ministry of Northern Development and Mines (MNDM) project.

All of the major active mines in the district, as well as many of the smaller stone operations, were visited by office staff. Staff also provided assistance to several companies and individuals interested in developing flagstone and/or dimensional stone properties as well as metallic mineral prospects.

R. Keevil was active in our public education and awareness program, delivering geological talks at provincial parks, public schools, rock and mineral clubs, and to Junior Rangers and senior citizens. He also played a major role in the delivery of the mineral education program at the Leslie M. Frost Natural Resources Centre in Dorset, and during the last 4 months of the year, he was ably assisted by Y. Renes. In 1992, the Ministry made a commitment to the Frost Centre regarding the delivery of the minerals program at the Centre. As part of his job responsibility, the Staff Geologist in the Dorset office will now be delivering the minerals program, as well as working on program development at the Centre. In 1993, plans call for the completion of a unit relating to industrial minerals in everyday life. MNDM and MNR staff provided 3769 user opportunities at the Centre where an opportunity is defined as 1 person participating in a half-day session. An additional 869 opportunities were realized by the client groups instructing themselves (self-guided trails, etc.).

R. Keevil developed an educational unit for the Muskoka Board of Education’s outdoor centre and initiated work on 2 units for the Frost Centre.

The Ministry has played an active role in helping to develop and fund the geology displays at the new Algonquin Park Visitors’ Centre scheduled to open in May 1993. It is anticipated that in excess of 250,000 people will visit this facility each year.

The office provided input for 4 major planning projects; the conversion of parts of highways 69, 11 and 60 to 4 lanes, as well as the proposed hydro corridor from Sudbury to Toronto.

A prospecting course was held in Huntsville in June. Approximately 60 people attended each of the 3 sessions that covered many aspects of prospecting. The course was organized by R. Keevil with assistance from M. Hall, the Chief Mining Recorder, who provided an excellent session on the mining act. C. Marmont and D. Villard also helped with the delivery of the sessions.

J. Reed spent a considerable amount of time upgrading the various mineral resource data bases and did a remarkable job of dealing with various client groups when the rest of the staff were out of the office. J. Jones took over this function in September and continued on with the same high level of
service as provided by J. Reed.

C. Marmont attended the 28th Forum on the Geology of Industrial Minerals at Martinsburg, West Virginia, May 3 to 8. A report on this meeting is filed with the OGS Mines Library, Sudbury, and at the Dorset Resident Geologist’s office.

C. Marmont gave an overview of Ontario’s stone industry and a tour of some Toronto building stones to a Japanese building-stone delegation in July. The visit was part of a Canada-wide tour organized by the Federal Departments of External Affairs, and Industry, Science and Technology.

C. Marmont attended Industrial Minerals ’92, the third Canadian Conference on Markets for Industrial Minerals at Toronto, October 22 to 23. He also attended the 48th Annual Convention of the Marble Institute of America in Seattle, Washington, November 2 to 5, with D. Spethmann of the Mineral Sector Analysis Branch, Sudbury. C. Marmont assisted in staffing the Ministry of Northern Development and Mines booth which displayed samples of building stone from across the Province of Ontario.

C. Marmont gave a review of central Ontario’s stone potential to an Italian delegation in Sudbury, on November 30.

C. Marmont and D. Spethmann gave a talk on Ontario’s building stone resources to the Ontario Association of Architects on December 7, as part of the Association’s “Focus on Stone” week.

Client Services Statistics

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<th>Service</th>
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<td>496</td>
</tr>
<tr>
<td>Office-Consultation</td>
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<td>203</td>
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</table>

PROPERTY EXAMINATIONS

Mica and Feldspar, Stisted Township

A previously unreported prospect has been located in Lot 10, Concession XII Stisted Township. An excavation, 3 by 1 by 1 m has exposed a pegmatite dike approximately 0.5 m wide in a hornblende-rich gneiss. Locally, magnetite and pyrite are present in small amounts. Other minerals include white and smoky quartz, garnet, mica, feldspar and pyroxene. These workings appear to be 40 to 50 years old with drill holes still visible in the undergrowth.

Wickern Deposit, Ryerson Township

Results of bedrock stripping and block extraction on a claim group in the township have produced some attractive polished tiles up to 0.5 by 0.25 m by 1 cm in size. The rock is a banded grey to black gneiss with quartz-feldspathic layers throughout.

The owner reports that there is a larger, less fractured zone on the claim group which will be investigated in 1993.

Southwood Road Dimension Stone, Wood Township

Located in Lots 9 and 10, Concession XII in Wood Township approximately 8.3 km southeast of Highway 169 on Muskoka Road 13 is a large outcrop of migmatitic gneiss approximately 1 km long striking at roughly 33°, 50 to 100 m wide and 3 to 8 m high. This rock consists of medium- to fine-grained, grey layers ranging from a few to several centimetres true thickness, interlaid with pink, medium- to coarse-grained granitic material. These layers dip from 25° to 40° east. Vertical joints are spaced 1 to 5 m apart and trend about 050°. A minor set of joints trends approximately 300°.

There are also some cross-cutting pegmatitic dikes within the deposit, ranging in size from 1 to 20 cm in width. These appear to be concentrated in areas which could be segregated from the migmatite. There is potential for the extraction of large blocks from this site from which attractive panels could possibly be produced. Within the central portion of the deposit, the rock appears to contain more orthoclase on its western side giving it a pinker colour. This opens the possibility of producing 2 varieties of stone.

Cormack Deposit, Monck Township

A very attractive stone was located on Lot 11, Concession A in Monck Township. It is a homogeneous migmatitic gneiss trending 310° with coarse-grained swirls and siliceous layers 1 to 6 cm thick. Present are some aplite and pegmatitic dikes which are spaced 3 to 5 m apart. In the outcrop nearest the road, joints trend north-south, with 3 to 4 m spacings. South along the ridge, exposure is poorer, making evaluation more difficult. This deposit has the potential to provide large blocks which may be suitable for sawing and polishing.

King Deposit, Baxter Township

Two large outcrops of pink granitic material were located on Lot 33, Concession III Baxter Township, approximately 2 km southwest of Highway 69 on Honey Harbour Road. The deposit is just west of a previously described rock (Verschuren et al. 1986).

The rock is a reddish-orange, medium- to coarse-grained material with granitic pegmatites ranging in size from 1 to 40 cm in width. Joints trend both 115°, with spacings of 1 to 3 m and 80° with spacings of approximately 1 m. Graphic texture is present throughout the westerly ridge.

Bardsville Deposit, Monck Township

Located 2 km east of Highway 118 on Lot 21, Concession X is an outcrop of grey and pink gneiss partially exposed for 430 m north of Eggs and Butter Road.
The Jeffery Quarry (Ryerson Natural Stone) has been operating on demand over the last 2 to 3 years. It is located in Lot 12, Concession XI Ryerson Township, about 500 m west of the Boyes Quarry. Mr. Jeffery quarries an attractive pink-maroon-grey and black granite flagstone from the west end of the ridge exploited by Boyes. The quarry face is oriented roughly north-south, exposing southerly dipping flagstone. The stone is lightly blasted and a backhoe is used to break out the stone from the face. The blocks are split manually into random shapes of 1, 2 and 4 inch thicknesses. Some 1 and 2 inch material is available in sawn 12 by 12 inch squares. The larger blocks of stone are reduced by feather and wedges, and split by hammer and wedges. The stone has the well-developed pink to maroon-grey lineation on split surfaces which is a characteristic of many granitic flagstones in the Muskoka-Parry Sound area. Stone is stockpiled on pallets, and sorted by thickness, size and colour.

**Pacific Granistone, Burton Township**

Several visits were made during August 1992, to Pacific Granistone's "Santa Rosa" dimensional granite property west of Ardbeg, in Burton Township. The company opened a quarry here to obtain blocks for sawing and polishing tests and market testing.

The site was identified in 1988 under the Canada-Ontario Mineral Development Agreement (COMDA), Industrial Minerals Program (MNDM 1989). The area was staked by Pacific Granistone in 1990, and gridded and mapped in the same year. In June 1992, a single diamond drill hole was sunk to 37 feet to test for horizontal structures. In August, test quarrying was initiated.

Quarrying was accomplished by line drilling and blasting, utilizing a quarry bar manufactured to Pacific Granistone's specifications by J & J Engineering Limited, of North Bay. Two Joy air drills were mounted 10 inches apart on the quarry bar. The drills used 1/4-inch hex drill steels with 1/4-inch chisel bits. A 350 cubic foot per minute compressor supplied the 2 drills and a plugger.

Vertical holes were drilled on 5 inch and 2.5 inch centres, to approach a flat-lying joint along which the block could be freed. Every third hole was charged with a third of a stick of Dynasheer low velocity explosive to break between the drill holes. Air bags were used to move the freed block from the face.

Six blocks were recovered, ranging in size from 8 by 4.5 by 4 feet to 9.5 by 5.5 by 4.5 feet. These were loaded onto a Caterpillar rock truck by a Caterpillar 998A loader and taken to Ardbeg, where they were loaded onto a flat bed for transportation to Pacific Granistone's plant.

A small backhoe was used for mucking and removal of loose surface rock.

The extracted blocks displayed very attractive maroon-coloured, layered gneiss with black streaks. The stone appears tough and competent. The presence of some tight sub-horizontal joints will likely result in minor wastage which is to be expected within 1 or 2 m of the surface. On the basis of the limited quarrying performed to date, there is evidence that this jointing decreases with depth.

**Jeffery Quarry, Ryerson Township**

The Jeffery Quarry (Ryerson Natural Stone) has been operating on demand over the last 2 to 3 years. It is located in Lot 12, Concession XI Ryerson Township, about 500 m west of the Boyes Quarry. Mr. Jeffery quarries an attractive pink-coloured, layered gneiss with black streaks. The stone displays very attractive maroon-grey and black granite flagstone from the west end of the ridge exploited by Boyes. The quarry face is oriented roughly north-south, exposing southerly dipping flagstone. The stone is lightly blasted and a backhoe is used to break out the stone from the face. The blocks are split manually into random shapes of 1, 2 and 4 inch thicknesses. Some 1 and 2 inch material is available in sawn 12 by 12 inch squares. The larger blocks of stone are reduced by feather and wedges, and split by hammer and wedges. The stone has the well-developed pink to maroon-grey lineation on split surfaces which is a characteristic of many granitic flagstones in the Muskoka-Parry Sound area. Stone is stockpiled on pallets, and sorted by thickness, size and colour.

**Rock Lake Granite Quarry, Proudfoot Township**

The Rock Lake Stone Quarry was opened in 1992 by the owner, Mr. M. Czura of Sundridge. It is located in Lot 10, Concessions 1 and 2, Proudfoot Township. The quarry is situated on a west-facing cliff, some 20 m high, and several hundred metres long, which exposes a gently eastward dipping, well-layered granitic gneiss. A considerable volume of stone exists as talus, with blocks ranging in weight up to 80 t. Quarry development is at an early stage, and has been oriented towards site preparation. However, clearing the face and work area has permitted the harvesting of fallen blocks which have been split into 2 inch and 4 inch random flagstones. At the time of the visit in early September, some truckloads had been shipped from the quarry, and 25 pallets of stone were ready for shipping. Two attractive colours have been produced to date: 1 pink, and the other grey, with rose-pink augen and laminae.

**RESEARCH BY RESIDENT OFFICE STAFF**

**Building Stone Evaluation of the District of Muskoka and Parts of Haliburton, Simcoe and Victoria Counties**

A project to further investigate the building stone potential was initiated in over 35 townships during the spring of 1992 by the Staff Geologist. Emphasis was placed on locating and evaluating sites which have potential for extracting large blocks (10 to 20 t) for the purposes of cutting and polishing. Several sites were also identified as having potential for producing thinly splitting gneisses (flagstone).

Airphoto interpretation was completed for the study area during the spring and summer. Most of the photos viewed were 1984, 1:30000 leafless. Significant outcrops within 2 km of a driveable road were marked on 1:50000 topographical maps which are available for viewing at the Resident Geologist's office.

Outcrops visited were evaluated and most were rejected as dimension stone sites for a variety of reasons: joint density...
too great in the vertical and/or the horizontal plane; variations in rock type or lack of uniformity; the presence of certain deleterious minerals such as mica, garnet, and pyrite where partings, plucking or staining of the material may be a problem. Several areas still need to be investigated and this project will be continued in 1993. Response has been favourable from the private sector so far.

Northern Ontario Development Agreement

Work continued in the second year of a program to investigate the economic potential of industrial minerals and building stone in Central Ontario. The program falls under NODA, which was signed on November 4, 1991. Restricted to Northern Ontario, the program includes the districts of Parry Sound and Nipissing within the Algonquin Resident Geologist’s District, and those parts of the Sudbury and Cobalt Resident Geologists’ districts which lie south of the Grenville Front.

Field work performed during 1992 focussed on anorthosite and building stone.

Anorthosite is a possible source of feldspar suitable for the ceramics, glass, filler and insulation industries, and for certain chemical applications (Dolan et al. 1991). A summary of the 1992 field program is presented by Marmont (1992). Geochemical and petrographic studies will be completed during the winter, and results will be reported in the spring in concert with similar programs in Northeastern and Northwestern MNDM regions.

The preliminary results of field work conducted on building stone during the summer of 1992 have been reported by Marmont (1992). Since that report was written, small blocks (200 to 300kg) of granite were collected from 9 prospective sites. These were sawn into thin tiles and polished by Khouri Granite Ltd., Sudbury. Samples and site photographs were displayed at the MNDM Mines and Minerals Symposium in Toronto, December 7 to 9, 1992, and are available for viewing at the Resident Geologist’s office at Dorset. Several of these sites were apparently staked immediately after release of this information.

Future Work

The use of granite in the construction industry is expected to increase. Central Ontario possesses granites with a wide variety of colours and textures, and several sites identified in the course of this NODA program have apparently been staked. There appears to be some investor interest in opening quarries and processing plants. It is therefore important to identify additional quarriable sources of granite. Many sites identified from airphotos in early 1992 have not yet been evaluated. Accordingly, it is planned to continue this program during the 1993 field season.

None of the Massif-type anorthosites studied during 1992 appear to contain significant areas of clean feldspar, such as have previously been noted in the Parry Sound–Haliburton area. It may be necessary to conduct further work on the Archean-age, River Valley anorthosite, depending upon this year’s geochemical results, and upon the MNDM’s ongoing anorthosite research being carried out by H. Veldhuyzen in the Northeastern Region.

Distribution of Mercury and Associated Elements in Rocks in the Huntsville Area

Work commenced in the summer on a program to investigate the possible geochemical controls on the distribution of mercury and associated elements in selected rocks in an area northwest of Huntsville. At the time of writing, results were pending. The work will continue in 1993 if sufficient financial resources are available. Initial sampling was carried out in the same general area where a sediment sampling program of 8 lakes was carried out in 1991. Results from a lake sediment sampling program planned for early 1993, should contribute significantly to the data base for the area and assist in the planning for the 1993 field program.

RECOMMENDATIONS FOR EXPLORATION

The demand for new varieties of dimensional granite is still high. It is likely that many sites of quarriable stone remain to be recognized. Prospectors should focus most of their attention on metaplutonic bodies in the Britt, Rosseau and Kiosk domains. The key elements to look for are good topography to facilitate quarrying, attractive or unusual colours and textures, and as few joints and fractures as possible. There is also a good demand for thin-splitting granite flagstone for use as pavers, interior and exterior veneer, steps and landscaping stone. Such flagstone most commonly occurs in ductile shear zones between geological domains.

Pelitic and semi-pelitic gneisses host varying amounts and qualities of graphite. Graphitic metapelitic gneiss occurs within the Britt, Algonquin, Rosseau and Go Home domains, and is common within the ductile shear zones which bound the domains.

The district contains such industrial rock and mineral commodities as marble, quartz, mica, graphite, anorthosite, garnet and wollastonite. These occurrences should be reviewed in the light of changing economic conditions and developments in mineral markets and applications.

ONTARIO GEOLOGICAL SURVEY ACTIVITY

R. Kelly, Sedimentary and Environmental Geoscience Section, Ontario Geological Survey–Geoscience Branch (formerly MNDM London), continued with a study of the Paleozoic geology in the Lake Simcoe area. He has evaluated the economic potential of these rocks for use as building stone,
cement, high-purity calcium carbonate and high specification aggregate.

RESEARCH BY OTHER AGENCIES

S.B. Lumbers of the Royal Ontario Museum continued with his geological mapping in the Muskoka area.

P. Rasmussen continued work on her PhD thesis at the University of Waterloo. She is attempting to determine if the source of mercury in some of the sport fish in several of the lakes in the Huntsville area is related to a geological source and to evaluate the relative importance of geological and atmospheric sources. Early in 1993, she plans to carry out a lake sediment drilling program in the Huntsville area. This program will follow-up on earlier work done (Rasmussen 1991) and will be jointly funded by Ontario Hydro and the GSC. Initial plans call for the sampling of 17 lakes.

Dr. N.G. Culshaw of Dalhousie University completed geological mapping and associated projects in the Georgian Bay area of the Central Gneiss Belt. The results of his mapping, performed under COMDA, were expected to be published as open file maps and subsequently, as coloured maps, by the GSC in 1992. These maps should be published in 1993.

SELECTED PUBLICATIONS RECEIVED


REFERENCES


INTRODUCTION

In 1992, there were 31 active mining operations and 15 mills plants operating in the Southeastern Resident Geologist’s District. With a single exception, the Chromasco magnesium metal plant in Ross Township, all produce industrial minerals, stone or stone products, and all, with the exception of the underground talc mine of Canada Talc Ltd., are open pit operations. In addition, there are numerous quarries producing construction aggregate which are regulated by the Ontario Ministry of Natural Resources under the Aggregate Resources Act. Advanced exploration is planned on 2 industrial mineral prospects and 1 underground gold prospect, and construction of a new industrial mineral milling/processing plant is in progress.

Exploration for gold, zinc, industrial minerals, and dimension stone continued in 1992, largely with the assistance of government incentive programs including the Ontario Prospector’s Assistance Program and the Ontario Mineral Incentive Program.

MINING ACTIVITY

Mining activity in the Southeastern Resident Geologist’s District in 1992 is summarized in Figure 18.1 and Table 18.1. Although some quarries have decreased production due to lower demand for stone products, the level of activity remained much as it was in 1991. One new quarry was opened in 1992, producing flagstone from red limestone in Harvey Township. This operation, the Redstone Quarry, is described in the section on Property Examinations.

The largest producers are the 4 cement companies: Lafarge Canada Inc., St. Mary’s Cement Co., St. Lawrence Cement Inc., and Essroc Canada Inc. (formerly Lake Ontario Cement). Production capacities range from 1 million to 1.9 million tonnes of cement per year. All, with the exception of St. Lawrence Cement Inc., quarry limestone at the plant site. Limestone at the St. Lawrence quarry near Colborne in Cramahe Township is shipped by barge to the Clarkson plant near Oakville for processing.

The combined plant and quarry operations employ 200 people.

Timminco Ltd.

Timminco Ltd. produces magnesium metal from high-purity dolomite marble quarried at the plant site near Haley Station in Ross Township.

The dolomite deposit was quarried intermittently for building stone and aggregate prior to 1942, since which time it has been quarried for the production of magnesium metal. It consists of a 75 m wide unit of white, coarsely crystalline, dolomitic marble containing less than 1% impurities, including chondrodite, talc, tourmaline, tremolite, and graphite. To date, the deposit has been mined in 2 quarries over a strike length of 700 m. All production is currently from the No. 2 quarry (LeBaron and MacKinnon 1990).

Magnesium is produced by a thermal reduction process (the Pidgeon process), in which calcined dolomite is combined with ferrosilicon and fluorspar flux in small-diameter vacuum furnaces, forming magnesium vapour and a residue of calcium silicate and iron oxide. The vapour is condensed externally, producing magnesium metal which is 99.98% pure.

The plant capacity is 6000 tonnes of magnesium metal per year, requiring about 45,000 tonnes of dolomite. In addition to magnesium, Timminco recovers calcium metal from southern Ontario limestone and strontium metal from imported celestite.

The combined plant and quarry operations employ 200 people.

Unimin Canada Ltd.

Unimin Canada Ltd. operates a nepheline-syenite quarry and 2 processing plants in Methuen Township. Although the current operation, known as the Blue Mountain Quarry, opened in 1955, quarrying in other parts of this very large deposit began in 1936.
Figure 18.1. Operating mines and mills, in 1992, in the Southeastern Resident Geologist's District (numbers keyed to Table 18.1).
### Table 18.1. Mining activity in 1992 in the Southeastern Resident Geologist’s District (numbers keyed to Figure 18.1).

<table>
<thead>
<tr>
<th>Map No.</th>
<th>Company</th>
<th>Mine</th>
<th>Location (Township)</th>
<th>Commodities</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3 M Canada Inc.</td>
<td>Belmont</td>
<td>Traprock</td>
<td>Roofing granules are produced from traprock at this quarry and processing plant.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Arriscraft</td>
<td>Bastard</td>
<td>Sandstone</td>
<td>Sandstone for manufacture of reconstituted sandstone. Raw material is shipped to Cambridge, Ontario for processing.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Blair, A.L. Construction Ltd.</td>
<td>Finch</td>
<td>Limestone</td>
<td>Agricultural lime and crushed stone are produced from this quarry.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Bolenders Ltd.</td>
<td>Guilford</td>
<td>Dolomite</td>
<td>Dolomite (marble): poultry grit, golf sand, decorative aggregate, white powder sold for use in bricks and mortar.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Canada Cement LaFarge Ltd. (Bath)</td>
<td>Ernestown</td>
<td>Cement</td>
<td>Cement is produced on site.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Canada Talc Ltd.</td>
<td>Henderson &amp; Conley mines</td>
<td>Huntingdon</td>
<td>Talc products, ground and Dolomite crushed dolomite products including terrazzo chips are produced from this mine. Canada Talc operates 2 mills, 1 at the mine site and another at Marmora.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Chromasco Ltd.</td>
<td>Ross</td>
<td>Magnesium</td>
<td>Magnesium is produced from dolomite quarried at this location. Strontium and calcium are produced from purchased material.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Cornwall Sand and Gravel</td>
<td>Cornwall</td>
<td>Limestone</td>
<td>Limestone blocks for and for dimension stone are produced from thick upper beds from this quarry.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Easton Minerals Ltd.</td>
<td>Northbrook Mill</td>
<td>Kaladar</td>
<td>This mill processes talc and dolomite from Madoc Tp., granite from the Rear of Leeds and Lansdowne Tp. and silica.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Easton Minerals Ltd.</td>
<td>Rear of Leeds and Lansdowne</td>
<td>Granite</td>
<td>Decorative red granite aggregate is produced from this quarry.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Exworth, T.</td>
<td>Redstone Quarry</td>
<td>Harvey</td>
<td>Flagstone</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Essroc Canada Inc.</td>
<td>Lake Ontario Cement Ltd.</td>
<td>Sophiasburg</td>
<td>Limestone is quarried and cement is produced on site.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Granimar Quarries Ltd.</td>
<td>Straw Hill Quarry</td>
<td>Rear of Leeds and Lansdowne</td>
<td>Red granite blocks are quarried and shipped to dimension stone plants.</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Hughes, W.</td>
<td>Pittsburgh</td>
<td>Silica</td>
<td>Sandstone is quarried and sold for use in manufacture of portland cement.</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Kingston Stone Products Ltd.</td>
<td>Rear of Leeds and Lansdowne</td>
<td>Sandstone</td>
<td>Sandstone is quarried from this site. A limestone finishing plant for sandstone and limestone is also located here.</td>
<td></td>
</tr>
<tr>
<td>Map No.</td>
<td>Company</td>
<td>Mine</td>
<td>Location (Township)</td>
<td>Commodities</td>
<td>Notes</td>
</tr>
<tr>
<td>--------</td>
<td>--------------------------------------------</td>
<td>----------------------</td>
<td>---------------------</td>
<td>-------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>18</td>
<td>McFarland Const. Co. (Wimpey Minerals Canada)</td>
<td>Crookston Quarry</td>
<td>Huntingdon</td>
<td>Limestone</td>
<td>Large building stone blocks are produced on demand.</td>
</tr>
<tr>
<td>19</td>
<td>Payne, E.W.</td>
<td>Dummer</td>
<td>Limestone</td>
<td></td>
<td>Flagstone</td>
</tr>
<tr>
<td>20</td>
<td>Ram Petroleum Ltd.</td>
<td>Palmerston</td>
<td>Tremolite</td>
<td></td>
<td>Tremolite is quarried, ground, and sold as mineral filler (&quot;Clarendite&quot;).</td>
</tr>
<tr>
<td>21</td>
<td>Rasmussen, P.</td>
<td>Princess Sodalite Mine</td>
<td>Dungannon</td>
<td>Gemstones</td>
<td>Sodalite is quarried and sold for mineral specimens.</td>
</tr>
<tr>
<td>22</td>
<td>Rideauview Contractors Ltd.</td>
<td>Rear of Leeds and Lansdowne</td>
<td>Sandstone building blocks (ashlar), and flagstone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Saint Lawrence Cement Co. Ltd.</td>
<td>Cramahe</td>
<td>Cement</td>
<td></td>
<td>Quarry only. Rock is barged to Clarkson plant near Oakville for processing.</td>
</tr>
<tr>
<td>24</td>
<td>Sloan, N.</td>
<td>Sloan Quarry</td>
<td>Storington</td>
<td>Sandstone</td>
<td>Sandstone building blocks (ashlar).</td>
</tr>
<tr>
<td>25</td>
<td>St. Mary's Cement Ltd. (Bowmanville)</td>
<td>Darlington</td>
<td>Cement</td>
<td></td>
<td>Cement is produced on site.</td>
</tr>
<tr>
<td>26</td>
<td>Steep Rock Resources Inc.</td>
<td>Tatlock Quarry</td>
<td>Darling</td>
<td>Calcite</td>
<td>High-purity, finely-ground calcite for fillers plus other grades of calcite, and marble chips. Mill is west of Perth.</td>
</tr>
<tr>
<td>27</td>
<td>Stoklosar Marble Quarries Ltd.</td>
<td>Madoc</td>
<td>Marble</td>
<td></td>
<td>Marble chips (terrazzo) are produced at this mill from stone quarried at several locations in the Madoc–Marmora area.</td>
</tr>
<tr>
<td>28</td>
<td>Two Island Marble Corp.</td>
<td>Griffith</td>
<td>Marble</td>
<td></td>
<td>White marble dimension stone, finishing plant is at Dacre.</td>
</tr>
<tr>
<td>29</td>
<td>Unimin Canada Ltd.</td>
<td>Blue Mountain Quarry</td>
<td>Methuen</td>
<td>Nepheline Syenite</td>
<td>Nepheline syenite produced from a mine in this township is processed in two mills. Magnetite is also produced.</td>
</tr>
<tr>
<td>30</td>
<td>Upper Canada Stone Ltd.</td>
<td>Mayo Marble Quarry</td>
<td>Mayo</td>
<td>Marble</td>
<td>Crushed white marble is produced at the quarry site.</td>
</tr>
<tr>
<td>31</td>
<td>Windover, N.</td>
<td>Harvey</td>
<td>Limestone</td>
<td>Flagstone</td>
<td></td>
</tr>
</tbody>
</table>

The main nepheline-syenite body is about 2 km wide and 4 km long and is composed of about 20 to 25% nepheline, 48 to 54% albite, 18 to 23% microcline, and accessory minerals including magnetite, biotite, muscovite, and hornblende (Easton et al. 1986). The Blue Mountain Quarry produces over 600,000 tonnes per year. Reserves are virtually unlimited, as 3500 acres of nepheline syenite are exposed and only 200 acres have been used to date in 7 or 8 quarries (Steve Clark, Unimin Canada Ltd., personal communication, 1992).

The ore is crushed, dried, and ground to −30, −40 and −50 mesh products for the glass industry. Magnetite, biotite, and hornblende are removed by high-intensity magnetic separation. Finer grades are also produced for the ceramic, paint, and plastics industries. Over 70% of the production is used in glass manufacturing.

A total of 158 people are employed at the quarry and 2 plants.

**Steep Rock Resources Inc.**

Steep Rock Resources Inc., a subsidiary of Pluessel-Staufer A.G., operates a high-purity calcite marble quarry for the production of calcium carbonate as a mineral filler. The quarry is located near Tatlock in Darling Township and the processing plant is about 40 km to the south, just west of Perth.
The marble belt which hosts the Tatlock quarry consists of zones of white and coloured (blue, pink, and buff) marbles which were extracted for dimension stone in the area of the present quarry between 1962 and 1971. The zone of white, high-purity marble being quarried by Steep Rock Resources Inc. is up to 85 m wide and contains reserves sufficient to permit over 50 years of production at current rates.

The quarry has been operated on a seasonal basis, producing 250 000 tonnes per year for year-round operations of the mill. In 1993, the quarry will begin producing year-round at an increased level. Stripping of the deposit to the north and south of the present quarry was done in 1992, in preparation for the quarry expansion. The plant capacity was increased in 1992 above its previous 250 000 tonnes per year limit by an addition to the wet-grind circuit which will produce very fine grades of calcium-carbonate filler for the paper industry in Canada and the United States (O. Chatillon, Fluess-Staufer A.G., Perth, personal communication, 1992). A new 4000 square foot office and administration building was opened in December 1992.

Additional products from the Perth mill include decorative aggregate, terrazzo chips, poultry grit, agricultural limestone, stucco mix, and fine-ground filler material for floor tile, wall joint compounds, paints, and plastics.

The quarry and plant operations employ a total of 50 people.

**3M Canada Inc.**

3M Canada Inc. operates a large quarry in basaltic metavolcanic rocks for the production of roofing granules. The quarry was originally opened in 1907 to produce aggregate for road surfacing, but has been operated for roofing granules since 1948. Crushing and colouring plants are located on site and the coloured granules are shipped to asphalt shingle manufacturers throughout Canada and parts of the United States.

The stone quarried is a uniform, dense, dark green metavolcanic rock that breaks into roughly equidimensional fragments and is essentially free of sulphide minerals. Over 600 000 tonnes are quarried annually and there is no foreseeable end to reserves (G. Amo, 3M Canada Inc, Havelock, personal communication, 1992).

Relatively small amounts of crushed rock are sold as road construction aggregate and as a component in the manufacturing of rock wool.

A total of 100 people are employed at the plant and quarry.

**Canada Talc Ltd.**

The Canada Talc Ltd. mine at Madoc is the oldest continuously operated mine in Ontario, having been opened in 1896 as the Henderson talc mine. Several talc ore-bodies have been developed on the property by underground and open-pit mining. Current production of high-grade talc and lower grade talcose dolomite is from the underground mine. Dolomite is also quarried at the mine site and used to produce decorative aggregate and a low-grade mineral filler.

The talc ore bodies are hosted by white dolomitic marble and vary in width from 7 to 25 m. The current underground workings are 250 m deep. High-grade talc ore has been intersected in diamond-drill holes at a vertical depth of 370 m. The mine produces about 30 000 tonnes per year, about 70% of which is sold as mineral filler to the plastics industry in Canada and the United States.

Canada Talc Ltd. operates 2 mills, 1 at the mine site, primarily for crushing of lower-grade "grey" talc, and another at Marmora. The Marmora plant includes a grinding and air-classifying system which produces a ~325 mesh (98% 40 μm or less) product. In recent years, the company has processed pink talc imported from China at the Marmora plant, also for use in the plastics industry. Negotiations were undertaken in 1992 with a company interested in developing the "East Ore Body" (3.5 million tonnes grading 25% talc) and constructing a flotation mill (R. Kirkwood, Canada Talc Ltd., personal communication, 1992).

In the latter part of 1992, Canada Talc Limited began developing a new fourth level at about 850 feet below surface and about 100 feet below the lowest current workings. The new development will be carried out by continuing the present decline to the new level and once the new level is developed, drifting to below the Conley shaft and raising up to connect with this shaft which is the current (only) production shaft. This will allow direct hoisting from the new 4th level. Additional ventilation raises will be developed as well. Hoisting capacity has already been increased by 30% by installing a new skip. At present, the small crusher is the production bottleneck and a new crusher is planned. All this work will be carried out by Canada Talc over the next 2 to 3 years as time and money allow (R. Lockstein, Canada Talc Limited, personal communication, 1992).

The mine and 2 mills employ a total of 30 people.

**I.K.O. Industries Ltd.**

In 1991, I.K.O. Industries Ltd. opened a new quarry in Madoc Township for the production of roofing granules from metavolcanic rock. Quarrying continued through 1992 and the company has started construction of a mill and a colouring plant at the quarry site, which will supply the company with roofing granules to be shipped by truck to its asphalt shingle manufacturing plant in Brampton. I.K.O. currently purchases pre-dried granules from 3M Canada Inc.

The quarry is within a ridge of grey to black, fine-grained, agglomeratic, intermediate metavolcanic rock, which has been shown, by testing over the past 5 years, to be durable and without undesirable weathering effects. Stone from the quarry, licensed for production of up to 1 million tonnes per year, is used to produce HL-1 aggregate (asphalt road surfacing mix) in addition to roofing granules.
The mill will consist of a primary cone crusher, secondary crushing and screening equipment, and extensive materials handling facilities. It is expected to be in operation by April 1993, producing granules which will be used on the uncoloured, overlapped part of the shingles. The colouring plant will not be completed before 1994. A large powerline into the site has been constructed and construction of a new gas pipeline from Stirling to Madoc is planned. The pipeline will supply natural gas to I.K.O.'s colouring plant and to the town of Madoc.

The construction phase will provide employment for about 20 people. About 60 people will be employed when the quarry, mill, and colouring plant are in full operation (L. Warner, I.K.O. Industries Ltd., personal communication, 1992).

**Granimar Quarries Ltd.**

Granimar Quarries Ltd. of Montreal operates a dimension-stone quarry north of Gananoque in the Rear of Leeds and Lansdowne Township. This operation, known as the Straw Hill quarry, produces rough blocks of an attractive, deep-red granite ("Rideau Red") which are shipped to building and monument industry suppliers in Ontario, Quebec and the United States.

Although the demand for large blocks was down in 1992, the company was active, quarrying and shipping blocks, removing waste material, and establishing access to good working faces of the granite.

Two men are employed at the quarry, and the company is prepared to increase production on demand (Granimar Quarries Ltd., personal communication, 1992).

**Kingston Stone Products Ltd.**

Kingston Stone Products Ltd. operates a sandstone quarry and stone processing plant at Ellisville, northeast of Kingston. The company also obtains limestone and various hues of sandstone for the production of cut building stone from Rideauview Contractors Ltd. of Inverary, Ontario.

The stone is cut with a four-foot diameter circular diamond-saw and a variety of finishes, with the exception of a polished surface, are available. The company, which began operations in 1990, supplies building stone for the residential market in addition to cutting stone for restoration of older buildings. Major contracts filled include cut limestone for restoration at Queen's University and limestone blocks for the addition of a floor at the Kingston Penitentiary.

The Kingston Stone Products Ltd. operation employs 4 people.

**EXPLORATION ACTIVITY**

Exploration activity in the district for 1992 is summarized in Figure 18.2 and Table 18.2. Claim staking activity (Table 18.3) remained at about the same level as in 1991. The amount of assessment work recorded is difficult to compare to previous years because of the change from "man days" to dollar value which was introduced in June 1991. Therefore, assessment work filed under the previous system has not been included in Table 18.3.

Much of the exploration activity that took place was funded by the Ontario Prospectors Assistance Program (OPAP) and the Ontario Mineral Incentives Program (OMIP). During 1992 in the Southeastern Resident Geologist's District, OPAP granted a total of $359,901 to 36 individual prospectors and OMIP approved $135,872 for 4 exploration programs.

**ADVANCED EXPLORATION AND DEVELOPMENT ACTIVITY**

**Pacific Coast Mines Inc. (Seeley's Bay Wollastonite Prospect)**

Pacific Coast Mines Inc., a subsidiary of the United States Borax and Chemical Corporation, is beginning advanced stage exploration on a wollastonite prospect near Seeley's Bay in Pittsburgh, and Rear of Leeds and Lansdowne Township.

Since the discovery of the prospect in 1990, detailed geological mapping has indicated widespread wollastonite mineralization associated with quartz- and diopside-rich siliceous metasedimentary rocks, within an area of about 800 by 500 m along the north flank of a small gabbroic intrusion. The main wollastonite-diopside unit averages about 50 to 60% wollastonite. A total of 6 diamond-drill holes were completed in 1990-91, and an additional 34 holes were drilled in 1992. Tonnage and grade estimates have not yet been released. Grinding and separation tests have shown that the wollastonite breaks into high-quality particles with respect to size and aspect ratio.

The company hopes to determine the feasibility of an open-pit mining and on-site milling operation by the end of 1993. Proposed exploration work includes a bulk sample test pit and additional beneficiation tests.

All exploration work on the prospect is being performed by Bedford Resource Management Inc. of Halifax, Nova Scotia (Peter Akerley, Bedford Resource Management Inc., personal communication, 1992).

**Ram Petroleum Ltd. (Hawley Zinc-Wollastonite Prospect)**

Ram Petroleum Ltd. continued beneficiation tests on a wollastonite prospect in Olden Township. Diamond-drilling completed prior to 1992 indicates reserves of 2.5 million tonnes grading 32% wollastonite. In order to determine the feasibility of the project, proposed work includes stripping, bulk sampling and pilot plant testing (Colin Bowdidge, Ram Petroleum Ltd., personal communication, 1992).
Canadian Mono Mines Inc. (Bannockburn Gold Prospect)

In 1992, Canadian Mono Mines Inc. filed a Mine Closure Plan and held a public notification meeting in preparation for an advanced exploration project to begin in January 1993. The project will consist of underground mining of a 10,000 tonne bulk sample from the company’s Bannockburn gold prospect. Previous exploration work has outlined reserves of 225,000 tonnes grading 9.15 g/t Au (0.267 ounces Au per ton).

The mining will be done via an existing ramp and workings on the 75-foot level, constructed during an underground exploration program in 1988. The bulk sample will consist of part of a high-grade "ore shoot" within the Discovery Zone lying above the 75-foot level. This material is estimated to grade 2.127 ounces Au per ton over a width of 4 feet above the 75-foot level, over a strike length of 220 feet.

Mining is expected to be completed in May, 1993, and the sample will be shipped to the Deak Resources Corp. mill in Virginia town, Ontario for processing. The Project will employ 10 to 12 workers at the mine site (Turner 1992).

Belrose Minerals Corp. (Belmont Granite Quarry)

Belrose Minerals Corp. owns the Belmont granite quarry, a former dimension-stone producer, in Belmont Township about 15 km north of Havelock. The company is in the process of setting up a stone processing plant at the quarry site for the production of a variety of stone products, primarily for landscaping applications. These will include edging, curb and paving stone as well as outdoor benches and tables. Initially, the plant will be equipped with a 3 m diameter diamond-saw, a smaller trimming-saw, and a hydraulic splitter. The company will begin processing stone that remains on site from previous quarrying operations, estimated to be a two-year supply, but will eventually put the existing quarry back into production.

The stone is an attractive, pink, medium-grained granite of uniform colour and texture, termed "Belmont Rose Granite" by the previous dimension-stone producer.

The plant, to be named the Belmont Granite Works, should be in production by spring of 1993, supplying stone products for markets in the greater Toronto area (U.H. Kretschmar, Belrose Minerals Corp., personal communication, 1992).

Zinc Corporation of America (Renprior Zinc Prospect)

In 1992, Zinc Corporation of America (ZCA), a subsidiary of St. Joseph Minerals, outlined a proposal to perform advanced exploration on the Renprior zinc prospect in Admaston Township, near Renfrew. A zone of sphalerite mineralization with minor galena, pyrite, and chalcopyrite hosted in calc-silicate rock is estimated to contain geological reserves of 750,000 tonnes grading 9% zinc.

The advanced exploration project, proposed to begin in 1993, consists of the construction of a decline and underground workings, removal of a bulk sample, and test milling of the bulk sample at the company’s mill in Balmat, New York. Zinc Corporation of America operates the Balmat–Edwards zinc mine in New York State. If a decision to advance to full-scale production is made, Zinc Corporation of America proposes to mine the zinc ore at a rate of 400 tonnes per day (4 to 5 year mine life) and truck the ore to the Balmat mill for processing.

TMF Mineral Resources (Summit Lake Iron Deposit)

The Summit Lake iron deposit is located near the village of Ompah in South Canonto Township. The main magnetite zone, which has been developed by an open cut measuring about 60 m long by 12 m wide by 8 m deep, contains an estimated 3 million tonnes of ore averaging 40% Fe.

About 3000 tonnes of crushed ore and 2000 tonnes of broken ore remain on the site from the previous mining operation. This material was used by Ontario Hydro for construction of high-density containment shields in nuclear reactors.

A second zone, about 600 m east-northeast of the main zone, consists of high-grade magnetite mineralization within massive to banded amphibolite. Magnetic surveys and diamond drilling are proposed on this zone in 1993. Work done in 1992 included beneficiation tests on ore from the main zone in an attempt to meet current specifications for high-density aggregate. The present owner of the property, TMF Mineral Resources, is negotiating the sale of the high-density aggregate for nuclear shielding applications in Ontario and Mexico.

PROPERTY EXAMINATIONS

Seeley’s Bay Wollastonite Prospect (Pacific Coast Mines Inc.)

The Pacific Coast Mines Inc. wollastonite prospect is located about 30 km northeast of Kingston along the east side of Hwy. 15 just south of Seeley’s Bay, in lots 36 to 38, Concession X, Pittsburgh Township, Frontenac County and lots 1 to 3, concessions VI and VII, Rear of Leeds and Lansdowne Township (Leeds Geographic Township), Leeds County.

The prospect lies within the Frontenac Axis in an area underlain predominantly by Precambrian carbonate and siliciclastic rocks (quartzite, paragneiss, calc-silicate rocks, and marble) which have undergone granulite-facies metamorphism. Regional strike is northeasterly and fold axes plunge gently northeast and southwest (Wynne–Edwards 1962). The metasedimentary rocks have been intruded by pink, coarse-grained syenitic and granitic plutons as well as
Figure 18.2. Active exploration sites in 1992 in the Southeastern Resident Geologist's District (keyed to Table 18.2).
### Table 18.2. Exploration activity in the Southeastern Resident Geologist’s District (keyed to Figure 18.2).

<table>
<thead>
<tr>
<th>Company/Individual (Occurrence Name)</th>
<th>Township (Commodity)</th>
<th>Exploration Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong> 1886 Holdings Ltd. <strong>1869 Holdings Ltd.</strong></td>
<td>Grimsthorpe, Marmora <strong>1869 Holdings Ltd.</strong> (Dimension stone)</td>
<td>GL</td>
</tr>
<tr>
<td><strong>2</strong> Archibald, J.C., <strong>Archibald, C.W.</strong></td>
<td>Cavendish <strong>Archibald, C.W.</strong> (Vermiculite)</td>
<td>Geophysical surveys, bedrock sampling</td>
</tr>
<tr>
<td><strong>3</strong> Barrie, C.</td>
<td>Madoc</td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>4</strong> Beeley, T., Laidlaw, C.J.</td>
<td>Grimsthorpe <strong>Beeley, T.</strong> (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>5</strong> Belrose Minerals Corp. <strong>Belrose Minerals Corp.</strong> (Belmont Granite)</td>
<td>Belmont <strong>Belrose Minerals Corp.</strong> (Dimension stone)</td>
<td>Preparation for construction of stone cutting plant</td>
</tr>
<tr>
<td><strong>6</strong> Blake River Explorations Ltd.</td>
<td>Sheffield <strong>Blake River Explorations Ltd.</strong> (Zn)</td>
<td>Overburden drilling</td>
</tr>
<tr>
<td><strong>7</strong> Brack, W.</td>
<td>Marmora, Kaladar <strong>Brack, W.</strong> (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>8</strong> Brown, W.A., Brown, W.J.</td>
<td>Methuen <strong>Brown, W.A., Brown, W.J.</strong> (Dimension stone)</td>
<td>Str, test block quarrying</td>
</tr>
<tr>
<td><strong>9</strong> Canadian Mono Mines Inc. <strong>Canadian Mono Mines Inc.</strong> (Bannockburn gold)</td>
<td>Madoc <strong>Canadian Mono Mines Inc.</strong> (Au)</td>
<td>Closure plan and public notice of underground bulk sampling project</td>
</tr>
<tr>
<td><strong>10</strong> Christie, B.</td>
<td>Lyndoch, Denbigh</td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>11</strong> Dadson, P.</td>
<td>Madoc</td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>12</strong> Dillman, R.J.</td>
<td>Grimsthorpe <strong>Dillman, R.J.</strong> (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>13</strong> Fogal, R.</td>
<td>Marmora <strong>Fogal, R.</strong> (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>14</strong> Gallo, E., Hauseaux, M., Surnacz, S.</td>
<td>Camden</td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>15</strong> Hardie, D.A., Hardie, A.A. <strong>Hardie, D.A., Hardie, A.A.</strong> (Gough)</td>
<td>Barrie <strong>Hardie, D.A., Hardie, A.A.</strong> (Au)</td>
<td>DD, Tr</td>
</tr>
<tr>
<td><strong>16</strong> Harper, S.E.</td>
<td>Monmouth, Sebastopol <strong>Harper, S.E.</strong> (Apatite)</td>
<td>GL, GRA, Tr</td>
</tr>
<tr>
<td><strong>17</strong> Hobbs, L. <strong>Hobbs, L.</strong> (Glanmire)</td>
<td>Tudor <strong>Hobbs, L.</strong> (Pb, Zn)</td>
<td>Prospecting</td>
</tr>
</tbody>
</table>

**Abbreviations**

- DD: Diamond drilling
- GL: Geological survey
- GC: Geochemical survey
- GM: Ground magnetic survey
- GRA: Ground radiometric survey
- VLF-EM: Very low frequency electromagnetic
- Str: Stripping
- Tr: Trenching

<table>
<thead>
<tr>
<th>Company/Individual (Occurrence Name)</th>
<th>Township (Commodity)</th>
<th>Exploration Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>19</strong> Johnson, W.</td>
<td>S.Canonto, Miller</td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>20</strong> Kearney, M.K.</td>
<td>Tudor</td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>21</strong> King, B., Tulonen, P.</td>
<td>Grimsthorpe <strong>King, B., Tulonen, P.</strong> (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>22</strong> MacLachlan, J., Proctor, A.</td>
<td>Anglesea <strong>MacLachlan, J., Proctor, A.</strong> (Au)</td>
<td>Prospecting, GC, GM, VLF-EM, Tr</td>
</tr>
<tr>
<td><strong>24</strong> Menard, A.</td>
<td>Bedford (Graphite) <strong>Menard, A.</strong> GL</td>
<td></td>
</tr>
<tr>
<td><strong>25</strong> North, J.W.</td>
<td>Lavant <strong>North, J.W.</strong> (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>26</strong> Osiel, M.</td>
<td>Lake Tp. <strong>Osiel, M.</strong> (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>27</strong> Pacific Coast Mines Inc.</td>
<td>Pittsburgh, Rear of Leeds and Lansdowne <strong>Pacific Coast Mines Inc.</strong> (Wollastonite)</td>
<td>GL, DD, beneficiation tests</td>
</tr>
<tr>
<td><strong>28</strong> Pitman, P.W.</td>
<td>Cavendish <strong>Pitman, P.W.</strong> (Zn)</td>
<td>Prospecting, GL, GL, geophysical surveys</td>
</tr>
<tr>
<td><strong>29</strong> Ram Petroleum Ltd. (Hawley)</td>
<td>Olden <strong>Ram Petroleum Ltd. (Hawley)</strong> (Wollastonite)</td>
<td>Beneficiation tests</td>
</tr>
<tr>
<td><strong>30</strong> Rapski, J.P.</td>
<td>Cavendish</td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>31</strong> Ross, R.J.</td>
<td>Marmora, Madoc <strong>Ross, R.J.</strong> (Au)</td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>32</strong> Senator Stone Supply Ltd.</td>
<td>Faraday <strong>Senator Stone Supply Ltd.</strong> (Dimension stone)</td>
<td>DD</td>
</tr>
<tr>
<td><strong>33</strong> Stewart, R.V.</td>
<td>Snowdon, Galway</td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>34</strong> TMF Mineral Resources (Summit Lake Iron)</td>
<td>South Canonto <strong>TMF Mineral Resources (Summit Lake Iron)</strong> (Magnetite)</td>
<td>Beneficiation tests</td>
</tr>
<tr>
<td><strong>35</strong> Wilkinson, S.J.</td>
<td>Lake Tp. <strong>Wilkinson, S.J.</strong></td>
<td>Prospecting</td>
</tr>
<tr>
<td><strong>37</strong> Zinc Corporation of America (Renprior Zn)</td>
<td>Admaston <strong>Zinc Corporation of America (Renprior Zn)</strong> (Zn)</td>
<td>Feasibility study</td>
</tr>
</tbody>
</table>
Table 18.3. Summary of claims recorded and assessment work credits in 1992.

<table>
<thead>
<tr>
<th>Year</th>
<th>Claims Recorded (Units)</th>
<th>Claims Cancelled (Units)</th>
<th>Claims Active (*)</th>
<th>Physical ($*)</th>
<th>Geotechnical ($)</th>
<th>Assays ($)</th>
<th>Prospecting ($)</th>
<th>Other **</th>
<th>Total ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>391</td>
<td>377</td>
<td>1157</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1984</td>
<td>555</td>
<td>498</td>
<td>1254</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>457</td>
<td>360</td>
<td>1312</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1986</td>
<td>744</td>
<td>426</td>
<td>1579</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>1987</td>
<td>619</td>
<td>526</td>
<td>1641</td>
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<td></td>
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<td></td>
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<tr>
<td>1988</td>
<td>982</td>
<td>404</td>
<td>2255</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1989</td>
<td>598</td>
<td>729</td>
<td>2423</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>431</td>
<td>613</td>
<td>2302</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1991</td>
<td>295</td>
<td>379</td>
<td>1818</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>331</td>
<td>218</td>
<td>1236</td>
<td>179 035</td>
<td>49 980</td>
<td>1044</td>
<td>7111</td>
<td>151 859</td>
<td>389 029</td>
</tr>
</tbody>
</table>

* 1992 figure includes both single and block claims

** Industrial mineral testing and marketing

Note: A change from “man days” to dollar value for assessment work was introduced in June 1991. For a record of assessment work credits prior to 1992, please refer to Papertzian et al. (1992).

by smaller granitic to gabbroic bodies and white pegmatite dikes.

The Seeley’s Bay wollastonite zone is in contact to the south with a gabbro intrusion situated at the northern margin of the Taylor syenitic pluton. A northeast-trending, horse-shoe-shaped band of quartzite with closure to the west is enclosed by biotite-quartz-feldspar gneiss and encloses an area described by Wynne-Edwards (1962) as rusty-weathering, quartz-diopside-feldspar gneiss. The latter unit comprises the wollastonite prospect and is more accurately termed a quartz-diopside-wollastonite gneiss. This unit can be divided into 3 sub-units based upon geological mapping and diamond drilling done by Pacific Coast Mines Inc., as follows: 1) wollastonite-diopside, 2) diopside-pyrite, and 3) diopside-quartz.

The wollastonite-diopside unit contains up to 80% wollastonite as white, rectangular grains averaging 2 to 5 mm in length, showing fibrous cleavage striations. Diopside occurs as disseminated pale green grains, generally concentrated in diopside-rich bands. Wollastonite-rich layers containing only minor disseminated diopside are reported to be up to 30 m thick. Minor quartz, pyrite, and pyrrhotite are also present in this unit.

The project geologists estimate that the wollastonite-diopside unit comprises about 30% of the area within the quartzite “horseshoe” and that the average grade of the unit is 50 to 60% wollastonite. Folding within this area is complex, as indicated by the diamond-drilling done to date and by small-scale folds in outcrops. Although the eastern limit of the wollastonite zone has not been determined, the surface area of the zone enclosed by the quartzite “horseshoe” is about 800 by 500 m, suggesting that there is good potential for a large deposit of wollastonite. A report by the company states that: “Our exploration has indicated that our deposit will rival the New York State operations and strongly compete on the world market” (Pacific Coast Mines 1992).

Harlowe Area Gold Prospects, Kennebec Township

The Harlowe area property of Rio Algom Exploration Ltd. consists of 2 blocks of land (all patented and acquired through option agreements): the first in Kaladar Township covering parts of lots 30 to 32, concessions 10 and 11, and the second in Kennebec Township, covering parts of lots 31 and 32, concessions 2 to 5. The company conducted geological and geochemical surveys, trenching, and diamond drilling in 1990–91. No work was done in 1992. Three properties, all in
Kennebec Township, were examined: 1) Shorts property, east half of Lot 32, Concession III; 2) Gibbs property, west half of Lot 31, Concession III; and 3) Boegel property, west half of Lot 31, Concession II.

In the Harlowe area, a narrow (2 km wide) belt of tightly folded Hermon Group mafic metavolcanics, marbles, siliciclastic metasediments, and Flinton Group quartz pebble conglomerates and quartzites trends northeastally along the northern margin of the Northbrook granodiorite pluton. The tight folding has produced a complex pattern of interfingering and interlayered metavolcanics, metasediments, and granitic intrusive rocks. This belt hosts a number of gold occurrences. The geology of the 3 properties listed above is described below.

**SHORTS PROPERTY**

Erratic native gold mineralization occurs within quartz-tremolite veins hosted by a 7 m wide dolomitic marble unit flanked by amphibolitic mafic metavolcanics to the south and predominantly calcitic marbles to the north. Minor rock units include folded and boudinaged granitic dikes and a biotite-rich metasediment, termed "mudstone" on the Rio Algom geology map. The latter forms the northern contact with the dolomite unit, and the granitic rock locally forms the southern contact.

The dolomite unit is fine-grained, mottled bluish-grey and white and weathers yellow-brown. It strikes 80° and dips about 80°. The quartz-tremolite veins are up to 10 cm wide and vary in attitude from sub-parallel to foliation to cross-cutting and are folded about axes parallel to the strike of the dolomite unit. The quartz-tremolite veins weather in high relief (up to 5 cm above the dolomite) and plunge about 70° to the west. Trace amounts of pyrite are present in the dolomite and in the quartz veins. Gold mineralization, occurring as native grains, is confined to the quartz-tremolite veins. Visible gold was seen in place during the property visit in a vein exposed by stripping of the dolomite unit.

The dolomite unit has been exposed in a series of trenches over a strike length of 80 m and was tested by 6 diamond-drill holes over a strike length of about 300 m. Gold values of up to 32 g/t Au across 1 m, but more commonly in the range of 10 g/t Au were obtained, but were considered to be too narrow and erratic to warrant further work.

This occurrence is a new showing, discovered by stripping of a moss-covered outcrop during geological mapping by R. Knowles of Rio Algom in 1990.

**GIBBS PROPERTY**

This previously known occurrence (New Dome Area occurrence) consists of quartz veins containing tetrahedrite, chalcopyrite, malachite, and azurite in a small lens of dolomite marble along the north side of a ridge of mafic volcanic rock. Homestake Mineral Development Company reported assays of up to 1.7 g/t Au (Lloyd and Bending 1989) and Rio Algom reported up to 10 g/t Au from grab samples (R. Knowles, Rio Algom Exploration Ltd., personal communication, 1992).

**BOEGEL PROPERTY**

An auriferous zone over 1 km in strike length is hosted by metasediments between 2 mafic metavolcanic units. A section across the geological units northward from the Northbrook pluton is as follows (based on the Rio Algom geological compilation map):

1. mafic metavolcanics (200 m)
2. quartzite pebble conglomerate (50 m)
3. mafic metavolcanics (30 m)
4. quartzite pebble conglomerate (30 m)
5. pseudo-granite conglomerate (tectonized granite dikes) within biotitic mudstone, 25 m; main auriferous zone, up to 8 g/t Au over 3 to 4 m
6. dolomitic marble (10 m); hematitic quartz veins with up to 10 g/t Au (1.5 m)
7. strongly altered, sheared metavolcanics; biotite-rich schist 25 m wide; 1 m sericite-rich schist and massive pyrite bands up to several cm wide at contact with dolomite; weakly auriferous (1 to 2 g/t Au) sericite-pyrite zone
8. mafic metavolcanics (250 m; local narrow shear zones or pyritic metasediments with minor gold content).

The main auriferous zone consists of a mafic (amphibole-biotite) metasediment containing contorted granite dikes, pods, and boudins. Gold mineralization is associated with fine-grained pyrite in quartz-tourmaline veins cutting the granite.

The zone was tested by Rio Algom in 17 diamond-drill holes (1990–91) along a strike length of 2 km (Knowles 1991). Although gold values were obtained in units 5, 6, and 7 (above), the zone is considered to have little potential for a significant tonnage of economic grade and no further work is planned.

Diamond-drill core from the Shorts and Boegel properties is stored at the Tweed Drill Core Library.

**Flagstone Quarry, Harvey Township**

Redstone Quarries was in its first full year of production in Lot 22, Concession VIII, Harvey Township. The owner, T. Exworth of Lindsay, Ontario, obtained his licence under the Aggregates Resources Act in 1991.

Attractive red, siliceous limestone of the Shadow Lake Formation is quarried for flagstone from a quarry in an eastward-facing escarpment. Below the thinly bedded flagstone is a bed of red-coloured siliceous limestone more than 12 inches thick, which may have dimension-stone potential. A block of this thicker bedded material was collected for use in the Ministry of Northern Development and Mines’ ongoing provincial building-stone project.

Thickly bedded, grey, lithographic limestone of the Gull River Formation was stripped off to expose the flagstone. The
stripped-off limestone blocks are available for sale as erosion-control material, and smaller, irregularly shaped pieces of limestone have been placed on pallets for sale as landscaping stone.

**Marble Prospect, Faraday Township**

Senator Stone Supply Limited has been exploring a marble hill as a dimension-stone prospect in the south part of Lot 31, Concession A, Faraday Township. There are several interesting colours of marble at this prospect including "peach", white and green marbles. In 1992, 8 diamond-drill holes were drilled.

**Vermiculite Prospect, Cavendish Township**

Three prospectors, J.C., F.T. and C.W. Archibald, have been exploring for vermiculite west of Mississagua Lake in Cavendish Township. Geophysics and systematic soil and rock sampling have been carried out. As at the nearby Goshawk Mines Limited property (MacKinnon et al. 1990), which was explored in the 1970s, the richest concentrations of vermiculite are found within overburden in low areas between outcrops.

**Zinc Prospect, Lutterworth Township**

Sphalerite in dolomitic marble is being explored by prospectors R. Jackson and A. Soever near Buller Lake in Lutterworth Township. Detailed geological and geochemical surveys have been carried out, and a visually estimated 2 to 5% sphalerite was observed during the property visit. A plunging structure had been delineated in which the sphalerite content was increasing toward the overburden-covered closure. The prospectors were planning to test the fold hinge area by diamond drilling.

**Granite Prospect, Methuen Township**

Prospectors W.A. and W.J. Brown stripped a large outcrop area of gabbro as a black granite dimension-stone prospect in Lot 10, Concession III, Methuen Township. The gabbro is an attractive stone, and joint patterns suggested that it might prove possible to extract some fairly large blocks. The prospectors have extracted some test blocks for producing polished tiles with which to display the stone to potential buyers.

**Gold Prospect, Anglesea Township**

Prospectors J. MacLachlan and A. Proctor have been conducting grass-roots exploration for gold in lots 4 to 8, Concession VIII and lots 5 to 8, Concession VII, Anglesea Township. Soil, humus, vegetation and rock samples have been geochemically analyzed, VLF electromagnetic survey lines have been run, and trenching has been carried out.

This area is underlain by mafic metavolcanic rocks and lies east of the Mooroton Shear Zone, which was defined by Easton (1990). In the lithogeochemical sampling, 1.3 ppm gold was obtained in a coarse-grained amphibolite sample which appears to be a part of a sheared, altered unit of interflow sediment.

**RESIDENT GEOLOGIST STAFF ACTIVITIES**

**Services**

The following briefly summarizes our normal activities. The Resident Geologist and his staff in the Tweed office provide a consultative technical service to people engaged in both mineral exploration and mining development in southeastern Ontario. This service involves consultations conducted both in the office and in the field, and use of the Resident Geologist's library, files, and computer systems.

We provide comprehensive data on all known past mining and exploration activities in the Southeastern Resident Geologist's District, and monitor ongoing exploration and development. We also maintain contact with other government ministries and agencies on concerns that might have an impact on exploration or mining.

The Resident Geologist's clientele also use the diamond-drill core libraries at Tweed and Bancroft, for examining archived drill core and for logging newly drilled core. Geological maps and reports, claim maps, and prospectors' licenses are sold by the Resident Geologist's secretary.

**Staffing**

In December of 1992, P.W. Kingston was the Resident Geologist, V.C. Papertzian was the Drill Core Library Geologist, P.S. LeBaron was the acting Staff Geologist, and M. Toner was the Secretary, temporarily replacing C.M. Neal, who was on maternity leave from June 1992 until February 1993.

The Staff Geologist, S. van Haaften, was on secondments, working on head office computer data projects throughout much of 1992. From September 1991 through February 1992, he was in Toronto in the Geoscience Data Centre of the Ontario Geological Survey working on database management projects including a pilot project in which a multi-user database system was created for abandoned mines information. During this secondment, V.C. Papertzian was acting Staff Geologist.

From April through June, S. van Haaften worked in Tweed for the Geoscience Data Centre on the 2 Mineral Deposits Inventory (MDI) database publications which were released in 1992. MDI was released as 1992 data accompanying a query program which had been written in 1988. MDI was also separately released as ASCII data, which can be uncompressed on an IBM-compatible personal computer and then imported into virtually any relational database manage-
During the 1992 calendar year, the Southeastern District offered services to the public through 2 offices. These are the office of the Resident Geologist in Tweed, and the office of the Regional Mineral Specialist in Bancroft. These 2 offices logged the following customer enquiries:

<table>
<thead>
<tr>
<th></th>
<th>Tweed</th>
<th>Bancroft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of telephone enquiries</td>
<td>2651</td>
<td>621</td>
</tr>
<tr>
<td>Number of office visits/consultations</td>
<td>924</td>
<td>741</td>
</tr>
<tr>
<td>Number of written requests/mail</td>
<td>301</td>
<td>87</td>
</tr>
<tr>
<td>Total Customer enquiries, 1992</td>
<td>3876</td>
<td>1449</td>
</tr>
</tbody>
</table>

We also logged the following sales to customers for the calendar year, 1992:

<table>
<thead>
<tr>
<th></th>
<th>Tweed</th>
<th>Bancroft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Geological Reports sold</td>
<td>251</td>
<td>104</td>
</tr>
<tr>
<td>Number of Geological Maps, GDIF’s, OBM maps sold</td>
<td>216</td>
<td>307</td>
</tr>
<tr>
<td>Number of Prospectors’ Licences renewed</td>
<td>32</td>
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<tr>
<td>Number of New Prospectors’ Licences sold</td>
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<tr>
<td>Number of Claim Maps sold</td>
<td>306</td>
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</tr>
<tr>
<td>Number of Regular Claim Tag Sets sold</td>
<td>86</td>
<td>11</td>
</tr>
<tr>
<td>Number of Red post tags Sold</td>
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<td>16</td>
</tr>
<tr>
<td>Number of Photocopies for Public @ 10 cents each</td>
<td>1495</td>
<td>177</td>
</tr>
<tr>
<td>Total Annual Revenue From Above Sales</td>
<td>$5165.90</td>
<td>$2447.00</td>
</tr>
</tbody>
</table>

The Regional Specialist, H.D. Meyn, has an office at Bancroft and was assisted by K. Fell, Secretary, and 2 temporary employees. The program of the Regional Specialist is separate from the Resident Geologist’s program. In 1992, he carried out geological mapping in the Belmont Lake area, near Marmora. Claim tags, prospectors’ licenses, and publications can be purchased at the Bancroft office and a library is available for public use.

Contractors Watts, Griffis and McOuat, and Chance and Burden worked on the Abandoned Mines Inventory compilation for the Southeastern District from February to March and May to June, respectively. This program consisted of a data search for the purpose of providing information on existing and potential mine hazards as the first stage of the Ministry of Northern Development and Mines’ (MNMDM) Abandoned Mines Hazards Program. Later stages will include on-site evaluations of mine hazards and recommendations for rehabilitation.

Activities

In addition to providing regular office and field services, the Resident Geologist and staff undertook other activities.

J.M. Ridgway worked on a contract basis from January through March and from June to mid-August, compiling and entering data on the MDI portion of the provincial Geoscience Exploration Database project. The total number of MDI files compiled to date in the Southeastern District is 6700.

D. Caterbury worked as assistant to the Drill Core Library Geologist for 3 weeks in October under a co-op program through one of the local high schools.

The ment system. Each 1992 MDI release contains information about more than 15,000 Ontario mineral occurrences, and these publications are referenced as van Haaften et al. (1992) and Ernsting et al. (1992).

Beginning in November 1992, S. van Haaften again began a secondment to work on provincial databases. In this most recent work assignment, he was to help prepare business cases and requests for proposals on projects which are planned as part of the provincial Earth Resources and Land Information System (ERLIS). P.S. LeBaron was acting Staff Geologist during the April to June and November to December secondments of the Staff Geologist.

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Activities

In addition to providing regular office and field services, the Resident Geologist and staff undertook other activities.
P.W. Kingston served on the Mines and Minerals Information Technology Committee, the Land Use Planning for Mineral Resources Committee, and on the Provincial Core Library Committee with V.C. Papertzian.

The Resident Geologist and Staff Geologist visited selected mineral prospects and active mines. Field trips and mine visits were arranged for a local high school, Queen's University, representatives of the MNMD Mineral Development and Rehabilitation Branch, and the Minister of Northern Development and Mines.

The Staff Geologist and Drill Core Library Geologist gave presentations and tours of the Resident Geologist's office and Drill Core Library facilities to several local schools and travelled to schools in Peterborough and Arnprior to present talks and mineral displays.

Poster displays were presented at the Ontario Mines and Minerals Symposium, the Ontario East Economic Development Commission Symposium in Kingston, and at the Resident Geologist's office during Mining Week. Staff from the Tweed and Bancroft offices provided displays and demonstrations at the Ontario Science Centre "Geofest" exhibit. H.D. Meyn and staff set up a booth at the Bancroft Gemboree, selling geoscientific publications issued by the MNMD.

Detailed planning input was provided for a number of townships with respect to Official Plans and re-zoning applications.

The Resident Geologist and Staff Geologist attended public information meetings held by mining companies giving public notice of advanced exploration projects.

Two prospector's courses were held in Tweed in 1992. The first, given on consecutive nights from June 1 to June 4 with a field trip on June 6, was attended by 32 aspiring prospectors. The size of the second class, held in October, was limited to 20 due to space restrictions, and the format was changed to 2 nights per week for 3 weeks, followed by a one-day field trip. The first course was instructed by P.S. LeBaron (geology and prospecting methods), P. Sangster, Staff Geologist from the Timmins Resident Geologist's office (rocks and minerals), M. Hall, Chief Mining Recorder (claim staking, assessment work, and the new Mining Act), and D. Leaper, Claims Inspector (field demonstration of claim staking), with assistance from P.W. Kingston and V.C. Papertzian. The second course was instructed by S. van Haften, P.W. Kingston, and V.C. Papertzian. R. Charnesky (Southern Ontario Mining Recorder) and D. Jollymore (Recording Office Clerk) instructed a session on claim staking and the Mining Act, and D. Leaper provided a claim staking demonstration during the field trip. Mr. A. Banner is gratefully acknowledged for allowing access to his property, the Ore Chimney gold mine in Barrie Township, as part of the field trip.

RESEARCH BY RESIDENT GEOLOGIST'S STAFF

Stratigraphy and Sedimentation of the Metasedimentary Rocks of the Grenville Supergroup in Southeastern Ontario

H.D. Meyn, Regional Specialist, Bancroft, started a detailed (1:5000) mapping program in 1988 in the metasedimentary rocks of the Madoc–Havelock area in order to determine if it is possible to conduct stratigraphic and sedimentation studies in these metamorphosed and deformed rocks (Meyn 1988, 1989, 1990, 1991). This was undertaken to get a better understanding of the setting of known mineralization and to provide possible leads to additional mineralization. In 1992, mapping was carried out in the area northeast of Belmont Lake, Belmont Township, Peterborough County.

Immediately east of Belmont Lake north of the Crowe river exit, there is a considerably greater thickness of clastic siliceous metasedimentary rocks exposed than is shown by Bartlett et al. (1982). Farther northeast away from Belmont Lake, a sequence of grey, calcitic marbles is present between the rocks tentatively assigned to the Belmont Lake formation and additional clastic siliceous metasediments and stromatolite-bearing dolomitic marble. Should the intervening marble and the additional clastic metasediments be assigned to the Belmont Lake formation? The definition of the Belmont Lake formation as given in Bartlett and Moore (1985, p.53) will need to be revised to accommodate the new information.

Southwest of the village of Cordova Mines a sequence of problematic rocks is exposed. Bartlett et al. (1982) label them lithic clastic sediments, thereby suggesting that these are older than the Belmont Lake formation. de Kemp (1984) labels the majority of these rocks meta-rhyolite (agglomerate and flow breccia). The author found that there are definite intrusive rocks, and definite metasedimentary rocks, and probably felsic extrusive rocks as well. Exposure is not good enough to get a clear picture of the physical and genetic relationships of these rocks.

A very prominent feature of this group of rocks is beds of fragmental rocks. Nearly 80% of the clasts are pink weathering felsic volcanic (rhyolite?) material. Other lithologies present are mafic volcanic, magnetite, pink chert, black chert, and vein quartz. The pink clasts are generally well rounded to subrounded. Some subangular to subrounded clasts are present, but most of these belong to the other lithologies.

The above rock sequences are close to the Cordova Gabbro which is intrusive into the sedimentary sequence under study. Subsurface extensions of the gabbro underneath the present exposure may be responsible for the metamorphic and metasomatic effects that have altered these rocks, presumably mostly sediments, beyond easy recognition.
New Industrial Mineral Applications — A: The Application of Natural Minerals in Ceramic and Metal Matrix Composites

This year, considerable progress has been made in an ongoing research project being carried out jointly between W.F. Caley of the Department of Mining and Metallurgical Engineering of the Technical University of Nova Scotia, and P.W. Kingston, Resident Geologist, from the Tweed office of the Ministry of Northern Development and Mines. The work over the last 2 years (Caley et al., in press) has concerned itself with possible applications of certain Ontario industrial minerals in both ceramic and metal matrix composites. The research focuses on examining the use of wollastonite and, more recently, kyanite, both relatively very low-cost minerals, in ceramic matrices of either mullite or alumina, or in metal matrices of zinc-aluminium or aluminium-silicon alloys. Four areas of research which were carried out in 1992 are described.

PREPARATION OF MULLITE-WOLLASTONITE AQUEOUS SUSPENSIONS

Work in the early part of the year was concerned with determining the parameters controlling the uniform dispersion of ground mullite in an aqueous suspension of powdered mullite. Authors Caley and Kingston attended the 16th Annual Conference on Composites and Advanced Ceramics sponsored by the American Ceramic Society, held at Cocoa Beach, Florida. The authors presented a paper entitled “Co-dispersion of Mullite and Wollastonite in Aqueous Suspensions”, which was subsequently published (Bryden et al. 1992).

This paper describes the laboratory work done to determine the precise pH at which wollastonite and mullite are co-dispersed, without agglomerating, in aqueous solution. This lays the groundwork for preparing an evenly mixed and dispersed mullite-wollastonite powder which can be dried and hot pressed or sintered at elevated temperatures to make mullite reinforced wollastonite test composites. Without this procedure, it is extremely difficult to achieve a dense mineral mixture without clumping and irregular dispersion, which would result in a product with poor directional mechanical stability.

PREPARATION OF ALUMINA-WOLLASTONITE AQUEOUS SUSPENSIONS

The authors also carried out similar research on co-dispersion of alumina-wollastonite mixtures in aqueous suspensions. The combined technique of rheological studies and direct scanning electron microscopy of dispersed composite powder mixtures of wollastonite and alumina was used to determine the optimum conditions for wet preparation of the composite from aqueous suspensions. This combination of experimental techniques yielded satisfactory results, indicating that the best pH conditions for co-dispersion of these powders in water coincided with the optimum conditions for dispersion of the alumina matrix powder in the acidic range, at a pH of 4.1. These results were published in a paper entitled “Dispersion Stability of Alumina-Wollastonite Aqueous Suspensions” (Bryden et al. 1992).

EXPERIMENTAL PRODUCTION OF WOLLASTONITE—ZINC-ALUMINUM METAL MATRIX COMPOSITES

Laboratory research, which has been carried out on actually making wollastonite—zinc-aluminum metal matrix composites, has resulted in a paper entitled “Natural Minerals as Secondary Reinforcing Agents in Metal Matrix Composites” (Caley et al. 1992), which was presented at the October 20 to 22, 1992, Society for the Advancement of Material and Process Engineering (SAMPE), 3rd International SAMPE Metals and Metals Processing Conference in Toronto.

This paper describes preliminary, successful attempts to make composites of wollastonite in zinc-aluminum alloys, specifically the ZA-8 and ZA-27 foundry alloys. The main challenge in preparing these composites is again in achieving a uniform dispersion of the wollastonite in the metal phase. The rheocasting process was chosen to make the composites, as this process is known to enhance the uniform distribution of the reinforcing phase in the molten metal phase. The equipment used in this process also allows the melting and casting to take place in an inert (argon) atmosphere, most important in preventing the development of oxide phases which would destroy the integrity of the composite. Seven preliminary experiments were conducted to test the rheocasting technique and the design characteristics of the apparatus. In at least 2 of the experiments a satisfactory dispersion of wollastonite in the ZA-27 alloy was observed. Refinement of the process is currently in progress.

EXPERIMENTAL PRODUCTION OF WOLLASTONITE-MULLITE CERAMIC MATRIX COMPOSITES

Late in 1992, the authors set out to make wollastonite-mullite ceramic matrix composites. The wollastonite and mullite were prepared by the aqueous suspension method described above (Bryden et al. 1992). Specific care was taken to remove hard agglomerates from the mullite powder by sedimentation. These hard agglomerates, or non-dispersable clumps of mullite, had caused considerable trouble in previous work.

The homogenized slurry of wollastonite and mullite was concentrated to a solids content of 50% by centrifuging and redispersion using a deflocculant, and the resulting final suspension was pseudoplastic at low and dilatant shear rates. After casting and drying, the composite samples were sintered in air and hot-pressed in argon at various temperatures and times. Microstructural analysis of sections of the composite products using electron microprobe and X-ray diffraction techniques revealed the formation of a high aspect ratio feldspar phase. This interesting development suggests that the physical properties of the composite may be considerably enhanced over those of pure mullite. This work was presented at the American Ceramic Society, 17th Annual Conference.
and Exponent of the secondary steelmaking slags used in ladle metallurgy.

Currently an expensive and environmentally undesirable component to complete replacement for fluorspar, which is the Sydney Steel Corporation (SYSCO) in Sydney, Nova Scotia, in which the application of an Ontario nepheline-syenite product is examined, both as a slag fluidizer, and as a partial to complete replacement for fluorspar in the secondary steelmaking slag. This trial was significant in that this was the first trial in which fluorspar was completely replaced by nepheline syenite; however, the trial was marred by an electrical fault in the equipment during the tapping of the electric-arc furnace (EAF) which tripped a circuit breaker causing a delay in the removal of the ladle car. This, in turn, allowed roughly 2000 to 4000 pounds of EAF slag to be added to the ladle, which should not have happened. The unfortunate presence of the spilled EAF slag in the ladle, mixed with the secondary steelmaking slag, complicated the refining process, and somewhat confused the interpretation of the efficacy of the nepheline syenite.

During 1992, the authors were able to conduct an additional 4 final trials in which nepheline syenite completely replaced fluorspar (and some ferrosilicon as well) without adverse effect on the final product quality. The final chemistry of the steel was well within acceptable limits, and the refining and casting processes proceeded smoothly, demonstrating the successful replacement of fluorspar by nepheline syenite. Specific details of the experimental procedure and plant trials will be described in a forthcoming paper.

DIAMOND-DRILL CORE LIBRARIES

Tweed Drill Core Library

The Core Library was managed by P.S. LeBaron until March 1, 1992. V.C. Papertzian then managed this facility for the balance of the year. D. Caterbury acted as the assistant for 3 weeks in October under a co-op program through one of the local high schools.

The following resources and services are offered at the Tweed Drill Core Library:

1. drill core from southern Ontario
2. facilities for logging and splitting core
3. binocular and petrographic microscopes
4. rock cutting and polishing equipment
5. level and section plans from past producing mines in the area

As of December 1, 1992, there were 109,550 m of core catalogued at the Tweed facility. Approximately 9000 m of recently acquired core has yet to be added to the inventory. Table 18.4 summarizes the library's holdings. During 1992, approximately 5240 m of core were catalogued.

Major contributors of core this year were Rio Algom Exploration Ltd., which contributed core from 28 diamond-drill holes for a total of 3995 m, Steep Rock Resources Inc., which contributed core from 51 diamond-drill holes from its Bathurst Township property, and Homestake Mineral Development Co. which contributed core from 13 holes from its Gilmour property in Grimsthorpe and Tudor townships.

New Industrial Mineral Applications — B: Replacement of Fluorspar by Nepheline Syenite in Ladle Metallurgy Slags

For several years, P.W. Kingston, Resident Geologist, Tweed, and W.F. Caley, Department of Mining and Metallurgical Engineering, Technical University of Nova Scotia (TUNS), have been carrying out a joint technical program which examines possible new applications of industrial minerals.

One project involves a series of on-going plant trials at the Sydney Steel Corporation (SYSCO) in Sydney, Nova Scotia, in which the application of an Ontario nepheline-syenite product is examined, both as a slag fluidizer, and as a partial to complete replacement for fluorspar, which is currently an expensive and environmentally undesirable component of the secondary steelmaking slags used in ladle metallurgy.

During a series of trials in 1991, which were described in last year's Report of Activities (Papertzian et al. 1991), SYSCO conducted 1 preliminary full-scale ladle trial in which nepheline syenite was used as a complete replacement of fluorite in the secondary steelmaking slag. This trial was significant in that this was the first trial in which fluorite was completely replaced by nepheline syenite, however, the trial was marred by an electrical fault in the equipment during the tapping of the electric-arc furnace (EAF) which tripped a circuit breaker causing a delay in the removal of the ladle car. This, in turn, allowed roughly 2000 to 4000 pounds of EAF slag to be added to the ladle, which should not have happened. The unfortunate presence of the spilled EAF slag in the ladle, mixed with the secondary steelmaking slag, complicated the refining process, and somewhat confused the interpretation of the efficacy of the nepheline syenite.

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A new diamond-drill core pad of approximately 2 acres in size was constructed 3 km south of Tweed on a Ministry of Transportation site. Core will be moved to this pad in the spring and will be made available to the public at that time. All of the excess core now stored on the Tweed site will be moved to this location.

There were 48 visitors to the facility between January 1, 1992 and December 1, 1992.

**Bancroft Drill Core Library**

The drill core library in Bancroft was staffed by V.C. Papertzian and P.S. LeBaron on an as-needed basis from the Tweed Resident Geologist’s Office.

Drill core from the northern part of the Southeastern District and also from the Algonquin District is stored at the Bancroft facility. As of December 1, 1992, 34 917 m of core were stored inside, whereas 19 724 m were stored outside on a nearby pad. A new pad was constructed and fenced off beside the Bancroft Core Library.

Table 18.5 summarizes the core that is stored in the core library. There were no major contributors of core to the Bancroft facility this year.

**RECOMMENDATIONS FOR EXPLORATION**

Industrial minerals are the mainstay of the Southeastern Resident Geologist’s District’s mining activity. The district’s proximity to markets and its diverse range of industrial mineral commodities make exploration for industrial minerals potentially worthwhile. In particular, white mineral fillers such as talc, wollastonite, diopside, and high-purity calcitic and dolomitic marbles are expected to undergo long-term market growth. Recent geological mapping in the Palmerston Lake area (Palmerston and South Canonto townships) by the Ontario Geological Survey has identified a large area of white tremolite, diopside, and dolomite and a separate area containing high-purity talc (Easton 1992).

Southeastern Ontario also hosts marbles and granites with a wide variety of colours and textures with potential applications as dimension stone and decorative aggregate.

**ONTARIO GEOLOGICAL SURVEY ACTIVITIES**

R.M. Easton, of the Precambrian Geoscience Section, Ontario Geological Survey—Geoscience Branch, conducted detailed (1:20 000) mapping in the Palmerston Lake area near Ompah, Ontario (Easton 1992). The project concludes mapping of the Northern Mazinaw Terrane of the Grenville Province begun in 1987 by R.M. Easton (Easton 1988), and follows units mapped to the west in 1991 (Easton and Ford 1991) up metamorphic grade. Significant results are as follows:

1. new occurrences of Flinton Group rocks were discovered near Mosque and Grindstone lakes.

2. the extent and significance of the northwest-trending, Paleozoic-age faults in the area was documented. These faults are more widespread than previously noted; they have significant apparent lateral movement (300 to 500 m), and basement-hosted radioactive mineralization in the area is associated with these faults.

3. a large area of white tremolite, diopside and dolomite occurs within the map area. In conjunction with this mapping project, F. Ford of Carleton University continued his study of the stratigraphy and metamorphism of the Flinton Group in the Cloyne to Ompah area. His progress is summarized in Ford (1992).

Mapping of aggregate deposits in Haldimand and Alnwick townships by staff of the Sedimentary and Environmental Geoscience Section of the Ontario Geological Survey—Geoscience Branch was completed in 1992 and the results were released in Aggregate Resources Inventory Paper 143.

D. Armstrong, Sedimentary and Environmental Geoscience Section, Ontario Geological Survey—Geoscience Branch conducted geological mapping and alkali-reactivity studies of the Paleozoic rocks in the Lake Simcoe area.

Publications released in 1992 that are applicable to the Southeastern Resident Geologist’s District are listed in Table 18.6.
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| Total          | 135 618.5                       | 109 550.8         |
Table 18.5. Summary of Bancroft Drill Core Library holdings, December 1, 1992.

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Geology of Ontario

Map 2578 Tectonic Assemblages of Ontario, southern sheet; by the staff of the Ontario Geological Survey, scale 1:1 000 000.

Map 2583 Tectonic Assemblages of Ontario, explanatory notes and legend; by staff of the Ontario Geological Survey.

Map 2599 Shaded Image of Vertical Gravity Gradient of Ontario, southern sheet; by V.K. Gupta, scale 1:1 000 000.

Mineral Deposits Circular (MDC)

MDC 33 Graphite Occurrences of the Frontenac Axis, Eastern Ontario; by A. MacKinnon and P.S. LeBaron, 31p.

Aggregate Resources Inventory Papers (ARIP)

Open File Aggregate Resources Inventory of Belmont
Map 183 Township, Sand and Gravel Resources; by staff of Engineering and Terrain Geology, Ontario Geological Survey, scale 1:50 000, on file at the Resident Geologist’s Office in Tweed.

Open File Aggregate Resources Inventory of Belmont
Map 184 Township, Bedrock Resources; by staff of Engineering and Terrain Geology, Ontario Geological Survey, scale 1:50 000, on file at the Resident Geologist’s office in Tweed.

ARIP 143 Aggregate Resources Inventory of Haldimand and Alnwick Townships; by staff of Sedimentary and Environmental Geoscience, 73p.

ARIP 149 Aggregate Resources Inventory of Somerville Township; by staff of Engineering and Terrain Geology, Ontario Geological Survey, 39p.

ARIP 152 Aggregate Resources Inventory of Galway and Cavendish Townships, Peterborough County; by staff of Sedimentary and Environmental Geoscience Section, Ontario Geological Survey, 38p.
REFERENCES


——— in press. The potential application of natural minerals in ceramic and metal-matrix composites; Canadian Institute of Mining and Metallurgy, Bulletin, accepted.


INTRODUCTION

The Southwestern Resident Geologist’s District provides the entire province’s production of salt and gypsum. The decline in saturated salt brine production is due to the closure of one chlorine plant in Sarnia. Gypsum production, at 50 to 75% capacity, is affected by the low demands of the construction industry.

Nearly all the province’s clay brick production, also at 50% capacity, is in the Southwestern District and is shale based. Cement limestone production, at 40 to 50% capacity, is also affected by slow construction markets.

All of the province’s high-calcium limestone production is in the Southwestern District. The local steel industry sold 3 high-calcium lime and dolomite operations during the year.

MINING ACTIVITIES

During 1992, a total of 40 mineral properties remained active in the Southwestern District. These operations produce salt, gypsum, clay and shale, building stone, and limestone and dolostone products. The locations of all producing mines, brine well fields, and quarries are indicated on Figure 19.1.

Gypsum

Gypsum is extracted from the Upper Silurian Salina Formation in underground mines at the following 3 locations: Drumbo Mine of Westroc Industries Limited in Blenheim Township, Caledonia No. 3 Mine of Domtar Gypsum, and Hagersville Mine of Canadian Gypsum Company, the latter 2 in the Town of Haldimand. Room-and-pillar mining techniques are employed at the Drumbo and Hagersville mines, while the Caledonia mine utilizes continuous mining methods eliminating the need for drilling and blasting.

The primary use for gypsum is in the manufacture of wallboard for the construction industry. During 1992, production levels at the three gypsum mines varied between 50 and 75% of capacity (slightly higher than in 1991) due to continuing low demands of the construction markets and imports of foreign-made wallboard. Ontario’s total 1992 mined gypsum production is 978 000 t.

Westroc Industries Limited operates the Drumbo Mine, east of the town of Woodstock. The gypsum bed is 1.7 m thick, 86% purity, and mined at a depth of 116 m in the Salina A-2 Unit. The mined gypsum, 160 000 t in 1992, is processed at the company’s wallboard plant in Mississauga.

Domtar Gypsum operates an integrated mine-mill-wallboard production facility at Caledonia. The company began full production from their new Number 3 Mine in 1991. The mined seam (“Main Gypsum Bed”) forms part of the Salina B Anhydrite unit, varies in thickness from 2.5 to 5 m, is at 85% purity, and is generally more than 20 to 25 m below surface. Paurat tunnelling machines are used to develop the mining panels in a chevron pattern off the main conveyor lines through the central part of the ore body. Current access to the mine is by a twin ramp system. The company is planning construction of a new shaft and “dry room” facilities. Production for 1992 is quoted by the company as 378 000 t, 50% of the full operating capacity.

The Canadian Gypsum Company also operates an integrated mine-mill-wallboard production facility along Highway 6 north of Hagersville. At the Hagersville Mine, the mined gypsum bed is contained within the Salina E Unit, is 1 to 1.5 m thick, and is found at depths of 25 to 35 m below the surface. The gypsum ore is generally massive with few impurities; locally the gypsum is nodular or has a chickenwire texture. The gypsum bed is offset locally by several faults. Access to the mine is both by shaft and ramp.

The mine employs a drill and blast, room-and-pillar mining method. Mining faces are advanced in an arrow type pattern in both the “east mine”, east of Oneida Road, and “west mine” area on Six Nations Indian Reserve lands west of Oneida Road. The crude gypsum rock is crushed underground to -15 cm size; production for 1992 is quoted by the company as 440 000 t, 68% of the operating capacity.

At the mill, the mine run gypsum ore is further crushed, screened, and washed. A heavy medium separates the lighter gypsum fraction from the heavier limestone-dolomite fraction, the latter being removed for use as road fill. The dried gypsum ore is further pulverized in roller mills and calcined at 150°C.

At the board plant, water is added to the calcined gypsum and the resulting gypsum paste is sandwiched between sheets of paper and hardened and cut into panels on each of the two wallboard machines. Wallboard shipments in busy times total 55 to 60 million square metres.

Salt

Salt deposits in Ontario are bedded, and occur in the subsurface in ascending stratigraphic order in the A-2, B, D, and F units of the Salina Formation principally underneath the Goderich–Sarnia–Windsor area; most of the salt beds pinch.
Figure 19.1. Southwestern Resident Geologist's District.
EXPLANATION


1. Paleozoic mapping and alkali-reactive aggregate studies, eastern Lake Simcoe area
2. Quaternary geology investigations in the Oak Ridges Moraine area, Whitchurch-Stouffville and Uxbridge Township municipalities
3. Radon soil gas investigations in southern Ontario: 3a) Essex–Windsor area; 3b) Kent–Lambton–Wallaceburg area; 3c) Markham–Stouffville area
4. Geochemical mapping traverse along the 80th meridian west

Producing Mines, 1992

Gypsum
1. Canadian Gypsum, Hagersville Mine
2. Domtar Gypsum, Caledonia No. 3 Mine
3. Westroc Industries, Drumbo Mine

Rock Salt
4. Canadian Salt, Ojibway Mine, Windsor
5. Sifto Canada, Goderich Mine

Producing Brine Wells, 1992

Fine Salt
6. Canadian Salt, Windsor Field
7. Sifto Canada, Goderich Field

Chemical Salt
8. Dow Chemical, Sarnia–Corunna Field
9. General Chemical, Anderdon Field

Producing Quarries, 1992

Building Stone: Dolostone
10. Adair Marble Quarries (2), Hope Bay, Albemarle Tp.
15. Owen Sound Ledgerock, Owen Sound Quarry, Keppel Tp.

Building Stone: Sandstone
17. Credit Valley Quarries, Terra Cotta Quarry, Caledon
18. Deforest Bros. Quarry, Caledon
19. Hilltop Stone Quarry, Halton Hills
20. Rice and McHarg Quarry, Halton Hills

Clay Products, Shale
21. Brampton Brick, Cheltenham Quarry, Caledon
22. Canada Brick, Aldershot Quarry, Burlington
23. Canada Brick, Britannia Quarry, Mississauga (Streetsville)
24. Canada Brick, Cooksville Quarry, Mississauga
25. Canada Brick, McFarren Quarry, Mississauga (Streetsville)
26. Canada Brick, Milton Quarry, Milton
27. Canada Brick, Tansley Quarry, Burlington
30. Martin Clay Products, Georgetown Quarry, Halton Hills

Cement: Limestone, Clay, Shale
32. St. Lawrence Cement, Clarkson Quarry, Mississauga

Lime: Chemical, Metallurgical, Filler Grade Limestone

Lime: Chemical, Metallurgical, Filler Grade Dolomite
37. Guelph DoLime Limited, Guelph Quarry
38. Owen Sound Dolomite, Sydenham Quarry
39. Steetley Lime and Aggregates, Dundas Quarry
out eastward. These salt beds contain and grade laterally into beds of anhydrite, dolomite, and shale.

The A–2 Unit salt deposits are widespread throughout the Goderich–Sarnia area, reach thicknesses of up to 45 m, and are being mined at Goderich by room-and-pillar methods for rock salt products used primarily for de-icing of roads; and near Sarnia by brine well solution mining techniques for the production of saturated salt brine used directly by the local chemical (chloralkali) industry.

The B Unit salt deposits are the thickest of all the units (90 m in the Sarnia area), however, natural dissolution processes have removed these deposits from the Essex–Kent area. B Unit salt deposits are being extracted exclusively by brine well solution mining techniques at Goderich and at Windsor mainly for manufacturing evaporated, fine granular food-grade salt products; and near Amherstburg and Sarnia for the production of saturated salt brine used directly by the local chemical (chloralkali) industry.

The D Unit salt deposits in Ontario are only up to 12 m thick and are not being mined. The F Unit may contain as many as 5 salt beds reaching a combined thickness of up to 90 m. One of these salt beds, the thinner Middle F Unit, is being mined by room-and-pillar methods at Windsor for rock salt production.

Ontario’s total 1992 salt production is 7 million tonnes including 5.5 million tonnes of rock salt from the Salina A–2 and Middle F Units and 1.5 million tonnes of fine granular (250 000 t) and chemical salt (1.27 million tonnes) in saturated salt brines mainly from the Salina B Unit.

**ROCK SALT**

At the Goderich Mine, Sifto Canada Inc. mines and mills the 23 m thick A–2 Unit salt bed at depths of 520 to 540 m beneath Lake Huron. Underground operations include drilling, undercutting, blasting, hand scaling, mucking, primary crushing, conveying, and milling (further crushing and screening). Two production shafts are used to hoist the rock salt products to surface storage facilities. The rock salt products are mainly sold for de-icing of highways and roads; other uses include water softening, feed salt, and chloralkali industry. Total production in 1992 amounted to 3.2 million tonnes, slightly below last year’s record production of 3.6 million tonnes.

The Goderich Mine advanced originally (since 1959) by using a conventional room-and-pillar system. This system was changed in the late 1970s to a stress relief method by advancing multiple, large, parallel rooms, leaving only small yield-pillars between them, and by diverting internal stresses to large abutment pillars. The current mining height is set at 13 m and room-width is set at 15 m.

The company plans to eliminate hand scaling at the mine and is currently testing conversion to the more competitive practices of overcutting (3 to 4 m top heading), bench mining (3 to 4 m mining height), and mechanical scaling; room height would ultimately increase to 18 to 18.5 m.

The mine has one production shaft for hoisting the mined rock salt in twelve-tonne skips to surface for milling, storage, and shipping. As at Goderich, the graded rock salt products are mainly sold for de-icing purposes; coarse, higher-purity rock salt is sold for water softening, and “fines” remaining from the milling process are sold to the chloralkali industry. The total production in 1992 amounted to 2.3 million tonnes, approximately 8% below last year’s level.

**FINE SALT**

The Canadian Salt Company Limited and Sifto Canada Inc. continued to produce saturated salt brines by solution mining techniques from B Unit salt deposits at the Windsor and Goderich brine well operations. The salt deposits are 30 m and 55 m thick, respectively, and occur at depths varying between 427 m and 457 m below surface.

At the Windsor and Goderich evaporator plants, the saturated salt brines are utilized in the manufacture of vacuum pan evaporated, high-purity, fine granular salt products for food-grade (60%), chemical (30 to 40%), and agricultural (10 to 20%) applications. Annual production at the Windsor plant is 150 000 t, and 100 000 t at the Goderich plant.

**CHEMICAL SALT**

General Chemical of Canada Limited and Dow Chemical Canada Inc. continued to produce saturated salt brines by solution mining techniques for direct use at their own chemical (chloralkali) plants at Amherstburg and Sarnia, respectively.

General Chemical operates brine wells in two B Unit salt beds, 21 m and 30 m thick at an average depth of 335 m, in Anderdon Township north of the Amherstburg plant. Salt production for 1992 is quoted by the company as 748 179 t for use in the manufacture of soda ash and calcium chloride products by the Solvay process. The lime necessary for this process is obtained by calcining high-purity limestone brought to the Amherstburg plant from the company's nearby McGregor Quarry.
Dow Chemical operates brine wells in the A-2 Unit and B Unit salt beds in the Sarnia–Corunna area of Moore Township; the salt deposits are 37 m and 80 m thick, respectively, at average depths of 780 m and 740 m.

Salt production for 1992 is quoted by the company as 521 168 t for direct use in the manufacture of chlorine and caustic soda at their Sarnia plants. The significantly lower (by 42%) 1992 production reflects the closure of 1 of the 2 chlorine plants during the year. In 1993, the company will close the second chlorine plant and the saturated salt brine production from the Moore Township brine wells.

**Building Stone**

In 1992, a total of 11 building stone quarry operations were active in the northern and east-central parts of the southwestern District as follows:

1) 7 in the southern Bruce Peninsula area (Owen Sound–Wiarton–Albemarle Township), where deposits in the Middle Silurian Amabel and Eramosa Formations are worked for the production of high-density dolostone marble including the commercially well-known “Adair Limestone Marble”; and

2) 4 in the Georgetown–Inglewood area of the Niagara Escarpment west of Toronto, where deposits in the Lower Silurian Whirlpool Formation are worked for the production of quartzitic sandstone commercially known as “Credit Valley”. The total building stone production from the dolostone and sandstone quarries in 1992 is similar to the 1991 production estimated at 60 000 t.

**DOLOSTONE**

Adair Marble Quarries Division of Arriscraft Corporation continued to produce dimension stone blocks from the thick-bedded, predominantly bluish-grey mottled Amabel Formation dolomite at two adjacent quarries south of Hope Bay in the Bruce Peninsula. The quarry blocks are separated from several stone ledges by air-drilling and broaching (modified quarry-bar and hydraulic plug-and-feather techniques). The mill blocks are then transported to Arriscraft’s modern fabrication facilities at Cambridge for further processing to precisely finished and variously surface-textured cut stone products marketed under the trade name “Adair Limestone Marble” for mainly architecturally designed projects throughout Canada and the United States.

Adair’s quarry production of 17 000 t in 1992 equals that of 1991, is among the highest of all the quarried building stone producers in the District, but still represents only half of the company’s annual quarry production during the late 1980s.

Adair Marble Quarries obtained in 1992 a licence under the Aggregate Resources Act to open a new dimension stone quarry deposit in the same dolomite formation west of Hope Bay.

The following active building stone quarry operations in the Bruce Peninsula all work the generally thinner bedded Eramosa dolomite for various landscaping, masonry, paving, decorative, and furniture stone products:

1) Owen Sound Ledgerock Limited: the largest producer of quarried building stone in the District (20 000 to 30 000 t per year) with modernized Wiarton Quarry operation and highly automated fabrication facilities at the Owen Sound Quarry; the only year-round building stone quarry operation in the District;

2) Amsen Quarries Limited, with Wiarton and Mar Quarry operations, increased annual production by 20% over 1991, and is steadily expanding licenced quarrying capacity in the Bruce Peninsula; and

3) the much smaller operations of Ebel Quarries Limited, at Wiarton, and Emerson McLay, along Highway 6 north of Mar, each produce about 1 000 t of stone in 1992 mainly for landscaping purposes.

The Wiarton Quarry operation of Owen Sound Ledgerock Limited has consistently produced around 18 000 t of stone per year over the last 4 years. Since 1989, the company extracts dimension stone blocks from the thicker bedded Eramosa dolomite “marble unit” at this Wiarton deposit by using a system of track-mounted belt saws and inflatable air bags. The stone is a compact, highly dense, fine crystalline, high-purity dolomite with light and dark grey brown colours and very low absorption. It polishes to a highly reflective oak, walnut, or fleuri patterned surface.

The quarry blocks are transported to the company’s 4000 m² fabrication plant at the Owen Sound Quarry where the Eramosa dolostone marble blocks are milled by computer programmable equipment to precisely finished cut stone products. This processing includes sawing, slabbing, cutting, routing, profiling, and polishing.

Eramosa dolostone products for exterior masonry uses include ashlar, copings, sills, steps, and veneer with various dressed surfaces available for walling and trim. Honed or polished Eramosa marble products for interior uses include hearths, mantels, tooled fireplace surrounds; tiles and panels; and table, kitchen, and bathroom counter tops. Distribution is direct to dealers in northeastern North America; the company also does custom fabrication.

Although existing reserves of the “marble unit” at the Wiarton Quarry deposit are sufficient for the next 10 years, Owen Sound Ledgerock recently acquired the property adjacent on the west side for future licenced expansion of its Wiarton operations.

Owen Sound Ledgerock also mills granite, limestone, marble, and sandstone blocks brought in from sources operated by other companies, including, in 1992, blocks of reddish brown Credit Valley Sandstone quarried at the De-
forest Bros. Quarry near Inglewood for the Queen’s Park masonry conservation project.

SANDSTONE

“Credit Valley” is the trade name for the grey, reddish brown, or mottled (“piebald”) building stone facies of the Lower Silurian Whirlpool Formation sandstone in southwestern Ontario. Total annual production of this fine-grained, quartzitic sandstone is 7,000 t of flagstone, drywall, rubble, coursing, coping, steps, and hearth products, predominately of the grey variety, and mainly destined for residential jobs (landscaping; interior and exterior masonry). About 10% of the annual production is for architectural building conservation projects such as the current Queen’s Park masonry restoration project. Products are shipped from the quarry directly to dealers, landscapers, or general contractors mainly in the Greater Toronto Area, or Barrie, Hamilton, Kitchener–Waterloo and London.

The current production comes from 3 small quarries located on the Manitoulin Formation terrace along the Niagara Escarpment in the Georgetown area where 2 of the quarries are operated by Hilltop Stone and Supply Inc. and Rice and McHarg Limited, and near Inglewood, where the third quarry is operated by Deforest Brothers Quarrries Ltd.

These operating quarries each work several up to 1 m thick, flaggy or medium-to-thick-bedded stone ledges, preferably in the horizontal plane-laminated deposits with good natural splitability (“straight reed”), within the 2 to 3 m thick, fluvially stratified, lower sandstone sequence of the Whirlpool Formation. This sequence consists entirely of grey sandstone at the Hilltop Stone and Rice McHarg quarry openings, however, at the Deforest Bros. quarry, it contains a 1 m thick interval of reddish brown or mottled sandstone. It is from this interval that the blocks of reddish brown Credit Valley Sandstone are quarried for use in the Queen’s Park restoration project. Overburden is relatively thick, viz. 3.5 to 6 m of glacial drift, Manitoulin dolostone, and/or upper Whirlpool marine facies interbedded sandstone and shale.

The operations employ mainly quarriers skilful with traditional hand tools and use little mechanical equipment in quarrying, shaping, and dressing of Credit Valley Sandstone. If the stone ledge is flaggy as at the Rice & McHarg quarry, large crowbars are used by the quarriers to separate thin slabs. If beds are thicker such as at the other 2 quarries, light blasting at air-drilled holes will separate quarry blocks from the working ledge. These blocks are then split using large wedges and the “straight reed” of the stone, or by plug-and-feather wedges placed in jackhammered holes. Further shaping is accomplished by rapid and efficient wedge-splitting of horizontal plane-laminated slabs into 5 mm thick panels for flagstone, coping, or pavers; or by using a bladed guillotine to split slabs into billets for coursing, drywall, or rubble stone.

Another 3 existing licensed quarry sites along the Niagara Escarpment, each with remaining resources of Whirlpool sandstone, have not been worked for quite some time: 1) Wm. R. Barnes Company Ltd. quarry near Georgetown; 2) Hazel M. Norrie quarry near Terra Cotta; and 3) Hazel M. Norrie quarry near Inglewood. The Barnes Company Ltd. quarry site has considerable grey sandstone resources remaining. Both Norrie quarry sites have been recently acquired by the Credit Valley Quarries Company Limited, which also operates a building stone retail outlet at Concord on the north side of Toronto. This company has plans for redevelopment of both quarry sites and carried out a test coring program this summer on the Terra Cotta property to assess the building stone potential of the considerable remaining resources of grey (and reddish brown?) Whirlpool sandstone.

The current Niagara Escarpment Plan makes provisions for the limited expansion of the existing licensed Whirlpool sandstone quarries (6) and for new quarry development in the Rural Area of the Plan. It has been proposed, however, to cancel these provisions at a time when: 1) several quarry operations in the grey sandstone are considering expansion in the near future based on the continuing demand for Credit Valley Sandstone products such as flagstone, drywall, coursing, etc.; 2) the ongoing requirement for architectural conservation of Credit Valley Sandstone public heritage buildings throughout southwestern Ontario needs ongoing viable quarry sources of all 3 varieties; 3) expansion at another quarry site for new supplies of the reddish-brown variety will be necessary; and 4) fabrication of value-added Credit Valley cut stone products, such as at the state-of-the-art facilities of Owen Sound Ledgerock Limited, will lead to the opening up of new markets in the architectural and commercial sectors, and modernization of the quarrying methods.

Shale

The structural clay products industry of Ontario is dominated by brick manufacturing nearly all of which is done in the southwestern District using local shale deposits. The 1991 “clay brick” production in Ontario, mainly for residential construction markets, stood at approximately 50% of manufacturing capacity. Other structural clay products made from local shales in the southwestern District include: flue lining, sewer pipe, structural tile (hollow block or terra cotta), filter tile, and drain tile. Surficial clay deposits in the District are no longer worked for these and other “heavy clay products.”

The brick industry of Ontario is chiefly located in the western part of the Greater Toronto Area (GTA), and utilizes shale of the Upper Ordovician Queenston Formation at a total of 7 quarry deposits located in Mississauga (Streetsville), Burlington, Milton, Caledon (Cheltenham), and Georgetown. More than 650,000 t of Queenston shale were quarried in total in 1992. Shale of the Upper Ordovician Georgian Bay Formation is also worked by the brick industry at a deposit at Cooksville in Mississauga, where, in 1992, slightly more than 100,000 t were extracted. All of the Georgian Bay shale and nearly all of the Queenston shale raw materials quarried are used for on-or-near-site brick manufacturing, however, small quantities of Queenston shale are trucked to brick plants in Wallenstein (near Kitchener–Waterloo) and Parkhill (northwest of London), and to a flue lining-sewer-pipe structural tile manufacturing plant in St. Thomas (south of Lon-
don), and also to another structural-, drain- and filter-tile plant at Paisley (southwest of Owen Sound).

Very small tonnages, approximately 5500 in total in 1992, of shale from the Middle Devonian Arkona Formation are quarried at deposits near Arkona and at Telford in the London–Lake Huron area for the manufacture of brick at Parkhill and drain tile at Norwich and Paisley.

Canada Brick is by far the largest brick producer and it operates the following quarries in the western part of the GTA:

1) the Britannia Quarry and the McFarren Quarry, both in the Queenston shale at Streetsville (Mississauga) and each to supply an on-site brick plant;
2) the Cooksville Quarry in the Georgian Bay shale at Mississauga to supply an on-site plant;
3) the Tansley Quarry in the Queenston shale to supply the on-site Burlington No. 1 plant;
4) the Milton Quarry in the Queenston shale at the Niagara Escarpment, to supply the modern Burlington No. 2 plant near Tansley and the company’s flue lining-sewer pipe-structural tile-terra cotta plant in St. Thomas; and
5) the Aldershot Quarries in the Queenston shale at Burlington to supply the company’s specialty brick plant in Wallenstein, the company’s St. Thomas plant, and the brick plant of Hamilton Brick Limited.

Canada Brick was denied permission in 1992 to construct a new brick plant—the “Milton Brickworks”—across from their Milton Quarry at Niagara Escarpment. Also, the company’s Aldershot shale lands in Burlington may be transferred in the near future to the development controls of the Niagara Escarpment Plan.

Brampton Brick Limited, the other large brick producer in the western part of the GTA, operates the Cheltenham Quarry in the Queenston shale west-northwest of Brampton. This quarry is considered a “model pit” in the Niagara Escarpment Plan Area, and supplies the company’s state-of-the-art plant in Snelgrove on the north side of Brampton.

Queenston shale from the small Georgetown Quarry deposit in the Niagara Escarpment area is trucked for great distances: 1) southwestward to the very small specialty brick plant of Martin Clay Products in Parkhill, where it is mixed with Arkona shale from a more local deposit operated by the company; and 2) northwestward to the very small plant of the Paisley Brick and Tile Company Limited at Paisley, where it is used in the manufacture of structural and filter tile, or mixed with Arkona shale from the Thedford Quarry for the manufacture of drain tile.

Cement Limestone

The following 2 grey portland cement plants and on-site quarry operations in the Southwestern District were in production during 1992: 1) the Woodstock plant and quarry of Lafarge Canada Inc.; and 2) the St. Marys plant and quarry of the St. Marys Cement Company. These cement works operated at 40 to 50% of total clinker capacity due to the continuing low demands of the construction industry and, at least at one producer, rising energy costs. A combined total of about 750 000 t of limestone were quarried for cement manufacture at both plants.

At the Woodstock Quarry, Lafarge Canada Inc. quarries and blends a 620 m thick sequence of Middle and Lower Devonian limestone strata classified in descending stratigraphic order as follows: 1) 320 m of Lucas Formation high-purity limestones with more than 53% CaO and less than 1% MgO; 2) 17 m of Amherstburg Formation more shaly and cherty limestones with up to 1.5% Al2O3 and 7% SiO2, and with less than 5% MgO; and 3) 13 m of Bois Blanc Formation very cherty or siliceous limestones with up to 41% SiO2 and less than 5% MgO.

The St. Marys Cement Company quarries and blends limestone from an 18 m thick Middle Devonian sequence with clayey glacial drift overburden at the company’s St. Marys works. The limestone section consists in descending stratigraphic order of: 1) 10.5 m of Dundee Formation limestones (52 to 53% CaO; up to 1.5% MgO); and 2) 7.5 m of Lucas Formation limestones with less than 53% CaO and 4% MgO. Approximately 40 000 t of clayey drift were quarried during 1992 for the required SiO2 and Al2O3 content from an on-site pit area south of the main plant. The St. Marys cement works have been temporarily shut down since October 1992.

Limestone and Dolomite for Lime, Chemical, Metallurgical and Pulverized Stone Products

High-purity limestones of the Lucas Formation (Middle Devonian) containing more than 53.5% CaO, less than 1% MgO, and up to 1% SiO2+Al2O3+Fe2O3 are quarried in the Southwestern District for high-calcium quicklime, hydrate, flux stone, and pulverized stone products. In 1992, more than 2 million tonnes of limestone were produced in total for these purposes at 3 quarries operating at approximately 75 to 80% capacity. The operations are the following:

1) Beachville Lime Limited, acquired by Calcitherm from Dofasco in August, with East and West plants and quarry operations in the Beachville–Ingersoll area, only quarried the 310 m section of the Lucas Formation in the West Quarry for on-site production of quicklime, hydrate, flux stone, and pulverized stone (agricultural, glass, and off-white filler applications).
2) Global Stone Corporation, which acquired Stelco's Ingersoll works in October of 1992, quarried a 33 m section of the Lucas Formation for on-site production of quicklime and flux stone; and

3) General Chemical of Canada Limited, which quarried the upper 13 to 14 m high-purity limestone section of the Lucas Formation at the McGregor Quarry, 10 km northeast of Amherstburg, for calcining and the manufacture of soda ash (Solvay process) at the company's Amherstburg plant.

Small tonnages of similar high-purity Amabel Formation dolomite screenings from the Sydenham Quarry of E.C. King Contracting near Owen Sound are processed for dolomite sand at the company's Owen Sound Dolomite Plant. The dolomite sand is used as flux at the local glass plant of Industries Canada Limited.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The office of the Resident Geologist is located at 659 Exeter Road, London, in the main provincial government building. Adjacent facilities include the Soils and Aggregates Testing Laboratory of the Ministry of Transportation, and the Petroleum Resources Laboratory, Ministry of Natural Resources, which includes facilities for the storage and examination of drill core and cuttings collected under the provisions of The Petroleum Resources Act.

The office of the Resident Geologist provides geoscience and mineral resources related information and advisory services through site or property visits and office consultations to industry, government agencies and the general public. The office maintains a publicly accessible geoscience and mineral resources information library, sells maps and reports published by the Mines and Minerals Division, and provides services required to obtain prospector's licenses.

Some of the consultative services provided to companies during the year included: 1) evaluation of buff dimension limestone deposits in the District; 2) evaluation of high-purity limestone and dolomite deposits in the District; 3) evaluation of natural brine potential in the District; and 4) geology and development potential of Whirlpool Sandstone quarries.

The office reviews and prepares geoscience and mineral resources related information for land-use plans and affiliated concerns, viz. Greater London Area, Bruce County Official Plan, Niagara Escarpment Plan Area, landfill sites, abandoned gypsum mines, or groundwater resources impairment from sewage disposal in areas of thin glacial drift.

The Southwestern District office is staffed by B. Feenstra, Resident Geologist; M. Garland, acting Staff Geologist since September 1992, replacing former Staff Geologist R. Kelly; and P. Smith, Secretary. Geologist M. Birchard and Geological Assistant A. Henry were employed at the District office until the end of March 1992. S. Kowela was our Summer Experience Program '92 student assistant.

Phase 1 of the Abandoned Mines Inventory System for the Southwestern District was completed by R. Goad, Contractor, of London during the summer of 1992, as a project of the Abandoned Mine Hazards Abatement Program of the Ministry's Mine Rehabilitation Section. Phase 2—"Site Investigations"—was cancelled in December 1992.

M. Birchard submitted a draft report of his study entitled "Facies analysis and evaluation of carbonate resources from Lucas Formation cores in the subsurface, southwestern Ontario" which was completed during February and March 1992. This project consisted of depositional and diagenetic facies analysis of the Lucas Formation and an evaluation of its potential as a high-purity and/or dense carbonate rock aggregate resource in the subsurface of southwestern Ontario. This study examined 30 drill cores from the London–Lake Erie–Windsor–Sarnia area and stored at the Petroleum Resources Laboratory in London. It makes the following important conclusions: 1) high-purity, dense, lime mudstones, 25 to 30 m thick, and similar to those quarried in the Beachville–Ingersoll–Thamesford area are characteristic of the Lucas facies in the southeasternmost parts of the study area and can likely be found throughout much of Elgin County, the southern part of Middlesex County, and parts of northern Lake Erie; and 2) dense dolomudstones, reaching a thickness of 75 m, are predominant in the northwesternmost parts of the study area (Sarnia and Plympton townships) and may prove to be a potential source of aggregate and higher purity dolomite. The results of this study are currently under review by the Sedimentary and Environmental Geoscience Section of the Ontario Geological Survey–Geoscience Branch to assess the need for additional studies.

R. Kelly completed a draft report, in August 1992, of his project "Geochemical analyses of southwestern Ontario Paleozoic carbonates". This project, started in 1990, is a broad survey both areally and stratigraphically of the major oxide and trace element composition in samples of carbonate strata exposed at operating quarries and at a few selected outcrops, or in several selected drill cores. The results of this sampling program were reported on in Kelly and Feenstra (1991, p.376-377).
A. Henry completed a draft report for a public brochure on the St. Marys Cement Rock Garden at the University of Western Ontario. This rock garden is an outdoor educational geoscience display realized by the joint efforts of the University of Western Ontario, mining and manufacturing industry, and the Ministry. The Ministry has contributed to this display through the collection, transportation, installation, and description of many of the glacial erratic or indicator boulders and specimen blocks of current and former industrial mineral operations in Southwestern Ontario. The rock garden was officially opened on April 27, 1992. The official opening was attended by the Minister, the Director of the Ontario Geological Survey-Information Services Branch, and field staff from the Toronto and London offices.

R. Kelly accompanied industry staff for evaluation of the following limestone building stone prospects: 1) Boat Lake property including the site of the former Boat Lake Quarry in the Guelph Formation, west of Wiarton; 2) McGregor Quarry operation of General Chemical of Canada Limited in the Lucas Formation, northeast of Amherstburg; 3) abandoned and operating quarries in the Dundee Formation limestone on Pelee Island; and 4) Vineland Quarry operation of Vineland Quarries and Crushed Stone Limited in the Niagara Peninsula, a possible “Queenston Limestone” source in the Gasport property including the site of the former Boat Lake Quarry in the Guelph Formation, west of Wiarton; 2) McGregor Quarry operation of General Chemical of Canada Limited in the Lucas Formation, northeast of Amherstburg; 3) abandoned and operating quarries in the Dundee Formation limestone on Pelee Island; and 4) Vineland Quarry operation of Vineland Quarries and Crushed Stone Limited in the Niagara Peninsula, a possible “Queenston Limestone” source in the Gasport Member of the Lockport Formation.

Staff arranged the following visits to active mining, quarrying, and manufacturing operations in the District:

1) to the Dundas plant and quarrying operations of Steetley Lime and Aggregates in March 1992;

2) to the Canadian Gypsum Company’s Hagersville Mine, Mill, and Wallboard Plant operations for the Minister and Staff in March 1992;

3) a four-day field excursion complete with guidebook to Brampton Brick’s Snelgrove Plant and Cheltenham Quarry operations; Arriscraft’s building stone plant at Cambridge; BeachviLimeLimited’s high-calcium limestone quarrying, crushing-pulverizing, calcining, and hydrate operations in the Beachville-Ingersoll area; Hagersville Mine and Wallboard Plant operations of Canadian Gypsum Company or Domtar Gypsum’s Caledonia No. 3 Mine and East Wallboard Plant operations; Goderich Salt Mine of Sifto Canada Inc.; and the Adair Marble dimension “limestone” quarrying operations near Hope Bay; and

4) to all the Credit Valley Sandstone quarries in the Georgetown–Inglewood area of the Niagara Escarpment for the Division’s Land-use Planning Staff.

The following education projects were initiated and completed by staff during 1992:

1) R. Kelly, with T. Carter of the Petroleum Resources Section of the Ministry of Natural Resources in London, conducted, in April, a geology education workshop on the geology and mining of salt for senior-level high school teachers in the London area. This workshop was followed by a tour in May of the Ojibway Mine of the Canadian Salt Company Limited in Windsor; and

2) B. Feenstra prepared an exhibit and an accompanying report on the architectural and structural terra cotta industry and resources in Ontario for display at the London Art Gallery from September 17 to November 22. This was a joint project with the London Regional Art & Historical Museums and the London Region Branch of The Architectural Conservancy of Ontario.

**ONTARIO GEOLOGICAL SURVEY ACTIVITIES**

The locations of the 1992 field investigations conducted by the Ontario Geological Survey–Geoscience Branch in the Southwestern District are shown in Figure 19.1. The following outlines briefly describe each project.

1) D.K. Armstrong, Sedimentary and Environmental Geoscience Section, and A.S. Anastas, Queen’s University, continued the project to map Paleozoic geology of the Lake Simcoe area. Lithostratigraphic mapping, new depositional models, and subsurface data will be used to determine geological controls on bedrock resources, particularly with respect to alkali-carbonate and alkali-silica reactivity problems encountered with some of the Paleozoic beds or intervals.

2) J.E. Tilsley, Aurora Environmental Surveys, and C.L. Baker, Sedimentary and Environmental Geoscience Section, continued work on the radon soil gas investigations by testing 4 areas in southern Ontario. The western Essex County–Windsor area, Kent and southern Lambton–Wallaceburg area, and Markham–Stouffville area fall within the District. The fourth area is in Prince Edward County.

3) J.A.C. Fortescue, R.D. Dyer, and C.R. Fouts, Sedimentary and Environmental Geoscience Section, took water, stream sediment and soil samples along the 80th meridian from Lake Erie to the northern boundary of the District and on to James Bay. This sampling is part of the geochemical mapping traverse along the 80th meridian west, to provide a geochemical database for the province.

4) P.J. Barnett, Sedimentary and Environmental Geoscience Section, is investigating the sediments composing the Oak Ridges moraine in the township municipalities of Whitechurch–Stouffville and Uxbridge, Ontario. This year was the first of a three-year project to study the origin, sediment distribution, and limits of the eastern half of the Oak Ridges moraine. Information from this study will be used for planning decisions within the Oak Ridges moraine area.
RESEARCH BY OTHER AGENCIES

The following are brief outlines of Ontario Geoscience Research Grants provided for academic studies relevant to the district.

1) S.J. Haynes, W.G. Parkins and S. Carbone, Brock University, are studying the stratigraphy of the Cayugan Series and lithofacies of the Bertie and Bass Islands Formations. The Upper Silurian Cayugan Series is the host for all of Ontario's current salt and gypsum production and significant crushed-stone production. Determination of the relationships of stratigraphic lithofacies to commodity reserves will be useful for regional land-use-planning initiatives.

2) M.B. Dusseault and A.D. Bogobowicz, University of Waterloo, are initiating a study to evaluate the potential of liquid and granular waste storage in solution caverns in southwestern Ontario. The study encompasses development of material properties, site investigation procedures, and the mathematical modelling methods necessary to design and implement liquid storage or solid granular waste disposal in abandoned solution caverns.

3) M.G. Sklash and K. Chekir, the Dragun Corporation and the University of Windsor, respectively, are working on a project to define the geology and recharge rates of an esker in Essex County, southwestern Ontario. The project is to determine if this esker is responsible for the anomalously young groundwater found in part of the water supply aquifer in this area. Results of the project will have local and regional implications for landfill siting.

4) M. Coniglio and K.I. Skene, University of Waterloo, are studying pore characterization of carbonate petroleum reservoirs to aid in predictive modelling and optimization of hydrocarbon reservoir recovery. This research will be of interest not only to companies actively exploring or producing in carbonates, but to organizations interested in natural gas storage or waste disposal.

SELECTED PUBLICATIONS RECEIVED


Barnett, P.J. 1992. Quaternary geology of the eastern half of the Barrie and Elmvale map area (NTS 31D/5 and 31D/12); Ontario Geological Survey, Open File Map 200, scale 1:50,000.


——— 1992b. Aggregate resources inventory of Euphrasia Township; Aggregate Resources Inventory Paper 99, 47p.


——— 1992g. Tectonic assemblages of Ontario, southern sheet; Ontario Geological Survey, Map 2578, scale 1:1,000,000.


——— 1992i. Tectonic assemblages of Ontario, Chart A (time-space chart); Ontario Geological Survey, Map 2579.


——— 1992k. Tectonic assemblages of Ontario, Chart C (time-space chart); Ontario Geological Survey, Map 2581.


REFERENCE

INTRODUCTION

The boring, drilling and deepening of wells into potentially oil- and gas-bearing strata in Ontario is regulated under the authority of the Petroleum Resources Act R.S.O. 1990. The Petroleum Resources Centre of the Ontario Ministry of Natural Resources in London administers and enforces the regulations made under the Act and, in addition, is the principal source of information on oil, gas and brine resources in the province. The information on industry activity summarized here is derived principally from information submitted by licensed operators to the Ministry of Natural Resources to meet regulatory requirements. Most information on drilling of development and service wells is confidential for a period of 30 days after drilling reaches total depth. The confidentiality period for exploratory wells is 1 year. Consequently only a limited amount of information on exploratory drill-holes is available for release at the time of writing.

This report is a preliminary summary of the results of exploration for, and development of, oil and natural gas in Ontario in 1992. Results of drilling in 1992 are up-to-date as of January 5, 1993. Preliminary production totals are also presented. Final totals for drilling and production will not be available until April 1993. A summary of final 1991 results are presented for comparison purposes.

OIL AND GAS PRODUCTION

Oil production in Ontario in 1992, up to and including November 31, 1992, totalled 203 625.6 m³ valued at $31 706 720.32, compared to a total volume of 235 249.7 m³ for all of 1991. Ordovician pools discovered since 1982 accounted for approximately 75% of the 1992 production.

Preliminary totals for production of natural gas in Ontario are not available. Total production in 1991 amounted to 418 million m³ (14.8 bcf), a 5% from the previous year. Approximately 75% of the gas was from wells on Lake Erie.

EXPLORATION AND DEVELOPMENT ACTIVITY

Drilling results had been reported for a total of 70 wells at the time of writing. These consisted of 33 exploratory wells, 30 development wells, and 7 service wells. This is considerably less than the previous year when 49 exploratory, 54 development, and 11 service wells were drilled. The 1992 exploratory drilling resulted in 7 wells completed as gas producers, 4 wells completed as oil producers, and 1 well completed for production of both oil and gas (Table 20.1, Figure 20.1). Development drilling resulted in 4 wells reported to be oil producers, 20 as gas producers, and 3 wells completed for production of both oil and gas. Projected figures indicate that a total of approximately 80 wells will have been drilled in Ontario by the end of the year, compared to 114 in all of 1991.

As in the previous 9 years, exploration for, and development of, Ordovician oil reservoirs was the highlight of drilling activity in Ontario, with drilling reported to be complete at 18 exploratory wells and 7 development wells. In other exploratory drilling, there were 7 tests of Cambrian targets, and 9 tests of Guelph and Salina formations targets. In development drilling, Clinton and Cataract groups reservoirs were the principal target for 8 wells, 4 in Guelph–Salina reservoirs, and 11 in Cambrian reservoirs. There was no exploratory or development drilling of Devonian targets.

The Ordovician exploratory drilling is reported to have resulted in 3 new oil producers and 1 combined oil and gas producer, while the development drilling resulted in 4 new oil producers and 3 wells capable of production of both oil and natural gas. As in the previous year, Essex County was the focus of most of the Ordovician exploratory drilling, accounting for all of the successful exploratory wells. Three of these wells were new pool discoveries: Telesis et al 34645 Mersea 3–6–V, Telesis et al 34630 Mersea 3–4–IV, and PPC et al Rochester 1–17–II EBR. The fourth well was an exploratory extension to the Romney 6–13–IV (Renwick) pool.

The Rochester discovery received a considerable amount of media coverage after the operator, Paragon Petroleum Corporation, issued a press release reporting initial production in excess of 80 m³ of oil per day (500 BOPD). Paragon expected that the stabilized and sustainable rate of production from the discovery well would be approximately 50 m³ per day (300 BOPD). An average Ordovician well in this area could be expected to produce 10 to 20 m³ per day. Paragon has subsequently completed a three-dimensional seismic program over the discovery and has already completed 1 additional well as an oil and gas producer to begin the development of the new pool.

Ordovician development-drilling was evenly divided between Essex and Kent counties. In Essex County, 3 wells were completed as oil producers in the Mersea 8–16–VIII pool (Goldsmith), and 1 well in the newly discovered Rochester 1–17–II EBR pool was completed as an oil and gas producer. In Kent County, 1 development well was completed as an oil producer in the Romney 3–8–II pool, and 2 wells were completed as oil and gas producers in the Dover 7–5–V pool.
**Table 20.1. Successful exploratory wells in southwestern Ontario, 1992. Location of wells shown on Figure 20.1.**

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<td>Cambrian</td>
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<td>NPW</td>
<td>92.11.11</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Aldborough 4-Z-II</td>
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<td>OP</td>
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<td><strong>ESSEX COUNTY</strong></td>
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Figure 20.1 Location of successful exploratory wells in southwestern Ontario in 1992.
There was a dramatic increase in the drilling of Cambrian targets in 1992, reaching a total of 7 exploratory tests and 11 development wells. Fifteen of these wells were completed in the Innerkip gas field, making this by far the most active single play in the province in 1992. All 15 wells, 10 development and 5 exploratory, were completed as gas producers. Gas production in the pool is derived from a thin horizon of porous Cambrian sandstones lying directly on the Precambrian basement. The pool was originally discovered in 1961 and was originally developed by a total of 9 wells. Exploration and development of a northerly extension to the field began in 1986, and with completion of the 1992 drilling the known productive area of the pool is over 8 km long in a northerly direction and up to 6 km wide. Gasol Inc., a small Ontario-based company, is the operator of most of the new wells drilled in the field in 1992. In other Cambrian drilling, Judo Tundra Aldborough 4–2–II was reported to have been completed as an oil producer in a Cambrian new pool wildcat test in Elgin County, and Brett Burford 17–IV was completed as a gas producer in a successful development test of a discovery well drilled in 1961.

Exploratory drilling of Silurian Guelph Formation reef targets and associated dolomitized zones in the Salina A–1 and A–2 units resulted in 2 new gas wells. Development drilling resulted in 1 gas producer. Development drilling of Silurian Clinton-Cataract sandstone targets resulted in 8 new gas wells.

Natural gas occurs in solution in many of the Ordovician oil reservoirs and is often flared during initial production at these pools. Recovery of natural gas from the Renwick, Goldsmith, Wheatley, and Yellow Creek oil pools in Romny Township commenced on February 1, 1992, after over 2 years of planning. The project was a joint venture by Telesis Oil and Gas, Pembina Exploration Ltd., and Devran Petroleum Ltd. Telesis is operator for the joint venture. The plant is ultimately expected to recover close to 34 million m³ of natural gas and 23 000 m³ of liquified petroleum gas. The plant makes a major contribution to meeting requirements of the Ministry of Natural Resources for conservation of petroleum resources by maximizing the recovery of hydrocarbons from these pools.

The Edys Mills Pool, a depleted natural gas reservoir in a Guelph Formation pinnacle reef, was recommended for designation as a natural gas storage pool in a report of the Ontario Energy Board to the Lieutenant Governor in Council dated October 7, 1992, after a three-day hearing held in Sarnia from September 22 to 24. The hearing dealt with 3 applications: E.B.O. 174 — request for designation as a natural gas storage area and permission to inject, store and remove gas; E.B.L.O. 243 — leave to construct natural gas pipelines; and E.B.R.M. 103 — referral of applications made to the Minister of Natural Resources for permits to drill natural gas storage wells in the pool. Union Gas Limited was the applicant and is the owner and operator of the pool. All of the applications were approved subject to several conditions relating to pipeline construction and drilling of the storage wells, but at the time of writing a regulation designating the storage area had not yet been passed. Union Gas staff at the hearing estimated that the pool would have a working capacity of 58.5 million m³ (2.1 bcf) when fully delta pressurized. Union Gas plans to drill 2 storage wells and convert 3 existing wells to storage wells in 1993 in order to develop the pool. They will also drill 1 observation well and convert an existing well for use as an observation well.

In other natural gas storage developments, 4 injection-withdrawal wells were completed in the Sarnia Block A pool which was designated as a storage pool in 1991. One observation well was also drilled at the Payne natural gas storage pool.

There are now 22 former gas pools in the subsurface of southwestern Ontario which have been designated as natural gas storage pools by the Ontario Energy Board. Twenty storage pools were in operation at the time of writing. Winter demand for natural gas in Ontario exceeds the capacity of the natural gas pipelines from western Canada. The shortfall is made up by injection of natural gas into the storage pools in the summer, and withdrawal of the stored gas in winter to meet winter peak demand. Total working capacity of the active storage pools in Ontario is approximately 5.8 billion m³ (203 bcf).

**STAFF ACTIVITIES**

Geological program staff employed at the Petroleum Resources Laboratory during the year consisted of T. Carter, Subsurface Geologist, M. Campbell, Laboratory Technician, P. Rath, Geology Technician, and M. Bernardo, Clerk Typist. A. Lundquist was employed during the summer as a geological assistant. Engineering and administrative staff include P. Palonen, Petroleum Manager; R. Rybansky, Engineering and Geology Supervisor; E. Habib, Operations Supervisor; J. Manocha, Caverns and Storage Engineer; C. Owen, Database Administrator; C. Wakeham, Database Technician; S. Fleming, Records Clerk; H. Wright, Crown Lands Administrator; I. Cameron, Mapping Technician; S. Armstrong, Secretary; and S. Shanks, Program Secretary.

Petroleum Resources inspectors are responsible for enforcement of the Petroleum Resources Act and associated regulations. M. Hunter, Deputy Chief Inspector, and L. Chambers are located in the Simcoe District office. B. Sealey and K. McConnell operate out of the Chatham District office. J. Chivers operates out of the Petroleum Resources Laboratory.

Geological staff continued their efforts to encourage investment in Ontario’s oil and gas industry by providing geological information, advice, and interpretations. In addition to Ontario-based companies, numerous inquiries and/or office visits were made by industry representatives from Calgary, Michigan, Ohio, New York, Pennsylvania, Texas and Quebec.
T.R. Carter acted as chairperson of the technical committee for the 31st Annual Conference of the Ontario Petroleum Institute which was held in Niagara Falls from October 28 to 30, 1992.

Oil and Gas Paper 11 (Carter 1992) was released on April 15, 1992. Summaries of oil and gas exploration, development and production in Ontario in 1991 were prepared for, and published by, the Ontario Petroleum Institute and Northeast Oilworld.

A data file and explanatory notes entitled “Lambton County Subsurface Geology” was released on January 5, 1993. The data is provided as 11 dBase IV dbf files, 1 for each township in the county, on 2 high density 3.5 inch diskettes. The files are also available as ASCII format txt files. The files were created as part of a project of regional mapping of Silurian reefs in the subsurface of southwestern Ontario. The data consists of a new set of consistently picked formation top depths and calculated elevations and thicknesses of selected Devonian and Silurian formations for 3577 oil and gas wells drilled in Lambton County to the end of 1988. Also included are geographic location, well ID number, results, latitude and longitude in decimal degrees, and UTM coordinates. Formation top picks are included for the following formations: Drift, Dundee, Columbus, C Shale, B Marker, B Equivalent, B Salt, B Anhydrite, A–2 Carbonate, A–2 Shale, A–2 Salt, A–2 Anhydrite, A–1 Carbonate, A–1 Anhydrite, Guelph, Goat Island, Gasport, and Rochester. Also included is the weighted percent dolomite content for each of the A–1 and A–2 Carbonate Units, for wells drilled in Sombra Township.

**RECOMMENDATIONS FOR EXPLORATION**

Ordovician oil reservoirs remain the most attractive targets for exploration in southwestern Ontario. These reservoirs occur in dolomitized limestones associated with vertical faults in the Trenton and Black River groups. Since 1982, most of the new Ordovician discoveries have been in Mersea Township in Essex County or in Romney Township and Dover Township in Kent County. In 1992, an important new Ordovician oil pool was discovered in Rochester Township in Essex County, broadening the area of Ordovician production. All of Essex County and the southern portion of Kent County is prospective for additional Ordovician oil production. There are also several past-producing natural gas reservoirs to the northeast in Bruce, Grey, and Wellington counties.

There has been a significant increase in exploration for Cambrian targets, although most of the 1992 activity was confined to 1 field. Cambrian strata have very large undiscovered potential in southern Ontario, and are expected to become the next major oil and gas play in Ontario when the current interest in Ordovician pools declines.

**RESEARCH BY OTHER AGENCIES**

A MSc thesis project by D. Harper, under the supervision of Dr. F. Longstaffe at the University of Western Ontario, is in the final stages of preparation. The thesis is entitled “Secondary potassium-feldspar at the Cambrian–Precambrian boundary, southwestern Ontario”. Work continued on 3 projects funded by the Ontario Geoscience Research Grant Program. Preliminary results from 1 of these projects was published in 1992 (Haynes and Parkins 1992).

1. “Liquid and granular waste storage in solution caverns”. University of Waterloo, Dr. M.B. Dusseault.
2. “Pore characteristics of carbonate petroleum reservoirs”. University of Waterloo, Dr. M. Coniglio.
3. “Stratigraphy of the Cayugan Series”. Brock University, Dr. S. Haynes.

**REFERENCES**


Conversion Factors for Measurements in Ontario Geological Survey Publications

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<td>km</td>
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**LENGTH**

| 1 cm²  | 0.155 0      | square inches | 1 square inch | 6.451 6 | cm² |
| 1 m²   | 10.763 9     | square feet   | 1 square foot | 0.092 903 04 | m² |
| 1 km²  | 0.386 10     | square miles  | 1 square mile | 2.589 988 | km² |
| 1 ha   | 2.471 054    | acres         | 1 acre       | 0.404 685 6 | ha |

**AREA**

| 1 cm³  | 0.061 02     | cubic inches  | 1 cubic inch | 16.387 064 | cm³ |
| 1 m³   | 35.314 7     | cubic feet    | 1 cubic foot | 0.028 316 85 | m³ |
| 1 m³   | 1.308 0      | cubic yards   | 1 cubic yard | 0.764 555 | m³ |

**VOLUME**

| 1 L    | 1.759 755    | pints         | 1 pint       | 0.568 261 | L |
| 1 L    | 0.879 877    | quarts        | 1 quart      | 1.136 522 | L |
| 1 L    | 0.219 969    | gallons       | 1 gallon     | 4.456 090 | L |

**CAPACITY**

| 1 g     | 0.035 273 96 | ounces (avdp) | 1 ounce (avdp) | 28.349 523 | g |
| 1 g     | 0.032 150 75 | ounces (troy) | 1 ounce (troy) | 31.103 476 8 | g |
| 1 kg    | 2.204 62     | pounds (avdp) | 1 pound (avdp) | 0.453 592 37 | kg |
| 1 kg    | 0.001 102 3  | tons (short)  | 1 ton (short)  | 907.184 74 | kg |
| 1 t     | 1.102 311    | tons (short)  | 1 ton (short)  | 907.184 74 | t |
| 1 kg    | 0.000 984 21 | tons (long)   | 1 ton (long)   | 1 016.046 908 8 | kg |
| 1 t     | 0.984 206 5  | tons (long)   | 1 ton (long)   | 1.016 046 908 8 | t |

**MASS**

| 1 g/t  | 0.029 166 6 | ounce (troy)/ton (short) | 1 ounce (troy)/ton (short) | 34.285 714 2 | g/t |
| 1 g/t  | 0.583 333 33 | pennyweights/ton (short) | 1 pennyweight/ton (short) | 1.714 285 7 | g/t |

**CONCENTRATION**

1 ounce (troy per ton) (short) 20.0 pennyweights per ton (short)
1 pennyweight per ton (short) 0.05 ounces (troy) per ton (short)

Note: Conversion factors that are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in co-operation with the Coal Association of Canada.