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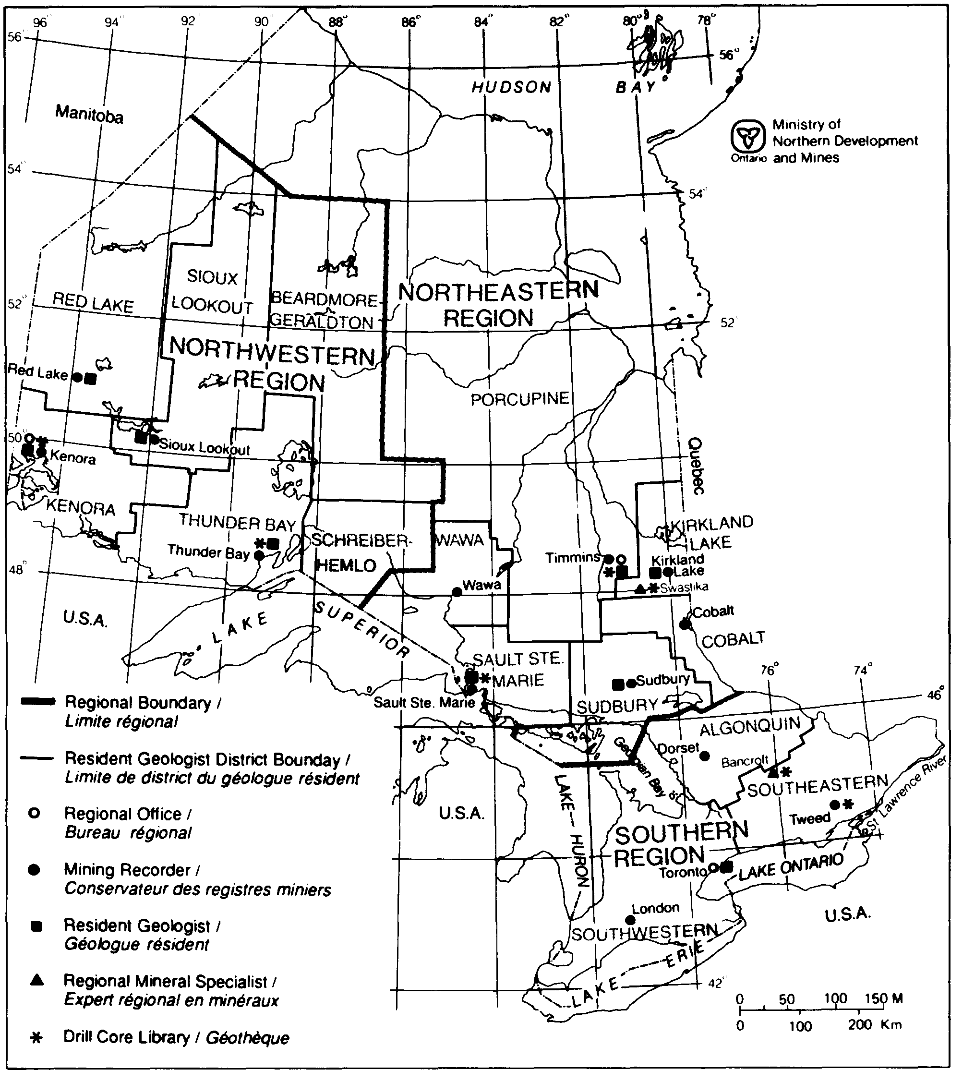

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1. Northwestern Region Introduction

K.G. Fenwick

Manager, Mineral Resources, Northwestern Region.

The Northwestern Region of the Mines and Minerals Division is made up of 6 Resident Geologists' districts and 4 Mining Divisions the Thunder Bay, Red Lake, Patricia and Kenora mining divisions. The region is approximately 700 km by 700 km in size.

The goal of the Regional Mineral Resources Program is to stimulate and monitor exploration, development and production of the mineral resources in the region. This is done through the 6 Resident Geologist programs, which cover the Red Lake, Sioux Lookout, Kenora, Thunder Bay, Beardmore–Geraldton and Schreiber–Hemlo districts; and the Drill Core Library program which is composed of 2 libraries, 1 in Kenora and the other in Thunder Bay.

The Resident Geologist programs provided a professional consultative service and advice in the office and in the field to the prospectors, the exploration companies and the public on the geology, the mineral deposits, and the exploration and mining activities in the region. In 1990, over 9000 office and phone consultations were provided to their clientele. The Regional Mines and Minerals staff made over 225 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 (Ministry of Natural Resources, Ministry of Environment, Ministry of Labour) on land use matters.

Basic prospecting courses were conducted in Ear Falls, Dryden, Sioux Lookout and Thunder Bay. A prospectors' workshop was held in Beardmore. Posters depicting the exploration and mining activities in the 6 Resident Geologists' districts and in Industrial Minerals in the Northwestern Region, 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 the entire region, was presented at the Institute on Lake Superior Geology Annual Meeting in Thunder Bay; at the 1990 Current Activities Forum of the Minnesota; and at the Northeastern Ontario Mines and Minerals Symposium in Timmins.

Reports were started or continued on research into, and field visits to, the mineral occurrences in the Birch–Confederation lakes area, Red Lake area, the Schreiber–Terrace Bay area, the Manitouwadge–Marathon–Hemlo area, the Fort Hope–Miminiska Lake area, Sturgeon Lake area, the Onaman–Tashota area, and the North Caribou and Central Uchi metavolcanic belts. Satellite summer field offices were maintained in Beardmore, and Marathon.

The staff of the Thunder Bay Drill Core Library collected 2056.6 m of diamond-drill core from 6 prospects in the Thunder Bay Mining Division during 1990. The staff from the Kenora Drill Core Library collected, from November 23, 1989 to November 20, 1990, 9898.6 m of core: 2694.2 m from Sioux Lookout District; 3489.5 m from Kenora District; and 3714.9 m from Red Lake District. Much of the core in this library is from recent gold exploration.

Exploration activity in the Northwestern Region in 1990 was approximately 70 percent of the activity in 1989. The decline is the result of a reduced number of active junior mining companies. Gold exploration accounted for more than 80 percent of this activity. In all, there were over 400 active exploration programs in the region in 1990. Of these, 5 were in the advanced exploration stage.

In 1990, 50 exploration projects in the Northwestern Region were designated under the Ontario Mineral Incentive Program (OMIP) for an approximate total of $2.7 million. One hundred and seventy-one projects were approved under the Ontario Prospectors Assistance Program (OPAP) for an approximate total of $1.6 million.

It has been another excellent year for production of gold in the Northwestern Region. 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 Dona Lake mines—was over 1.7 million ounces of gold. This amount represents two thirds of Ontario's and one third of the nation's gold production.

Four base metal mine's the Lyon Lake, the Winston Lake, the Geco and the Shebandowan mines, were in production during the year.

Three granite dimension-stone quarries, 2 pink and 1 grey, were in production. Active mining at 5 amethyst deposits, northeast of Thunder Bay, continued on a seasonal basis. Other industrial minerals produced in the region include white quartz and diabase.

2. Kenora Resident Geologist's District—1990

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[2]Staff Geologist, Kenora Resident Geologist's Office, Northwestern Region.

[3]Drill Core Library Geologist, Kenora Drill Core Library, Northwestern Region.

[4]Compilation Geologist, Kenora Resident Geologist's Office, Northwestern Region.

INTRODUCTION

For the second year in a row, exploration activity in the Kenora Resident Geologist's District was down in 1990, compared with the peak period of 1988. Sixty-five projects by prospectors and mineral exploration companies were under way. Gold was the commodity sought in 50 of them, compared with 62 in 1989 and 100 in 1988. No advanced exploration was conducted in 1990, the 3 underground developments of Nuinsco Resources Ltd.–Deak Resources Corporation (Cameron Lake gold project), Consolidated Professor Mines Limited (Duport Mine gold project) and Boise Cascade Canada Ltd. (Scramble Mine gold project) being inactive. Exploration was also conducted in the district for base metals and dimension stone, but interest in platinum group metals remained flat with no programs active, compared with 3 in 1988.

Production of pink dimension stone by Nelson Granite and by Granite Quarriers (G.Q.I.) Incorporated continued at 2 quarries, both in Docker Township, near Vermilion Bay. Crystal Quarries Limited continued to produce white quartz decorative stone from a quarry south of Vermilion Bay.

At the Kenora Resident Geologist's office, the three-year Mineral Commodity Geologist program for the Dryden area, and the four-year program to produce Geological Data Inventory Folios (GDIFs), terminated at the end of March. Both of these programs were part of the five-year Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario. A mineral deposit compilation into the Mineral Deposit Inventory (MDI), which will become part of the computerized, province-wide data base for geoscience exploration, the Geoscience Exploration Database (GED), was commenced under contract in November. Ongoing programs from the Kenora office included acquisition of exploration diamond-drill core from the Kenora, Red Lake and Patricia mining divisions, monitoring of exploration activity, mineral property field visits and studies, and provision of geoscience information and professional advice to mineral explorationists.

MINING ACTIVITY

There was no precious metal or base metal production from mining in the Kenora Resident Geologist's District in 1990.

DIMENSION STONE

Production of granite dimension stone continued at 2 quarries in Docker Township. The pink, granitic stone has been quarried by Nelson Granite, a division of Nelson Monuments Limited, Sussex, New Brunswick, since 1981, and by Granite Quarriers (G.Q.I.) Incorporated, of Beebe, Quebec, since 1984. The latter quarry has operated intermittently since 1948. Most of the stone from Nelson Granite's quarry, which operated throughout 1990, was shipped as rough blocks to eastern Canada, and to various destinations in the United States, for monumental and architectural applications. Blocks from Granite Quarriers (G.Q.I.) Incorporated's quarry were shipped to eastern Canada and the United States for processing as monumental and architectural stone.

DECORATIVE STONE

Crystal Quarries Limited continued to extract white quartz from a vein located adjacent to a forest access road about 30 km due south of the town of Vermilion Bay, for use as exposed aggregate in precast concrete panels.

SMALL-SCALE MINING

A. Kozowy (prospector, Dryden) continued production of a gold concentrate from his Flambeau Lake prospect, close to Dryden in Van Horne Township. Mr. Kozowy commenced production of concentrate in 1988, utilizing a small crusher, ball mill, sluice box and accelerator. Mr. Kozowy also removed for test purposes less than 10 tons of quartz vein material as a bulk sample from the Brockman gold prospect north of Church Lake in the Kawashegamuk Lake area.

Nipigon Gold Resources Limited extracted about 10 000 tons of ore-bearing rock, including 5 000 tons of higher grade, at their McKenzie–Gray gold-zinc property at the south end of Bad Vermilion Lake (Max Reiter, Nipigon Gold Resources

Limited, personal communication, 1990). Mr. Reiter estimates the higher grade material to average about 1.0 ounce Au per ton, and between 8 to 12% Zn. A gravitation mill was installed on the property in August, and stockpiled ore subsequently run through it.

ADVANCED EXPLORATION AND DEVELOPMENT

No further work was conducted in 1990 at any of the 3 underground development projects that have been under way in recent years.

At the Cameron Lake property of Nuinsco Resources Ltd., in which Deak Resources Corporation holds a controlling 53.8 percent interest, reserves of 3 160 148 tons grading 0.168 ounce Au per ton in the proven, probable and possible categories from surface to 2600 feet, were calculated by Orocon Inc. in early 1989. A review of these calculations by Watts, Griffis and McQuat Consulting Geologists and Engineers, Toronto, did not substantially change these figures (*The Northern Miner*, January 22, 1990). Preproduction capital costs, based on a 1000 ton per day mill are estimated at $22.7 million.

At the Duport Mine, the Shoal Lake property of Consolidated Professor Mines Limited, no underground or surface exploration has been conducted since 1987. Proven and drill-indicated reserves at the mine stand at 2 million tons averaging 0.35 ounce Au per ton, with preproduction capital costs, based on milling 450 t of ore per day, estimated at $52.9 million. The entire project is presently under review under the Environmental Assessment Act.

At Boise Cascade Canada Ltd.'s wholly owned Scramble Mine gold property, 10 km northeast of Kenora, underground development has not been conducted since 1988, when in a joint venture with Madeleine Mines Ltd. as operator, a shallow decline and drift were excavated along the ore-bearing zone. In a press release, February 1990, the company announced that "rudimentary reserves estimates" vary from 140 000 tons grading 0.42 ounce Au per ton to 270 000 tons grading 0.18 ounce Au per ton.

EXPLORATION ACTIVITY

The scale of exploration in Kenora District dropped for the second year running, using assessment work credits as a measure (Table 2.1). However, the number of projects (Table 2.2; Figure 2.1) was comparable to that in 1989 (65 compared with 74 last year). This discrepancy is largely attributable to the scale of individual projects, 40 percent of them being conducted by individual prospectors, compared to 20 percent in 1989. Sixteen of the 65 projects were conducted with the help of the Ontario Prospectors Assistance Program (OPAP).

Despite the predicted future shortfall in base metal inventories, and current buoyancy of base metal prices compared to the continued downturn in gold price below the US$400 level, gold remained the commodity most sought after, with 50 out of the 65 exploration and prospecting projects listed in Table 2.2 primarily directed at its assessment. Exploration for platinum group metals remained flat, with no projects active in 1990. Interest in stone products continued, and a marl deposit was investigated.

GOLD

Exploration for gold continued in the 4 major areas that have been active since about 1983: Lake of the Woods–Shoal Lake; Kakagi–Rowan–Pipestone lakes; Manitou–Wabigoon–Eagle lakes; and Fort Frances–Mine Centre. Interest in the Umfreville–Treelined lakes area north of Kenora that started in 1988 continued, but the Bee–Eagle lakes belt in the extreme northwest of the district remained inactive.

Lake of the Woods–Shoal Lake Area

Prospecting and limited exploration for gold continued in the Lake of the Woods metavolcanic–metasedimentary belt in 3 general areas: at the west end of the belt, in proximity to the Duport deformation zone and the Crow Duck Lake–Rush Bay lineament; at the east end of the belt, in supracrustal rocks marginal to the Dryberry batholith; and along the southern edge of the belt, in proximity to the western extension of the Pipestone–Cameron fault.

Bond Gold Canada Inc. conducted geological mapping late in the year on claims around its option from Kenora Prospectors and Miners Limited, following announcement (*The Northern Miner*, August 20, 1990) that a settlement has been reached in a legal dispute between the 2 companies. Under the terms of the settlement, Bond Gold Canada Inc. must spend $1.7 million by September 1994, of which $175 000 must be spent by September 1991. The property includes the past-producing Mikado and Cedar Island (Cornucopia) mines among other gold prospects. Following diamond drilling in the winter of 1989-1990, drill-indicated reserves stood at 1 401 801 tons grading 0.25 ounce Au per ton, of which 749 360 tons grading 0.26 ounce Au were reported from the "Main" vein, the extension of the Cedar Island Zone lying between the old Cedar Island and Mikado Mines. Bond Gold Canada Inc. also contracted a combined magnetic, electromagnetic and VLF-EM (very low frequency electromagnetic) survey, flown by Aerodat Limited, over a block of about 100 claims west of the west end of Echo Bay, along the Crow Duck Lake–Rush Bay lineament. The strong east-trending structural grain along and in proximity to the lineament was reflected in the magnetic and electromagnetic survey results.

TABLE 2.1. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total (Man Days)
1990	1 263	4 207	9 431	31 970	56 517	12 356	130 170
1989	2 875	3 370	12 375	56 599	103 573	11 359	205 619
1988	3 531	2 639	12 694	119 947	267 990	16 957	443 554
1987	5 211	2 578	12 496	86 321	153 077	12 067	251 465
1986	4 041	5 054	9 863	64 099	47 883	9 698	144 837
1985	2 216	5 195	10 875	55 090	185 148	29 765	292 729
1984	3 216	3 042	13 854	36 055	281 359	23 670	364 692
1983	11 061	1 472	13 635	35 746	42 221	12 006	106 397
1982	1 579	1 609	4 046	23 525	26 270	5 330	68 439
1981	2 121	846	4 076	26 127	37 624	3 383	72 732
1980	1 877	788	3 208	15 428	3 149	859	21 368
1979	984	1 357	2 119	9 992	10 658	1 420	24 182
1978	808	1 357	2 300	22 299	7 576	2 143	34 934
1977	1 495	1 585	2 820	15 405	11 366	1 760	33 838
1976	1 380	2 125	3 234	25 030	21 367	5 960	55 042
1975	1 677	2 452	3 975	23 584	31 509	940	57 266
1974	2 653	1 076	4 727	29 496	18 049	3 070	52 134

Exploration Brex Inc. continued exploration commenced in 1989 on ground along and adjacent to the Duport deformation zone. Gold values resulted from diamond drilling in 1989, at 2 localities, 1 immediately adjacent to the Duport gold property of Consolidated Professor Mines Limited, at the northeast end of Stevens Island, and the second about 2 km to the northeast. Further drilling was done in early 1990. A 132 m drill hole at the former locality was collared in the Stevens Island diorite, and at the latter locality 4 holes tested the Duport deformation zone but no assay values have been reported (assessment files, Resident Geologist's office, Kenora).

Mingold Resources Inc. concluded a combined geological, geochemical and geophysical survey program commenced in late summer of 1989 at Abernathy Lake, 5 km southwest of the town of Keewatin, over a 25 claim block (assessment files, Resident Geologist's office, Kenora). VLF-EM and magnetic surveys were completed in February 1990. Three hundred and fifty-seven soil samples and 24 rock samples were collected and analyzed, outlining gold anomalies that the company was able to correlate with geophysical anomalies. A 2-foot wide quartz vein in an old trench analyzed 1000 ppb Au, and the altered host rock 358 ppb Au. Prior to the 1989–1990 program, the company had diamond drilled 3 holes immediately southwest of Abernathy Lake in 1985, and obtained anomalous gold values only (assessment files, Resident Geologist's office, Kenora), and discovered old trenches.

Noranda Exploration Company, Limited, as operator in a joint-venture partnership with Noront Resources Ltd., continued exploration at their Chisholm Island, Lake of the Woods property, along the westward extension of the Pipestone–Cameron fault. Work commenced in 1989, when a 7.9-foot section in a diamond-drill hole had assayed 0.42 ounce Au per ton, 1.42 ounces Ag per ton and 0.65% Cu. In January 1990, 6 holes were drilled for a total of 1087 m, all on 1 claim at the northwest end of Chisholm Island (assessment files, Resident Geologist's office, Kenora). Trace to low amounts of chalcopyrite and sphalerite were logged from these holes, but no assay data are available. A 90.2 m long hole drilled on an adjacent claim in February 1990, for a length of 90.2 m, encountered anomalous and higher gold values, with one 1 m intersection assaying 1.37 ounces Au per ton (assessment files, Resident Geologist's office, Kenora).

BP Resources Canada Limited diamond drilled 5 holes for a total of 2185 feet on their gold prospect optioned from Bob Fairservice, prospector, at Separation Point, in the Monument Bay area, Lake of the Woods. Drill logs (assessment files, Resident Geologist's office, Kenora) indicate the target to have been a mineralized quartz-chlorite-actinolite-biotite breccia zone. This work resulted from a geological survey, funded by COMDA, of the Monument Bay area by the Ontario Geological Survey (Morrice 1989) in which preliminary values of up to 870 ppb Au were reported (Morrice and McMaster 1987) from the host northeast-trending deforma-

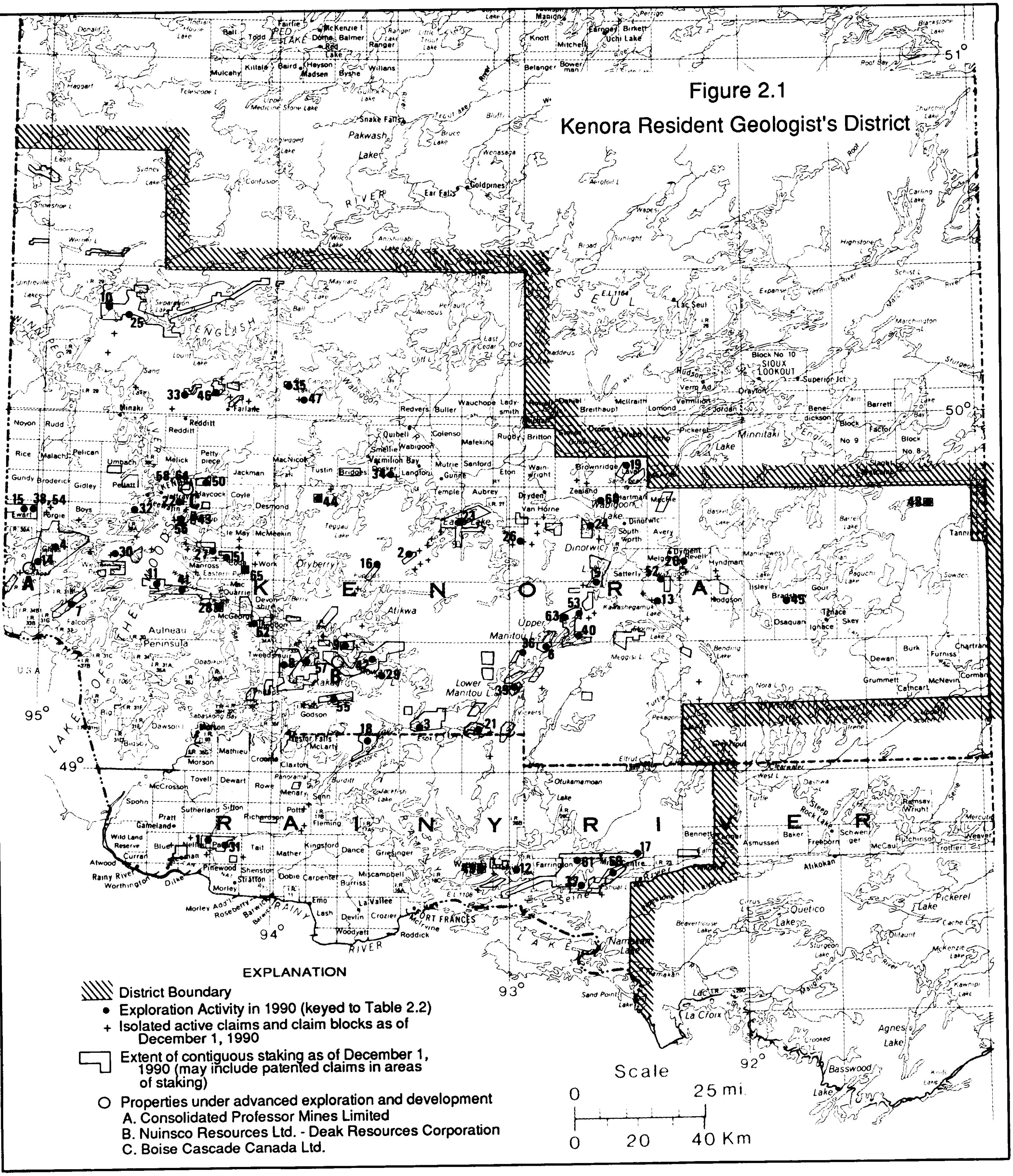

Figure 2.1
Kenora Resident Geologist's District

TABLE 2.2. EXPLORATION ACTIVITY DURING THE YEAR.

ABBREVIATIONS

AEM	Airborne electromagnetic survey	GL	Geological survey
Amag	Airborne magnetometer survey	IP	Induced polarization survey
BS	Beneficiation studies	Mag	Magnetometer survey
DD	diamond drilling	OVD	Overburden drilling
EM	electromagnetic survey	SA	Sampling and assaying
Geochem	Geochemical survey	STr	Power strippoing and manual stripping
Geophys	Geophysical survey	Tr	Trenching
Geo R	Geological report		

Number on Figure	Individual or Company	Area/Township	Activity
1	Asarco Exploration Co.	Nelles, Pattullo, Sutherland and Sifton townships	DD
2	Barton, Bernard	Garnet Bay Area	STr, SA
3	Bolen, John	Bluffpoint Lake Area	DD, SA
4	Bond Gold Canada Inc.	Glass Township	AEM, AMag, GL
5	Bond Gold Canada Inc.	Turtlepond Lake Area	DD
6	Bond Gold Canada Inc.	Lower Manitou Lake Area	GL, Geochem
7	B.P. Resources Canada Ltd.	Monument Bay Area	DD
8	Bruce, Mary	Dogpaw Lake Area	SA
9	Caliban Resources Inc.	Rowan Lake Area	DD, SA, Tr
10	Champion Bear Resources Ltd.	Paterson Lake Area	STr, Tr
11	Conway, J. and R. Theriault	Wiley Bay and Yellow Girl Bay areas	GL, EM, Mag
12	Cousineau, Ray	Halkirk Township	Tr
13	Doherty, William	Kawashegamuk Lake Area	SA, STr, Tr
14	Exploration Brex Inc.	Echo Bay and Snowshoe Bay areas	DD
15	Fairservice, Robert	Ewart Township	SA, GL
16	Falconbridge Limited	Fisher Lake Area	DD
17	Fire River Gold Corp.	Bennett Lake Area	EM, Tr, SA
18	Freewest Resources Inc.	Dash Lake Area	DD
19	Glatz, A. and J. Riives	Laval Township	Mag
20	Glatz, Alex	Revell Township	EM, Mag
21	Homestake Mineral Development Co.	Napanee Lake and Vista Lake areas	DD
22	Hood, Bill	Jaffray Township	EM, Mag, SA
23	International Platinum Corp.	Buchan Bay and Garnet Bay areas	EM, Mag, DD, SA
24	Johnson, Stan	Butler Lake Area	EM
25	Kamo Energy & Resources Ltd. and Khalife, Samir	Paterson Lake Area	AEM, AMag
26	Kozowy, Alex and Alex Glatz	Contact Bay Area	EM, Mag
27	Kretschmar, Ulrich	Manross Township	Mag, STr, Tr, SA
28	Kuehnbaum, R. and G. Zebruck	Aulneau Peninsula Area	Geochem, SA
29	MacEachern, Donald	Rowan Lake Area	Mag
30	McLandress, Ian	Wiley Bay Area	STr
31	Mingold Resources Inc.	Pattullo Township	EM, Mag, SA, Tr
32	Mingold Resources Inc.	Clearwater Bay Area	EM, Mag, GL, SA
33	Nelson Granite Ltd.	Forgotten Lake Area	STr
34	Nelson Granite Ltd.	Docker Township	Tr
35	Nelson Granite Ltd.	Kilgour Lake Area	SA
36	Nelson, Doug	Lower Manitou Lake Area	SA
37	Nipigon Gold Resources	Bad Vermilion Lake and Little Turtle Lake areas	AEM, AMag

TABLE 2.2. CONTINUED.

Number on Figure	Individual or Company	Area/Township	Activity
38	Noranda Exploration Co. Ltd.	Ewart Township	BS, GL
39	Noranda Exploration Co. Ltd.	Mang Lake Area	GL, SA
40	Noranda Exploration Co. Ltd.	Boyer Lake Area	GL, STr
41	Noranda Exploration Co. Ltd.	Yellow Girl Bay Area	DD
42	Nuinsco Resources, Ltd.	Rowan Lake Area	DD
43	Onysko, Robert	Kirkup Township	SA, Tr
44	Palin Granite Canada Inc.	Silvery Lake Area	AMag, ARad
45	Palin Granite Canada Inc.	Bradshaw Township	AMag, ARad
46	Palin Granite Canada Inc.	Forgotten Lake and Wonderland Lake areas	AMag, ARad
47	Palin Granite Canada Inc.	Kilgour Lake	AMag, ARad
48	Parker, Doug	English Lake Area	OVD, SA
49	Pitkanen, D. and R. Pitkanen	Watten and Halkirk townships	STr, Tr
50	Pogson, Gordon	Haycock Township	STr
51	Pogson, G. and J. Currie	Code Township	STr, Tr
52	Redden, Jim	Melgund Township and Tabor Lake Area	STr
53	Redden, Jim	Boyer Lake Area	BS, AEM, AMag
54	Rio Algom Exploration Inc.	Ewart Township	EM, Mag, DD
55	Rio Algom Exploration Inc.	Brooks Lake and Heronry Lake areas	Mag, IP, SA, DD
56	Roberecki, Ed	Bigstone Bay Area	STr
57	Scout Resources Ltd.	Dogpaw Lake Area	Tr
58	Scramble Mining Co. Ltd.	Jaffray Township	Tr
59	Seine River Resources Inc.	Bad Vermilion Lake Area	STr, SA
60	Teck Explorations Limited	Zealand Township	EM, Mag
61	Thompson, L. and J. Bolen	Bad Vermilion Lake and Little Turtle Lake areas	DD
62	Willingdon Resources	Willingdon Township	DD
63	Woitowicz, Mike	Boyer Lake Area	STr, Tr
64	Zebruck, George	Jaffray Township	GL
65	Zebruck, George	Code Township	Geochem, SA

tion zone which may link with the Pipestone–Cameron fault. Other work in the Lake of the Woods area included: geological mapping and sampling by Noranda Exploration Company, Limited, that included claims held by Gordon Pogson, David Busch and Jack Martin, all in Ewart Township (assessment files, Resident Geologist's office, Kenora); sampling and assaying at Electrum Lake, Ewart Township, by Bob Fairservice, where anomalous gold, copper and zinc values were obtained (assessment files, Resident Geologist's office, Kenora); stripping by Ian McLandress at the Hatmaker Lake occurrence, Western Peninsula, Lake of the Woods; geological, magnetic and electromagnetic surveys at the Ambrose prospect, Gull Island, Lake of the Woods, by Alistair Mowat, on claims held by James Conway and Rod Theriault; electromagnetic and magnetic surveys, and sampling and assaying by Bill Hood at the Thrasher prospect, Jaffray Township, where a grab sample from the Pinetree vein assayed 2.87 ounces Au per ton (assessment files, Resident Geologist's office, Kenora); trenching on a claim adjacent to the Scramble Mine, by Scramble Mining Co. Ltd., a wholly owned subsidiary of Boise Cascade Canada Ltd.; trenching, sampling and assaying by Bob Onysko in Kirkup Township on his newly discovered Katrina occurrence, where he obtained assays of up to 6003 ppb Au (Bob Onysko, Prospector, personal communication, 1990); stripping at the Sultana Mine by E. Roberecki; stripping on claims between Black Sturgeon and Island lakes, Haycock Township, by Gordon Pogson; stripping and trenching near the Witch Bay prospect by Gordon Pogson and James Currie; geological survey for George Zebruck in Jaffray Township; and a magnetic survey, stripping, trenching, and sampling and assaying by Ulrich Kretschmar on the Lac La Belle occurrence, Manross Township.

Kakagi–Rowan–Pipestone Lakes Area

The lower level of activity reported in 1989 compared with previous years, when exploration was at an all-time high following mine development at Cameron Lake by Nuinsco Resources Ltd., continued in 1990.

Nuinsco Resources Ltd. conducted no further exploration at its Cameron Lake property in 1990, but did conduct diamond drilling at Rowan Lake on its wholly owned Monte Cristo prospect claim group, from funding arranged through the sale of flow-through shares and under the Canadian Exploration Incentive Program (CEIP).

Rio Algom Explorations Inc. continued exploration commenced in 1989 at the east end of Kakagi Lake. Rio Algom has an option agreement on part of this ground from Laramide Resources Ltd., Marbank Minerals, and Calnor Resources Ltd. In early 1990, a 144 claim group, in 2 blocks, extended from the west end of Chase Point in an easterly direction along the south arm of Kakagi Lake to the vicinity of the Pipestone–Cameron fault. Ground magnetometer and IP (induced polarization) surveys were conducted over most of the eastern block of claims in March 1990. A diamond drilling program, for a total of 1525 m in 6 holes, was conducted during February and March 1990. The holes were spaced along an easterly-trending zone close to the base line over a 6 km distance, between Hay Island in the west, including East Island in the central portion, and the mainland at the east end of the lake in the east. As in the previous drilling of 7 holes in the vicinity of East Island along the same zone, done by Barrier Reef Resources Ltd. in 1983 (Blackburn and Hailstone 1984, p. 4), strongly altered (silicification, sericitization, pyritization) and sheared pyroclastic and flow rocks were encountered (assessment files, Resident Geologist's office, Kenora). No assay results are available.

Caliban Resources Inc. conducted diamond drilling in 3 holes for a total of 579 feet in the vicinity of the Roseman–Thompson gold occurrence, on the north shore of Isinglass Lake in the Rowan Lake area. This was done as follow-up to a program of geochemical soil sampling, VLF-EM and magnetometer surveying, trenching, sampling and geological mapping in 1988, and rock geochemical sampling and trenching in 1989. Low gold and silver values were reported from assays on samples from the 3 drill holes, the highest gold assay being 0.035 ounce Au per ton over 2.5 feet (assessment files, Resident Geologist's office, Kenora).

Freewest Resources Inc., in a joint venture with Sparton Resources Inc., diamond drilled 13 holes for a total length of 1463 m on their 22 claim Helena Lake gold property near Pipestone Lake. Ten of the holes tested the Hook Bay gold prospect, at the south end of Helena Lake. The drill program tested the north-northeast-trending zone parallel to the Helena Lake fault along a strike length of 650 feet (assessment files, Resident Geologist's office, Kenora). Assays from 3 of the holes (*The Northern Miner*, February 19, 1990) were as follows: 17.3 feet containing 0.24 ounce Au per ton in hole 6; 6.5 feet containing 0.28 ounce Au per ton in hole 10; and 7.4 feet containing 0.14 ounce Au per ton in hole 5.

Other work done included: diamond drilling, sampling and assaying, producing low gold values, of 5 holes for a total of 2671 feet by John Bolen on his claims over Straw Lake adjacent to and north of the Straw Lake Beach Mine, as follow-up to an electromagnetic survey done in 1988; rock geochemical sampling and assaying by Mary Bruce on 15 claims north of Jessie Lake in the Dogpaw Lake area; trenching, sampling and assaying on 19 old trenches in 2 claims by Scout Resources between Cedartree and Stephen Lake in the Dogpaw Lake area, which produced a best assay of 1.5 ounces Au per ton from 1 trench, but low to anomalous gold values in all other trenches; a 4000-foot, 6 hole diamond drilling program by Willingdon Resources Limited on its Sioux Narrows gold property, Willingdon Township (*The Northern Miner*, October 15 and November 12, 1990) where assays obtained included a 1-foot section containing 1.4 ounces Au per ton, a 2-foot section containing 0.44 ounce Au per ton and an 8.8-foot section containing 0.1 ounce Au per ton (John Moses, Willingdon Resources, personal communication, 1990); and a magnetometer survey on 4 claims in the Rowan Lake area by Donald MacEachern.

Umfreville–Treelined Lakes Area

Champion Bear Resources Ltd. continued its exploration program in the Separation Lake greenstone belt, commenced in 1988, which continued work started by Shabu Gold Mines Ltd. in late 1987. Champion Bear Resources Ltd. had previously conducted airborne geophysical surveys over an area extending from Umfreville Lake in the west to Helder Lake in the east, a distance of about 45 km, and encompassing on the order of 850 claims, in the Paterson, Treelined, Lennan, Stop and Snook lakes areas. The 2 main targets have been a gold occurrence at Helder Lake, where geological mapping, stripping, trenching and diamond drilling were done in 1988 and 1989, and the Gauthier–Oneman Lake base metal-gold occurrence at Umfreville Lake, where geological mapping, stripping, trenching and geochemical sampling and analyses were done at the occurrence and intermittently over a 10 km strike length to the east in 1989 (assessment files, Resident Geologist's office, Kenora). At the latter occurrence gold, silver, zinc, and other base metals occur in an arsenopyrite-bearing sulphide zone on a peninsula at the east end of Umfreville Lake (*see* Recommendations for Exploration *in* Blackburn et al. 1990).

Kamo Energy and Resources Ltd. contracted an airborne magnetic and VLF-EM survey over 2 claim blocks near Umfreville Lake in the Paterson Lake area. One block of 104 claims, over half of which are held in the name of Khalife Samir, lies south of and ties on to the Oneman Lake gold-base metal property of Champion Bear Resources Ltd. The second block, of 31 claims, lies along the English River west of Separation Lake.

Manitou-Wabigoon-Eagle Lakes Area

Emphasis in gold exploration shifted somewhat away from Eagle and Wabigoon lakes, where Noranda Exploration Company, Limited, and Raleigh Resources Ltd. had both conducted diamond drilling in the Buchan Bay area, Eagle Lake, and where International Platinum Corp. had done diamond drilling on Flambeau Lake prospect, 10 km southwest of Dryden, in 1989.

Bond Gold Canada Inc. continued exploration on their claims at Whitewater Lake, immediately southwest of Dinorwic Lake. Diamond drilling in 12 holes, for a total of 970 m, was done in March and April. Ten of the holes were drilled on 2 vein systems, 1 of which, the Johnson occurrence, had assayed a best value of 0.136 ounce Au per ton over a 1.90 m width, and the other, the Johnny Wayne quartz vein, had assayed a best value of 0.42 ounce Au per ton over a 1.95 m width (assessment files, Resident Geologist's office, Kenora). No assay results from the drilling program are available. Bond Gold Canada Inc. also did geological mapping and geochemical sampling on a 27 claim group at Carleton Lake, south of Upper Manitou Lake, which included the recently rediscovered Queen Alexandra prospect (Delisle 1990). Homestake Mineral Development Company diamond drilled 9 holes for a total length of 3457 feet in February and March 1990 at the Sorry Mac and Gates Lake occurrences at Manitou stretch, southwest of Lower Manitou Lake (assessment files, Resident Geologist's office, Kenora). No assay results are available. In 1988, Homestake had obtained assay results as high as 21.95 g/t Au in trench No. 2 at the Gates Lake occurrence.

Noranda Exploration Company, Limited, did geological mapping on a 15 claim group optioned from Alex Glatz, which encompasses the West and East shafts at the Giant prospect, on the south shore of Mosher Bay, Upper Manitou Lake. The mapping identified the gold-bearing quartz veins to be hosted in a 90 m wide shear zone, striking about 080°, within metasediments of the Manitou Group. Five trenches were excavated across the shear zone and quartz veins, and a total of 197 samples taken for assay, 96 out of the trenches (assessment files, Resident Geologist's office, Kenora). No assay values are available from this project, but recently Delisle (1990) obtained a best assay of 0.59 ounce Au per ton from a quartz-carbonate vein at the West shaft. Noranda also did geological mapping, sampling and assaying, on an 18 claim group at Lower Manitou Lake that includes the Aronson Lake gold occurrence, where Delisle (1990) obtained a best assay of 0.57 ounce Au per ton.

Teck Explorations Ltd. conducted electromagnetic, magnetic and geological surveys on a 60 claim group and on a number of privately owned parcels east of Thunder Lake, Zealand Township. The property covers metagreywackes, arkoses and magnetite ironstones of the Thunder Lake sedimentary series (Satterly 1943), as well as metavolcanic rocks. Previous work in the metasedimentary rocks had indicated traces of sphalerite and chalcopyrite both in outcrop by G.L. Pidgeon in 1956 and in diamond drilling by Canadian Nickel Company Limited in 1971 (assessment files, Resident Geologist's office, Kenora). A regional lake sediment survey (Hornbrook and Friske 1989) indicates elevated gold values (94 ppb) at Thunder Lake, but no elevation in other metals tested.

Alex Glatz did a magnetometer survey over an 11 claim block held by Glatz and Joe Riives at Beartrack Lake, Laval Township, in December 1989 and January 1990 (assessment files, Resident Geologist's office, Kenora). Prospecting in 1989 had led to the discovery of gold-bearing zones, and a 3-foot chip sample from sheared mafic rock reportedly assayed in excess of 3 ounces Au per ton. Previous work by Graham Bousquet Gold Mines Limited in 1950 had led to gold discoveries in outcrop and in diamond drilling (assessment files, Resident Geologist's office, Kenora).

Alex Glatz did magnetometer and VLF-EM surveys over a 6 claim block that included the old SV 309 and SV 310 occurrences (assessment files, Resident Geologist's office, Kenora). In 1988, Mr. Glatz found 2 large pits on claim SV 309, and obtained assays between 0.18 ounce Au per ton and 0.22 ounce Au per ton from dump material.

Other work included: stripping, trenching, sampling and assaying by Bernard Barton at the S.500 occurrence, Higbee Lake, 25 km southwest of Vermilion Bay and southwest of Eagle Lake where the best results from assaying were in 2 samples that returned 4160 ppb and 3060 ppb Au on analysis (assessment files, Resident Geologist's office, Kenora); sampling and assaying by Doug Nelson at the Dryden Red Lake Syndicate occurrence near Early Lake, between Merrill and Lower Manitou lakes; a VLF-EM survey done for Stan Johnson over a 12 claim group along the northeastern boundary of the Butler Lake provincial park, Wabigoon Lake; stripping and trenching by Mike Woitowicz on 3 separate claims at Trafalgar Bay, Upper Manitou Lake; stripping, trenching, sampling and assaying, producing low gold values, by Bill Doherty, at the north end of Kawashegamuk Lake; beneficiation studies by Jim Redden at Sasakwei Lake, northwest of Upper Manitou Lake, and at Trafalgar Bay of Upper Manitou Lake, stripping at Trafalgar Bay, and airborne magnetic and electromagnetic surveys over a larger area in the Boyer Lake area; and stripping and trenching by Jim Redden in the vicinity of the Sakoose Mine, south of Melgund Township.

Fort Frances–Mine Centre Area

Exploration for gold continued in the Rainy River lowlands, west of Fort Frances, where 2 companies, Mingold Resources

Inc. and Asarco Exploration Co. of Canada Ltd. have been working since at least 1988, in part as a result of surveys by the Ontario Geological Survey, including Quaternary mapping (Bajc and Gray 1987; Bajc and White 1990; Bajc et al. 1990), an overburden drilling program (Bajc 1988), a bedrock mapping program (Johns 1988) and an airborne geophysical survey (Ontario Geological Survey 1990). Near Mine Centre, a number of prospectors and junior companies explored for gold around deposits known since the early years of this century.

Mingold Resources Inc. did overburden and bedrock trenching on Crown and private lands in Pattullo Township (assessment files, Resident Geologist's office, Kenora) and in the same general area conducted electromagnetic and magnetic surveys, sampling and assaying, and diamond drilled 3 holes for a total of 1400 feet (Gerry Bidwell, Mingold Resources Inc., personal communication, 1990).

Asarco Exploration Co. of Canada Ltd. concluded, in early 1990, a diamond drilling program commenced in 1989, conducted on private and Crown lands in Nelles, Pattullo, Sutherland and Sifton townships, as follow-up to ground and airborne geophysical surveys, and overburden drilling (R. Dean, Asarco Exploration Co. of Canada Ltd., personal communication, 1990). Fire River Gold Corp. conducted a VLF-EM survey and follow-up trenching, and sampling and assaying on a group of 18 claims near Glenorchy in the Bennett Lake area, which included the old Alice A occurrence (assessment files, Resident Geologist's office, Kenora). Five trenches were excavated on magnetic lows and coincident VLF-EM anomalies, and 42 overburden and bedrock samples taken. Most samples assayed ppb Au, but anomalous values (up to 310 ppb Au) were found in 4 bedrock samples. Seine River Resources Inc. conducted stripping and sampling on a 35 claim block that includes the Dinosaur and Smylie occurrences, north of the Seine River between Shoal and Wild Potato lakes. This program is a continuation of work done in 1987 by the company, when airborne geophysical surveys, geological mapping, stripping and sampling were done, and chip samples assayed up to 0.50 ounce Au per ton (assessment files, Resident Geologist's office, Kenora).

Nipigon Gold Resources Inc., in addition to their development work at their McKenzie–Gray gold-zinc property at the south end of Bad Vermilion Lake, contracted out 2 airborne magnetic and VLF-EM surveys, flown by Terraquest Ltd., one over 66 claims that included the development property, and another over 3 claims adjacent to the Little Turtle River, about 6 km east of Mine Centre (assessment files, Resident Geologist's office, Kenora).

Other work included: diamond drilling of 8 holes for a total of 1124 feet on a 3 claim group held by Larry Thompson and Jack Bolen on the north shore of Bad Vermilion Lake, adjacent to the Verlac prospect, which returned nil to anomalous gold values, except in 1 hole where values in the order of 6800 ppb Au were obtained in 2 short sections (assessment files, Resident Geologist's office, Kenora); and trenching by Ray Cousineau on 1 claim near Bear Passage between Redgut and Swell bays in Halkirk Township (assessment files, Resident Geologist's office, Kenora).

BASE METALS

Falconbridge Limited carried out a 1320-foot, 3 hole diamond-drill program on their 22 claim block in the Fisher Lake area, 35 km southwest of the town of Vermilion Bay. Copper-nickel drill targets were selected on the basis of ground electromagnetic and magnetic anomalies (assessment files, Resident Geologist's office, Kenora). The area was selected on the basis of coincident electromagnetic conductors and magnetic anomalies detected by an airborne survey flown for the Ontario Geological Survey (1987a). The drill holes intersected mafic volcanics and gabbros, but no significant sulphide mineralization (assessment files, Resident Geologist's office, Kenora).

International Platinum Corp. continued their exploration program at Eagle Lake in the Buchan Bay area, with joint venture partner Teck Corporation. A 3500-foot diamond-drill program was carried out on drill targets selected on the basis of geology and geophysics. Teck Corporation can earn a 50 percent interest in the property by spending $1.65 million over the next 4 years (J. Trusler, International Platinum Corp., personal communication, 1990).

Rio Algom Exploration Inc. carried out a single hole, 489-foot diamond-drill program in Forgie Township on a 16 claim block optioned from R. Fairservice. The drill target was selected on the basis of an electromagnetic and magnetic survey conducted over 6 claims (assessment files, Resident Geologist's office, Kenora). Drill logs indicate that the hole intersected up to 20 percent pyrite and 30 percent pyrrhotite in intermediate tuffs in contact with a rhyolitic fragmental rock (assessment files, Resident Geologist's office, Kenora). No assay data are available.

Other exploration included: a lithogeochemical survey by G. Zebruck on 2 claim blocks in MacQuarrie and Code townships (assessment files, Resident Geologist's office, Kenora); a soil geochemistry and rock sampling program by R. Kuehnbaum and G. Zebruck on their Passage base metal-gold property in the Aulneau Peninsula area (assessment files, Resident Geologist's office, Kenora); stripping and trenching by D. Pitkanen and R. Pitkanen at the Pocket Pond copper-nickel prospect in Halkirk and Watten townships (assessment files, Resident Geologist's office, Kenora); and an electromagnetic and magnetic survey by A. Glatz and A. Kozowy over a copper-nickel occurrence at Nabish Lake in the Contact Bay area, Wabigoon Lake.

TABLE 2.3. PROPERTY VISITS.

	Gold		Base Metals and/or Gold
1	Bottle Bay pit and trenches, Manross Township	16	Hansen–Sukava claims, Bending and Dibble lakes area
2	Boulder prospect, Phillips Township	17	Minaki Pyrite prospect, Sand Lake area
3	Brockman prospect, Tabor Lake area	18	Nabish Lake prospect, Contact Bay area
4	E163 prospect, Melgund Township	19	Pidgeon occurrence (Rio Algom Explorations Inc.), Zealand Township
5	Heenan prospect, Bigstone Bay area	20	Robertson Island sulphide zone, Manross Township
6	Island Lake occurrence, Haycock Township	21	Thor prospect, Yellow Girl Bay area
7	Kakagi Lake East Group occurrence (Rio Algom Explorations Inc.), Heronry and Brooks lakes area		**Dimension Stone**
8	McKenzie–Gray prospect (Nipigon Gold Resources Limited), Bad Vermilion Lake area	22	Snook Lake claims (Palin Granite), Snook Lake area
9	Onysko occurrence, Kirkup Township		
10	Peninsula occurrence, Haycock Township		
11	Roseman prospect, Jaffray Township		
12	Stella prospect, Code Township		
13	SV 254 prospect, Melgund Township		
14	SV 309 and SV 310 occurrence, Revell Township		
15	Witch Bay prospect, Code Township		

INDUSTRIAL MINERALS

Dimension Stone

Nelson Granite Ltd. conducted stripping, trenching and bulk sampling on a number of granite properties in Kenora District, including north and northeast of Kenora, at Forgotten Lake, and adjacent to the North Jones Road near Havik Lake, and west of the town of Vermilion Bay in Docker Township adjacent to the company's producing quarry (assessment files, Resident Geologist's office, Kenora).

Palin Granite Canada Inc. contracted airborne magnetic and radiometric surveys over the following 4 claim groups: 47 claims near Direct Lake, north of Kenora, in the Forgotten Lake and Wonderland Lake areas; 4 claims northeast of Kenora near Kilgour Lake; 5 claims east of Kenora, near Geejay Lake, in the Silvery Lake area; and 7 claims near Butler, west of Ignace, in Bradshaw Township. The latter site is close to the site from which Nelson Granite quarried a grey granite in 1989.

Marl

A lake sediment study was done under contract by Dominion Soil Investigation Inc. on claims held in the name of Doug Parker at the Surprise Lake marl deposit (Speed et al. 1985) near the intersection of the Canadian National Railway main line and Highway 599, about 50 km northeast of Ignace. At the request of Noranda Inc., 18 test holes were driven, for the purpose of estimating the quantities of marl and organics in Surprise Lake and surrounding swamp. Total quantity of marl estimated was 5800 m^3, and of silty organic sediment, 3700 m^3 (assessment files, Resident Geologist's office, Kenora).

ONTARIO GOVERNMENT INCENTIVE PROGRAMS

In 1990, 7 exploration projects in the Kenora Resident Geologist's District were designated as of November 26, 1990 under the Ontario Mineral Incentives Program (OMIP), for a total of $539 032. Forty-two projects were approved under the Ontario Prospectors Assistance Program (OPAP), for a total of $388 412.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

Current permanent staff of the Resident Geologist's office include: C.E. Blackburn, Resident Geologist; M.R. Hailstone, Staff Geologist; C.C. Storey, Drill Core Library Geologist; C.B. Ravnaas, Assistant Drill Core Library Geologist; and M.J. Guderyan, Secretary. Contract staff during 1990 included the following people: P.-C. Delisle, Project Geologist in the Dryden–Ignace area, who concluded the current program at the end of March; M.E. Perrault and H.M. Klatt,

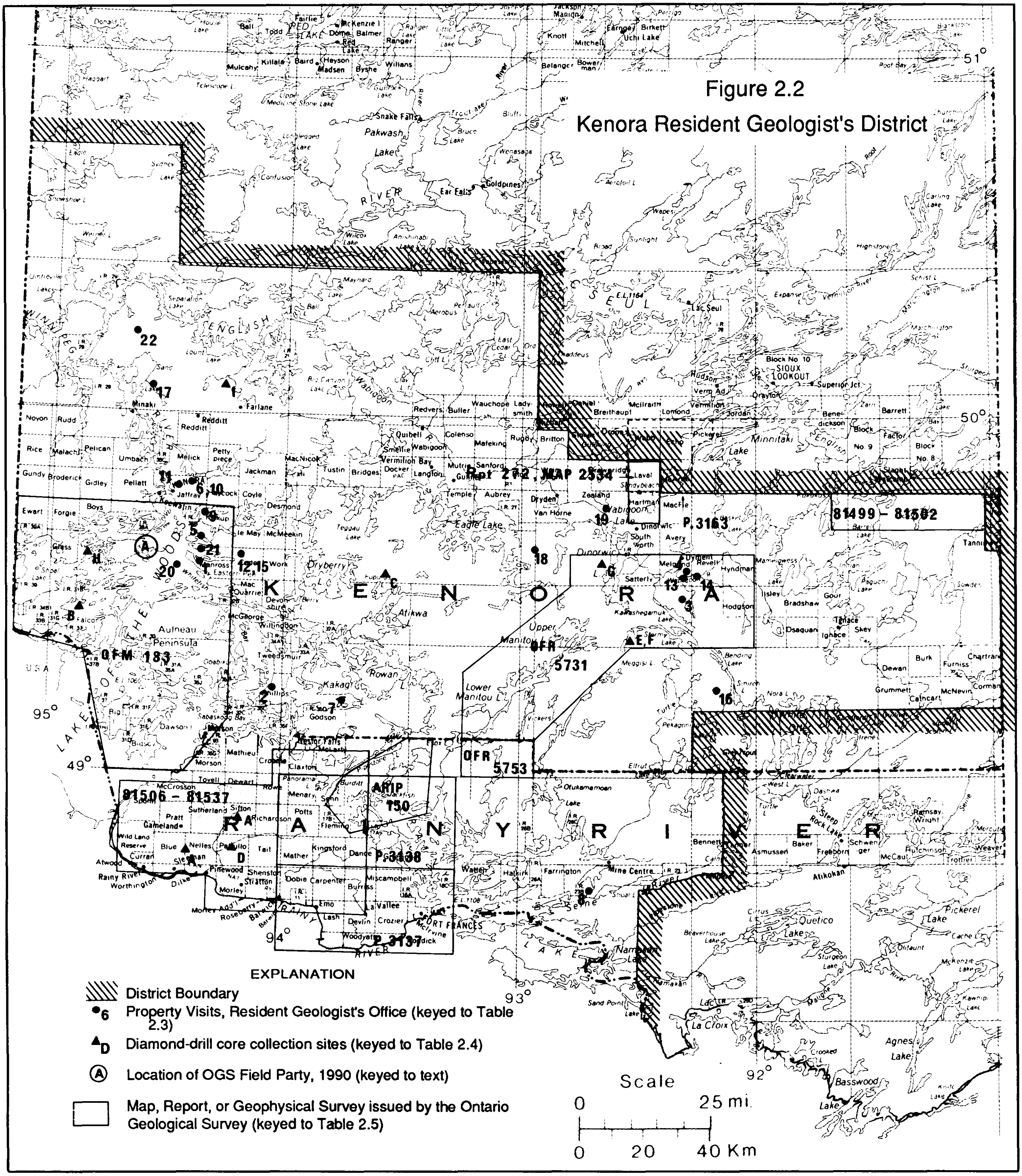

Figure 2.2
Kenora Resident Geologist's District

EXPLANATION
- District Boundary
- ●6 Property Visits, Resident Geologist's Office (keyed to Table 2.3)
- ▲D Diamond-drill core collection sites (keyed to Table 2.4)
- Ⓐ Location of OGS Field Party, 1990 (keyed to text)
- ▭ Map, Report, or Geophysical Survey issued by the Ontario Geological Survey (keyed to Table 2.5)

who prepared Geological Data Inventory Folios; and J.L. Lemay and V.S. Tetreault, clerk-typists.

In 1990, the exploration properties and mineral occurrences and prospects listed in Table 2.3 were examined in the field by staff of the Kenora Resident Geologist's office. Companies undertaking exploration are indicated in brackets. Their locations are indicated on Figure 2.2.

P.-C. Delisle (1990) completed a program of assessment of gold potential and controls on gold emplacement in the Manitou–Stormy lakes greenstone belt. Emphasis was placed on understanding the structural geometry of deposits in the vicinity of Lower Manitou Lake, and also Kawashegamuk Lake. This project was funded by the Canada–Ontario 1985 Mineral Development Agreement (COMDA).

M.R. Hailstone conducted a study of the metavolcanic, metasedimentary and gabbroic rocks of Eastern Peninsula, Lake of the Woods, to assess their potential for hosting gold and base metals. Office staff contributed to 2 Mines and Minerals Division geoscience symposiums, 1 organized by Northwestern Region and held in Thunder Bay in February 1990, and the second organized by the Ontario Geological Survey and held in Toronto in December 1990, by presenting displays emphasizing exploration activity in the Kenora Resident Geologist's District.

At the former seminar, C.E. Blackburn gave a talk on exploration activity in the Kenora Resident Geologist's District, and P.-C. Delisle presented a paper that utilized examples from field work the previous summer entitled "The Usefulness of Structural Analysis in Mineral Exploration", authored by P.-C. Delisle.

Office staff contributed to the Twelfth Annual District Four, Canadian Institute of Mining, Metallurgy and Petroleum meeting, hosted by CIM Thunder Bay Branch in September 1990. C.E. Blackburn helped in the organization of Field Trip No. 2, "Kenora–Rainy River Gold and Base Metals". Unfortunately the trip had to be cancelled due to insufficient enrollment. C.C. Storey presented a display advertising the services of the Kenora Drill Core Library.

During 1990, 2 Geological Data Inventory Folios were published, bringing the total published to 35 since commencement of the project in 1985. Another 15 were in various stages of preparation at year end, including 10 that are complete and awaiting publication. The project was funded in part by COMDA.

The Kenora Drill Core Library, serving the combined Kenora, Red Lake and Patricia mining divisions, housed 77 741.2 m of completely catalogued core by November 20, 1990; 9 898.2 m of core was collected in the period November 20, 1989 to November 20, 1990.

M.R. Hailstone, assisted by Resident Geologist's office staff, presented an 18 hour prospecting course in Dryden in April 1990, which ran 3 evenings a week over a two-week period. Thirty-two people attended. A follow-up field trip was held in May.

A field trip and a talk were provided for the Superannuated Teachers Association of Kenora, entitled "Kenora — at the edge of a continent three thousand million years ago", and a field trip was provided for the Dryden High School Conservation Course. Talks were given to students at Rainy River High School and Lakewood Intermediate School in Kenora. A display was provided for the Mount Carmel School's science fair in Kenora.

Office staff attended the annual meetings of the Prospectors and Developers Association of Canada in Toronto, the Institute on Lake Superior Geology in Thunder Bay, and the State of Minnesota Mineral Activities Symposium in Chisholm, Minnesota. The 8th Symposium of the International Association on the Genesis of Ore Deposits (IAGOD) was attended in Ottawa.

C.E. Blackburn continued to contribute to *The Geology of Ontario* project of the Ontario Geological Survey, by providing input to the innovative Tectonic Map of Ontario. The chapter on the geology of the Wabigoon Subprovince, written by a team of Mines and Minerals geologists lead by C.E. Blackburn, was submitted for editorial review late in the year.

A comprehensive compilation of on the order of 1400 mineral deposits in the Kenora Resident Geologists District into a data base called Mineral Deposit Inventory (MDI) was commenced in November, under contract by Double Rainbow Exploration Services Inc. (DRESI). This data will become part of a computerized, province-wide data base for geoscience exploration, the Geoscience Exploration Database (GED).

C.E. Blackburn sat on the following interministerial and interprovincial committees: the Kenora Area Local Government Study Co-ordinating Committee; the Access Roads Steering Committee; and the Shoal Lake Watershed Management Committee.

ACKNOWLEDGMENTS

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

C.E. Blackburn did the field work on and wrote up the examinations of the following properties: SV 309 and SV 310 occurrences; SV 254 occurrence; and Nabish Lake copper-nickel occurrences. He also wrote the section on Recommendations for Exploration.

M.R. Hailstone did the field work on and wrote up the examinations of the following properties: Island Lake and

Peninsula occurrences; and Boulder prospect. He also did the field work for and wrote up the section on Base Metal Potential of Volcanic Rocks, Eastern Peninsula, Lake of the Woods.

C.C. Storey wrote the section on Drill Core Storage Program, and in the capacity of acting Staff Geologist, did the field work on and wrote up the examinations of the following properties: Heenan occurrence; and Snook Lake claims.

M.E. Perrault wrote the section on Geological Data Inventory Folios.

PROPERTY EXAMINATIONS

GOLD

SV 309 and SV 310 Occurrence

Two old pits, not mentioned previously in the literature, were discovered by Alex Glatz (prospector, Dryden) while traversing a northeast-trending magnetic high identified by the Dryden area airborne electromagnetic and magnetic survey (Ontario Geological Survey 1987b). The old pits are on the east-trending boundary between old mining locations SV 309 and SV 310, in parts of lots 11 and 12, concession 3, Revell Township, adjacent to the Trans Canada Highway 17. They lie in amphibolite-grade mafic volcanic rocks, close to the boundary of the Revell batholith (Satterly 1960). Quartz veins in the pits strike easterly, subparallel to the regional foliation, and to the margin of the batholith. Mr. Glatz reports that samples he took from 1 of the pits consistently assayed between 0.18 and 0.22 ounce Au per ton. A grab sample taken by C.E. Blackburn from the dump of the same pit returned 548 ppb Au on analysis (Temiskaming Testing Laboratory, Mines and Minerals Division, Cobalt). A magnetometer survey run by Mr. Glatz (assessment files, Resident Geologist's office, Kenora) identified a 4000 gamma high above background level over the pits, and a VLF-EM survey identified a conductor axis to be nearly coincident. Eight humus geochemical samples taken by Mr. Glatz in the vicinity of the pits returned values from 7 to 192 ppb Au on analysis.

Numerous small quartz vein-hosted gold deposits have been identified in metavolcanics around the north end of the Revell batholith in Melgund, Revell and Hyndman townships (Parker 1989). It is evident that numerous old gold workings remain to be rediscovered in this area, these pits being an example. Many of the known deposits lie close to, or just within, the Revell batholith, and where they are in the volcanics, close to the transition from amphibolite to greenschist facies grade imparted by emplacement of the batholith (*see* Figure 10 *in* Parker 1989).

SV 254 Occurrence

This occurrence, also known as the New Klondike occurrence, includes mining location SV 263, in parts of lots 3, 4 and 5, Concession 3, Melgund Township. It is accessed by a bush road branching east off the Sandy Point Road, about 1.4 km south of its intersection with Highway 17 at Borups Corners. A number of government geologists have reported on this prospect, the most recent being Parker (1989), who gives a detailed description. Briefly, gold-bearing quartz veins occur in a shear zone at least 60 m wide striking between 060° and 080°, within mafic metavolcanics containing up to 15 percent disseminated pyrite. Gold values from the quartz veins range from 0.02 to 36.22 ounces Au per ton (Silver Lake Resources Inc.: assessment files, Resident Geologist's office, Kenora). Movement along the shear zone has been interpreted by Silver Lake Resources geologists to be dextral on the basis of displacement of felsic dikes and other rock units in the vicinity of the shear. Parker (1989) noted 2 sets of quartz veins: veins of 1 set strike parallel to the shear zone and are boudinaged; and veins of a second set are tightly folded, are interpreted to be ptygmatic, and crosscut the shear zone. Parker (1989) suggested 2 periods of deformation, the first boudinaging veins parallel to the shear zone, and the second being compressional and perpendicular to the shear zone, thus folding the crosscutting veins, which by implication were a later set of veins.

Observations made in 1990 by C.E. Blackburn confirm the general dextral movement along the shear. Most of the folded quartz veins show predominant Z-shapes, but S-shapes are also present. Some of the gold-bearing veins, on which pits have been opened up, have a seemingly very irregular form, which has been called ptygmatic by other workers (Satterly 1960; Parker 1989). However, recent enlargement of the pits by A. Glatz, owner of SV 254 and SV 263, shows them to be refolded, so that the original fold axial planes are oblique to the second fold axial surfaces, defined by the 060° to 080° shear.

Because elevated gold values to date have been found to be confined to these refolded quartz veins, and because the fold axes all plunge steeply, this deposit is probably best considered as a potential small-scale, high-grade mining project. The process of refolding has concentrated the veins into nodes, making them particularly rich pockets.

Heenan Occurrence

The Heenan occurrence is an old gold prospect located on the east side and close to the shore of Hay Island, Lake of the Woods. Access is by boat from Kenora. The area was mapped by Ayer et al. (1987), who described the occurrence under the name of Bigstone Minerals Limited, and also by Davies and Smith (1988). No recent assay values were reported in either of these reports. Gold was initially discovered on this property about 1880. High-grade gold mineralization in a pit on the lakeshore was reported by Coste (1885). No work is reported since this period. Four shallow overgrown pits and trenches, and a shaft reported to be as much as 25 m deep, occur over a distance of 110 m along an east-trending vein system. The shaft is located on high ground at the west end of the vein. At its closest point the lakeshore is approximately 85 m from the shaft. A second shaft at the shoreline is now underwater.

The workings are heavily overgrown and do not appear to have been recently examined. Most of the rock on the shaft dump consists of fine-grained, apparently unmineralized basalt and a small amount of sugary white quartz vein material hosted in slightly carbonatized basalt. A grab sample from the dump of dark green basalt cut by 2 cm quartz veins returned 250 ppb Au on analysis.

A shallow overgrown pit immediately east of the shaft dump does not expose bedrock. An overgrown trench approximately 1.5 m by 3 m by 1 m deep crosses the vein 70 m east of the shaft. The bottom and sides of this trench are overgrown, but dark green weakly foliated basalt is exposed at the 2 ends. Dump material includes mineralized basalt with 2 to 3 cm wide white quartz veins with 1 to 2 cm altered carbonatized zones along each contact. Pyrite and arsenopyrite are present in the alteration zone and in the basalt but only small amounts appear in the quartz vein. A sample, taken from the dump, of dark green mineralized basalt, quartz vein and carbonate alteration, returned 250 ppb Au on analysis. A second trench 25 m from the shore is completely overgrown. A third trench, about 1 m wide, 0.5 m deep and 3 m long is oriented along the vein. Basaltic bedrock is exposed at the east end of the trench. This is the only exposure of vein material *in situ*, and was the original discovery site (Davies and Smith 1988). The vein consists of narrow quartz veins trending east and dipping steeply to the south. Several quartz veins are present in a zone 30 cm wide. East-trending shearing is present along the vein contacts for a few centimetres but is not pervasive in the rock. A grab sample returned 2800 ppb Au on analysis. Silver was less than the detection limit of 2 ppm for all 3 samples.

The poor exposure of the vein in the old workings limits present interpretation. Only 1 vein system, trending easterly and hosted in a narrow, weak shear zone in mafic metavolcanics, has been identified. Carbonate alteration is limited to the immediate shear zone. The highest gold value obtained corresponds to the original discovery trench on the shore.

Island Lake and Peninsula Occurrences

The Island Lake and Peninsula occurrences are located in Haycock Township, immediately east of Kenora, between Black Sturgeon and Island lakes. The Island Lake occurrence was discovered in the fall of 1986 by Gordon Pogson, prospector, at the north end of Island Lake, north of the Jones Road, and in the vicinity of the Trans Canada Pipeline and a hydroelectric transmission line. Mr. Pogson has exposed, by stripping and trenching, shear-hosted vein systems in 2 parallel zones striking 070°, separated by 200 m of relatively unsheared and unaltered quartz diorite of the Island Lake intrusion (King 1983). The northern zone is here termed the Pipeline zone, and the southern zone, the Powerline zone. A 5 hole diamond-drill program was carried out in 1988 under an option agreement with J.P. Sheridan. The Powerline zone was tested with 2 holes and the Pipeline zone with 2 holes. Quartz veins within sheared, silicified, sericitized, biotitic and pyritic granodiorite were logged in the core (assessment files, Resident Geologist's office, Kenora). Grab samples taken from surface trenches have assayed as high as 1.06 ounces Au per ton (G. Pogson, Prospector, personal communication, 1990).

The vein quartz is of 2 varieties, sugary and blue-grey opalescent, and both types may be laminated. The veins are boudinaged, vary from 5 cm to 2 m wide, and dip to the south between 60° and 85°. In the hanging wall are 1 to 5 cm wide tension fractures. Quartz knots and pervasive silicification are more abundant in the footwall than in the hanging wall. Other alteration includes carbonatization, sericitization and biotitization. The veins are commonly sinusoidal and lensoidal. Pyrite and pyrrhotite occur as disseminations and stringers in the veins and wall rock. Patches of chalcopyrite and trace amounts of sphalerite are in the vein. Alteration envelopes extend 1 to 2 m into the wall rock from the vein. These alteration envelopes are commonly pyritic, particularly in the footwall.

Mr. Pogson reported that assay values from grab samples from the veins exposed at surface in the 2 zones have given highly variable results. Six large samples were therefore collected for gold metallics analysis to reduce any nugget effect. The best assay result was obtained from a silicified footwall zone containing quartz knots and 2 to 3 percent pyrite and pyrrhotite in patches and stringers, which returned 0.21 ounce Au per ton, 57 ppm Cu, 24 ppm Pb and 99 ppm Zn on analysis. Another sample, of quartz vein material, assayed 0.09 ounce Au per ton, 270 ppm Cu, 20 ppm Pb and 273 ppm Zn, suggesting that there is no increase in gold content with increase in copper and zinc.

During the summer of 1990, Mr. Pogson found additional quartz veins associated with shearing oriented at 070° on a peninsula jutting into Black Sturgeon Lake, 2 km east-northeast of the Island Lake occurrence. The veining and wall rock alteration are similar in all respects to that at the Island Lake occurrence. The veining has been exposed in 5 trenches over 80 m along strike and averages 5 m in width. The zone has been exposed for an additional 30 m to the east in outcrop by Mr. Pogson. Four samples were collected from each of 4 trenches and analyzed by the total digestion cyanide method. The best sample assayed 0.066 ounce Au per ton, <1 ppm Ag, 0.004% Cu, 0.001% Pb and 0.006% Zn (Accurassay Laboratories Ltd., Thunder Bay). All samples from the Peninsula occurrence included vein, footwall and hanging wall material. Sulphides consist of 2 to 3 percent euhedral pyrite in seams, and 1 trench contained less than 1 percent chalcopyrite and less than 1 percent sphalerite within blue-grey, laminated and opalescent quartz vein material.

The Island Lake and Peninsula occurrences are located in a regional deformation zone that hosts the Princess, Black Sturgeon and Black Sturgeon East prospects. Anomalous gold values are found over a 4 km strike length within this zone. The anastomosing nature of the shears, and the fact that gold accompanies sulphidic alteration, particularly in the footwall rocks, suggests that there is the potential for gold to occur over substantial widths. The zones are composed of numerous sinusoidal, lensoidal and boudinaged veins which parallel the shear direction, but are not connected, and were probably emplaced in a number of stages.

Boulder Prospect

The Boulder prospect is located in Phillips Township, at the south end of Whitefish Bay, Lake of the Woods. Its exact location was unknown for many years, but the old workings were recently found by Bob Tinkess and Ray Haggberg, prospectors, who have staked the prospect and surrounding area.

The prospect is accessed by boat from the government boat launch at Atikaminike Bay, 2 km away (Atikaminike Bay is located in the northwest corner of Map 2447, Kaye 1981). A currently flagged trail leads east 300 m from the shore of Whitefish Bay, 1 km south of the peninsula at the mouth of Atikaminike Bay, to shaft No.1. A second flagged trail leads to shaft No.2, 300 m north-northwest of shaft No.1. The first shaft is reportedly 300 feet deep with 4 levels, and the second shaft has a reported depth of 70 feet. The 2 shafts were sunk about 1898 (Bow 1899), but there is no evidence of gold production: no mill foundations have been found on the property.

The workings are hosted within pillowed and massive mafic metavolcanic flows that face east. To the southwest, a 200 m thick northeast-trending elongate gabbro body intrudes the mafic metavolcanics. The contact between the Aulneau Batholith and the mafic metavolcanics lies 300 m to the west, and has imparted a regional 1 to 1.5 km wide amphibolite-grade aureole to volcanic rocks adjacent to the contact. A northeast-trending 2 km by 200 m quartz-feldspar porphyry body intrudes the mafic metavolcanics 0.5 km east of the shafts (Kaye 1981).

The vein at the No.1 shaft strikes 060° within a 045° trending shear that dips 80° east. The vein pinches and swells along strike and the shear has minor carbonate and moderate biotite alteration. The same quartz vein is exposed in a recently stripped area some 25 m northeast of the shaft, where it is 1 to 2 m wide. Quartz is seen on 3 sides of the shaft. At the stripped area, a minor 0.5 m wide, 075° trending shear can be seen cutting the 045° shear. Orientation of 5 cm wide quartz-filled tension fractures and drag folding of the 045° trending structure indicates movement along this shear to have been left handed. Some of the pillows exposed in this stripped outcrop have epidotized cores. The 075° trending shear also hosts minor quartz veins.

Only a minor amount of quartz vein material was found on the dump at shaft No.1. Alteration associated with the shear is not intense. A sample of quartz vein material taken from the dump produced the following results on analysis: 115 ppb Au, 1.2 ppm As, <2 ppm Pb and <2 ppm Ag (Temiskaming Testing Laboratory, Mines and Minerals Division, Cobalt). A sample of mafic metavolcanics from the dump gave the following results on analysis: 5 ppb Au, 1.8 ppm As, 118 ppm Cu, 91 ppm Zn, <10 ppm Pb and <10 ppm Ag (Temiskaming Testing Laboratory, Mines and Minerals Division, Cobalt).

At shaft No. 2, a moderately biotitized and carbonatized, 1 m wide shear dipping 80° to the southeast and trending 045°, hosts a 10 cm wide, blue-grey quartz vein with a tourmaline envelope that dips 70° east. The vein is exposed on the south wall of the shaft and is hosted within the biotite-tourmaline schist. Assays from this vein are as follows: 7640 ppb Au, <3 ppm Ag, 152 ppm Cu, 92 ppm Zn, <10 ppm Pb and <10 ppm As (Temiskaming Testing Laboratory, Mines and Minerals Division, Cobalt). Visible gold has reportedly been found in samples from the dump (R. Tinkess, Prospector, personal communication, 1990). The amount of quartz present on this dump is considerably more than that at shaft No.1. The vein is exposed in outcrop at surface 2 m south of the shaft. Here the vein is 5 cm wide at surface, suggesting a pinching and swelling of the vein in a vertical and horizontal sense. A sample of quartz from this vein gave the following results on analysis: 2845 ppb Au, <3 ppm Ag, 148 ppm Cu, 400 ppm Zn, 16 ppm Pb and <10 ppm As (Temiskaming Testing Laboratory, Mines and Minerals Division, Cobalt).

At shaft No.2, sulphides, occurring as disseminations and 1 to 2 mm wide stringers, consist of 2 to 3 percent pyrrhotite and pyrite, and trace amounts of chalcopyrite. Sulphides in quartz vein material at shaft No. 1 consist of up to 1 percent euhedral 2 to 5 mm pyrite grains.

A sheared 3 m wide sulphide zone containing up to 3 percent pyrite and pyrrhotite is exposed in outcrop 150 m to the southwest of shaft No.2. Sulphides occur as interpillow material and vesicle fillings, and as stringers in sheared rock. A similar sulphide zone 300 m southwest of this zone is possibly its along strike continuation. A sample from this zone gave the following results on analysis: 16 ppb Au, <3 ppm Ag, 168 ppm Cu, 40 ppm Zn, <10 ppm Pb and <10 ppm As (Temiskaming Testing Laboratory, Mines and

Minerals Division, Cobalt). A second sulphide zone, 200 m west of the first, is 2 to 3 m wide, sheared and carbonatized, and contains quartz stringers. A sample from this zone gave the following results on analysis: 36 ppb Au, <3 ppm Ag, 72 ppm Cu, 24 ppm Zn, <10 ppm Pb and <10 ppm As (Temiskaming Testing Laboratory, Mines and Minerals Division, Cobalt).

The structure at shaft No.1 is paralleled by a second structure at shaft No.2. The quartz vein at the No.2 shaft is blue-grey, fine grained, and sulphide-bearing. The vein at shaft No.1 has a sugary texture and contains minor pyrite. The vein is reported in old newspaper articles to widen to 40 feet at depth (Mineral Deposits files, Resident Geologist's office, Kenora).

The sugary texture in many of the veins in Phillips Township indicates the quartz to be recrystallized. The presence of a number of gold occurrences close to or just inside the regional amphibolite isograd, suggests the area near the isograd to be a favourable environment for additional gold occurrences to be found. Furthermore, many of the veins are associated with northeast-trending structures such as at the Bully Boy, Trojan and Mascote occurrences, all in Phillips Township.

BASE METALS

Nabish Lake Copper-Nickel Occurrences

Copper and nickel mineralization has been known to occur since the mid 1950s in and around the margins of the Nabish Lake gabbroic intrusion, southeast of Eagle Lake. Exploration was conducted between 1956 and 1958, and again between 1966 and 1971, under approximately 10 programs. All of this work was done in the northern part of the intrusion, centred on Nabish Lake. To date, no base metal deposits are known in the southern part of the intrusion south of Century Road. In 1987, the potential of the northern part of the intrusion to host platinum group elements was investigated by at least 2 major mining companies, St. Joe Canada Inc. (now Bond Gold Canada Inc.) and Eldor Resources Limited (now Cameco Corporation).

The most recent geological surveys that cover the intrusion are those of Moorehouse (1941) and Satterly (1943). There is no record of any systematic geological mapping having been done under any of the exploration programs conducted since the 1950s, and the only geological study undertaken has been the petrological and geochemical work by Davies (1966) in his regional study of basic intrusions. J. Parker has recently summarized the known geological features of the intrusion in Blackburn et al. (1988, p.26), in a discussion of its platinum group element potential.

Some of the more promising copper-nickel occurrences are in the northwest lobe of the intrusion, northwest of Nabish Lake. This area can be reached by a logging road, the Nabish road, extending off the Century Road, 1.5 km from the turn of Highway 502, the Dryden–Fort Frances highway. Three companies, World Mining Explorations Ltd. in 1967, Hollinger Mines Ltd. in 1968 and 1969, and Lynx-Canada Exploration Ltd. in 1971, have diamond drilled a total of 6 holes, for a total length of 2 401 feet. Only 1 of these companies, Hollinger Mines Ltd., carried out a ground geophysical program. A predominant 020° to 040° trend was identified by both magnetic anomaly axes and vertical loop electromagnetic axes. World Mining Explorations Ltd. diamond drilled a single hole, for a length of 409 feet at an occurrence on then claim K40072, 300 m north of the Nabish road, and 300 m east of Nabish Creek, intersecting only a trace of chalcopyrite. Hollinger Mines Ltd. diamond drilled 3 holes, each between 400 and 500 feet long, to test a linear electromagnetic conductor and magnetic anomaly close to the Nabish road, and west of Nabish Creek. Only minor chalcopyrite was recorded in all holes, and assay results from 1 hole only returned 0.10% Cu and nil Ni. Lynx-Canada Exploration Ltd. diamond drilled 2 holes, each about 300 feet long, in the vicinity of a chalcopyrite occurrence on then claim K40210, about 1 km southwest of Nabish Creek, and east of the Nabish road. Minor chalcopyrite was reported from both holes, over a 3-foot length in 1 hole, and in a breccia zone over a 141-foot length in the second hole. Assays from the second hole ranged from 0.02 to 0.51% Cu, and 0.07 to 0.29% Ni. In addition to the above, Shklanka (1969) reported that grab samples from the latter occurrence returned assay values of up to 3% Ni and 0.5% Cu. Parker (p.27 *in* Blackburn et al. 1988) indicated only low Pt and Pd values, all below 100 ppb, from 4 grab samples taken in 1987.

Recent work by A. Kozowy and A. Glatz at the showing drilled by Lynx-Canada has indicated that further exploration for nickel and copper is warranted. Further stripping and trenching has been carried out, and a magnetometer and VLF-EM survey conducted over 2 claims. Trenching exposed a sulphide-bearing zone containing massive to net-textured chalcopyrite and nickeliferous pyrrhotite, and possibly pentlandite. The host rock is diverse, in some places a breccia zone, in which felsic fragments occur in a mafic matrix, and in others, fractured gabbro locally with blue quartz eyes. Other workers have interpreted the breccia to be an intrusion breccia although it may be a pyroclastic breccia lying at the edge of the gabbro body. The geophysical data indicate that the occurrence overlies a coincident magnetic anomaly and VLF-EM conductor, both of which have a northerly trend. This detail was not picked up in an airborne geophysical survey flown for the Ontario Geological Survey (1987c) where flight lines were run at a low angle to the indicated magnetic and conductor axes. Two composite grab samples recently taken by the principal author from the new trench, chosen for their high chalcopyrite and suspected high nickeliferous pyrrhotite and/or pentlandite content respectively, returned assays of 3.68% Cu, 0.494% Ni, and 0.068% Cu, 2.588% Ni, respectively (Accurassay Laboratories Ltd., Thunder Bay).

DIMENSION STONE

Snook Lake Claims

A granite deposit near Snook Lake was staked in 1987 by George Zebruck of Kenora. The claim block is located 27 km due north of the town of Minaki, from where it can be reached via Highway 525 north for 23 km to the Sand Lake Road, then east for 15 km on the Sand Lake Road to the Snook Lake Road, and then north along this road for 8 km. The property is currently optioned to Kenora Gold Occurrences Inc.

Work to date consists of geological mapping, ground radiometric survey and sampling of the granite for American Society for Testing and Materials (ASTM) strength testing and polishing.

The granite is exposed and has been sampled in an area 200 m by 200 m. Additional outcrop areas of similar granite are present in the claim group. Gneissic to migmatitic granitoid rocks with abundant melanocratic inclusions surround the deposit. The surrounding area has been mapped at reconnaissance scale only, by Breaks et al. (1975), and comprises syntectonic and late- to posttectonic granitoid rocks. This type of terrane commonly contains small bodies of uniform massive granite surrounded by less uniform rocks that show a variety of inclusions and migmatitic textures. The granite under evaluation is massive with a megacrystic texture. There is no foliation or preferred grain orientation. The rock body is well exposed and only lichen and a small amount of moss cover the surface. Subvertical joints are spaced wider than 10 m and trend roughly northwest, northeast and east. Horizontal joint spacing is 1 to 1.5 m at the surface and appears to increase with depth.

Subhedral potassium feldspar megacrysts 1 to 1.5 cm in size form 40 percent of the rock. The remainder is a matrix of quartz (20 percent), sodic feldspar (35 percent), and biotite and magnetite (5 percent), all with a grain size of 1 to 2 mm. Fine hematite, distributed along grain boundaries and fractures in the megacrysts, lends a dark reddish-brown colour to the fresh rock. The matrix is darker than the megacrysts. The quartz is clear and colourless, and the feldspars translucent pinkish white to colourless except where tinted pink by hematite. Small biotite, quartz and sodic feldspar inclusions are present in many of the potassium feldspar megacrysts.

Storey (1986) indicates that this part of the English River Subprovince has significant potential for pink, red and brown granite deposits. The apparently late stage potassic granitoid intrusive bodies commonly contain massive megacrystic units similar to those investigated at Snook Lake. Many of them are deep pinkish brown to reddish brown in colour.

RESEARCH BY KENORA RESIDENT GEOLOGIST'S STAFF

BASE METAL POTENTIAL OF METAVOLCANIC ROCKS, EASTERN PENINSULA, LAKE OF THE WOODS

Introduction

The present study was undertaken in 1990 in response to an increased interest in exploration for base metals. In 1989, field visits to Manross, Code and MacQuarrie townships were made by M.R. Hailstone (*see* Property Examinations, Black Lake Copper-Zinc occurrence, and Dome Exploration Jadakin Lake occurrence, p.22 to 24 *in* Blackburn et al. 1990). This work suggested that the Eastern Peninsula, Lake of the Woods, deserved further exploration for base metals. Intermediate to felsic subaqueous pyroclastics and flows, and associated subvolcanic feeders, together with chemical sediments such as cherts and graphitic argillites, suggest a favourable environment for volcanogenic massive sulphides, while gabbro sills could host magmatic sulphide deposits.

The study area (Figure 2.3), located in eastern Lake of the Woods, may be reached by boat from Kenora, 20 km to the north or from Witch Bay Lodge at the west end of the Witch Bay Road, off Highway 71.

General Geology

The following account is based on the recent mapping of Ayer et al. (1987) and Ayer and Buck (1989). Ayer (1989) has assigned the volcanic rocks to the Lower Mafic, Upper Diverse and Upper Mafic groups.

The north half of the study area, including the Eastern Peninsula, is underlain by pillowed and massive Mg-rich to Fe-rich tholeiitic basalt of the Lower Mafic group.

Basaltic flows of the Lower Mafic group are conformably overlain by dominantly intermediate, with minor felsic, subaqueous debris flows and flows of the Upper Diverse group. South of Allie Island, bedded wacke, tuffaceous wacke, siltstone and minor oxide and sulphide-facies ironstone are intercalated with the pyroclastics.

Pillowed and massive mafic volcanic rocks of the Upper Mafic group are exposed at Robertson Island. These flows are Mg-rich tholeiitic basalt with subordinate komatiitic basalt, and elevated Ni, Cr and Co trace element values.

Synvolcanic intermediate to felsic porphyry intrusions in the vicinity of Shore, Robertson and Whiteout islands are emplaced within the Upper Diverse group. These porphyry intrusions, up to several kilometres long and 500 m wide, roughly parallel regional stratigraphy. The best exposures of this rock type are found at Shore Island where coarse pyro-

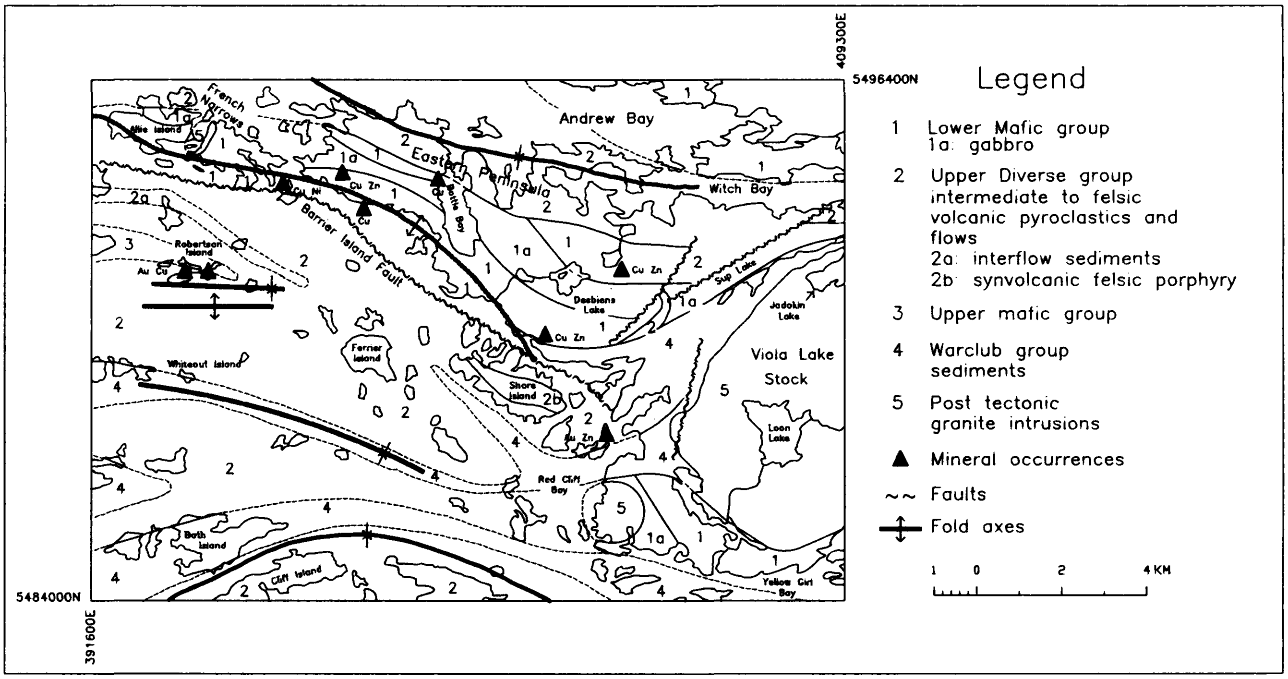

Figure 2.3. Base metal occurrences and geology, Eastern Peninsula, Lake of the Woods.

clastics in contact with the porphyry intrusions are interpreted by the author (M.R. Hailstone) to be rubble deposits that flank felsic domes.

In the vicinity of Shore Island and the mainland to the east, wackes, siltstones and minor chert and argillite of the Warclub group overlie pyroclastics of intermediate composition.

At Hay Island and Eastern Peninsula, supracrustal rocks are intruded by mafic sills. These sills are moderately differentiated to undifferentiated, or are composite intrusions. They range from fine to coarse grained, and may in part be large massive flows, although local crosscutting contacts clearly show intrusive relationships.

The posttectonic, granitic to granodioritic, Viola Lake, Red Cliff Bay and other smaller stocks are circular structures from 500 m to 8 km in diameter that lack strain-related fabrics.

Structure

Upper Diverse group rocks along the north shore of the Eastern Peninsula have been folded about an east-trending syncline. Lower Mafic group volcanics underlying Eastern Peninsula are folded about an east-trending anticline. Another major synclinal axis trends easterly from Whiteout Island to Red Cliff Bay (Figure 2.3).

The Barrier Islands Fault (Ayer 1989) lies just south of the Eastern Peninsula, and separates dominantly Lower Mafic group rocks to the north from Upper Diverse group rocks to the south. Initial movement (D_1) along this fault was essentially vertical, with north side up. Later movement (D_2) was subhorizontal.

D_1 and D_2 deformation are both related to north-directed compression and the 2 styles are distinguished in the field by plunge of fold axes, which are shallow and steep respectively (Ayer and Buck 1989). A third deformation, D_3, is developed locally in the Shore Island area and is defined by folding along northerly-trending axes. D_3 folds are subhorizontal and are attributed to intrusion of late tectonic stocks such as that at Viola Lake.

In the vicinity of Shore Island, arcuate northeast-trending faults and refolding of anticlinal and synclinal axes together with bowing and thickening of stratigraphy may be related to D_3 events.

Zinc-Copper Exploration History

The area was investigated for base metals between 1966 and 1979 on the Eastern Peninsula between French Narrows and Jadakin Lake along the southern contact of an east-trending gabbro intruding east-trending, fine-grained pillowed to massive mafic volcanics of the Lower Mafic group. Mineralization is commonly hosted in chloritic schists and carbonatized zones and associated with quartz porphyry felsite intrusions. Exploration work filed for assessment credit consisted predominantly of ground geophysics and follow-up diamond drilling.

In 1966, Copconda Mines Ltd. carried out trenching and electromagnetic and magnetometer surveys at French Narrows over sulphides hosted within mafic volcanics cut by easterly-trending gabbro intrusions (assessment files, Resident Geologist's office, Kenora). In 1968, Norlex Mines Ltd. tested 2 areas of mineralization with 4 diamond-drill holes totalling 1254 feet.

In 1967, Cominco Ltd. investigated the Ellard occurrence at Desbiens Lake. Two east-northeast-trending electromagnetic conductors with associated magnetic anomalies were intersected in 2 diamond-drill holes (assessment files, Resident Geologist's office, Kenora). A 4.5-foot section of graphitic argillites assayed 0.10% Cu, 0.26% Zn and 0.03% Ni, and a 4-foot section of graphitic argillite assayed 0.04% Cu, 1.04% Zn and 0.02% Ni, respectively (assessment files, Resident Geologist's office, Kenora). Chip samples collected from either side of a pit blasted into a copper-bearing chert zone were found to contain 1.25% Cu over 12 feet and 1.49% Cu over 8 feet (assessment files, Resident Geologist's office, Kenora).

In 1966–67, Augmitto Explorations Ltd. carried out ground geophysics and diamond drilling in the northwestern part of the Eastern Peninsula, 1.5 km north of the previously described occurrence. Three holes were drilled to test easterly-trending conductors. One conductor was at the contact between gabbro and mafic volcanics, and the other 2 holes at the contact between mafic volcanics and intermediate pyroclastics (assessment files, Resident Geologist's office, Kenora). Although no assays were reported, 1 drill hole intersected 6 feet of 30 to 40 percent sulphides consisting of banded pyrite, pyrrhotite and graphite. In the other 2 holes, banded pyrite, pyrrhotite and graphite were intersected over 29 and 28 feet respectively (assessment files, Resident Geologist's office, Kenora).

In 1967, Norlex Mines Ltd. diamond drilled 11 holes totalling 1949 feet to test east-southeasterly-trending conductors between Bottle Bay and French Narrows on the Eastern Peninsula. Mineralization was exposed in trenches over a strike length of 2000 feet. Sulphides were encountered in many of the holes over core lengths of up to 24 feet. The best intersection of chlorite schist was found to contain 0.14% Cu, 0.57% Zn, 0.005 ounce Au per ton, and 0.05 ounce Ag per ton 8.2 feet (assessment files, Resident Geologist's office, Kenora).

In 1968, Norlex Mines carried out a ground magnetometer and diamond-drill program at Robertson Island. Mafic volcanics were intersected in 2 drill holes and no sulphides were reported (assessment files, Resident Geologist's office, Kenora).

In 1970, Kerr Addison Mines Ltd. drilled 7 holes to the west, south and east of Desbiens Lake, and 2 holes at Sup Lake (assessment files, Resident Geologist's office, Kenora). The holes intersected sheared chloritic mafic volcanics and gabbro that were variably silicified and carbonatized, and contained graphitic sections. The whole sequence was cut by quartz-feldspar porphyry dikes. Mineralization consisted of up to 40 percent pyrrhotite with minor to trace amounts of chalcopyrite (assessment files, Resident Geologist's office, Kenora). No assays were reported. In 1 of the holes southeast of Desbiens Lake, a 1-foot core length of sheared silicified basalt containing 2 to 3 percent sphalerite and 10 percent pyrrhotite was intersected. In 1 of the holes at Sup Lake, chlorite schist with 2 to 3 percent pyrite and rare flecks of sphalerite are reported (assessment files, Resident Geologist's office, Kenora).

In 1979 Teck Corporation carried out electromagnetic and magnetometer surveys over 6 claims north of Sup Lake. In 1981, the company diamond drilled a 600 m long hole to test an east-trending conductor. A highly contorted graphitic argillite horizon, interbedded with intermediate pyroclastics, contained 30 percent massive, banded or heavily disseminated pyrrhotite with minor pyrite and trace chalcopyrite. A 1.6 m core length assayed 598 ppm Ni, 910 ppm Zn, 0.3 ppm Ag and 30 ppb Au (assessment files, Resident Geologist's office, Kenora).

Prospective Areas

During the present study, 3 general areas were identified that have specific geological characteristics that warrant consideration for base metal exploration, including: 1) Robertson Island area; 2) Eastern Peninsula between Allie Island and Desbiens Lake, including French Narrows and Bottle Bay; and 3) Shore Island area. Samples were analyzed by Geoscience Laboratories section, Ontario Geological Survey, Toronto, except where indicated.

Robertson Island

Robertson and adjacent islands are underlain by massive and pillowed mafic flows of the Upper Mafic group in conformable contact with intermediate pyroclastic debris flows and overlying felsic pyroclastics and flows of the Upper Diverse group. Graded bedding is present in the intercalated fine-grained volcaniclastics. The volcanics are intruded by 0.25 to 2 m wide quartz-feldspar dikes that are probably offshoots of subvolcanic intrusion 2 km to the west. All units are intruded by coarse-grained 1 to 3 m wide melanogabbro dikes. The volcanic units strike easterly and are folded about an east-trending syncline and anticline couple.

An east-trending, 750 m long, 2 to 4 m wide shear zone exposed on Robertson Island and a small island 500 m to the west, contains up to 10 percent pyrite as micro stringers, disseminations and blebs. The shear zone parallels a pyroclastic unit composed of stretched lapilli up to cobble-sized siliceous fragments composing 20 to 30 percent of the rock. Sericitization, silicification, carbonatization and local fuchsitic alteration predominate.

Fifteen samples were collected by the author (M.R. Hailstone) on Robertson and adjacent islands. The highest analytical values are 191 ppb Au, 160 ppm Zn and 171 ppm Cu.

Several pits along the shear zone were sampled by the author. A sample from a 0.5 m chert horizon near the contact of the mafic flows with the overlying intermediate pyroclastics was found to contain 184 ppb Au and 108 ppm Zn (Temiskaming Testing Laboratory, Mines and Minerals Division, Cobalt).

The only previous exploration recorded at Robertson Island was that of Norlex Mines in 1968. Factors such as the presence of ubiquitous sulphides, a favourable geological environment and characteristic alteration associated with the sulphides promote further exploration for gold and base metals. Seven of the 15 samples collected gave results greater than 100 ppb Au, considered anomalous for gold in this area of Lake of the Woods by John Ayer (Ontario Geological Survey, personal communication, 1990).

Allie Island–Desbiens Lake (Eastern Peninsula)

Sulphide occurrences on Eastern Peninsula are hosted by fine-grained massive and pillowed mafic flows of the Lower Mafic group. These occurrences are all north of the Barrier Island Fault and spatially related to the southern contact of the gabbro sill.

On the south side of a small island immediately south of French Narrows, a 30 m wide east-trending gabbro sill intrudes mafic volcanics. Copper-nickel-bearing sulphides were reported to occur at the contact of the sill on the southwest side of the island (Davies 1967). Sulphides consist of up to 2 percent pyrrhotite and pyrite with trace chalcopyrite in micro veins. A sample collected by the author from a pit on the south side of the sill returned 2 ppb Au, 40 ppm Ni and 383 ppm Cu on analysis, and a sample from a pit on the north side of the sill returned 190 ppb Au, 150 ppm Ni, 540 ppm Cu and 570 ppm Zn on analysis. A sample from the east side of the island on the north side of the gabbro returned 5 ppb Au, 28 ppm Ni, 130 ppm Cu and 105 ppm Zn on analysis.

Two kilometres east of French Narrows on the south shore of the Eastern Peninsula is a sulphide occurrence in an east-northeast-trending carbonatized shear zone in pillowed mafic volcanics. A sample from the shear zone returned <2 ppb Au, 100 ppm Cu and 117 ppm Zn on analysis. Two hundred metres north of the shear zone, up to 2 percent pyrrhotite and pyrite occurs within pillow selvages and vesicles. A sample from this locality returned <2 ppb Au, 194 ppm Cu and 107 ppm Zn on analysis.

On the south shore of Eastern Peninsula, north of Shore Island, mafic flows are in contact with intermediate pyroclastics and graphitic argillites and interbedded siliceous siltstone. Four samples were collected and analyzed. A sample from pillow breccia near the gabbro contact that contained finely disseminated pyrite along fractures, was found to contain 15 ppb Au, 129 ppm Cu and 133 ppm Zn.

On the north shore of a small island 1 km south of French Narrows, an easterly-trending sericitic, carbonatized shear zone is hosted in pyroclastic rocks. A quartz-feldspar porphyry intrudes the sheared pyroclastics and is itself sheared along its margins. A grab sample of quartz vein material from a pit in the sheared porphyry returned 535 ppb Au, 26 ppm Cu and 36 ppm Zn. Sulphides are dominated by up to 3 percent cubic pyrite. On the south shore of another island 200 m to the northeast, is a similar east-trending sericitic shear zone hosted in felsic rocks. A sample of quartz vein material from this shear zone returned 150 ppb Au, 36 ppm Cu and 53 ppm Zn on analysis.

Field observations and analytical work from the present study suggest that on Eastern Peninsula, sulphides are related to easterly-trending carbonatized or chloritic shears. Previous exploration also suggests that the southern contact of the gabbro is a favourable area for mineralization, particularly where it is embayed or folded.

Shore Island

Shore Island, islands adjacent to it, and the mainland to the east are predominantly underlain by intermediate to felsic pyroclastics and flows and related subvolcanic feeders of the Upper Diverse group. Many of the coarser pyroclastics appear to be rubble deposits that may have developed on the flanks of domes.

None of the 8 samples collected in the present study produced significant results on analysis. The best analysis came from a sample from a sheared felsic porphyry dike intruded into sheared metasediments that contained stretched blebs of pyrite making up to 15 percent of the rock. The 2 m wide carbonatized, sericitized and silicified shear zone strikes 170°. The sample returned 4 ppb Au, 54 ppm Cu and 123 Zn ppm on analysis.

The best analysis from 4 samples of graphitic argillites and interbedded siliceous siltstones was <2 ppb Au, 37 ppm Cu, 87 ppm Zn and 34.4 ppm As. It is interesting to note that 3 of the 4 samples collected from graphitic argillites with interbedded siliceous siltstones and chert were found to be similarly enriched in As.

Despite the poor analytical results obtained in the present study, the Shore Island area warrants further exploration. The area displays many characteristics favourable for base metal deposition (Hodgson and Lydon 1977; Franklin et al. 1981) such as coarse pyroclastics indicative of proximity to an eruptive centre, alignment of structurally localized features, for example the dike-like nature of the quartz-feldspar porphyry, and the presence of chemical sediments. Subvolcanic intrusions and proximity to vent centres are considered favourable environments for base metal deposition.

The geological mapping by Ayer and Buck (1989) suggests that other volcanic centres are present in this southeastern corner of the Lake of the Woods greenstone belt. This clustering of volcanic centres suggests the presence of a collapsed caldera, as yet undetected. In this regard, Ayer and Buck (1989) have suggested that synvolcanic intermediate to felsic porphyry intrusions in the vicinity of Shore, Robertson and Whiteout islands are feeders to Upper Diverse group pyroclastics and flows.

Summary and Conclusions

Centres of felsic magmatism characterized by phreatic breccias, debris flows, and associated wackes, cherts and carbonaceous argillites figure prominently as host rocks to volcanogenic massive sulphide deposits (Franklin et al. 1981). The documented submarine environment is favourable for formation of volcanogenic massive sulphide deposits. Furthermore, synvolcanic structures such as radial and ring faults, that may be intruded by dikes, and rapid change of thickness of units, are also salient characteristics of ore deposition environments (Easton and Johns 1986). Permeable horizons within the volcanic stratigraphy where cut by synvolcanic faults, could serve as depositional environments for mineralized solutions (Watkinson 1990).

Many of these features are found in the southeastern corner of the Lake of the Woods greenstone belt, suggesting a favourable environment for base metal deposition. Although no significant mineralization was encountered during this study, the anomalous amounts of copper and zinc found in previous exploration suggests that further work is warranted. A large portion of the area is under water, and therefore best explored using geophysical methods.

GEOLOGICAL DATA INVENTORY FOLIOS

Compilation of Geological Data Inventory Folios (GDIFs) continued during 1990, funded in part by COMDA. The program was started in 1985 and by the end of 1990, 35 GDIFs had been released (Figure 2.4). Fifteen more are in preparation and may be viewed at the Kenora Resident Geologist's office.

During the year, 4 new GDIFs were completed in the western part of Lake of the Woods, a historic gold camp that has seen renewed activity in the last decade. The Exploration Data and Property Location maps for one of the GDIFs, the Shoal Lake area, were completed digitally using a CAD system. All such maps will in future be produced in this way, thus allowing for easy updating.

Four new GDIFs covering NTS area 52 F/05 are being prepared and will be available in 1991. This NTS area, which includes Dogpaw Lake, Rowan Lake, Lobstick Bay and Atikwa Lake areas, was the scene of a staking rush in the mid-1980s, due to developments at the Cameron Lake gold property of Nuinsco Resources Ltd.

Geological Data Inventory Folios provide a map-based index, not only to assessment files in the Kenora Resident Geologist's office, but to all other available mineral-related data in the area of coverage.

DRILL CORE STORAGE PROGRAM

The Kenora drill core library serves 3 of the 6 Resident Geologist's districts in Northwestern Ontario: Kenora, Patricia (Sioux Lookout) and Red Lake. Core stored consists of core from entire drill holes from both exploration and mine development drilling, incomplete core recovered from old drill sites, and short samples of core submitted for credit under section 77(6) of the Mining Act, Revised Statutes of Ontario, 1980. The current content of the library consists of 55 408.3 m of core stored inside the building and an additional 22 332.9 m of core on pallets in secure outdoor storage for a total of 77 741.2 m. Core in outdoor storage consists of excess core from several drilling projects that were collected in their entirety, core removed from inside the building when core in better condition became available and surplus core after some holes were relogged and reduced.

The library holds 45 104.7 m of core from 532 drill holes in the Kenora District, 30 780.0 m (399 holes) inside the building and 14 324.7 m (133 holes) in outdoor storage. Further, 9 898.2 m of core from 78 drill holes were added to the collection between November 23, 1989 and November 20, 1990, 3 489.5 m from 28 holes from within Kenora District. All assessment credit core from all 3 districts is now stored at the Kenora core library.

There were 107 visitors for the year, compared with 193 in 1989. A total of 42 man-days were spent by industry personnel examining and logging drill core and rock sample suites. The depressed state of the exploration industry in 1990 is probably responsible for the 45 percent reduction in visitors and 54 percent reduction in man-days of use over 1989 figures. There was an increase in inquiries by exploration geologists on the use of stored pulps and rejects from previous sampling programs.

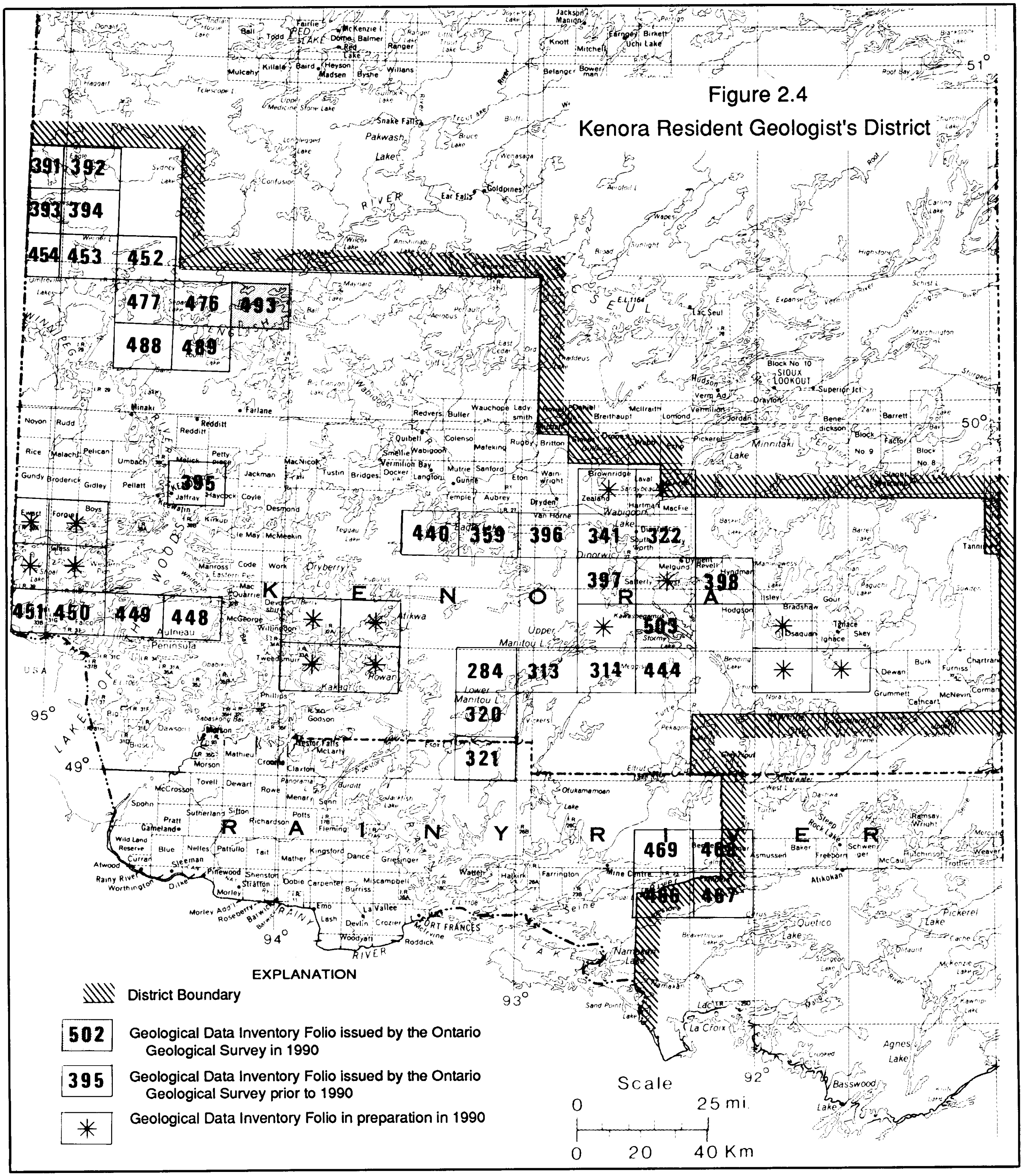
Figure 2.4
Kenora Resident Geologist's District
EXPLANATION
District Boundary
502
Geological Data Inventory Folio issued by the Ontario Geological Survey in 1990
395
Geological Data Inventory Folio issued by the Ontario Geological Survey prior to 1990
Geological Data Inventory Folio in preparation in 1990
Scale
0 25 mi.
0 20 40 Km
51°
50°
49°
95°
94°
93°
92°
KENORA
RAINY RIVER
LAC SEUL
LAKE OF THE WOODS
SIOUX LOOKOUT
FORT FRANCES
391
392
393
394
454
453
452
477
476
493
488
489
395
440
359
396
341
322
397
398
503
451
450
449
448
284
313
314
444
320
321
469
468
466
467

TABLE 2.4. DRILL CORE COLLECTION SITES.

A	Asarco Exploration Co. of Canada Ltd.	Pinewood Project	(8 holes)
B	BP Canada Inc.	Morrice Gold Showing, Fairservice Option	(5 holes)
C	Falconbridge Limited	Lava Creek Property	(3 holes)
D	Mingold Resources Inc.	Pattullo Township	(3 holes)
E	Noranda Inc.	Patterson Option	(1 hole)
F	Noranda Inc.	Pelham Option	(2 holes)
G	Peter Island Resources Inc.	Dryden–Van Houten Property	(2 holes)
H	Teeshin Resources Ltd.	Squaw Lake Property	(1 hole)
I	Zebruck, George (Palin Granite)	Botanist Lake	(3 holes)

Gold remained the primary target for diamond drilling in all 3 districts. Core was collected from 9 projects in the Kenora District (Table 2.4; Figure 2.2). Of these all but 1 were drilled primarily for gold. Re-evaluation of base metal properties and of gold properties for their base metal potential has continued. There was no further overburden drilling in the Emo–Rainy River area by government agencies but Mingold Resources Inc. and Asarco Exploration Co. of Canada Ltd. continued diamond drilling in the area. Gold was the primary exploration target of these projects.

Diamond drilling has not been used to any great extent in exploration for building stone or industrial minerals in the Kenora District. A series of short vertical holes across a granite prospect can give valuable information about horizontal joint spacing, colour, texture and grain size changes, and the effect of weathering on the granite. George Zebruck of Kenora recently carried out such a program on a granite deposit in the English River Subprovince northeast of Redditt.

RECOMMENDATIONS FOR EXPLORATION

In recent years mafic and ultramafic intrusions in northwestern Ontario have been increasingly targeted by exploration companies for their platinum group element (PGE) potential. This followed the increase in PGE metal prices and the success of Madeleine Mines Ltd. in outlining PGE concentrations at Lac des Iles, 80 km north of Thunder Bay. The Kenora Resident Geologist's office undertook studies of mafic and ultramafic intrusions in the Kenora District, commencing in 1986 with a literature survey of all such intrusions with attendant PGE analyses (p. 22 to 24 *in* Blackburn et al. 1987). The study continued in 1987 with lithogeochemical sampling of intrusions in three general areas including the Emo–Fort Frances–Mine Centre area, the Nabish Lake area near Dryden, and the Werner–Rex Lake area, 50 km northwest of Kenora (p.22 to 30 *in* Blackburn et al. 1988). Sampling of intrusions concluded in 1988 in 3 additional areas including the Atikwa Lake area 30 km east of Sioux Narrows, the Entwine Lake intrusion 65 km south of Dryden, and the Beaverhouse Lake–Factor Lake areas 40 km southeast of Mine Centre (p.32 to 40 *in* Blackburn et al. 1989). Interest in PGEs fell off abruptly in 1989 due to price decreases which continued to the present time. Because of a renewed interest in base metal exploration spurred by the perceived depletion in reserves, some recommendations were given in Blackburn et al. (1990) for new targets for volcanic-hosted base metals. The continued interest makes it appropriate to discuss the potential for massive sulphides associated with some of the mafic to ultramafic intrusions, particularly since many of the intrusions recently investigated for PGE were originally looked at for their copper-nickel potential.

BASE METALS

The potential for copper-nickel deposits to be hosted in mafic to ultramafic intrusions distributed around the margins of the Atikwa batholith has been pointed out by Mackasey et al. (1974) and Trowell et al. (1980). Copper-nickel deposits were first discovered in this environment in the 1930s, when mineralization was discovered west of Atikwa Lake, at Kathleen Lake. In the 1950s, both Falconbridge Nickel Mines Ltd. and The International Nickel Company of Canada Limited did extensive exploration on mafic to ultramafic intrusions around the west end of the Atikwa batholith, resulting in substantial underground development by Falconbridge at their Kenbridge nickel deposit at Kathleen Lake. Davies (1973) reported that the Kenbridge property had reserves of over 3 million tons grading 1.06% Ni and 0.54% Cu.

Apart from the substantial number of low-grade copper-nickel occurrences discovered around the west end of the Atikwa batholith (summarized by M.R. Hailstone *in* Black-

TABLE 2.5. MAPS AND REPORTS PERTAINING TO THE KENORA RESIDENT GEOLOGIST'S DISTRICT ISSUED BY THE ONTARIO GEOLOGICAL SURVEY, 1990.

Airborne Geophysical Maps	
81506 – 81537	Airborne Electromagnetic-Magnetic Survey (1:20 000 and 1:31 680)
81499 – 81502	Airborne Electromagnetic-Magnetic Survey (1:20 000 and 1:31 680)
Maps	
Map 2534	Precambrian Geology, Laval and Hartman Townships
Open File Reports	
OFR 5731	Property Visits by the Dryden Area Mineral Commodity Geologist
OFR 5718	An Evaluation of the Industrial Mineral Potential of Parts of the Districts of Kenora and Rainy River
OFR 5753	Geology of the Vista Lake Area
Preliminary Maps	
P.3137	Quaternary Geology, Emo Area
P.3138	Quaternary Geology, Northwest Bay Area
P.3163	Precambrian Geology, Sandybeach Lake Area
P.3178	Precambrian Geology, Vista Lake Area, West Part
P.3179	Precambrian Geology, Vista Lake Area, East Part
Miscellaneous Papers	
MP 147	Report of Activities 1989, Resident Geologist
MP 151	Summary of Field Work and Other Activities, 1990
Aggregate Resources Inventory Papers	
ARIP 150	Aggregate Resources Inventory of Northwest of Fort Frances, Northern Ontario
Geological Data Inventory Folios	
GDIF 503	Kawashegamuk Lake Area (52F/08 NW)
GDIF 493	Lennan Lake Area (52L/08 SE)
Open File Maps	
OFM 133	Geology of the Lake of the Woods Area

burn et al. 1989), copper-nickel deposits have only been discovered in mafic to ultramafic intrusions around the northeast, or Doré Lake, lobe of the Atikwa batholith. Most notable are the Mile Lake–Contact Bay (Nichro Mines), the Harrison–Hanson, and the Pidgeon–Contact Bay occurrences (assessment files, Resident Geologist's office, Kenora). Discoveries in the Nabish Lake intrusion include the Kozowy claim K40072 and K40210, the Kozowy–Latin American Mines, and the Johnston–Jeness occurrences. Another deposit, recently described by P.-C. Delisle *in* Blackburn et al. (1990, p.24) as the Glatz occurrence is at the west margin of the Doré Lake lobe in the Turtlepond Lake area.

The values of 3.68% Cu and 2.588% Ni recently obtained from composite grab samples from the Kozowy K40210 occurrence (*see* Nabish Lake Copper-Nickel Occurrences *under* Property Examinations, this paper), and the values of up to 3% Ni reported by Shklanka (1969) from the same occurrence, suggest that the Nabish Lake intrusion is an excellent exploration target for copper-nickel deposits. P.-C. Delisle (*in* Blackburn et al. 1990) quoted A. Glatz as reporting 1.95% Ni and 1.6% Cu for 2 grab samples respectively from the Glatz occurrence. To date only limited surface trenching and shallow diamond drilling has been done on any of these deposits.

All of the above observations suggest that copper-nickel deposits generally are to be found in mafic to ultramafic intrusions around the west and east ends of the Atikwa batholith, and that in particular those intrusions around the Doré Lake lobe of the Atikwa batholith warrant considerably more exploration than has been performed in the past. An excellent tool that can be used to search for additional deposits in these areas is the airborne electromagnetic and total intensity magnetic survey maps published by the Ontario Geological Survey. Examples of their use (Ontario Geological Survey 1987a, 1987b, and 1987c) have been given elsewhere in this paper.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

During the year, 1 field party from the Precambrian Geology Section operated within the Kenora Resident Geologist's District (Figure 2.2). The project, headed by John Ayer, concluded a synoptic study of the geology of the Lake of the Woods greenstone belt.

The Geophysics/Geochemistry Section contracted a 11 720 line-kilometre electromagnetic and magnetometer airborne survey of the Rainy River area to Geoterrex Limited. The Ministry of Northern Development and Mines released the results of this airborne survey on December 3, 1990.

RESEARCH BY OTHER AGENCIES

UNIVERSITY THESES

Geological theses relating to the Kenora Mining Division, believed to be in progress or completed during 1990, are as follows:

Master's Theses

T. Warman completed a study of the geochemistry, sedimentology and history of sedimentation of the red varved clays at Dryden (University of Manitoba, Winnipeg).

OTHER RESEARCH

Dave Sharpe of the Geological Survey of Canada is completing a summary of COMDA-supported studies carried out over the preceding 3 years on the Quaternary geology of the area covered by NTS 52F and part of 52E. The study will include trace element signatures of tills, and an overview of the Wabigoon clay basin. This work will be a useful contribution to aggregate development and environmental studies on waste management and groundwater.

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3. Red Lake Resident Geologist's District—1990

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[3]Drill Core Library Geologist, Kenora Drill Core Library, Northwestern Region.

INTRODUCTION

Exploration activity increased moderately over last year's depressed levels as indicated by the number of claims staked and assessment work recorded. A year-to-year comparison of claim staking activity and assessment work credits filed in the Red Lake District is shown in Table 3.1. Diamond drilling credits are considerably less than last year, but this is offset by significantly higher geophysical survey credits. Although the number of claims staked has increased, the number of claims cancelled increased markedly, resulting in an overall reduction in active claims.

There were 25 companies with active exploration projects in the district. Inco Gold Inc. completed a bulk sampling program at the Cochenour Willans Mine. Aur Resources Inc. opened an exploration office in Red Lake and acquired several mineral properties in the Red Lake greenstone belt. Chevron Minerals Ltd. continued exploration on several properties under a joint venture agreement with Goldquest Exploration Inc. However, toward the end of the year, the company terminated all Canadian mineral exploration. Placer Dome Inc. actively explored for gold throughout the Red Lake District. Teck Corporation continued exploration in the Dixie Lake area south of Red Lake and Noranda Exploration Company, Ltd. was active on a number of properties in Red Lake, Birch–Confederation lakes and Stull Lake greenstone belts. A number of other companies were also actively exploring in the district for precious and/or base metals.

TABLE 3.1. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1990	2, 264	3, 648	9, 844	39, 162	91, 499	7, 540	151, 384
1989	1, 841	1, 548	11, 228	61, 422	39, 814	8, 510	132, 620
1988	2, 286	2, 368	10, 935	175, 600	215, 300	42, 666	457, 500
1987	4, 512	1, 708	11, 017	81, 854	138, 443	23, 440	261, 741
1986	3, 803	1, 598	10, 427	48, 325	127, 445	6, 360	189, 633
1985	2, 673	2, 260	8, 212	42, 000	201, 052	16, 642	269, 262
1984	4, 344	1, 725	7, 799	32, 588	78, 538	12, 495	128, 664
1983	2, 407	1, 204	5, 180	18, 637	22, 035	3, 468	53, 207
1982	942	1, 884	3, 992	23, 967	79, 662	6, 787	118, 775
1981	1, 719	1, 249	4, 889	28, 771	66, 000	8, 182	107, 430
1980	2, 220	1, 115	4, 301	38, 482	30, 240	871	71, 975
1979	1, 068	1, 763	3, 221	21, 108	38, 380	3, 154	62, 949
1978	1, 207	1, 521	3, 916	25, 574	19, 496	2, 480	50, 997
1977	2, 324	2, 395	4,.261	12, 994	45, 080	620	59, 196
1976	2, 705	1, 382	4, 332	18, 680	23, 578	380	46, 544
1975	1, 368	2, 059	2, 957	29, 377	12, 714	960	44, 717
1974	1, 339	1, 829	3, 648	47, 362	5, 660	3, 040	57, 719
1973	1, 616	3,157	4, 009	60, 027	20, 474	NIL	83, 019
1972	2, 219	5, 284	5, 588	34, 261	14, 858	5, 216	56, 173
1971	1, 541	4, 922	8, 486	73, 019	50, 920	2, 243	127, 556
1970	3, 971	7, 194	11, 759	73, 886	329, 065	17, 606	427, 527

Exploration activities throughout the district are summarized in Table 3.2. Figure 3.1a,b documents the locations of exploration activity and claim staking during the year.

There were 12 Ontario Prospectors Assistance Programs (OPAP) in the district during the year totalling $119 800 in financial assistance to qualified prospectors. Of these, 11 programs sought gold mineralization and 1 was directed toward base metal prospecting. Under the Ontario Mineral Incentive Program (OMIP), 12 programs received financial assistance totalling $449 397.

MINING ACTIVITY

Since the closure of the Griffith iron mine in 1986, only precious metals have been produced in the Red Lake District. Two mines continue to operate, Placer Dome Inc.'s Campbell Mine and Dickenson Mines Limited's Arthur W. White Mine. The Cochenour Willans Mine was the site of an underground bulk sample extraction and was the only other active mining operation during the year (*see* Advanced Exploration and Development).

Placer Dome Inc.—Campbell Mine

The Campbell Mine began production of gold in 1949 as the 12th producer in the Red Lake camp, and has operated continuously since that time. To the end of 1989, the mine has recovered 6 954 612 ounces of gold from 11 606 825 tons of ore for an average mine life grade of 0.60 ounce Au per ton. During 1990, the mine reached the its 7 million ounces mark of gold and production for the year is projected to be 248 400 ounces of gold from 427 000 tons of ore. This is a slight decline from actual 1989 production figures of 267 876 ounces of gold from 420 000 tons of ore, and is in accordance with long-term mining plans. The present mine head grade is 0.605 ounce Au per ton and the milling rate remains unchanged at 1170 tons of ore per day.

Underground development work in the mine amounted to 11 100 feet of drifting and 4300 feet of raising. Ore definition diamond drilling totalled 60 000 feet and an additional 40 000 feet of exploration drilling was completed.

The installation of a pressure oxidation process to the mill circuit began during the year and is scheduled for completion in 1991. This system is designed to treat refractory sulphide ore and eliminate the need for the on-site roaster, thereby ending atmospheric emissions. Three diesel electric generators, each capable of producing 1000 kilowatts of power, were added to the mill complex as standby units for emergency power.

A new carbon-in-pulp circuit was commissioned in May as a replacement for a previously converted carbon-in-pulp circuit that was dismantled. The capacity of the carbon plant in the tailings circuit was doubled to handle all tailings solutions. Prior to discharge, all tailings solutions now pass through carbon columns to extract residual gold and heavy metals, effecting a recovery of an additional 3000 ounces of gold annually. Discharge water is treated with ferric sulphate to precipitate arsenic before being discarded. As a result of improvements in the mill circuit, gold recovery has increased from 95 percent to 96.1 percent.

The mine employs a total of 502 people: 260 work in the mine department, 48 in the mill, 134 in the plant, and 60 in administration.

Proven and probable ore reserves as of December 1990 are 6 166 400 tons grading 0.634 ounce Au per ton for a total of 3 909 498 ounces of contained gold (R. Church, J. Frostiak, Campbell Mine, personal communication, 1990).

S. Reid retired as General Manager of the mine in May and was replaced by T. Mann.

Dickenson Mines Limited—Arthur W. White Mine

In 1948, the Arthur W. White Mine became the 11th mine to start gold production in the Red Lake District. In continuous production since start-up, the mine has produced 2 704 071 ounces of gold to the end of 1989. Production for 1989 amounted to 75 600 ounces and 9 months' production for 1990 totalled 59 884 ounces of gold. Total gold production for 1990 is projected to be 80 000 ounces.

New developments at the mine include drifting on the 6th level to access the D zone, which hosts gold mineralization between the 13th level and the surface.

Approximately 80 000 feet of underground diamond drilling was completed during the year. Of this amount, 60 000 feet was for production and development and 20 000 feet was for exploration.

Sulphide concentrate is currently being stockpiled on site and is excluded from mill recovery. Hence, recovery stands at 84 percent.

Underground drifting amounted to 3500 feet, and an additional 3500 feet of ramping and 2300 feet of raising was completed.

Ore reserves in the proven and probable category amount to 3.1 million tons at a grade of 0.32 ounce Au per ton. The mine employs a work force of 366 (J. Rogers, Arthur W. White Mine, personal communication, 1990). B. Bried is the Mine Manager.

TABLE 3.2. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
1	AUR RESOURCES INC.	GEOLOGICAL MAPPING, SAMPLING: MAY-SPIERS PROPERTY, BALL TWP. GEOLOGICAL MAPPING, SAMPLING: MEUNIER PROPERTY, FAIRLIE TWP.
2	BHP-UTAH MINES LTD.	DIAMOND DRILLING (3)-358.7 m: WOLF BAY PROPERTY, TODD TWP. DIAMOND DRILLING (2)-541.9 m: SOLTERMANN OPTION, TODD TWP.
3	CANADIAN PATRICIA EXPLORATION LTD.	GROUND GEOPHYSICAL SURVEY, 52.8 km LINE CUT, PROSPECTING: DIXIE LAKE MAP SHEET
4	CHARLARMAR RESOURCES INC.	POWER STRIPPING, MANUAL WORK, SAMPLING: BYSHE AND HEYSON TWPS.
5	CHEVRON MINERALS LTD.	DIAMOND DRILLING (7)-3129 m: ROWAN PROPERTY, TODD TWP. DIAMOND DRILLING (23)-7855 m: EAST BAY, ABINO/KAYMAC GROUP, DOME AND BALMER TWPS.
6	CREAM SILVER MINES LTD./HLX RESOURCES LTD.	AIRBORNE GEOPHYSICAL SURVEY: SEAGRAVE LAKE MAP SHEET
7	DESMEULES, G.	POWER STRIPPING, SAMPLING: GERRY LAKE MAP SHEET
8	ECHO BAY MINES LTD.	22 km I.P. SURVEY, DIAMOND DRILLING (10)-1400 m, ASSAYS: BERENS RIVER EAST PROPERTY, SETTING NET LAKE MAP SHEET
9	GOLDEN ARROW LTD.	DIAMOND DRILLING (5)-630.3 m: BALMER TWP.
10	GOLDEYE EXPLORATIONS LTD.	GROUND GEOPHYSICAL SURVEY, I.P. SURVEY, 141.8 km LINE CUT: GRANITE BAY OF SANDY LAKE MAP SHEET
11	GOLD FIELDS CANADIAN MINING LTD.	SOIL GEOCHEMICAL SURVEY, PROSPECTING, SAMPLING: CASUMMIT LAKE MAP SHEET
12	HERBERT, L./BOBINSKI, M. (HERBO EXPLORATIONS)	GEOLOGICAL MAPPING, DIAMOND DRILLING (2)-360 m, POWER STRIPPING, TRENCHING: HEYSON TWP. POWER STRIPPING, TRENCHING: BALMER TWP.
13	HERMISTON, W.	PROSPECTING: DEDEE LAKE AND SOUTH OF OTTER LAKE MAP SHEETS
14	INCO GOLD INC.	GROUND GEOPHYSICAL SURVEY: BATEMAN AND MULCAHY TWPS. GEOLOGICAL MAPPING, POWER STRIPPING, ROCK SAMPLING, DIAMOND DRILLING 396.2 m: WILMAR PROPERTY, DOME TWP. 10,000 TON BULK SAMPLING PROGRAM, UNDERGROUND DIAMOND DRILLING 11,581.8 m: COCHENOUR WILLIANS MINE, DOME TWP.
15	LAC MINERALS LTD.	GEOLOGICAL MAPPING, LINE CUT: AGNEW AND EARNGEY TWPS.
16	LAVERTY RED LAKE RESOURCES INC.	DIAMOND DRILLING (4)-621.7 m: THRALL PROPERTY, HEYSON TWP.
17	LIGHTVAL MINES LTD.	GROUND GEOPHYSICAL SURVEYS, DIAMOND DRILLING (4)-633.4 m: SOUTH OF OTTER LAKE MAP SHEET
18	MACIEJEWSKI, A.	GEOLOGICAL MAPPING, GROUND GEOPHYSICAL SURVEYS, POWER STRIPPING: BAIRD TWP. TRENCHING: BALL TWP. GEOLOGICAL MAPPING, GROUND GEOPHYSICAL SURVEYS: FAULKENHAM LAKE AND MEDICINE STONE LAKE MAP SHEETS SAMPLING, TRENCHING: DOUGLAS LAKE, MULCAHY TWP.
19	MAJOR GENERAL RESOURCES	GEOLOGICAL MAPPING: BROWNSTONE LAKE MAP SHEET
20	MCFINLEY RED LAKE MINES LTD.	CARE AND MAINTENANCE, UNDERGROUND WORKINGS CONTINUE TO BE DEWATERED: MCFINLEY MINE, BATEMAN TWP.
21	MCNERNEY, WM.	GROUND GEOPHYSICAL SURVEY: DIXIE LAKE MAP SHEET
22	MEUNIER, D. J.	DIAMOND DRILLING (1)-152 m: FAIRLIE TWP.
23	MILESTONE RESOURCE CORPORATION	DIAMOND DRILLING (19)-1639.7 m: SHABUMENI LAKE MAP SHEET DIAMOND DRILLING (3)-369 m: FALCONBRIDGE BIRCH LAKE PROPERTY, SHABUMENI LAKE MAP SHEET
24	MINNOVA INC.	GEOLOGICAL MAPPING, LITHOGEOCHEMICAL SURVEY: MITCHELL, EARNGEY AND BELANGER TWPS.
25	NORAMCO MINING CORPORATION	GROUND GEOPHYSICAL SURVEYS, DIAMOND DRILLING (3)-952 m: FLY LAKE PROPERTY, MITCHELL TWP.

TABLE 3.2. CONTINUED.

Number on Figure	Individual or Company	Activity
26	NORANDA EXPLORATION CO., LTD.	GEOLOGICAL MAPPING, TRENCHING, SOIL AND LITHOGEOCHEMICAL SURVEYS: LOYDEX PROPERTY, SATTERLY LAKE MAP SHEET AIRBORNE GEOPHYSICAL SURVEY, I.P. SURVEY, GRADIOMETER SURVEY, DIAMOND DRILLING (3)-412.4 m, TRENCHING: BLUE EMERALD PROPERTY - PRYSLAK OPTION, CASUMMIT LAKE MAP SHEET AIRBORNE GEOPHYSICAL SURVEY, I.P. SURVEY, GRADIOMETER SURVEY, DIAMOND DRILLING (7)-1749 m, ASSAYS (DRILL CORE), LITHOGEOCHEMICAL SAMPLING (DRILL CORE): SELCO/SPRINGPOLE PROPERTY, CASUMMIT LAKE MAP SHEET GEOLOGICAL MAPPING, HUMUS, SOIL AND LITHOGEOCHEMICAL SURVEYS, PROSPECTING, ROCK SAMPLING: GENESSEE PROPERTY, DIXIE LAKE, FAULKENHAM LAKE AND SOUTH OF BYSHE AND WILLANS MAP SHEETS GROUND GEOPHYSICAL SURVEYS: STULL LAKE PROJECT, STULL LAKE MAP SHEET GEOLOGICAL MAPPING, AIRBORNE GEOPHYSICAL SURVEY, GROUND GEOPHYSICAL SURVEYS, SOIL GEOCHEMICAL SURVEY, TRENCHING, DIAMOND DRILLING (22)-5992.8 m: GOLD FIELDS PROPERTY, CASUMMIT AND SEAGRAVE LAKE MAP SHEETS GEOLOGICAL MAPPING, SOIL AND LITHOGEOCHEMICAL SURVEYS: RICE BAY PROPERTY, SATTERLY LAKE MAP SHEET TRENCHING: LUXOR PROPERTY, MCDONOUGH TWP. ASSAYS (ROCK SAMPLES): BOND/GRACE LAKE PROPERTY, SHABUMENI LAKE MAP SHEET SOIL AND LITHOGEOCHEMICAL SURVEYS, GROUND GEOPHYSICAL SURVEY, ROCK ASSAYS: HORSESHOE LAKE PROSPECT - MEYER OPTION, MITCHELL TWP. I.P. SURVEY, GEOLOGICAL MAPPING, DIAMOND DRILLING (3)-402.7 m: HORSESHOE ISLAND, CASUMMIT AND SATTERLY LAKE MAP SHEETS GEOLOGICAL MAPPING, LITHOGEOCHEMICAL SURVEY: BELANGER TWP. DIAMOND DRILLING (1)-117.7 m: FLY LAKE, MITCHELL TWP.
27	OROFINO RESOURCES LTD.	GEOLOGICAL MAPPING, SOIL AND LITHOGEOCHEMICAL SURVEYS, PROSPECTING: JACKSON-MANION PROPERTY, DENT TWP.
28	OUTOKUMPU MINES LTD./SHERRITT GORDON LTD.	DIAMOND DRILLING (7)-1211 m: DORION ISLAND, DOME TWP.
29	PELANGIO-LARDER MINES LTD.	GEOLOGICAL MAPPING, SAMPLING: HEWITT LAKE MAP SHEET
30	PETERSON, C.	DIAMOND DRILLING (4)-318 m, POWER STRIPPING: HEYSON TWP.
31	PLACER DOME INC.	GEOLOGICAL MAPPING, GROUND GEOPHYSICAL SURVEYS, 220 km LINE CUT, STRIPPING: MCINNES LAKE AND SOUTH MCINNES LAKE MAP SHEETS GEOLOGICAL MAPPING, GROUND GEOPHYSICAL SURVEYS, 37 km LINE CUT, LITHOGEOCHEMICAL SURVEY, DIAMOND DRILLING (11)-2210 m, RELOGGED 12 HOLES DRILLED IN 1982: BRUCE CHANNEL, DOME TWP. GEOLOGICAL MAPPING, LITHOGEOCHEMICAL SURVEY, 150 km LINE CUT, POWER STRIPPING: SOBEL LAKE PROPERTY, SOUTH OF OTTER LAKE MAP SHEET GROUND GEOPHYSICAL SURVEY: CLEVELAND LAKE MAP SHEET GEOLOGICAL MAPPING, GROUND GEOPHYSICAL SURVEYS, 82 km LINE CUT, LITHOGEOCHEMICAL SURVEY, DIAMOND DRILLING (9)-1858 m, POWER STRIPPING: BIRCH LAKE EAST PROPERTY, KEIGAT LAKE AND CASUMMIT LAKE MAP SHEETS DIAMOND DRILLING (1)-152 m: LABINE OPTION, KEIGAT LAKE MAP SHEET
32	RED LAKE BUFFALO RESOURCES LTD.	SAMPLING, DIAMOND DRILLING (9)-1299.3 m: MADSEN MINE, BAIRD TWP.
33	RIVARD, O.	DIAMOND DRILLING (1)-94.5 m: HEATH PROPERTY, TODD TWP. DIAMOND DRILLING (1)-74.4 m: BATEMAN TWP.
34	SHANE RESOURCES LTD.	GEOLOGICAL MAPPING, ROCK SAMPLING: WEST RED LAKE PROPERTY, BALL TWP.
35	ST. JUDE RESOURCES LTD.	GEOLOGICAL MAPPING, SOIL GEOCHEMICAL SURVEY: EARNGEY TWP.
36	TECK CORPORATION	GEOLOGICAL MAPPING, AIRBORNE GEOPHYSICAL SURVEY, DIAMOND DRILLING (5)-724.2 m, TRENCHING: DIXIE LAKE MAP SHEET GEOLOGICAL MAPPING, I.P. SURVEY, DIAMOND DRILLING (6)-892.1 m, TRENCHING: PAKWASH PROPERTY, BRUCE LAKE MAP SHEET
37	TWIN GOLD MINES LTD./AGASSIZ RESOURCES LTD.	AIRBORNE GEOPHYSICAL SURVEY: NORTH OF LINGMAN LAKE, LINGMAN LAKE AND VANDERBRINK LAKE MAP SHEETS
38	WILLIAMSON, J.	DIAMOND DRILLING (1)-30.8 m: AVIS LAKE MAP SHEET

ADVANCED EXPLORATION AND DEVELOPMENT

Inco Gold Inc.—Cochenour Willans Mine

Inco Gold Inc. continued underground exploration on the Cochenour Willans Mine in Dome Township. This is the third year the company has been active on the mine property and exploration concentrated on the extraction of a 10 000 ton underground bulk sample. The bulk sampling program was targeted on select areas of mineralization previously drill tested on the 1800-, 2050-, and 2000-foot levels. The southern chert zone and north-south vein structures were tested. The bulk sample was composed of 40 ton rounds which were crushed on site and reduced to 50 kg representative samples in a sampling tower. The representative samples were shipped to Inco's assay laboratory in Copper Cliff, Ontario for analysis.

Underground drilling amounted to 38 000 feet; targets included the main sedimentary facies and north-south structures on the 2050- and 2200-foot levels, the southern chert zone on the 1800-foot level, and the Cochenour main zone on the 2200-foot level.

In addition to the underground program, a surface program was conducted on the Wilmar property, which is situated south of the Red Lake airport. Surface exploration consisted of power stripping, sampling, geological mapping, and a 1300-foot drilling program.

Expenditures to date by the Wilanour partnership (Inco Gold Inc., Wilanour Resources Limited, Pronto Explorations Ltd., and R. H. Fasken) total $9.7 million (H. Virtanen, Inco Gold Inc., personal communication, 1990).

The Cochenour Willans 500 tons per day mill is maintained in good condition (*Canadian Mines Handbook*, 1990–91, p.455).

McFinley Red Lake Mines Ltd.

Although underground workings continued to be dewatered, the property was idle throughout the year.

EXPLORATION ACTIVITY

Gold continued to be the most sought after commodity in the district and exploration concentrated in the Uchi Subprovince. Exploration projects were also carried out in several of the northern greenstone belts, including McInnes Lake, North Spirit Lake, Favourable Lake, Sandy Lake, Lingman Lake, and Stull Lake greenstone belts.

RED LAKE GREENSTONE BELT

A total of 11 companies actively engaged in mineral exploration in the Red Lake greenstone belt. As well, a number of prospecting programs were carried out, many of which received assistance under the Ontario Prospectors Assistance Program.

Aur Resources Inc.

Aur Resources established an exploration office in Red Lake and acquired the 8 claim May–Spiers property in Ball Township and a block of 169 claims covering the Fisher Islands and adjacent ground in Fairlie Township. Aur completed reconnaissance mapping and sampling on both properties.

BHP–Utah Mines Ltd.

BHP–Utah completed a diamond drilling program on their Wolf Bay and Soltermann properties in Todd Township as follow up to geological, geophysical and geochemical surveys conducted the preceding year. The drilling program included 2 holes with a combined length of 1778 feet on the Soltermann option and 3 holes totalling 1177 feet on the Wolf Bay property. Drilling encountered biotite and carbonate altered mafic metavolcanics with narrow silicified zones hosting pyrite, arsenopyrite, chalcopyrite, pyrrhotite, sphalerite, and galena mineralization. Core from this drilling program is archived in the Kenora Drill Core Library.

Chevron Minerals Ltd.

Chevron Minerals continued to explore Goldquest Exploration Inc. properties in the second year of a 5 year, $8 million joint venture agreement plan. Work included a 7 hole drilling program totalling 3129 m on the Rowan Mine property in Todd Township to test the depth potential of known gold mineralization. Twenty-three holes, totalling 7855 m were drilled and surveyed on the Abino and Kaymac properties at the southern end of East Bay in Dome and Balmer townships. The drill program concentrated on the Chevron Zone, discovered during a 1989 drilling program. This zone consists of altered, gold-bearing dikes, of undetermined composition, hosted by altered and sheared ultramafic rocks. Alteration of the dikes includes biotitization, chloritization, silicification, carbonatization, and albitization. Numerous quartz-carbonate veins invade the dikes. The veins and dikes host sulphide mineralization, consisting of pyrite and pyrrhotite. Visible gold occurs sporadically and is associated with the most intense alteration.

Chevron rehabilitated the McMarmac Mine site and seeded the area as well as sites that had been stripped the previous year (S. Fumerton, Chevron Minerals Ltd., personal communication, 1990).

Noranda Exploration Company, Ltd.

Noranda carried out a trenching program on the Luxor property in McDonough Township.

Placer Dome Inc.

Placer Dome completed 37 km of line cutting and a magnetic survey over its Bruce Channel claim group in Dome Township. A drilling program consisting of 11 holes totalling 2210 m was completed by the company.

Red Lake Buffalo Resources Ltd.

Red Lake Buffalo Resources Ltd. carried out a surface drilling program consisting of 9 holes totalling 4263 feet on the McVeigh zone of the Madsen Mine in Baird Township. Drilling encountered several ore grade intersections, including 0.36 ounce Au per ton over a width of 5 feet, 0.304 ounce Au per ton over 5 feet, and 0.264 ounce Au per ton over 9 feet (J. Morlock, Red Lake Buffalo Resources Ltd., written communication, 1990).

The company also commenced clean-up operations of mine buildings at the Starratt–Olsen and Madsen mines in Baird Township.

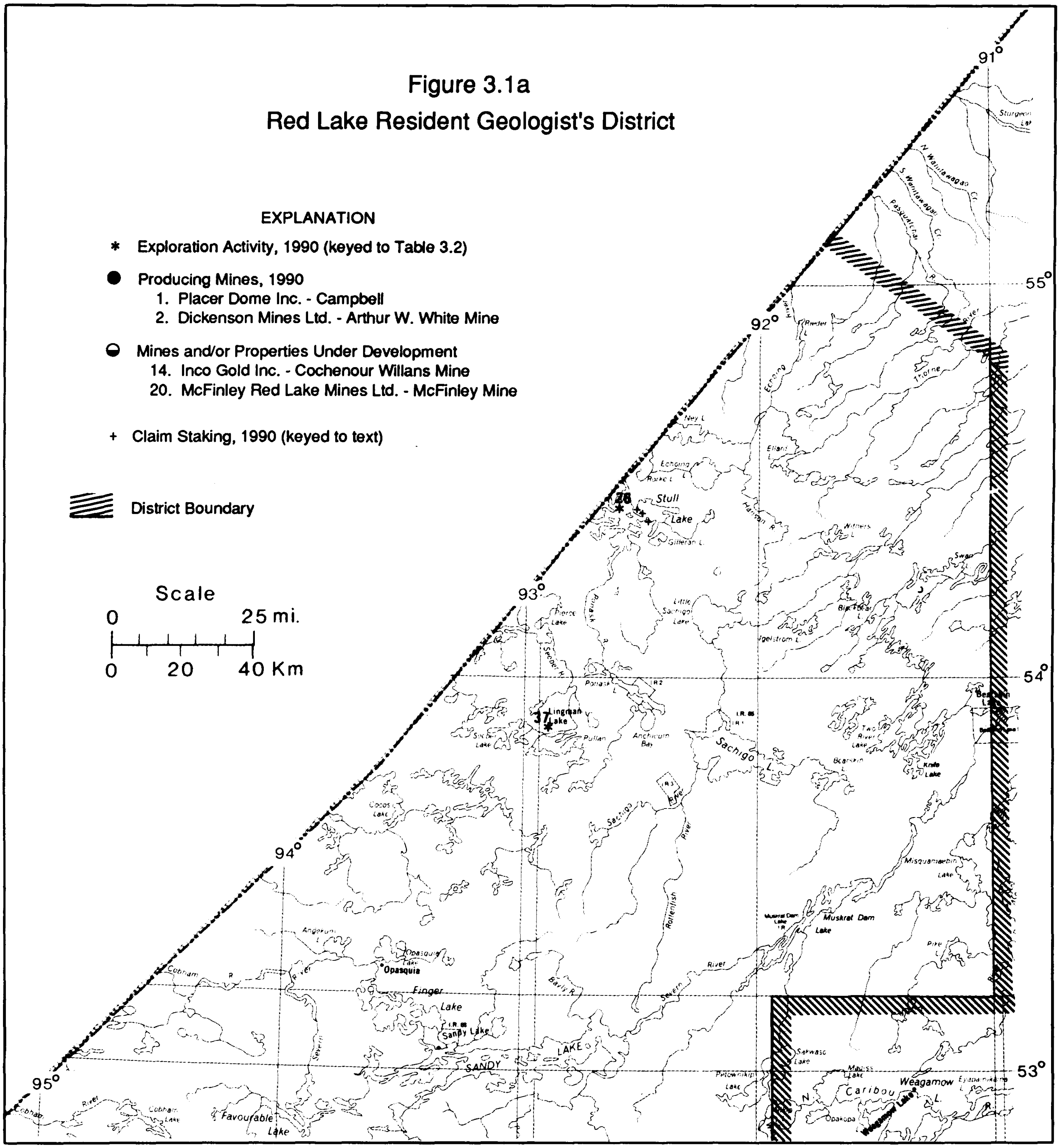

Figure 3.1a
Red Lake Resident Geologist's District

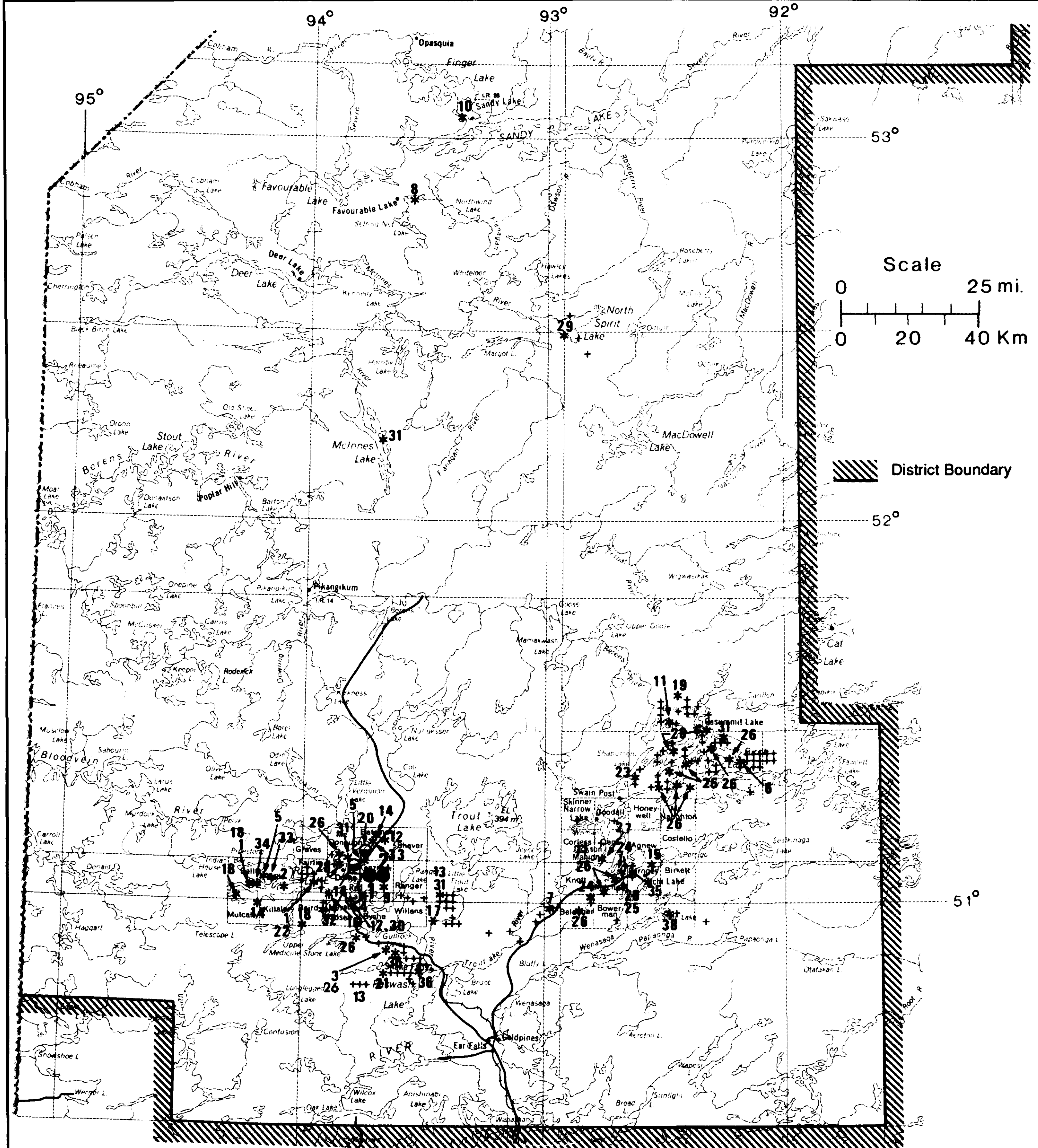

Figure 3.1b
Red Lake Resident Geologist's District

DIXIE LAKE AREA

Teck Corporation

Teck continued exploration in the Dixie Lake area on their previously discovered 88-4 zone. The company has outlined a gold inventory of 420 000 tons grading 0.13 ounce Au per ton (*Vancouver Stockwatch*, August 14, 1990). Thirteen holes totalling 6980 feet were drilled on the Dixie Lake property this year. Teck also completed geological mapping of the claims.

The company conducted trenching, mapping, induced polarization (IP) surveys, and diamond drilling on the nearby Pakwash property. Six drill holes totalling 2927 feet explored IP targets on the Pakwash property.

Teck flew an 1800 line kilometre airborne survey over its claims and adjacent area (J. Janzen, A. Christopher, Teck Corp., personal communication, 1990).

Noranda Exploration Company, Ltd.

Noranda completed prospecting and soil geochemical surveys in the Dixie Lake area.

Canadian Patricia Exploration Ltd.

Canadian Patricia completed magnetic and electromagnetic surveys over 30 claims in the Dixie Lake area. Prospecting located a new gold occurrence in an oxidized shear zone with quartz veining that analyzed between 1200 and 2170 ppb Au (S. Waldie, Canadian Patricia Exploration Ltd., personal communication, 1990).

BIRCH–CONFEDERATION LAKES

Gold Fields Canadian Mining Ltd.

Gold Fields completed prospecting, sampling, and geochemical surveys on a 190 claim group in the Casummit and Mink lakes areas, including the past-producing Jason Mine.

Lac Minerals Ltd.

Lac Minerals carried out line cutting and geological mapping on 24 claims in Agnew and Earngey townships.

Major General Resources

Major General completed a geological survey on their Blondin property in the Brownstone Lake area.

Milestone Resource Corporation

Milestone Resource drilled 3 holes totalling 369 m on claims optioned from Falconbridge Limited, located on the south shore of Swain Lake. The drilling targeted gold-copper mineralization identified during a 1988 surface exploration program, but no significant mineralization was encountered.

Milestone Resource drilled 19 holes totalling 1639.7 m on Shabumeni Lake. Visible gold was reported in hole number Shb-90-16 which assayed 6.16 ounces Au per ton over 1 foot.

Minnova Inc.

Minnova acquired several groups of claims in Mitchell, Earngey, and Belanger townships. The company completed detailed geological mapping and lithogeochemical sampling over the claim groups in a quest for base metals.

Noramco Mining Corporation

Noramco drilled 3 holes totalling 952 m on electromagnetic conductors on Fly Lake in Mitchell Township.

Noranda Exploration Company, Ltd.

Noranda, as operator of the Springpole property, in a joint venture with Gold Fields Canadian Mining Ltd. and Akiko–Lori Gold Resources Ltd., completed additional geological and geochemical surveys and both airborne and ground geophysical surveys. Twenty-two diamond-drill holes totalling 5992.8 m were drilled on the Main, Portage, and Fluorite zones. Geological reserves on the Portage Zone are 7.9 million tons at a grade of 0.07 ounce Au per ton (*The Northern Miner*, April 2, 1990). Noranda also acquired additional claims to the east of the Gold Fields Springpole claim group and completed geophysical surveys and drilled 7 holes totalling 1749 m on these claims.

On the Horseshoe Island property, in addition to geological, geophysical, and geochemical surveys, Noranda drilled 3 holes totalling 403 m. Geological and geochemical surveys were completed on the Rice Bay claim group.

One hole was drilled to a depth of 118 m on the Snake Falls claim group as follow-up to geophysical and lithogeochemical surveys.

Several other properties held by Noranda in the Birch–Confederation lakes area received exploration attention.

Orofino Resources Limited

Orofino completed limited prospecting, mapping, and soil and lithogeochemical sampling on the Jackson–Manion Mine in Dent Township.

Placer Dome Inc.

In an ongoing exploration program in the area, Placer Dome drilled 10 holes totalling 2010 m in eastern Birch Lake. Magnetic, very low frequency electromagnetic (VLF-EM), and geological surveys were also completed.

NORTHERN GREENSTONE BELTS

McInnes Lake

Placer Dome Inc. holds a large block of claims in the McInnes Lake greenstone belt located approximately 130 km north of Red Lake. This year the company completed 220 km of line cutting and carried out magnetic, VLF-EM, and geological surveys on the claims.

North Spirit Lake

In addition to several prospectors being active in this belt, Pelangio–Larder Mines Ltd. completed sampling and geological surveys on claims with previously documented gold showings. The program uncovered 5 new gold showings (*The Northern Miner*, September 17, 1990, p.13).

Favourable Lake

Echo Bay Mines Limited conducted 22 km of induced polarization surveys and completed 10 diamond-drill holes totalling approximately 4000 feet on the Berens River East property.

Sandy Lake

Goldeye Explorations Ltd. completed geophysical surveys over the northwest arm of Sandy Lake.

Lingman Lake

Twin Gold Mines Ltd. flew an airborne geophysical survey covering 550 line kilometre in the Lingman Lake greenstone belt.

Stull Lake

Noranda Exploration Company, Ltd. completed geophysical surveys at Stull Lake.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The Resident Geologist's office moved to new quarters on Howey Street, Red Lake, on October 19, 1990. The office was staffed by Brian Atkinson, Resident Geologist; Jack Parker, Staff Geologist; and Lynn Kosloski, Secretary. In addition, short-term contract staff included Rick Dutka, Data Folio Geologist; Rob Thompson, field assistant; and Christine Godby, office assistant.

Staff activities included examination of a number of mineral occurrences and exploration projects throughout the district (Figure 3.2). Both producing mines were visited during the year, and tailings ponds of several past-producing mines were examined for the possibility of nearby beaver activity.

Exploration personnel took part in 10 field trips throughout the year.

Rick Dutka completed compilation of the Geoscience Data Inventory Folio for Casummit Lake.

Jack Parker instructed an introductory prospecting course to 20 participants in Ear Falls in the spring of 1990.

Brian Atkinson worked on field mapping of Baird Township geology and completed marginal notes for Heyson Township geology. Marginal notes for the Red Lake gold compilation map were also completed.

Jack Parker continued his examination and description of base metal occurrences in the western Uchi Subprovince.

B.T. Atkinson, J.R. Parker, and C.C. Storey contributed to field trip guidebooks for the Twelfth Annual District Four Canadian Institute of Mines, Metallurgy and Petroleum meeting held in Thunder Bay in September 1990.

The write-up on gold deposits and occurrences in the Birch–Confederation lakes continued during the year.

The authors spent 1 week examining the geology and mineral occurrences at Setting Net Lake. Results of that work are described below.

ACKNOWLEDGMENTS

L. Kosloski drafted several of the figures and typed the manuscript. K.G. Fenwick, Manager, Mineral Resources,Northwestern Ontario Region reviewed the text.

Information on past work included in this report has been taken from the assessment files of the Resident Geologist's office, Red Lake District, Red Lake, unless otherwise stated.

RECONNAISSANCE OF THE FAVOURABLE LAKE GREENSTONE BELT — SETTING NET LAKE AREA

INTRODUCTION

The Setting Net Lake area, located in the southern part of the Favourable Lake greenstone belt, is situated 120 km north of Red Lake. Access to the area is by aircraft or winter road from Sandy Lake. An aircraft runway is located at the abandoned town of Favourable Lake.

The Berens River Mine, also known as the Golsil Mine and the Zahavy Mine, was the only producer in the Favourable Lake greenstone belt. Between 1939 and 1948, the Berens River Mine produced 157 341 ounces of gold, 5 676 486 ounces of silver, 6 million pounds of lead, and 1.8 million pounds of zinc. Developments at the mine are described by Bateman (1939).

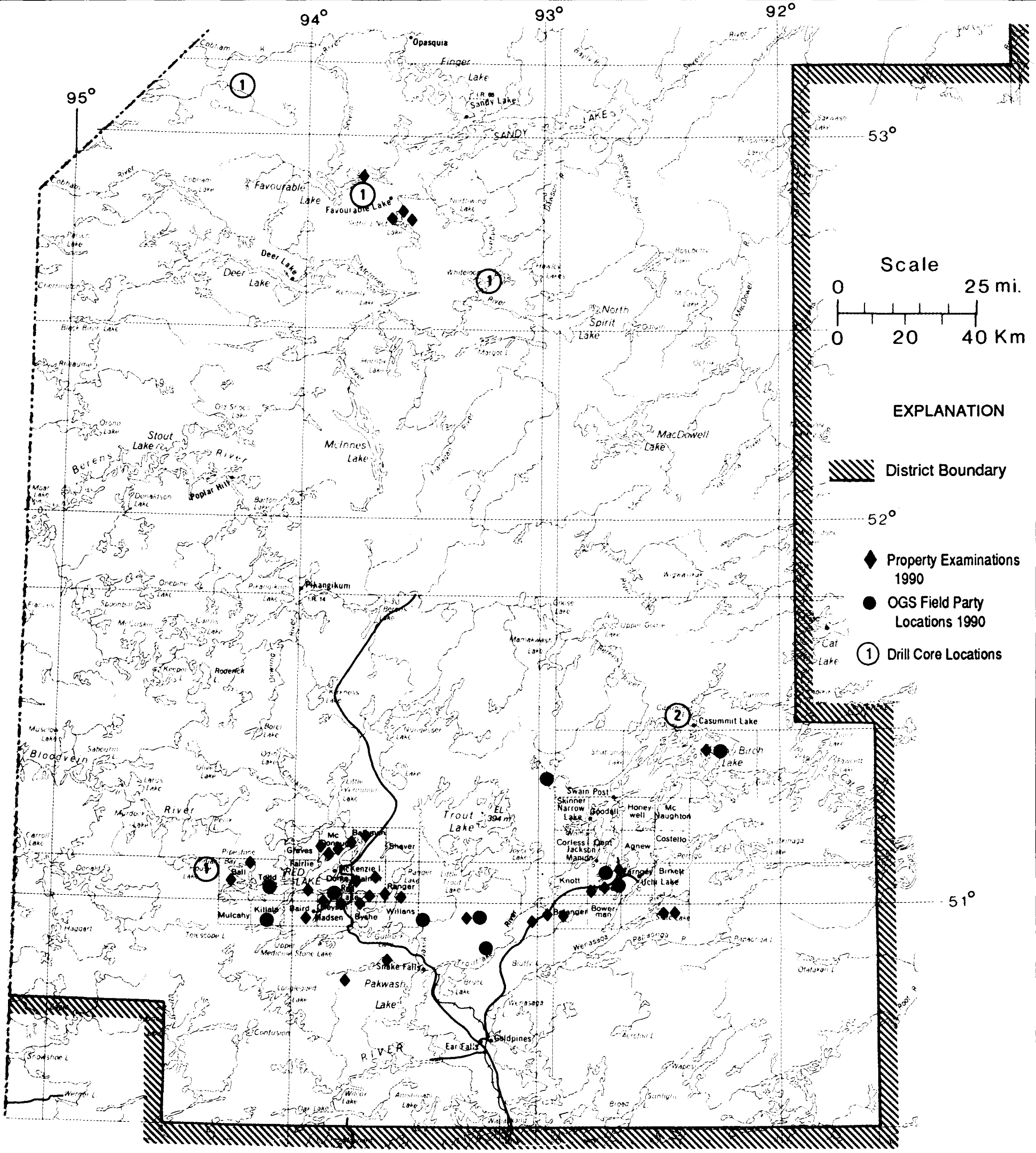

Figure 3.2
Red Lake Resident Geologist's District

Numerous occurrences of precious and base metal mineralization have been discovered by extensive prospecting and exploration in the area.

The Favourable Lake area was originally mapped by Hurst (1930) at a scale of 1:126 720. Quarter mile mapping of the greenstone belt was completed by Ayres (1968b, 1968c, 1970a, 1972a). Reconnaissance scale mapping (1:50 000) of the Berens River Subprovince (Stone and Good 1990; Stone, in prep.) included part of the Favourable Lake greenstone belt.

GOLD OCCURRENCES

The majority of gold occurrences visited by the authors in the Setting Net Lake area, including the Young, Newconex, and Geotest occurrences, are situated within a small, trondhjemite intrusion located northeast of the southern portion of Setting Net Lake. The trondhjemite intrudes dominantly mafic metavolcanic flows, interflow metasediments, felsic tuffs, and ultramafic rocks.

Several of the occurrences described below have been collectively named the Koleff property on map P.756 (Ayres 1972a). These include the Young occurrence and Watt and Durham occurrence, as well as the McCloskey base metal occurrence and the Senet Copper Mines Ltd. Main Copper showing.

Young (or Yonge) Occurrence

The Young occurrence consists of numerous pits and trenches located in the southwest corner of leased mining claim KRL 36756. The occurrence is approximately 1.1 km northeast of the southern portion of Setting Net Lake (Figure 3.3).

Kega Gold Mines Limited discovered gold-bearing quartz veins on the Young claim in 1944 and conducted trenching, channel sampling, and diamond drilling.

Senet Copper Mines Ltd. conducted geological mapping and sampling as well as resistivity, self-potential, electromagnetic, and magnetic ground geophysical surveys over the occurrence in 1956 and 1957.

Leased mining claim KRL 36756, which encompasses the Young occurrence, was last reported to be held by K. Koleff (Ayres 1972a).

The Young occurrence is situated within an intrusion of porphyritic, hornblende-biotite trondhjemite (Ayres 1972b) near the western contact with massive, mafic metavolcanic flows. The mafic flows immediately adjacent to the intrusion are amphibolitized, fine grained, and dark green to black hosting numerous, variably oriented, epidote-filled fractures.

The Young occurrence consists of numerous, narrow, shear zones hosting quartz veins. The shear zones trend 128° and are 0.6 to 1 m wide. Quartz veins are 0.2 to 0.6 m wide and up to 30 m long (Ayres 1971). The veins consist of glassy, grey and white quartz hosting pyrite, chalcopyrite, and pyrrhotite, with minor amounts of bornite, molybdenite, and digenite. Sulphides are disseminated throughout the quartz veins but also occur as coarse-grained clots and blebs. Host rocks consist of grey-green, medium-grained, quartz-phyric trondhjemite that is intensely sheared, pyritic, and variably sericitized adjacent to the quartz veins.

Kega Gold Mines Limited reported that 6 parallel quartz veins were discovered within a 400-foot wide zone. Channel samples taken across 1 of the quartz veins by Kega Gold Mines gave the following assay values: 0.94 ounce Au per ton and 10.14 ounces Ag per ton across 30 inches; 3.94 ounces Au per ton and 2.6 ounces Ag per ton across 20 inches; 0.86 ounce Au per ton and 8.06 ounces Ag per ton across 35 inches; 0.44 ounce Au per ton and 6.56 ounces Ag per ton across 18 inches; and 0.42 ounce Au per ton and 4.0 ounces Ag per ton across 21 inches.

A grab sample taken by the authors from a quartz vein at the Young occurrence assayed 0.71 ounce Au per ton and 6.1 ounces Ag per ton, whereas a grab sample taken from the pyritic altered wall rock analyzed 1090 ppb Au and 11 ppm Ag (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Thirteen grab samples taken by Ayres (1972a) from the quartz veins at the occurrence assayed up to 0.92 ounce Au per ton, 10.18 ounces Ag per ton, and 2.51% Cu.

Ayres (1972a) also noted quartz-filled fractures hosting chalcopyrite in the trondhjemite lying 200 m due north of the Young occurrence. A grab sample taken at this location assayed 0.15% Cu (Ayres 1972a).

Newconex Occurrence

The Newconex occurrence is located on mining claim KRL 1000620 (formerly mining claims KRL 40117 and 40120) and is approximately 600 m northeast of the Young occurrence. The occurrence is 2 km northeast of the southern portion of Setting Net Lake (Figure 3.3).

Valour Lithium Mines Ltd. conducted ground magnetic and resistivity surveys over the occurrence in 1956 and 1957.

Newconex Canadian Exploration Ltd. conducted prospecting and ground magnetic and electromagnetic surveys over the property during 1969 and 1970.

Geotest Corporation conducted reconnaissance prospecting and a geological evaluation of the occurrence during 1987 and flew airborne magnetic and VLF-EM surveys over the occurrence in 1988.

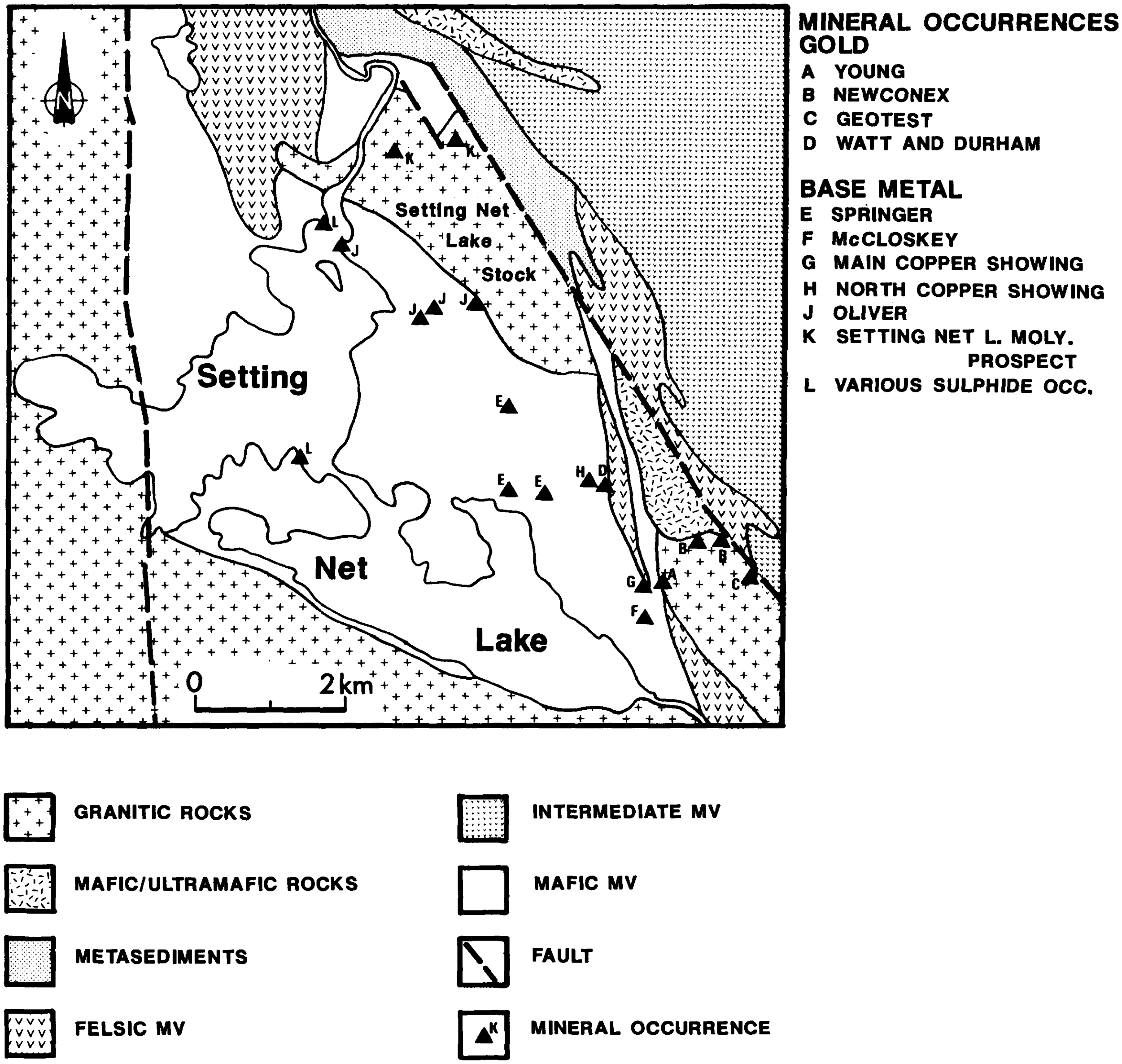

Figure 3.3. General geology of the Setting Net Lake area.

The Newconex occurrence is located within the same trondhjemite intrusion that hosts the Young occurrence. The occurrence is situated near the northern contact of the trondhjemite with an irregular intrusive body of massive serpentinized peridotite (Ayres 1972a).

The occurrence consists of several north-trending quartz veins, up to 2 m wide, which have been traced by trenching for a strike length of 70 feet (Ayres 1972a). Some of the veins have been exposed along the northern edge of a large outcrop.

The main quartz vein strikes 350° and extends along a sheared contact between biotite-hornblende trondhjemite and an 8 m wide, gossan-stained, sulphide-bearing gabbro dike. The quartz vein is approximately 0.2 m wide but widens to 2 m at the northern edge of the outcrop. The quartz vein contains abundant pyrite and chalcopyrite with malachite staining. Geotest Corporation reported that the vein had been traced for a strike length of 12 m.

The authors observed broken pieces of sheared, intensely altered mafic rocks hosting abundant sphalerite, galena, and green mica in a rock dump at the edge of the outcrop.

Several trenches are located along the north side of the outcrop, approximately 60 m due east of the main trenches. The trenches have been excavated on several discontinuous quartz veins trending 060° to 070° and up to 0.6 m wide.

Ayres (1972a) reported that the quartz veins occur within a 10-foot wide zone over a strike length of 140 feet. The quartz veins are hosted by narrow shear zones in biotite-hornblende trondhjemite. Wall rocks are very intensely sericitized and pyritic adjacent to the quartz veins. The veins host disseminated pyrite and chalcopyrite with minor galena, sphalerite, and native copper. Pyrrhotite and arsenopyrite have been reported to occur in the quartz veins but were not observed by the authors.

A grab sample taken by the authors from the main quartz vein was found to contain 2090 ppb Au and 7 ppm Ag (Geoscience Laboratories Section, Ontario Geological Survey, Toronto). A sample of the altered mafic rock hosting abundant sphalerite and galena contained 170 ppb Au, 1.98 ounces Ag per ton, 15.5% Pb, and 5.5% Zn (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Ten grab samples taken by Ayres (1972a) in the vicinity of the north-trending main vein were found to contain 0.03 to 0.42% Cu, trace to 0.46 ounce Au per ton, and 0.08 to 2.15 ounces Ag per ton. One grab sample assayed 4.62 ounces Au per ton (Ayres 1972a).

Two samples taken from the main quartz vein by Geotest Corporation contained 11.2 g/t Au, 3.6 g/t Ag, and 2320 ppm Cu; and 7.9 g/t Au and 3.5 g/t Ag. A second vein sampled by Geotest analyzed 351 ppb Au, 0.9 ppm Ag, and 18 ppm As. Samples taken by Geotest from the sulphide-bearing gabbro dike adjacent to the main quartz vein assayed 1.1 g/t Au and 3.4 g/t Ag. The gabbro dike hosts up to 5 percent disseminated pyrite and chalcopyrite.

Two grab samples taken by the authors from northeast-trending quartz veins, 60 m east of the main vein, analyzed 2570 ppb Au and 11 ppm Ag; and 670 ppb Au, 12 ppm Ag and 220 ppm Cu (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Twelve grab samples taken by Ayres (1972a) from the northeast-trending quartz veins assayed as high as 0.54 ounce Au per ton, 2.18 ounces Ag per ton, 0.52% Cu, 1.36% Pb, and 1.63% Zn. Samples taken from the quartz veins by Geotest Corporation contained between 182 and 558 ppb Au, 2.2 ppm Ag, and 9690 ppm Cu.

Geotest Occurrence

The Geotest occurrence is located 1 km east-northeast of the Young occurrence and approximately 2 km northeast of the southern portion of Setting Net Lake (Figure 3.3). The occurrence is situated on the northeastern side of a large outcrop on mining claim KRL 993418.

Valour Lithium Mines Ltd. conducted ground magnetic and resistivity surveys in the vicinity of the occurrence during 1956 and 1957.

Newconex Canadian Exploration Ltd. conducted prospecting, ground magnetic, and electromagnetic surveys in the vicinity of the occurrence during 1969 and 1970.

Geotest Corporation conducted reconnaissance prospecting and a geological evaluation of the occurrence in 1987. This was followed by airborne magnetic and VLF-EM surveys in 1988.

The occurrence is situated within the biotite-hornblende trondhjemite intrusion that also hosts the Young and Newconex occurrences. The Geotest occurrence is located along the northeastern contact of the intrusion with mafic metavolcanic flows. A strong, northwest-trending fault extends along the contact (Ayres 1972a).

Geotest Corporation described the occurrence as an old trench sunk on a zone of numerous, narrow shear zones and quartz veins trending between 140° and 185°. The quartz veins are up to 20 cm in width and contain disseminated pyrite, chalcopyrite, and arsenopyrite. Geotest reported that 1 cm wide veinlets of arsenopyrite or chalcopyrite are also present at the occurrence.

The best analyses from samples taken at the occurrence by Geotest Corporation were 5370 ppb Au and 4.1 g/t Ag. Geotest reported that numerous other samples gave anomalous gold and silver values and some arsenic values above 10 000 ppm.

This occurrence was not visited by the authors.

Watt and Durham Occurrence

The Watt and Durham occurrence is located about 1.8 km northeast of the southern portion of Setting Net Lake (Figure 3.3). The occurrence was situated in the northeastern corner of former mining claim KRL 36763, but is now encompassed by the northwestern corner of claim KRL 1000603.

The Watt and Durham occurrence was discovered by Kega Gold Mines Limited during an exploration program on the property in 1944.

Senet Copper Mines Ltd. sunk 6 shallow test pits along a quartz vein at the occurrence in 1956. The company also conducted geological mapping, sampling, and resistivity, self-potential, electromagnetic, and magnetic ground geophysical surveys over the occurrence during 1956 and 1957.

Newconex Canadian Exploration Ltd. conducted ground magnetic and electromagnetic surveys over the occurrence during 1969 and 1970.

Geotest Corporation conducted a reconnaissance prospecting program in the vicinity of the occurrence during 1987, which was followed by airborne magnetic and VLF-EM surveys in 1988.

The Watt and Durham occurrence is situated within dominantly massive, mafic metavolcanic flows hosting narrow units of felsic tuff that have been intruded by a small gabbro sill. Kega Gold Mines Limited reported that the occurrence consisted of a single quartz vein between 3 and 30 feet wide hosting visible gold. Senet Copper Mines Ltd. also reported that the quartz vein was "strongly auriferous" and contained disseminated pyrite with traces of chalcopyrite.

Geotest Corporation discovered narrow, north-trending quartz veins hosted by mafic and felsic metavolcanic rocks in the vicinity of the occurrence. The quartz veins contain minor amounts of chalcopyrite, pyrite, pyrrhotite, arsenopyrite, and carbonate. A grab sample taken by Geotest from 1 of the quartz veins analyzed 95 ppb Au. Geotest also sampled pyritic, gossan-stained felsic tuffs which analyzed 2939 ppb Au, 2.9 ppm Ag, and 1000 ppm Pb.

This occurrence was not visited by the authors.

BASE METAL OCCURRENCES AND PROSPECTS

The majority of base metal occurrences and prospects visited by the authors in the Setting Net Lake area occur within the lower part of the Cycle 2 metavolcanic sequence of the Favourable Lake greenstone belt (Ayres 1977; Corfu and Ayres, in press). The lower part of the Cycle 2 sequence consists of the oldest supracrustal rocks documented in the Favourable Lake belt, and is interpreted by Corfu and Ayres (in press) to be part of a mafic to ultramafic shield volcano. The rocks in the lower part of the Cycle 2 sequence dominantly consist of massive, mafic metavolcanic flows intercalated with minor units of interflow metasediments commonly interlayered with felsic tuffs and flows. All of the supracrustal rocks are intruded by sills, dikes, and irregular intrusive bodies of intermediate, mafic, and ultramafic rocks (Ayres 1970a, 1972a).

The majority of the base metal occurrences and prospects described below are hosted by felsic tuffs and interflow metasediments within the mafic flows and are commonly adjacent to mafic intrusions.

Springer Occurrence

The Springer occurrence consists of 3 separate showings situated northeast of the southern portion of Setting Net Lake and approximately 2.4 km due east of Setting Net Lake narrows (Figure 3.3). The showings are located on mining claims KRL 1000584, 1000555, and 1000556.

The occurrence was discovered, staked, stripped, and trenched by L.G. Springer in 1928 (Hurst 1930; Thomson et al. 1957).

In 1956, Senet Copper Mines Ltd. conducted geological mapping and resistivity, self-potential, electromagnetic, and magnetic ground geophysical surveys over the occurrence.

Newconex Canadian Exploration Ltd. conducted ground magnetic and electromagnetic surveys over the northern portion of the Springer occurrence during 1970.

Geotest Corporation sampled and mapped the Springer occurrence during 1987 as part of a larger program of reconnaissance prospecting and geological evaluation. Geotest also conducted airborne magnetic and VLF-EM surveys over the Springer occurrence in 1988.

The East showing of the Springer occurrence is located about 400 m northeast of Setting Net Lake on mining claim KRL 1000584 (formerly mining claim KRL 36765). The showing consists of an east-trending, sulphide-rich unit of interflow metasediments within massive and pillowed mafic metavolcanic flows. The metasediments have been intruded by a medium- to coarse-grained gabbro situated immediately west of the showing.

The interflow metasediments consist of gossan-stained, sulphide-bearing, sericitic chert or felsic tuff interlayered with black argillite. Sulphides consist of disseminated, layered and semimassive pyrrhotite with accessory pyrite and minor chalcopyrite. Foliation of metasediments is oriented at 136/80N.

Pieces of sulphide-bearing ultramafic rock were observed by the authors on the rock dump at the trench, but ultramafic rocks were not recognized in the trench.

Four diamond-drill holes totalling 1700 feet, targeted on the East showing by Senet Copper Mines Ltd., intersected wide zones of low grade copper mineralization. One zone contained 0.17% Cu over 50 feet hosted by felsic tuffs, rhyolite, greywacke, and argillite.

Two grab samples taken by the authors from the trench at the East showing contained 20 ppb Au, 163 ppm Zn, and 106 ppm Cu; and 10 ppb Au, 45 ppm Zn, and 375 ppm Cu (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

The best analysis obtained from samples taken at the showing by Geotest Corporation was 2140 ppm Cu.

The West showing of the Springer occurrence is located approximately 500 m due west of the East showing. The showing consists of a shallow trench striking 012° for approximately 80 feet. The trench has been sunk on black, graphitic, argillaceous interflow metasediments within mafic metavolcanic flows. The argillite contains finely disseminated, fine-grained pyrrhotite and pyrite. The sulphides also occur along hairline fractures and in coarse-grained clusters in the argillite. Pillowed, chloritic, mafic flows were observed by the authors about 150 m due west of the trench. Mafic flows are massive and amphibolitized to the west.

Two grab samples taken by the authors from the trench at the West showing contained 10 ppb Au, 565 ppm Zn, and 350 ppm Cu; and 3 ppb Au, 240 ppm Zn, and 108 ppm Cu (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

The North showing of the Springer occurrence is situated 1 km north of the West showing, but was not visited by the authors. Hurst (1930) described the North showing as a 90-foot long zone of disseminated chalcopyrite and pyrrhotite, occurring along a contact between gabbro and mafic metavolcanic rocks.

McCloskey Occurrence

The McCloskey occurrence is located in the southwestern corner of leased mining claim KRL 33407 and is approximately 400 m northeast of the southern portion of Setting Net Lake (Figure 3.3).

Kega Gold Mines Limited drilled 20 diamond-drill holes totalling 3541.6 feet in the vicinity of the occurrence in 1944.

Peteque Mines and Exploration Company drilled 7 diamond-drill holes totalling 627.5 feet at the occurrence in 1952. The company also completed trenching, stripping, and sampling.

Senet Copper Mines Ltd. conducted geological mapping and resistivity, self-potential, electromagnetic, and magnetic ground geophysical surveys over the occurrence during 1956 and 1957.

Ayres (1972a) reported that Minorex Ltd. also conducted prospecting and ground and airborne geophysical surveys in the vicinity of the occurrence during 1969 and 1970.

A partially overgrown drill trail extends from Setting Net Lake to the McCloskey occurrence. Shoreline outcrops at the start of the trail consist of greenschist grade, mafic metavolcanics trending 090°. Pillowed flows were observed inland along the trail and a large outcrop of massive, mafic metavolcanic flow, containing disseminated chalcopyrite, outcrops 300 m inland on the trail. Approximately 50 boxes of unsalvageable drill core were located at the site of a deteriorating log cabin 400 m along the trail from Setting Net Lake. The drill core was composed of mafic metavolcanics with lesser amounts of chert-magnetite with pyritic and graphitic units. Minor serpentinized rocks and intermediate tuffaceous rocks were also noted in drill core specimens. The origin of the core could not be determined.

Outcrops north of the cabin include schistose metasediments with andalusite porphyroblasts and strained mafic metavolcanics trending 130°.

Only 1 trench, measuring 3 m by 3 m by 1 m deep, was found by the authors at the McCloskey occurrence. The trench was excavated on gossan-stained, grey-green, sulphide-rich chert which is thickly laminated to very thinly bedded. The chert hosts abundant, disseminated, pyrrhotite, and pyrite mineralization which also occurs in thin layers and fine laminations. Senet Copper Mines Ltd. reported that the sulphides occur in massive seams up to 5 inches in width. The sulphide-rich chert is situated along the eastern contact of a medium-grained gabbro intrusion. Massive and pillowed mafic flows are situated immediately west of the occurrence.

Ayres (1971, 1972a) reported that the sulphide-rich chert is 100 feet thick and hosts disseminated pyrrhotite, rare sphalerite, and narrow veinlets of chalcopyrite. The chert is underlain by intensely altered mafic flows composed of epidote, quartz, diopside, garnet, pyrrhotite, pyrite, minor chalcopyrite, and calcite. The alteration zone varies in thickness from a few feet to several tens of feet and increases in intensity toward the chert (Ayres 1971).

A grab sample taken by the authors from the trench at the McCloskey occurrence contained 4 ppb Au, 895 ppm Cu, and 230 ppm Zn, while a grab sample of red dirt beside the trench contained less than 2 ppb Au, 149 ppm Cu, and 63 ppm Zn (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Fourteen grab samples collected by Ayres (1972a) from the trench at the McCloskey occurrence contained up to 0.32% Cu, 2.2% Zn, and 0.72 ounce Ag per ton.

Senet Copper Mines Ltd.—Main Copper Showing

Main Copper showing of Senet Copper is situated in the central portion of 2, contiguous, leased mining claims (KRL 33410 and 33407). The Main Copper showing is located about 750 m northeast of the southern portion of Setting Net Lake (Figure 3.3).

Senet Copper conducted geological mapping, trenching, and sampling and resistivity, self-potential, electromagnetic, and magnetic ground geophysical surveys over the showing during 1956 and 1957. The company drilled 23 diamond-drill holes totalling 8690 feet on the Main Copper showing.

Ayres (1972a) reported that Minorex Ltd. conducted some prospecting and ground and airborne geophysical surveys in the vicinity of the showing during 1969 and 1970.

Leased mining claims KRL 33410 and 33407, which encompass the Main Copper showing, were last reported to be held by K. Koleff (Ayres 1972b).

Senet Copper described the Main Copper showing as a zone of weakly sheared, variably silicified, and chloritized andesite, interlayered with felsic tuffs hosting disseminated sulphides, narrow sulphide stringers, and massive sulphide pods.

Ayres (1970b, 1972a,b) described the showing as a narrow mineralized zone consisting of discontinuous quartz-chalcopyrite veinlets and minor disseminated chalcopyrite enclosed by felsic to intermediate tuff breccia. The northwest-trending, southwest-facing unit of tuff breccia is underlain by mafic tuff breccia and overlain by felsic tuff. The tuff breccia unit is 200 to 400 feet thick with a strike length in excess of 1300 feet. The tuff breccia hosts an irregular zone of copper mineralization that has been traced by diamond drilling and trenching for a strike length of 900 feet. The mineralized zone trends between 330° and 335° and has a maximum horizontal width of 70 feet (Ayres 1970b, 1972a,b).

The authors observed narrow, gossan-stained chert horizons trending 155° within biotitic, moderately sheared, mafic metavolcanic flows at the showing. Broken pieces of magnetite-rich chert, containing abundant chalcopyrite mineralization, occurs in a rock dump beside some small pits and trenches. Highly strained, drag-folded and crenulated mafic flows outcrop immediately northwest and along strike of the Main Copper showing. The mafic flows are foliated at an orientation of 134/80N, and host discontinuous, contorted and boudinaged quartz veins and narrow units of felsic to intermediate interflow metasediments and tuffs. Several drill collars were observed in the vicinity of the pits.

Ayres (1972b) reported that the overall copper content of the mineralized zone ranged from 0.2 to 0.4% Cu, with discontinuous high-grade lenses up to 5 feet in width assaying as high as 2% Cu. Grab samples collected from the surface showings by Ayres (1972b) assayed up to 0.2 ounce Au per ton and 1.09 ounces Ag per ton.

Two chip samples taken from the trenches by Senet Copper assayed 2.55% Cu across 18 feet and 1.9% Cu across 5 feet. The samples were reported to be separated by 9 feet of barren material (Thomson et al. 1957).

Diamond drilling conducted by Senet Copper intersected numerous mineralized sections, including 2.85% Cu across 6 feet, 3.53% Cu across 6 feet, 0.44% Cu across 12 feet, 1.96% Cu across 12 feet, and 1.1% Cu across 21 feet. The majority of the mineralized sections were reported to be hosted by altered andesite, rhyolite, and felsic tuffs.

Senet Copper also conducted some limited work on the North Copper showing situated in the northeastern corner of former mining claim KRL 36763 approximately 1.2 km northwest of the Main Copper showing (Figure 3.3). The company described the North Copper showing as a 12 to 18 inch wide unit of siliceous rock containing disseminated chalcopyrite and pyrite as well as fine layers of sulphides. Senet Copper completed 1 diamond-drill hole totalling 300 feet on the showing in 1957.

Oliver Occurrence

The Oliver occurrence consists of 8 sulphide showings at the northern end of Setting Net Lake. The main mineralized zone, which consists of 5 separate showings, is situated 600 m inland from the east shore of the lake. Another showing is located 600 m due east of the main mineralized zone. An additional 8 showings are located along the east shore of Setting Net Lake (Figure 3.3). The showings are encompassed by the following 8 contiguous mining claims: KRL 993321, 993322, 993325, 993328, 1000513, 1000514, 1000545, and 1000546.

The occurrence was first discovered and staked by D.G. Oliver in 1928 (Ayres 1970a). Hurst (1930) reported that 2000 feet of stripping and trenching had been completed on the property during the summer of 1929.

Continental Mining Exploration Ltd. completed ground magnetic and resistivity surveys over the occurrence in 1957.

Minorex Ltd. conducted prospecting and ground magnetic surveys over the eastern portion of the Oliver occurrence in 1969. Minorex also completed airborne magnetic and electromagnetic surveys over the property in 1970. The airborne surveys were followed up with geological mapping, prospecting, and more ground magnetic and electromagnetic surveys. In 1971 the company completed 3 diamond-drill holes, totalling 928 feet, targeted on the main mineralized zone of the Oliver occurrence.

Geotest Corporation conducted extensive reconnaissance prospecting and a geological evaluation program over the property in 1987, which was followed by airborne magnetic and VLF-EM surveys in 1988.

The various sulphide showings at the Oliver occurrence consist of disseminated and semimassive sulphides hosted by interflow metasediments within massive, mafic flows or disseminated sulphides in variably altered mafic flows.

The main mineralized zone at the Oliver occurrence consists of numerous large trenches sunk along a steep outcrop ridge consisting of a north-northeast-trending unit of sulphide-rich, interflow metasediments enclosed by massive, mafic metavolcanic flows. The metasediments have a maximum width of 23 m and have been traced by trenching and geophysical surveys for a strike length of 1.2 km. The sulphide showings are located approximately 600 m west of the Setting Net Lake stock, which has a biotite granodiorite to quartz monzonite composition (Ayres 1970a).

The metasediments consist of thinly bedded, biotitic greywacke, grey chert, and black, fissile argillite. Some of the more siliceous metasediments have been sericitized and contain fine-grained green mica. Minorex Ltd. reported that the southwestern part of the metasediments consist dominantly of siliceous, felsic tuffs. The metasediments strike between 015° and 072° and dip 35° to the east. The metasediments are intersected by narrow faults trending 070° which offset bedding. Sugary, gossan-stained, concordant quartz veins occur within the metasediments which may be recrystallized chert.

Sulphides are concentrated in the siliceous metasediments and consist of pyrrhotite, pyrite, minor chalcopyrite, and sphalerite. The sulphides occur in thin layers and discontinuous massive pods or lenses, and are also disseminated amongst the host rocks. An alteration mineral assemblage of the metasediments includes large, brown-red garnets up to 3 cm in size; fibrous, green actinolite; and epidote. Chalcopyrite appears to be more abundant in the garnetiferous metasediments.

A grab sample taken by the authors from the garnet-actinolite-epidote altered rocks contained 115 ppb Au, 3 ppm Ag, 910 ppm Cu, and 170 ppm Zn. Four samples taken from the sulphide-rich metasediments were found to contain 50 ppb Au, 650 ppm Cu, and 3150 ppm Zn; 7 ppb Au, 670 ppm Cu, and 1550 ppm Zn; 37 ppb Au, 3930 ppm Cu, and 370 ppm Zn; and 3 ppb Au, 3800 ppm Cu, and 305 ppm Zn (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Samples taken by Minorex Ltd. from the sulphide-rich metasediments assayed between 0.16 and 0.70% Cu. Chip samples taken from the trenches by Geotest Corporation analyzed as high as 4220 ppm Cu, 5600 ppm Zn, 3.6 ppm Ag, and 51 ppb Au.

Another sulphide showing is situated approximately 600 m due east of the main sulphide showings (Figure 3.3), and consists of 4 trenches on the edge of a steep outcrop immediately east of a wide creek. The largest and most southerly trench measures 1 m by 1 m by 15 m long. Three other smaller trenches have been excavated in bedrock along an outcrop ridge trending 020° over a distance of 50 m.

The showing consists of amphibolitized and silicified interflow metasediments in mafic metavolcanic flows at the western contact of the Setting Net Lake stock. The metasediments trend 144/85NE and are about 3 m wide with an approximate strike length of 160 m. The metasediments consist of interlayered, thinly bedded greywacke, argillite, and sericitic felsic tuff which host variable amounts of disseminated pyrrhotite and pyrite, discordant veinlets of quartz and chalcopyrite, and numerous rosettes of molybdenite. Molybdenite is most abundant within a zone of coarse-grained, dark green, pyroxene alteration.

A small mafic to ultramafic rock exposure, consisting of dark green, fibrous actinolite, outcrops west of the most northerly trench. The outcrop hosts a molybdenite-filled, hairline fracture trending 106°. A 1 m wide granitic dike trending 020° intrudes rusty metasediments in the most northerly trench.

Samples taken at this location by Geotest Corporation analyzed as high as 2170 ppm Cu, 2090 ppm Zn, and 3.9 ppm Ag.

Four grab samples taken from the trenches by the authors analyzed between 2 and 6 ppb Au (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Approximately 50 m west of the trenched outcrops, on the east side of a small gully, an outcrop of biotitic granodiorite hosts a 15 cm wide, rusty, quartz-filled shear trending 100°. A sample from this shear contained 2 ppb Au (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Six sulphide showings are situated on a small peninsula on the north side of the drainage exit of Setting Net Lake (Figure 3.3) approximately 4 km northwest of the main showings. Numerous large trenches have been sunk on narrow units of interflow metasediments in coarse-grained mafic metavolcanic flows. Other trenches were sunk on gossan-stained zones consisting of abundant disseminated pyrite in fractures cutting chloritic mafic flows. Interflow metasediments consist of argillite and chert and host disseminated pyrite and magnetite. The lithologies have a moderate foliation that trends 075°.

Grab samples taken by the authors from these trenches were found to contain 555 ppm Cu, 150 ppm Zn, and 20 ppb Au; and 65 ppm Cu, 256 ppm Zn, and 8 ppb Au (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Samples taken from the trenches by Geotest Corporation analyzed as high as 981 ppm Cu, 393 ppm Zn, 43 ppb Au, and 1.6 ppm Ag.

Setting Net Lake Molybdenum Prospect

The Setting Net Lake molybdenum prospect is located at the northern end of Setting Net Lake and lies 800 m east-northeast of the mouth of Setting Net Creek (Figure 3.3).

The prospect is encompassed by 12 contiguous mining claims, KRL 943967 to 943974 inclusive, and KRL 944047 to 944050 inclusive.

The Setting Net Lake molybdenum prospect was first discovered by L. D. Ayres in 1968 during detailed geological mapping for the Ontario Department of Mines. Ayres (1968a) reported that molybdenite, pyrite, and chalcopyrite mineralization occurs in fractures, veins, and shear zones at the northern end of the Setting Net Lake stock.

Minorex Ltd. acquired ground over a portion of the Setting Net Lake stock in 1969 and conducted geological mapping, trenching, sampling, and a ground magnetic survey. Minorex reported that a 10 000-foot diamond-drill program had been planned on the property for 1969 (*The Northern Miner*, September 6, 1969). However, Minorex only reported the completion of 7 drill holes, totalling 1945.6 feet, for assessment credits. Minorex also conducted airborne magnetic and electromagnetic surveys over the property in 1970.

Conwest Exploration Co. Ltd. optioned a group of claims encompassing a portion of the Setting Net Lake stock from North Rock Explorations Ltd. and associated companies in 1969. Conwest conducted stripping, trenching, mapping, ground magnetic surveys, and diamond drilling, which consisted of 7 holes totalling 3550 feet, in 1969.

Vantreal Resources Ltd. conducted ground magnetic surveys over the prospect in 1977.

Caspian Resources Ltd. (formerly Vantreal Resources Ltd.) completed 4 drill holes totalling 3092 feet during 1978.

Noramco Explorations Inc. conducted geological mapping and sampling on the property in 1987 and 1989. The company also completed geochemical surveys on the property in 1989.

Ayres et al. (1982) described the Setting Net Lake stock as an oval, epizonal intrusion of porphyritic, biotite granodiorite to quartz monzonite, which intrudes mafic metavolcanic flows and metasediments. A 450 m wide by 2500 m long, east-trending, molybdenite-mineralized zone is situated at the northern end of the stock (Ayres 1972b; Ayres et al. 1982).

Numerous trenches have been sunk on closely spaced quartz veins hosted by joints and fractures trending 065° to 070/75S. Quartz veins are less than 2 cm wide and contain up to 5 percent disseminated molybdenite with minor pyrite and chalcopyrite. Sulphides also occur disseminated within numerous shear zones that range from 0.3 to 0.6 m wide and commonly trend 080°. The shear zones typically offset and displace the quartz veins. Aplitic dikelets are dragged into the shear zones.

The granitic host rocks are pale green to grey, massive, medium- to coarse-grained, and contain blue-grey quartz phenocrysts up to 6 mm in size, and pink, euhedral, potassic feldspar phenocrysts up to 2 cm in size.

Alteration in the wall rocks, adjacent to the quartz veins, consists of variable sericitization, albitization, chloritization of mafic minerals, epidotization, pyritization, and minor carbonatization. Pale pink alteration halos occur around mineralized fractures. Ayres et al. (1982) reported evidence of potassium metasomatism in the western portion of the mineralized zone. The authors observed minor amounts of purple fluorite disseminated in the wall rocks and quartz veins, and rare pink-brown garnets and green mica in the altered intrusive. Mafic xenoliths in the intrusive rocks are strongly pyritized.

Three grab samples taken from a test pit containing sheared, pyritic wall rocks and minor fluorite analyzed 4920 ppb Au (0.14 ounce Au per ton) and 21 ppm Ag, 610 ppb Au and 1.46 ounces Ag per ton, and 60 ppb Au and 2 ppm Ag (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Samples taken from the trenches at the prospect by Noramco Explorations Inc. analyzed between 200 and 500 ppb Au.

The average grade in the eastern part of the mineralized zone is 0.06% MoS_2 with traces of Cu (Ayres et al. 1982). Published drill indicated reserves are 100 000 000 tons at 0.09% MoS_2 to a depth of 600 feet (*The Northern Miner*, March 23, 1978).

Various Sulphide Occurrences

A small chalcopyrite occurrence is located on the southern shore of the northern portion of Setting Net Lake, about 400 m northwest of the Setting Net Lake narrows (Figure 3.3).

The occurrence consists of a 5 m wide unit of sulphide-rich interflow metasediments within massive, coarse-grained, mafic metavolcanic flows. The mafic flows are vesicular and amygdaloidal near the contact with the metasediments. The metasediments trend 085/80S and consist of argillite and chert, which host disseminated pyrite, pyrrhotite, and minor chalcopyrite. The metasedimentary unit was traced inland by the authors for approximately 100 m but trenching was restricted to the shoreline outcrop.

A grab sample taken by the authors from the sulphide-rich metasediments at this occurrence analyzed 15 ppb Au, 53 ppm Cu, and 160 ppm Zn (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Several polymetallic sulphide occurrences are situated on a few small islands and a small peninsula on the western shore of Setting Net Lake, approximately 400 m due south of the mouth of Setting Net Creek (Figure 3.3). Ayres (1970a) reported the presence of Cu, Ag, W, and Ni at these occurrences.

Several of the occurrences consist of numerous, narrow, quartz veins trending 085°, 100°, 120°, and 145° within massive and pillowed, amphibolitized, mafic metavolcanic flows. The quartz veins contain variable amounts of molybdenite, pyrite, pyrrhotite, and chalcopyrite with malachite staining. The wall rocks adjacent to the quartz veins host minor disseminated pyrite and chalcopyrite. The best analysis obtained from 5 grab samples taken by the authors from the quartz veins was 19 ppb Au and 3 ppm Ag (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

A nickel showing (Ayres 1970a) consisting of a 12 m long trench sunk on a pyritic gabbro intrusion or coarse-grained mafic flow also occurs on the peninsula. A grab sample taken by the authors from this occurrence analyzed 159 ppm Cu, 108 ppm Ni, and 4 ppb Au (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

PROPERTY EXAMINATIONS

GOLD OCCURRENCES AND PROSPECTS

Headway No. 2 Property

The Headway No. 2 property consists of 6 patented claims on the Balmer–Dome township boundary north of the Chukuni River. Claims include KRL 20834 to 20837 in Balmer Township and KRL 20838 and 20839 in Dome Township. Highway 125 traverses northward across the property.

Earliest available records indicate the ground was first staked by Noranda Mines prior to October 1925. The first reported work on the property was done by Headway Red Lake Gold Mines Limited in July 1946. Work included stripping, trenching, geological mapping, and drilling of 28 diamond-drill holes totalling 6180 feet. Additional geological and geophysical surveys and a 5 hole drilling program were completed in 1963, but drill logs for this work are not available.

In 1987 Gunnar Gold Inc. completed geological mapping and magnetic, VLF-EM, and induced polarization surveys over the property. Additional power stripping on either side of Highway 125 was carried out and the company drilled 4 holes totalling 527 m. Core from this drill program, as well as portions of core from the 1946 drilling program, is in storage in the Kenora Drill Core Library. Several anomalous intersections were reported from the 1987 drilling. The richest intersection yielded 0.108 ounce Au per ton across 1.8 feet. Surface grab samples yielded assays up to 2.28 ounces Au per ton.

The property is underlain largely by mafic metavolcanic flows, which are massive to pillowed and amygdaloidal. Interbedded with the metavolcanics are tuffaceous, clastic metasediments of mafic composition. Pillow tops, exposed on a stripped outcrop on the west side of the highway, indicate that the stratigraphy is south-facing. Roadcut outcrops on the

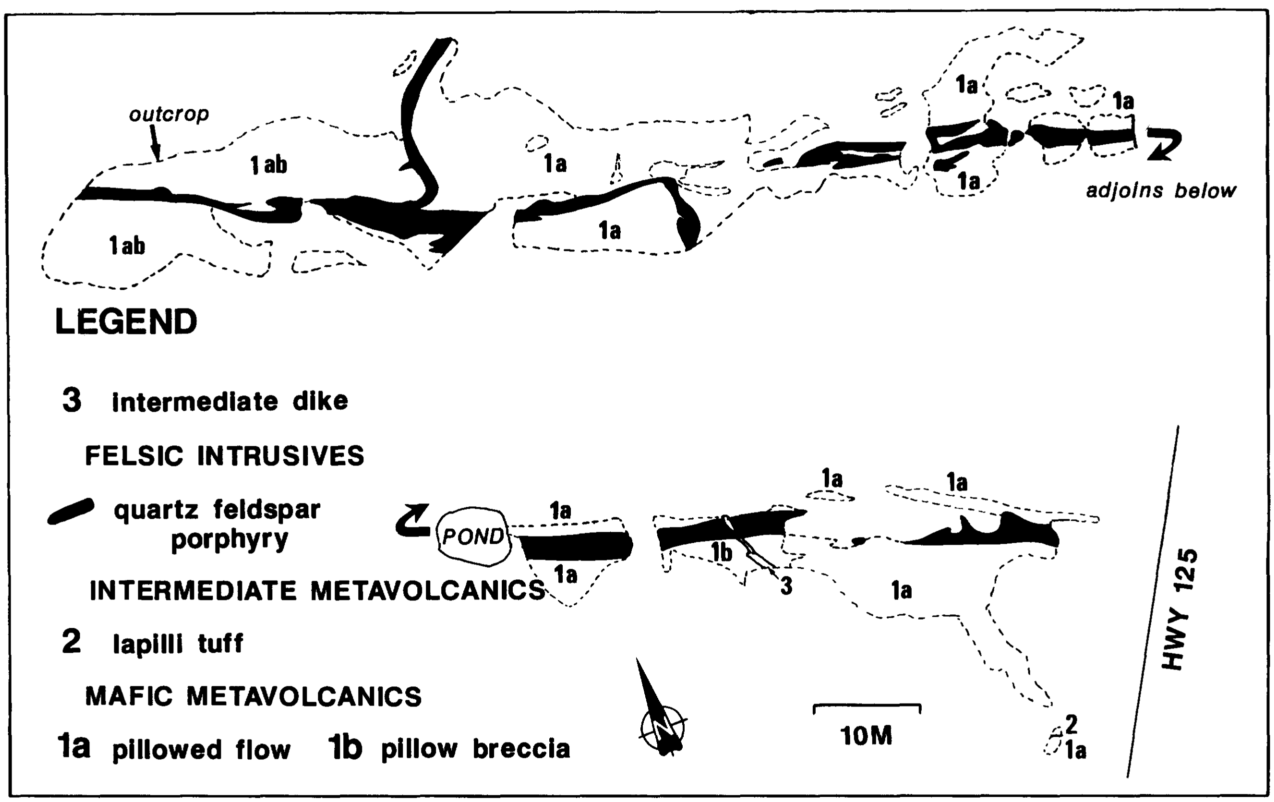

Figure 3.4. Geology of the Headway No. 2 property.

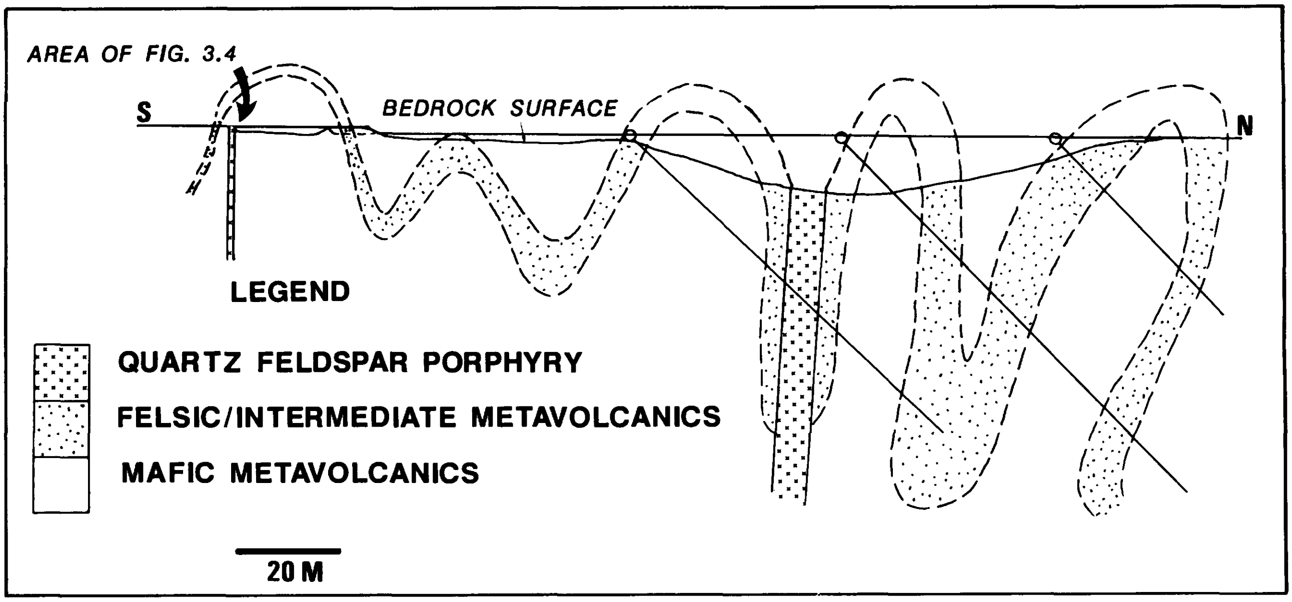

Figure 3.5. Vertical stratigraphic section of the Headway No. 2 property.

property expose metre-wide horizons of intermediate, heterolithic, lapilli tuff in contact with mafic flows. The lapilli tuff units are commonly sheared and have been affected by carbonate, iron carbonate, and sericite alteration. An antiformal fold structure with vertical axial planar cleavage is exposed in a roadcut on the east side of the highway.

Detailed mapping of the recently stripped Main zone on the property was completed by B.T. Atkinson and is shown in Figure 3.4. In this area, a 2 m wide quartz-feldspar porphyry dike has intruded mafic metavolcanics parallel to the regional stratigraphic trend.

The dike hosts numerous quartz-filled tension gashes that are mineralized with disseminated pyrite and rare visible gold. Arsenopyrite has been reported accompanying gold and pyrite mineralization (Chisholm 1952). A 0.3 m wide dike of intermediate composition crosscuts both pillow breccia and the quartz-feldspar porphyry dike. A vertical stratigraphic section based on diamond drilling and outcrop mapping is depicted in Figure 3.5.

Duroc Red Lake Mines Limited Property

The Duroc Red Lake property is located in the northeastern corner of Heyson Township. Access to the property is via Highway 125, which bisects the claim group.

The property currently consists of 5 mining claims: KRL 697237, 697238, 775361, 775362, and 775363. Staked in 1983, the claims are held by C. Peterson and J. Spinelli of Red Lake.

The property includes part of the Byshe Red Lake Mines Limited claim group. In 1936, a small amount of drilling was done by the company to check earlier drilling done by a previous operator. Prospecting, trenching, and stripping were completed by Byshe in 1937.

Duroc Red Lake Mines Limited completed geological and magnetic surveys on the property in 1947 and 5 drill holes were completed. Limited drilling on the property was done by D. Olsen in 1951 and 1954. In 1956, the property formed part of the Sanden claims and was tested by 4 drill holes totalling 1452 feet. In 1978, R. Wood drilled 2 holes and reported quartz monzonite and intermediate metavolcanic rocks in core logs. Re-examination of this core by B.T. Alkinson revealed that is was composed largely of variably carbonate-altered and sheared diorite, with minor mafic metavolcanic sections, with local felsic dikes invaded by quartz-tourmaline veins.

The current claim holders have excavated numerous trenches on the property to expose bedrock. A total of 4 drill holes totalling 1046 feet were completed in 1990.

The property is underlain mainly by Howey diorite, with a lesser component of mafic metavolcanics (Horwood 1945).

A stripped outcrop in the southwestern corner of claim KRL 775362 was mapped by B.T. Atkinson and is illustrated in Figure 3.6. A 3 m wide east-trending shear at the contact between the diorite and mafic metavolcanics hosts a 5 to 20 cm wide quartz vein. The vein is sparsely mineralized with pyrite, chalcopyrite, and malachite. Minor iron carbonate veins occur in the sheared wall rock in close proximity to the quartz vein. Multiple generations of dikes are evident in the

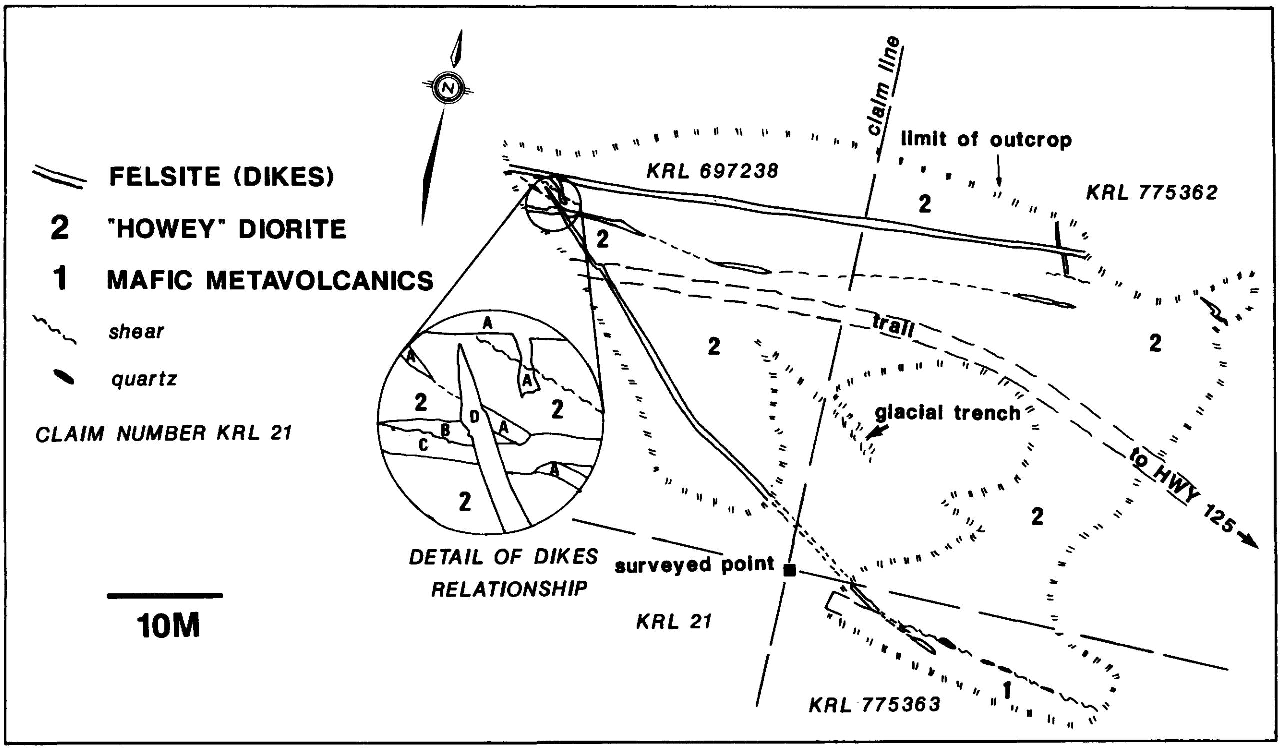

Figure 3.6. Detailed geology of Duroc Red Lake Mines Limited property.

outcrop. The latest, north- to northwest-trending dike set is offset by left-lateral displacements up to 1 m. One such dike is boudinaged and dragged into the mineralized shear.

The mineral composition of the dike was determined by thin section analysis to consist of chlorite, carbonate, amphibole, plagioclase, minor quartz, and 1 percent pyrite. The specimen from which the thin section was obtained analyzed 570 ppb Au and 125 ppm As (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

An outcrop located 80 m northeast of that described above exposes medium-grained leucocratic diorite in contact with mafic metavolcanics. The contact between lithologies is bleached and diffused. Intense brecciation of the diorite occurs adjacent to the contact and is mineralized with magnetite. Locally, magnetite forms a breccia matrix of up to 20 percent of the diorite. Thin section analysis of the breccia indicated a mineral composition of plagioclase, quartz, relict amphibole, minor biotite, carbonate, and magnetite. The magnetite occurs as corroded crystal aggregates.

A rock submitted for assay from the magnetite breccia was found to contain 4 ppb Au and 20 ppm As (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

BASE METAL OCCURRENCES AND PROSPECTS

Base metal occurrences and prospects in the Red Lake and Birch–Uchi greenstone belts were researched and examined during the second year of an ongoing study of base metal mineralization in the western Uchi Subprovince by the staff of the Red Lake Resident Geologist's office. Several base metal properties are described below.

RED LAKE GREENSTONE BELT

Fox Farm or Northolt Prospect

The Fox Farm prospect is located on the northeastern shore of Gullrock Lake in Willans Township. The prospect consists of numerous trenches and test pits situated near the lakeshore, and several trenches located about 610 m due east of the lakeshore. The trenches are currently encompassed by mining claims KRL 1143115 and 1124911.

Conquest Explorations Ltd. undertook trenching at the Fox Farm prospect and completed 15 diamond-drill holes, totalling 2028 feet, in 1960.

Northolt Mining Corp. Ltd. conducted prospecting and ground magnetic and electromagnetic surveys over the prospect in 1965. The company also completed 3 diamond-drill holes, totalling 1006 feet, in 1966.

Cochenour Willans Gold Mines Ltd. conducted airborne magnetic and electromagnetic surveys over the prospect and drilled 2 diamond-drill holes totalling 409 feet in 1969. The company also conducted ground magnetic and horizontal loop electromagnetic surveys over the prospect in 1970.

Selco Mining Corp. Ltd. conducted airborne magnetic and electromagnetic surveys over the prospect in 1978 (Pirie and Kita 1979a). Selco also completed ground magnetic and horizontal loop electromagnetic surveys over the prospect in 1979 and 2 diamond-drill holes totalling 527 feet in 1980.

The Fox Farm prospect is occurs within massive and pillowed, mafic metavolcanic flows intercalated with minor interflow metasediments consisting dominantly of chert, argillite, and calc-silicates (Pirie and Kita 1979a). These rocks are part of the Lower Mafic sequence in the Red Lake greenstone belt (Pirie 1981). The prospect is situated 1.2 km due south of the contact between mafic metavolcanic rocks and granitic rocks of the Trout Lake batholith (Pirie and Kita 1979a).

The trenches and test pits near the lakeshore have been sunk on fine-grained, dark grey-green, amphibolitized, mafic metavolcanic flows. The mafic flows are hard, massive, and rust-stained and contain narrow layers of sulphide-rich, siliceous metasediments hosting disseminated pyrite, pyrrhotite, and magnetite. The metavolcanic rocks also host abundant disseminated pyrite, pyrrhotite, and magnetite.

Trenches located 610 m east of the lakeshore have been sunk on fine-grained, amphibolitized, massive, mafic flows hosting a west-northwest-trending, 0.3 to 2 m wide, quartz-calcite vein. The vein is mineralized with sphalerite, galena, pyrite, chalcopyrite, pyrrhotite, and minor amounts of specular hematite and stibnite. The sulphides occur in coarse-grained masses intergrown with euhedral white quartz and calcite crystals. Rocks in the dump beside the trenches commonly consist of coarse-grained, crystalline masses of calcite intergrown with large, euhedral, dark green crystals identified as prehnite (Pirie and Kita 1979a).

The mafic metavolcanic rocks adjacent to the quartz-calcite vein are variably silicified and contain minor amounts of disseminated pyrite and chalcopyrite. The metavolcanic rocks are also intruded by a dark grey, fine-grained, felsic, quartz porphyry dike. The dike is brecciated and silicified and contains abundant narrow quartz veins in fractures. Diamond drilling conducted on this zone, by Conquest Explorations, encountered silicified and brecciated, mafic metavolcanic rocks hosting numerous sulphide-bearing quartz-carbonate stringers and veinlets and pink, quartz porphyry dikes.

Four grab samples taken by J.R. Parker from the quartz-calcite vein assayed 9 ppb Au, 2.16% Pb, and 3.7% Zn; 10 ppb Au, 1260 ppm Pb, and 7000 ppm Zn; 33 ppb Au, 6.5% Pb, and 7.2% Zn; and less than 2 ppb Au, 2240 ppm Pb, and 6200 ppm Zn. A grab sample of the massive calcite and prehnite crystals analyzed less than 2 ppb Au, 670 ppm Pb, and 1550 ppm Zn (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Hermiston–Keg Lake Occurrence

The Hermiston–Keg Lake occurrence is located on mining claims KRL 869864 and 869865 (formerly on mining claim KRL 55601), 460 m northeast of Keg Lake, in the northeastern corner of Byshe Township.

W. Hermiston discovered and staked the occurrence in the early 1960s.

A ground electromagnetic survey was conducted over the occurrence by Dickenson Mines Ltd. in 1966 (Riley 1971).

Kerr Addison Mines Ltd. conducted a ground electromagnetic survey over the occurrence in 1968.

In 1972, W. Hermiston conducted a ground electromagnetic survey over the occurrence and completed 1 diamond-drill hole to a depth of 130 feet.

Mid-North Engineering Services conducted ground magnetic, electromagnetic, and self-potential surveys over the occurrence for Redcon G.M.L. in 1973. The company also completed 8 diamond-drill holes totalling 2695.5 feet at the occurrence.

Pure Gold Resources Inc. (Noramco Explorations Inc.) conducted geological mapping, humus, and lithogeochemical surveys over the occurrence in 1986, and drilled 1 hole to a depth of 218 m in 1987.

The Hermiston–Keg Lake occurrence is hosted by intermediate pyroclastic rocks of the Heyson calc-alkalic sequence in the Red Lake greenstone belt (Pirie 1981). The occurrence is situated at the contact between the calc-alkalic sequence and underlying mafic metavolcanic flows of the Lower Mafic sequence (Pirie 1981).

The occurrence consists of 2, subparallel, east-trending, mineralized zones that are approximately 8 m apart (Riley 1971), hosted by intermediate pyroclastic and tuffaceous rocks. The sulphide zones are about 1 m in width and between 30 and 60 m in length (Riley 1971) with fine-grained, disseminated pyrite, sphalerite, and galena. The sulphides are concentrated in layers and laminations which range in thickness from 1 mm to 2 cm. The sulphides are hosted by siliceous, fine-grained, pale grey to buff brown metavolcanic rocks, and by sericitized, cherty metasediments or tuffs. Pirie and Kita (1979b) noted that the sulphide mineralization appeared to be associated with a narrow unit of interflow ironstone.

Pyroclastic rocks in the vicinity of the trenches consist of moderately sorted, lapilli-sized to tuff breccia-sized, subrounded, intermediate to mafic clasts in a more siliceous, fine-grained, buff-brown matrix. The pyroclastic rocks are variably biotitic and contain minor amounts of red-brown garnets, 1 to 2 mm in size. North of the mineralized zones, mafic metavolcanic flows are dark green, biotitic, variably chloritic, feldspar-phyric, and amygdaloidal. The mafic rocks include massive and pillowed flows and pillow breccias.

A grab sample taken from one of the trenches at the occurrence contained 14.4% Zn, 7.25% Pb, 4.24 ounces Ag per ton and trace amounts of Au (mineral deposit inventory files, Resident Geologist's office, Red Lake). An 18-inch wide chip sample taken across 1 of the mineralized zones by Riley (1971) assayed 0.53% Zn, 0.13% Pb, and 0.19 ounce Ag per ton with trace amounts of Au and Cu.

Three grab samples taken from the test pit by J.R. Parker contained 24 ppb Au and 4500 ppm Zn, less than 2 ppb Au and 137 ppm Zn, and less than 2 ppb Au and 226 ppm Zn (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Diamond drilling, conducted by Mid-North Engineering Services, intersected narrow sections of pyrite and sphalerite mineralization that assayed up to 0.3% Zn across 2.7 feet.

Diamond drilling conducted by Pure Gold Resources Inc. intersected 2 sections of pyritic, quartz-carbonate veining that assayed 0.028 ounce Au per ton across 1.6 m and 0.038 ounce Au per ton across 1.5 m.

BIRCH–CONFEDERATION GREENSTONE BELT, SOUTH CONFEDERATION LAKE AREA

Numerous base metal occurrences and prospects occur within the south Confederation Lake area of the Birch–Confederation greenstone belt. The south Confederation Lake area extends southwest from the South Bay Mine in Dent Township to the Copper Lode base metal prospects in Belanger Township and the Queensland occurrences at Gerry Lake (Figure 3.7).

The metavolcanic-metasedimentary belt consists of 3 mafic to felsic volcanic cycles known as Cycle I (lower sequence), Cycle II (middle sequence), and Cycle III (upper sequence) (Thurston 1985). The Cycle III sequence hosts the South Bay Cu-Zn-Ag massive sulphide deposit at Confederation Lake (Figure 3.7). The deposit occurs within felsic pyroclastic rocks associated with an endogenous felsic dome of quartz-feldspar porphyry (Thurston 1985). The South Bay Mine produced 1.6 million tons of ore with an average grade of 1.8% Cu, 11.06% Zn, and 2.12 ounces Ag per ton, from 1971 to 1981 (mineral deposit files, Resident Geologist's office, Red Lake). The Cycle III sequence also hosts the Horseshoe Lake, Triangle Lake, and Fly Lake base metal prospects (Figure 3.7, numbers 8, 9, and 10).

In the south Confederation Lake area, the Birch–Confederation belt is split by a granitic intrusion extending west-southwest from Fredart Lake (Figure 3.7). The belt of metavolcanic rocks north of the granitic intrusion extends west from Fredart and Gerry lakes and joins the Red Lake greenstone belt at Gullrock Lake in Willans Township. This north belt is interpreted (Thurston and Paktunc 1985a; Wallace et al. 1986) to be part of Cycle III and dominantly consists of mafic metavolcanic flows intercalated with intermediate to felsic pyroclastic rocks and interflow metasediments. The north belt hosts the sulphide occurrences at Gerry Lake (Figure 3.7, numbers 1 and 2) and the Copper Lode A prospect (number 3).

The metavolcanic belt situated south of the granitic intrusion at Fredart Lake extends west-southwest from Belanger Township to Bruce and Pakwash lakes (Thurston and Paktunc 1985a-c). The south belt is interpreted (Thurston and Paktunc 1985a; Wallace et al. 1986) to be part of the Cycle II and Cycle III sequences and is dominantly composed of intermediate to felsic pyroclastic rocks and fine-grained metasediments with minor mafic metavolcanic flows. The south belt hosts the Copper Lode B, C, D, and E zones (Figure 3.7, numbers 4, 5, 6, and 7).

Gerry Lake Area

Gerry Lake is located immediately southeast of the South Bay mine road approximately 44 km north-northeast of Ear Falls (Figure 3.7). Sulphide occurrences are situated immediately northeast and west of Gerry Lake (Figure 3.7, numbers 1 and 2) and have been the focus of mineral exploration since 1959.

Queensland Explorations Ltd. staked 24 contiguous mining claims immediately northeast of Gerry Lake in 1958. The company conducted trenching, geological mapping, and self-potential, electromagnetic, and magnetic surveys on the property and drilled 7 diamond-drill holes totalling 2722.3 feet in 1959. The majority of the work was concentrated on Cu, Zn, and Ag mineralization associated with iron formation.

Gunnex Limited conducted stripping and trenching on the Queensland property in 1965 (Fenwick 1966).

Airborne magnetic and electromagnetic surveys, flown over Gerry Lake by Roxmark Mines Ltd. in 1968, identified 11 electromagnetic conductors. The Roxmark property encompassed Gerry Lake as well as the Queensland sulphide occurrences northeast of the lake, and was known as the Roxmark "B" or Roxmark West occurrence. Roxmark Mines followed up the airborne surveys with a ground magnetic

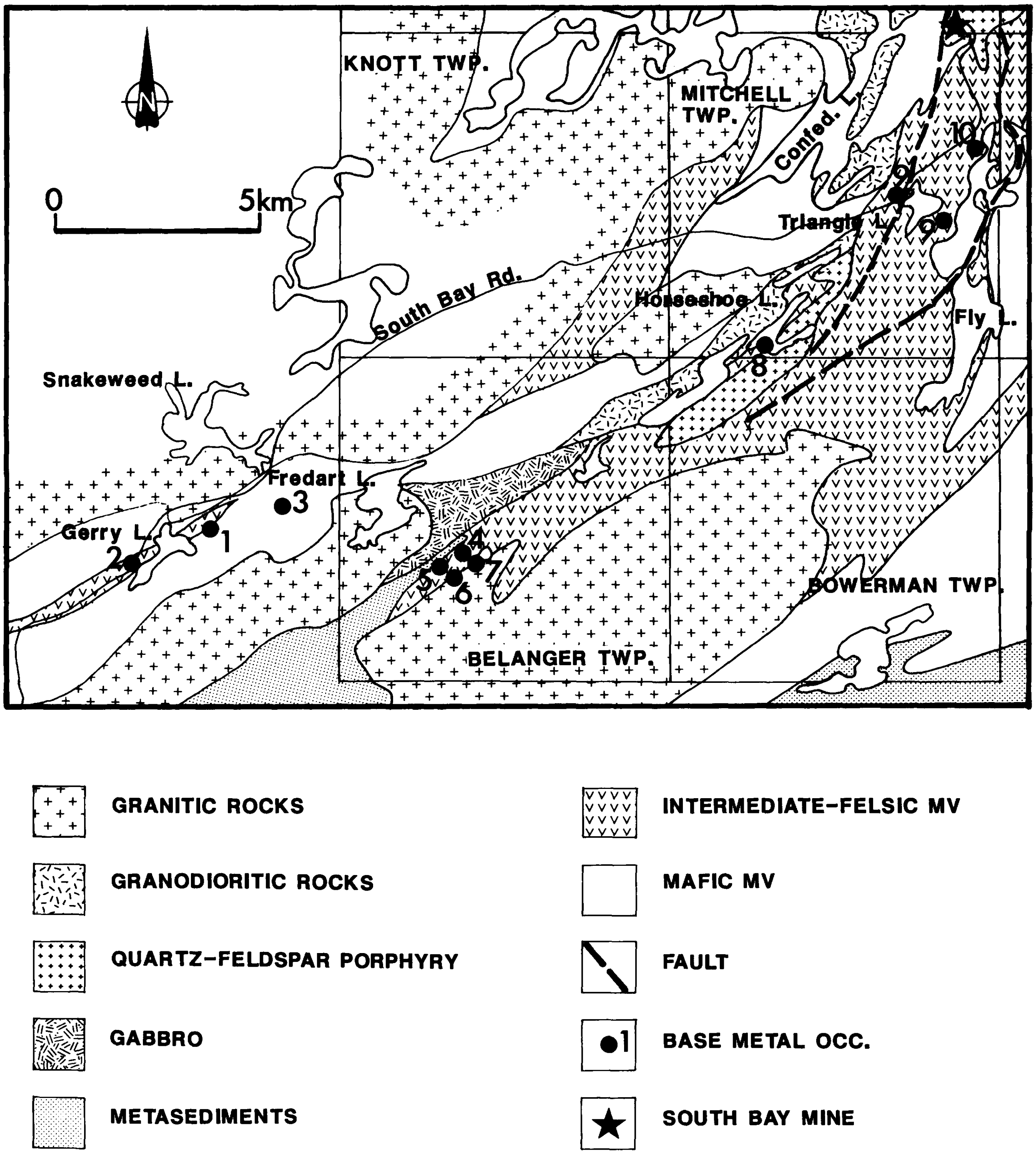

Figure 3.7. General geology of the southern Confederation Lake area. Occurrences/prospects 1 through 10 are explained in the text.

survey in 1969 and a 4 hole diamond-drill program totalling 2699 feet on the Queensland property at Gerry Lake in 1970.

Erzgesellschaft m.b.H. optioned a contiguous group of 91 mining claims, located immediately southwest of Gerry Lake, from Yorbeau Mines Inc. in 1969. The company conducted airborne magnetic and electromagnetic surveys over the property in 1969, which were followed up with ground magnetic, electromagnetic, and induced polarization surveys during the same year. Erzgesellschaft completed 5 diamond-drill holes totalling 2162 feet (*The Northern Miner*, July 16, 1970), targeted on induced polarization anomalies southwest of Gerry Lake in 1970. The drilling intersected banded, biotitic, and siliceous metavolcanic rocks hosting disseminated pyrite and pyrrhotite with a few specks of chalcopyrite.

During 1977, Hudson Bay Exploration and Development Co. Ltd. conducted ground electromagnetic surveys over the area previously explored by Erzgesellschaft.

BP Canada Inc. conducted ground magnetic, electromagnetic, and deep pulse electromagnetic surveys in 1984 over the area previously explored by Erzgesellschaft and Yorbeau Mines Inc.

Selco Mining Corp. Ltd. conducted horizontal loop electromagnetic and magnetic surveys on its Dixie 150-41 grid, which encompassed the northeast end of Gerry Lake, during 1977 and 1978.

Noranda Exploration Company, Ltd. conducted lithogeochemical surveys, geological mapping, and magnetic, horizontal loop electromagnetic, and deep pulse electromagnetic surveys over the Gerry Lake area in 1985. Noranda conducted more lithogeochemical sampling and airborne magnetic and VLF-EM surveys over Gerry Lake in 1988.

G. Desmeules conducted stripping and trenching near the northwest shore of Gerry Lake in 1990.

Gerry Lake is situated within a unit of mafic metavolcanic flows at the base of the Cycle III metavolcanic sequence described by Thurston (1985) at Confederation Lake. The basal unit of mafic metavolcanics is part of Formation K in the Cycle III sequence and consists predominantly of massive, pillowed, and variolitic flows with minor, interflow metasediments (Thurston 1985). The mafic metavolcanic unit can be traced from Confederation Lake in Mitchell Township southwest to Gerry Lake (Thurston and Paktunc 1985b). Large biotite and hornblende-biotite granodiorite intrusions are situated immediately north and south of the metavolcanic rocks at Gerry Lake (Fenwick 1966; Thurston and Paktunc 1985b, 1985c). The metavolcanics are also intruded by irregular bodies of dioritic to gabbroic rocks (Fenwick 1966).

The metavolcanic rocks at Gerry Lake consist of massive mafic flows and tuffs intercalated with felsic pyroclastic rocks that trend northeast through the lake. Discontinuous, narrow units of northeast-trending chert-magnetite iron formation are situated immediately southeast of the felsic pyroclastic rocks and also extend through Gerry Lake. Very minor, narrow and discontinuous units of dolomitic limestone are interbedded with the iron formation.

The felsic pyroclastic rocks consist of interlayered tuff, lapilli tuff, and tuff breccia. The tuff breccia is well exposed along a hydro power line northeast of Gerry Lake. The tuff breccia is clast-supported and consists of subangular to angular clasts in a dark green, coarse-grained, amphibolitic matrix. The clasts have been partially altered by amphibole along hairline fractures and clast rims. A few of the clasts contain faint layering implying that they may be redeposited clasts of lithified tuff.

Queensland Occurrence

The Queensland sulphide occurrence consists of several trenches located about 900 m east-northeast of Gerry Lake (Figure 3.7, number 1).

The occurrence consists of chert-magnetite iron formation up to 3 m wide which hosts disseminated pyrite, pyrrhotite, and minor chalcopyrite. Sulphides also occur in thin layers and laminations up to 2 cm in width. Queensland Explorations Ltd. reported minor amounts of sphalerite and molybdenite in the mineralized zones. The iron formation consists of rusty and brecciated, sugary, recrystallized chert, which alternates with thin layers of magnetite. The chert is variably sericitized and contains minor epidote. Sheared and fissile, sericitized tuffs and metasediments occur in the vicinity of the trenches and contain abundant biotite, anthophyllite, chlorite, and garnet. Some of the mafic flows near the trenches are intensely altered to massive, green, felted masses of anthophyllite.

Intensely folded, crenulated, and altered mafic flows hosting very thinly layered and laminated chert-magnetite iron formation are exposed on the northeast shore of Gerry Lake. Shearing in the metavolcanics trends 065° and 080/85SE and folds plunge 45° to the southwest. Abundant fibrous, green anthophyllite occurs throughout the mafic metavolcanic rocks.

Intensely contorted and folded chert metasediments interlayered with mafic metavolcanics outcrop on a small island near the northeast shore of Gerry Lake. The mafic rocks are completely altered to massive fibrous masses of anthophyllite.

Lithogeochemical sampling over the Queensland occurrence by Noranda Exploration Company, Ltd. delineated 2 zones of hydrothermal alteration within the felsic metavolcanic rocks. The alteration zones are situated 400 m and 2.3 km northeast of Gerry Lake. Alteration consists of strong

MgO enrichment and Na_2O depletion, which is accompanied by mineral assemblages of fine- to coarse-grained cordierite, anthophyllite, and biotite. A thin-section analysis of rock samples taken by Noranda Exploration from the most easterly alteration zone indicated that the rocks consisted of 48 percent quartz, 25 percent biotite, 22 percent cordierite, 5 percent muscovite, and a trace of sillimanite, zircon, monzonite, and apatite. The alteration zones in the felsic metavolcanic rocks lie northwest of the sulphide-bearing, chert-magnetite iron formation at Gerry Lake.

Diamond drilling conducted at the occurrence by Queensland Explorations Ltd. intersected narrow mineralized zones that assayed as high as 2.56 ounces Ag per ton, with trace amounts of Cu.

Samples taken from the occurrence by Roxmark Mines Ltd. were reported to assay as high as 14 ounces Ag per ton (*The Northern Miner*, March 26, 1970). The best drill intersection reported by Roxmark was 0.23% Cu and 0.2 ounce Ag per ton across 4 feet in sheared, biotite-garnet schist.

Grab samples taken by Noranda Exploration Company, Ltd. from siliceous, altered rocks in an old trench at the Queensland occurrence assayed 2.94% Zn, 1.08% Pb, 0.04% Cu, and 1.36 ounces Ag per ton. Anomalous Zn and Cu values were also reported by Noranda in the 2 alteration zones northeast of Gerry Lake.

A grab sample taken by J.R. Parker from the iron formation in 1 of the trenches at the Queensland occurrence contained 260 ppb Au, 4 ppm Ag, 338 ppm Cu, and 325 ppm Zn (Geoscience Laboratories Section, Ontario Geological Survey, Toronto). The sample consisted of magnetite, biotite, chert, and anthophyllite.

G. Desmeules Occurrence

The G. Desmeules occurrence is situated along a hydro power line at the boat launch on the west side of Gerry Lake, adjacent to the South Bay mine road (Figure 3.7, number 2).

A chert-magnetite iron formation hosted by intensely altered metavolcanic rocks has been exposed in backhoe trenches at the occurrence. The iron formation is gossan-stained, leached, and consists of sugary, sericitized, recrystallized chert, hosting massive and disseminated pyrrhotite with minor pyrite and chalcopyrite. The iron formation also contains 1 to 2 mm thick layers of magnetite-actinolite and 5 mm wide layers and veinlets of dark green, coarse-grained pyroxene (diopside).

The rocks immediately north of the iron formation are intensely altered and of questionable origin. The rocks are very thinly layered, sheared, and intensely crenulated and Z-drag folded. Dark, grey-brown, biotitic layers alternate with more felsic, sericitic, light-coloured layers that contain green mica and pink-brown porphyroblasts of andalusite up to 2 mm in size. Foliation trends 062° and folds plunge between 15° and 25° to the southwest. The altered rocks also host masses of coarse-grained, green anthophyllite, pyroxene (diopside), and carbonate. A narrow carbonate horizon on the north side of the chert-iron formation has a calc-silicate alteration assemblage of calcite, pyroxene, and actinolite.

Copper Lode A Prospect or Rexdale A Zone

The Copper Lode A prospect is located 2.1 km west-southwest of Fredart Lake and 3 km northeast of Gerry Lake (Figure 3.7, number 3). The prospect is situated on leased mining claim KRL 53370 (formerly claim KRL 35826), 1 km east-southeast of the South Bay mine road and about 49 km from Ear Falls.

Split Rock Mines Ltd. acquired a group of 91 contiguous mining claims in the Fredart Lake area in 1956. Mining claim KRL 35826 encompassed the first showing of copper-silver mineralization on the Copper Lode A zone. Split Rock Mines conducted prospecting, trenching, and ground magnetic and electromagnetic surveys and completed 12 diamond-drill holes totalling 3828.7 feet on the property between 1956 and 1964.

Rexdale Mines Ltd. acquired the property and conducted stripping and trenching, ground magnetic, electromagnetic, and induced polarization geophysical surveys and completed 59 diamond-drill holes totalling 24 246 feet during 1964 and 1965. The geophysical surveys delineated 5 electromagnetic conductors on the property. One of the conductors coincided with the Copper Lode A prospect on mining claim KRL 53370 (formerly KRL 35826). The company also delineated a second zone of copper-molybdenite mineralization on mining claims KRL 53451 and 53450, situated approximately 1 km northeast of the A zone.

The Rexdale property was subsequently optioned to Copper Lode Mines Ltd., who conducted airborne magnetic and electromagnetic geophysical surveys over the property in 1968. The company also completed induced polarization and resistivity geophysical surveys on the property and 11 diamond-drill holes totalling 4614 feet in 1968.

Subsequent work on the Rexdale property was conducted by Phelps Dodge Corporation of Canada Ltd. under a suboption agreement with Copper Lode Mines Ltd. Phelps Dodge completed trenching, geological mapping, sampling, relogging of old drill core, 18 diamond-drill holes totalling 13 410 feet, and a feasibility study on the property between 1969 and 1972.

In 1977, Copper Lode Mines Ltd. conducted a pulse electromagnetic survey on the property and completed 2 diamond-drill holes totalling 1001.8 feet.

Diamond drill indicated reserves on the Copper Lode A zone are 236 424 tons grading 1.94% Cu and 1.22 ounces Ag per ton to an average vertical depth of 400 feet and along a strike length of 1400 feet (Consolidated Copper Lode Developments Inc., prospectus, Resident Geologist's files, Red Lake).

The Copper Lode A prospect is situated within mafic, metavolcanic flows at the base of the Cycle III metavolcanic sequence that was identified and described by Thurston (1985) at Confederation Lake. The mafic metavolcanics can be traced from Confederation Lake in Mitchell Township, southwest through Belanger Township, to Fredart and Gerry lakes (Thurston and Paktunc 1985b, 1985c).

The metavolcanic rocks are intruded by small, irregular, dioritic to gabbroic intrusions and by 2, large, granodiorite intrusions situated immediately north and south of the Copper Lode property (Fenwick 1966).

The metavolcanic rocks at the Copper Lode A prospect consist of east-northeast-trending, amphibolitized, massive

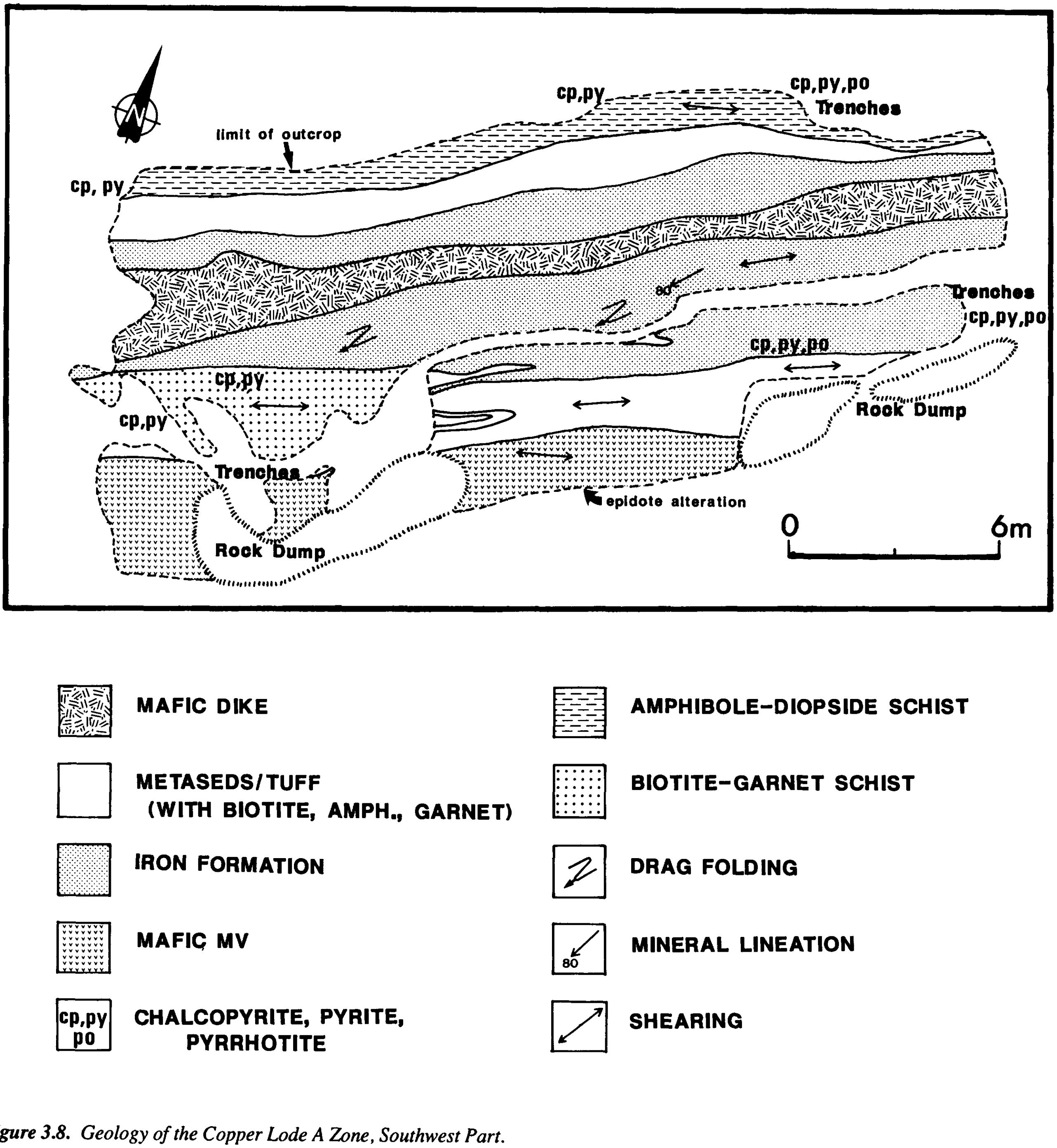

Figure 3.8. Geology of the Copper Lode A Zone, Southwest Part.

and pillowed, fine- to coarse-grained, mafic metavolcanic flows intercalated with interflow metasediments and intermediate to mafic tuff and lapilli tuff. The metasediments consist predominantly of thin, discontinuous units of recrystallized, chert-magnetite-amphibole iron formation. The metavolcanic rocks are commonly biotitic, and contain variable amounts of garnet and green-black amphibole. Intermediate metavolcanic rocks are also variably sericitized.

The east-northeast-trending A zone has been traced for a strike length of approximately 400 m. The zone consists of sulphide mineralization which is closely associated with numerous subparallel horizons of chert-magnetite-amphibole iron formation intercalated with amphibolitized mafic flows and thinly bedded, intermediate to mafic tuffs. The iron formation is also interlayered with units of coarse-grained, dark green pyroxene and anthophyllite which may represent metamorphosed calcareous metasediments. The rocks within the mineralized zone are highly strained, sheared, fissile, boudinaged, and folded and trend 065° to 080° with a strong mineral lineation plunging 080° to the southwest. Dextral, northwest-trending faults intersect the mineralized zone and displace chert-magnetite-amphibole units (Figure 3.8).

The units of chert-magnetite-amphibole iron formation are commonly 1.8 to 4.5 m wide and contain contorted, discontinuous, and Z-drag folded layers of magnetite which are less than 2.5 cm wide. The magnetite is interlayered with boudinaged and brecciated chert layers which are less than 5 cm to 0.6 m wide. The chert is rusty-red, recrystallized, and sugary-textured. The chert also contains sheared and fissile layers of green, fibrous anthophyllite, black amphibole, calcite, and/or coarse-grained biotite.

Discontinuous stringers, pods, and lenses, consisting of pyrrhotite, pyrite, and variable amounts of chalcopyrite, occur almost exclusively in horizons of iron formation. Some pyrite and pyrrhotite nodules occur in magnetite-rich layers within the chert. The sulphides are also disseminated throughout the amphibolitized mafic flows and intermediate to mafic tuffs adjacent to the iron formation. The metavolcanic rocks commonly are composed of coarse-grained black biotite, black amphibole, and large red-brown garnets up to 2 cm in size. Chalcopyrite is typically concentrated within the biotite-rich rocks. Sulphides also occur along fractures and foliation planes in intensely deformed rocks.

Thin discontinuous units of massive pyroxene are interlayered with the chert-magnetite-amphibole iron formation. These units contain massive aggregates of dark green, euhedral diopside crystals up to 30 cm long and 8 cm wide, with interstitial quartz and calcite. Thin layers of massive anthophyllite and magnetite occur throughout the diopside units as well as minor amounts of disseminated chalcopyrite, pyrite, pyrrhotite, and galena. A 15 m wide zone of pervasive silicification and abundant white quartz veining occurs within the diopside unit at the extreme northeastern end of the A zone. The silicification does not appear to be associated with mineralization.

Three grab samples taken by J.R. Parker from trenches on the Copper Lode A zone were found to contain 40 ppb Au, 3980 ppm Cu, and 700 ppm Zn; 730 ppb Au, 11.2% Cu, and 2680 ppm Zn; and 200 ppb Au, 3.8% Cu, and 760 ppm Zn (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Diamond drilling has indicated that the Copper Lode A zone consists of numerous narrow, discontinuous, *en échelon* and subparallel sulphide zones. Some of the best drill intersections from the A zone, reported by Rexdale Mines Ltd. assayed 5.24% Cu and 5.45 ounces Ag per ton across 6 feet; 2.94% Cu and 2.43 ounces Ag per ton across 18 feet; 2.23% Cu and 3.32 ounces Ag per ton across 37.8 feet; and 1.89% Cu and 3.10 ounces Ag per ton across 57.2 feet.

Copper Lode B, C, D, and E Zones

The Copper Lode B, C, D, and E zones are situated approximately 1.8 km southeast of Fredart Lake in Belanger Township (Figure 3.7, numbers 4, 5, 6, and 7). The mineralized zones are encompassed by a group of 20 contiguous, leased, mining claims (KRL 51105 to 51124 inclusive).

H. Lundmark and G. Ramstad discovered, staked, and trenched the B and C showings during the summer of 1962.

The property was optioned to Falconbridge Nickel Mines Ltd., which conducted geological mapping and a reconnaissance electromagnetic survey over the property in 1962.

J. E. Ayrhart acquired the claims in 1962 and transferred them to Zinc Metal Corp. Ltd.

Copper Lode Mines Ltd. acquired the property in 1964 and conducted several ground electromagnetic surveys and a 64 hole diamond-drill program totalling 19 226.7 feet. The electromagnetic surveys delineated the D and E zones, which do not outcrop. In 1968, the company conducted airborne magnetic and electromagnetic surveys over the property and completed an induced polarization survey in 1969. In 1970, Copper Lode Mines conducted prospecting, geological mapping, and a ground electromagnetic survey on the property.

Selco Mining Corp. Ltd. optioned the property from Copper Lode Mines in 1972 and completed airborne and ground magnetic and electromagnetic surveys, relogged old drill core, and drilled 3 diamond-drill holes on the property between 1972 and 1973.

The Copper Lode B, C, D, and E zones are subparallel, *en échelon*, northeast-trending sulphide zones. The E zone is the most significant mineralized zone on the property, with drill-indicated reserves of 104 000 tons grading 7.39% Zn, 0.98% Cu, and 0.62 ounce Ag per ton to an average vertical depth of 200 feet and along a strike length of 1000 feet

(Consolidated Copper Lode Developments Inc., prospectus, Resident Geologist's files, Red Lake).

The Copper Lode B, C, D, and E zones are situated within intermediate metavolcanic rocks that are part of Formation L within the Cycle III metavolcanic sequence described by Thurston (1985) at Confederation Lake. The metavolcanic rocks extend south from Confederation Lake in Mitchell Township and trend southwest through the central portion of Belanger Township into the Pakwash Lake area (Thurston and Paktunc 1985b, 1985c; Wallace et al. 1986).

The intermediate metavolcanic rocks on the Copper Lode property dominantly consist of northeast-trending, fine-grained, biotitic and sericitized, sandy-textured tuff and lapilli tuff, quartz porphyry, and feldspar-quartz porphyry. A unit of fine-grained metasedimentary rocks extend through the northwestern portion of the Copper Lode property, and was mapped by Muir and Graydon (1982) as biotite-sericite-quartz schist containing garnet, staurolite, and andalusite.

The metasedimentary and metavolcanic rocks are intruded by irregular dioritic to gabbroic intrusions and by 2 large granodiorite intrusions situated northwest and southeast of the Copper Lode property (Muir and Graydon 1982).

The Copper Lode B zone (Figure 3.7, number 4) is situated along the southern boundary of leased mining claim KRL 51113. A large trench has been sunk on very coarse-grained, biotite-garnet schist and anthophyllite-biotite schist hosting abundant disseminated and massive pyrrhotite and pyrite with minor chalcopyrite. Falconbridge Nickel Mines Ltd. reported that a unit of quartz-biotite-sericite schist hosting 2 to 5 percent disseminated pyrite and chalcopyrite is also exposed in the trench. The altered, sulphide-bearing schist zone is approximately 7 m wide and is in contact with a massive, medium-grained rock which may be gabbro or a coarse-grained mafic flow south of the trench. Copper Lode reported that a 9-foot wide zone of massive sulphides consisting of pyrrhotite, sphalerite, and chalcopyrite occurred along the southern edge of an east-northeast-trending, coarse-grained, garnetiferous amphibolite in the B zone trench. The company also noted that up to 20 percent disseminated sulphides occurred in rocks adjacent to the massive sulphide zone.

Small pits and trenches are also situated about 300 m north of the main trench at the B zone. The trenches have been sunk on strongly sheared (070°), sericitized, fine-grained, siliceous metavolcanic rocks containing 3 to 10 percent disseminated pyrite on fractures and shear planes. Metavolcanic rocks east of the trenches are quartz-biotite-feldspar schists hosting abundant, pale brown, andalusite porphyroblasts up to 3 cm long and 1 to 1.5 cm wide. The andalusite appears to be associated with numerous, pale blue-green quartz veins. Rocks north of the trenches consist of thickly bedded, intermediate to felsic, quartz-feldspar crystal tuff and minor lapilli tuff.

The C zone trenches (Figure 3.7, number 5) are located approximately 700 m west-northwest of the B zone trench and are situated in the northwest corner of leased mining claim KRL 51115. The C zone trench has been sunk on very coarse-grained, black, amphibole-biotite schist hosting disseminated and massive pyrite and pyrrhotite and coarse-grained, disseminated magnetite. Thickly laminated, intermediate metavolcanic rocks consisting of quartz, biotite, and feldspar occur along the north side of the trench. The amphibole schist is in contact with a massive, medium-grained gabbro situated south of the trench. Copper Lode reported that a 4-foot wide zone of massive pyrrhotite, chalcopyrite, and sphalerite occurred along the northern edge of an east-northeast-trending, coarse-grained amphibolite in the C zone trench. The company also reported 3 to 10 percent disseminated sulphides in the rocks adjacent to the main sulphide zone.

The B zone was delineated for a strike length of 1200 feet and to a depth of 200 feet during diamond drilling conducted by Copper Lode Mines Ltd. The best drill intersection reported by the company from the B zone assayed 1.68% Cu and 2.5% Zn across 20.5 feet. A grab sample taken from the B zone trench by G. Holbrooke assayed 0.94% Cu and 3.96% Zn.

The C zone was delineated by diamond drilling for a strike length of 700 feet and to a depth of 140 feet. The best drill intersection reported by Copper Lode Mines from the C zone assayed 0.63% Cu and 2.17% Zn across 3 feet.

The D and E zones do not outcrop and were originally discovered by electromagnetic geophysical surveys conducted by Copper Lode Mines Ltd. The 2 zones are northeast-trending and are approximately 1200 feet southwest of the B and C zones. Copper Lode Mines reported that the sulphide mineralization in the D and E zones occurred within sheared and faulted micaceous metasediments.

The D zone (Figure 3.7, number 6) was traced by diamond drilling for a strike length of 1200 feet and to a depth of 350 feet. Some of the best drill intersections from the D zone, reported by Copper Lode Mines, assayed 1.75% Cu, 0.86% Zn, 7.7 ounces Ag per ton, and 0.32 ounce Au per ton across 11.2 feet; 0.7% Cu, 0.67% Zn, 3.01 ounces Ag per ton, and 0.1 ounce Au per ton across 48.7 feet; and 0.72% Cu, 12.6% Zn, and 1 ounce Ag per ton across 7.4 feet.

The main lens of sulphide mineralization at the E zone (Figure 3.7, number 7) was delineated by diamond drilling for a strike length of 800 feet. Three of the best drill intersections from the zone, reported by Copper Lode Mines, assayed 0.16% Cu and 15% Zn across 11 feet; 1.23% Cu, 6.22% Zn, and 0.57 ounce Ag per ton across 33.5 feet; and 0.49% Cu, 4.77% Zn, and 0.35 ounce Ag per ton across 19.5 feet.

Horseshoe Lake Prospect

Trenches at the Horseshoe Lake prospect are located on the southwest shore of Horseshoe Lake and on a small island in the lake. The prospect consists of numerous trenches and test pits situated on mining claim KRL 895651 in the southwestern corner of Mitchell Township (Figure 3.7, number 8).

The Horseshoe Lake prospect was first discovered, sampled, trenched, and staked by L.N. Parker in 1927.

The prospect was staked by J. Hodgson in 1950 and optioned to Heath Gold Mines Limited in 1951 (Thomson 1952). The company trenched the property and completed 8 diamond-drill holes totalling 2207 feet.

Norite Explorations Ltd. drilled 4 holes totalling 1307 feet in 1965, although it was reported that the company had completed 6 holes on the property (*The Northern Miner*, June 19, 1965).

In 1969 Selco Exploration Co. Ltd. completed 1 diamond-drill hole totalling 455 feet and conducted detailed geological mapping on the property during 1970.

South Bay Mines Ltd. drilled 10 diamond-drill holes totalling 3421.5 feet on the property in 1971.

Cominco Limited conducted a ground magnetic survey over the prospect in 1984.

Noranda Exploration Company, Ltd. flew airborne magnetic and electromagnetic surveys and completed lithogeochemical sampling over the Horseshoe Lake prospect in 1988. The company conducted ground horizontal loop electromagnetic and gravity surveys in 1989 and completed an electromagnetic survey and lithogeochemical sampling during 1990.

The Horseshoe Lake prospect is situated within intermediate metavolcanic rocks that are part of Formation L within the Cycle III metavolcanic sequence (Thurston 1985). The metavolcanic rocks extend south from Confederation Lake in Mitchell Township and trend southwest through the northwestern corner of Bowerman Township into Belanger Township (Thurston and Paktunc 1985b, 1985c; Wallace et al. 1986).

The Zn-rich, sulphide mineralization at the Horseshoe Lake prospect occurs within very intensely sheared and altered, east-northeast-trending, intermediate metavolcanic rocks, which may be tuff and lapilli tuff interlayered with thinly laminated, siliceous rocks. Selco Exploration mapped the sheared, intermediate metavolcanic rocks as dacitic schists, spherulitic dacite, and felsic tuffs. The shear zone that extends through the intermediate metavolcanic rocks is at least 90 m wide, trends 060° to 075° and dips vertically for a strike length of at least 5 km. The presence of Z-drag folding and the orientation of primary and secondary shear bands in the rocks indicate overall dextral movement in the shear zone. The metavolcanic rocks within the shear zone are fissile, platy, chloritized, sericitized, and hematite-stained. Some of the sheared intermediate rocks contain thin bands of small, pale brown to buff-white andalusite porphyroblasts. The intensely sheared rocks are in contact with moderately to weakly sheared, quartz-feldspar porphyry and porphyritic felsic flows to the southwest and a relatively massive granodiorite sill to the northeast.

Discontinuous sulphide mineralization within the sheared metavolcanic rocks has been traced by stripping and trenching for a strike length of 1400 feet. Trenches and pits have been excavated in a well-exposed section of the mineralized zone on a small island at the southwestern end of Horseshoe Lake. Sulphides occur in very siliceous, very thinly laminated rocks within intermediate tuff at the contact with intensely sheared, felsic quartz porphyry. The sulphide-rich, laminated, siliceous rock unit is approximately 2 to 6 m wide. Abundant, fine-grained sphalerite and pyrite are disseminated throughout the siliceous rock, but also occur in sulphide-rich layers less than 1 cm wide. Small pods, up to 2 m wide, of massive and semimassive pyrrhotite with minor sphalerite, pyrite, and chalcopyrite also occur in the trenches. Felsic rocks on the island are intensely sericitized and variably silicified, whereas the intermediate rocks are intensely chloritized. Numerous contorted, boudinaged, and Z-drag folded white quartz veins and stringers are concentrated within the sheared quartz porphyry.

Two grab samples taken by J.R. Parker from the trenches on the island assayed 13.5% Zn, 1500 ppm Pb, and 9 ppm Ag; and 13.6% Zn, 8800 ppm Cu, 1.11 ounces Ag per ton, and 80 ppb Au (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Grab samples taken from the trenches on the property by L.N. Parker and W. Mackle assayed 19% Zn and 20.52% Zn respectively. A 2-foot wide chip sample taken from 1 of the trenches by Heath Gold Mines Ltd. assayed 6.22% Zn, whereas a channel sample taken by Norite Explorations Ltd. assayed 21.34% Zn across 5 feet.

Diamond drilling conducted by Heath Gold Mines Ltd. intersected 1- to 4-foot wide sections of sulphide-rich rock assaying between 2 and 3% Zn. The best intersections encountered during diamond drilling conducted by Norite Explorations Limited assayed 2.01% Zn, 0.12% Cu, and 0.38 ounce Ag per ton across 6 feet; 5.46% Zn and 0.43 ounce Ag per ton across 5 feet; and 1.55% Zn and 0.91 ounce Ag per ton across 6 feet.

A hole drilled by South Bay Mines Ltd., at the extreme northeastern end of Horseshoe Lake, intersected 2.79% Zn across 3 feet in a spherulitic, banded, siliceous rock containing 30 to 40 percent sulphides consisting of pyrrhotite with minor sphalerite.

Noranda Exploration Company, Ltd. detected numerous wide zones of Na_2O depletion during lithogeochemical sampling within the metavolcanic rocks at the Horseshoe Lake prospect. The Na_2O depleted zones extend south and southwest from the prospect and also occur at the extreme northeastern end of Horseshoe Lake.

A lithogeochemical survey conducted by Closs and Colvine (1980a, 1980b) detected anomalous Sn (between 12 and 16 ppm Sn) and enriched MgO in the metavolcanic rocks adjacent to the sulphide mineralization at Horseshoe Lake. Closs and Colvine (1980b) also detected a zone of barium depletion, immediately northwest of the sulphide mineralization, that corresponds with a zone of Na_2O depletion detected by lithogeochemical sampling conducted by Noranda Exploration Company, Ltd. A zone of boron enrichment (greater than 40 ppm B) was also detected along the contact between sheared, intermediate metavolcanic rocks and the felsic, quartz-feldspar porphyry in the vicinity of the sulphide mineralization (Closs and Colvine 1980b).

Triangle Lake Prospect

The Triangle Lake prospect is located immediately northwest and southeast of Triangle Lake near the eastern boundary of Mitchell Township (Figure 3.7, number 9). The prospect consists of numerous large backhoe trenches situated near the South Bay mine road approximately 71 km from Ear Falls.

South Bay Mines Ltd. drilled 15 diamond-drill holes totalling 5597.5 feet on targets situated northwest and southeast of Triangle Lake in 1970.

Kerr Addison Mines Ltd. drilled 6 holes totalling 1922 feet on targets situated northwest and southeast of Triangle Lake in 1975 and 1976 and conducted ground electromagnetic and magnetic surveys northwest of Triangle Lake in 1977.

Noranda Exploration Company, Ltd. conducted airborne magnetic and electromagnetic surveys over the property in 1988. Noranda completed horizontal loop electromagnetic (HL-EM), VLF-EM, magnetic and gravity surveys, lithogeochemical sampling, geological mapping, trenching, and stripping on the property in 1989. The company also conducted humus and soil sampling as well as lithogeochemical sampling during 1990. All of Noranda's work was concentrated on a group of 10 contiguous mining claims (KRL 895668, 895669, 895673, 895674, 895678, 895679 and 1104014 to 1104017 inclusive) situated on the northwestern shore of Triangle Lake.

The northwestern portion of the Triangle Lake prospect is situated within intermediate metavolcanic rocks that are part of Formation L within the Cycle III sequence. The southeastern portion of the prospect occurs within felsic metavolcanic rocks of Formation M that are also part of the Cycle III sequence. A north- to north-northeast-trending fault is situated along the northwestern shore of Triangle Lake and extends along the contact between Formation L and Formation M. This fault extends northeast to the South Bay massive sulphide deposit on Confederation Lake (Thurston 1985).

Metavolcanic rocks along the northwestern shore of Triangle Lake consist of intermediate tuff and lapilli tuff intruded by dioritic to gabbroic sills and dikes and by granodioritic sills. The metavolcanic rocks southeast of Triangle Lake dominantly consist of felsic porphyritic flows intercalated with felsic tuff and lapilli tuff intruded by gabbroic to granodioritic rocks (Pryslak 1970; Thurston 1985).

J.R. Parker visited the trenches situated northwest of Triangle Lake. Metavolcanic rocks exposed in trenches east of the South Bay mine road consist of alternating layers of intermediate to felsic quartz porphyry and quartz-feldspar porphyry. The felsic rocks are intercalated with coarse-grained, feldspar-phyric, gabbroic rocks, mafic flows, and feldspar-phyric granodioritic rocks. The intermediate to felsic porphyritic rocks are sheared at 060°, gossan-stained, chloritic, variably silicified, and contain tiny, pink porphyroblasts of andalusite and fine-grained, black crystals of disseminated magnetite. The intermediate to felsic metavolcanic rocks host a narrow, chloritic, red-stained, mineralized zone consisting of disseminated pyrite, pyrrhotite, and chalcopyrite with semimassive stringers of chalcopyrite and sphalerite. The mineralized zone trends 075/90.

Metavolcanic rocks exposed in trenches west of the South Bay mine road consist of mafic metavolcanic flows in contact with intermediate to felsic quartz and quartz-feldspar porphyry. A 25 m wide zone of disseminated pyrite, pyrrhotite, and chalcopyrite, occurs within the felsic porphyritic rocks near the contact with the mafic flows. A graphitic, 25 m wide shear zone trending 045° is also exposed in the trenches and intersects stratigraphy.

Numerous rock samples were taken along the trenches northwest of Triangle Lake by Noranda Exploration Company, Ltd. Thirty-eight of the 53 samples collected contained greater than 140 ppm Zn with 3 samples assaying 1.18%, 1.13%, and 2.29% Zn. Fifteen of the 53 samples collected contained greater than 130 ppm Cu.

The best drill intersections at the Triangle Lake prospect were encountered in diamond-drill holes completed by Kerr Addison Mines Ltd. southeast of Triangle Lake. Drilling intersected 35 percent pyrrhotite in a sheared, chloritic, graphitic and siliceous zone at the contact between rhyolitic and mafic flows. This mineralized zone assayed 1.78% Zn, 0.07% Cu, and 0.2 ounce Ag per ton across 2.5 feet; 4.36% Zn, 0.14% Cu, 0.03% Sn, and 0.54 ounce Ag per ton across 3 feet; and 0.27% Zn and 0.03% Cu across 5.5 feet. A chloritic, silicified breccia zone intersected by diamond drilling in rhyolitic rocks assayed 1.93% Zn, 0.08% Cu, and 0.245

ounce Ag per ton across 5 feet, whereas a zone of chloritic rhyolite hosting 80 percent pyrrhotite assayed 2.92% Zn, 0.17% Pb, 0.07% Cu, and 0.215 ounce Ag per ton across 1.5 feet. A zone of pyritic dacite intersected by drilling assayed 1.16% Zn, 0.09% Cu, and 0.17 ounce Ag per ton across 4 feet.

Fly Lake Prospect

The Fly Lake prospect is situated about 200 m due north of Keewatin Bay of Fly Lake, near the eastern boundary of Mitchell Township (Figure 3.7, number 10). The prospect is located on mining claims KRL 1056740 and 1056741 about 400 m south of the South Bay mine road and 73.7 km from Ear Falls.

The Fly Lake prospect was discovered and staked by J. Hodgson in 1950 (Thomson 1952).

The property was optioned to Heath Gold Mines Limited which trenched and sampled the property in 1951 and completed 5 diamond-drill holes totalling 728 feet during the same year.

Kerr Addison Mines Ltd. drilled 3 holes totalling 982 feet on the property in 1976 and completed ground magnetic and electromagnetic surveys in 1977.

Selco Mining Corp. completed ground horizontal loop electromagnetic and magnetic surveys on the Fly Lake prospect in 1980.

B. Cronley trenched and stripped the property in 1985.

Placer Dome Inc. conducted ground magnetic and electromagnetic surveys on the property and completed 4 diamond-drill holes totalling 597 m. Core from this drill program is archived in the Kenora Drill Core Library.

The Fly Lake prospect is situated within felsic and intermediate metavolcanic rocks that are part of Formation M within the Cycle III metavolcanic sequence described by Thurston (1985) at Confederation Lake. The metavolcanic rocks extend southwest from Confederation Lake through the northwestern corner of Bowerman Township into Belanger Township (Muir and Graydon 1982; Thurston and Paktunc 1985c; Wallace et al. 1986).

Metavolcanic rocks at the Fly Lake prospect consist dominantly of intermediate to felsic quartz and quartz-feldspar porphyry and spherulitic flows. The metavolcanic rocks are intruded by small, sill-like intrusions of quartz diorite.

The Fly Lake prospect consists of trenches excavated in very intensely sheared and altered, north-northeast-trending, felsic, quartz porphyry. The porphyry weathers buff grey-white and is pale grey-green on fresh surfaces. Shearing trends 030° and dips steeply to the southeast. The porphyry is intensely sericitized, variably silicified, and chloritized. The quartz porphyry hosts sphalerite, fine-grained cubic pyrite, and minor chalcopyrite, which are concentrated along shear planes less than 1 mm to 3 cm wide. Sphalerite-rich layers also intersect the shear planes. Massive quartz veins and veinlets also occur in the trenches and consist of white to grey and red, fine-grained, sugary quartz hosting variable amounts of disseminated sphalerite, pyrite, and chalcopyrite.

Sheared, intermediate to felsic, spherulitic flows were observed by J.R. Parker on an outcrop located north of the trenches. Elliptical spherules are up to 7 cm long and 4.5 cm wide, with silicified rims and dark green, chloritic cores. Spherules are elongated along a 050° trend.

A grab sample taken by J.R. Parker from the sheared and altered quartz porphyry analyzed 34 ppb Au, 4 ppm Ag, 18 ppm Pb, and 5.3% Zn, whereas a grab sample taken from the quartz vein assayed 0.42 ounce Au per ton, 1.86 ounces Ag per ton, 210 ppm Pb, and 3.32% Zn (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

The best drill intersections obtained by Heath Gold Mines Limited assayed 2.64% Zn across 5.4 feet and 2.44% Zn across 2.7 feet. Drill holes intersected sheared sericitized, chloritic, and biotitic rhyolite and quartz-feldspar porphyry hosting seams and veins of sphalerite and pyrite.

DIAMOND-DRILL CORE STORAGE PROGRAM

The Kenora Drill Core Library serves 3 of the 6 Resident Geologist's districts in northwestern Ontario: Kenora, Patricia (Sioux Lookout), and Red Lake. The storage facility contains core from entire drill holes from both exploration and mine development drilling, incomplete core recovered from old drill sites, and short samples of core submitted for credit under section 77(6) of the Mining Act, Revised Statutes of Ontario, 1980 (Table 3.3).

The library holds 13 838.9 m of core from 125 holes drilled in the Red Lake District, 11 032 m (106 holes) inside the building and 2806.1 m (19 holes) in outdoor storage. During the year, 9898.2 m of core from 78 drill holes were added to the collection. Of this amount, 3714.9 m (from 30 holes) were collected from 9 properties in the Red Lake District (Figure 3.2). In addition to the core stored in Kenora, there is core in temporary storage at Red Lake to be moved to permanent storage when drill logs and other documentation become available.

Gold remained the primary exploration target in the Red Lake District, and most of the core collected during 1990 was from gold exploration. Re-evaluation of base metal properties and re-evaluation of gold properties for their base metal potential has continued. Drilling in the south of Otter Lake claim map area, east of Willans Township, by Noranda Exploration Company, Ltd. was directed toward base metal mineralization. Core from several other projects such as

TABLE 3.3. SUMMARY OF CORE FROM THE RED LAKE RESIDENT GEOLOGIST'S DISTRICT IN THE KENORA DRILL CORE LIBRARY.

Area	NTS	Company	Holes
Balmer Township	52N/04SE	Eldor Resources	3
	52N/04SW	Golden Exploration and Dev. Co.	3
	52N/04SE	Granges Exploration	8
	52N/04SW	Gunnar Gold Inc.	4
Bateman Township	52N/04NE	Penway Explorers Ltd.	9
Bruce Lake	52K/14SW	Griffith Mine	8
Buckett Lake	53C/10SW	Rockspan Res. Ltd.	4
Dent Township	52N/02SE	Selco Mining Corp. Ltd.	7
		Sherritt Gordon Mines Ltd.	3
		Silverside Resources Ltd.	3
Dome Township	52N/04SW	Sherritt Gordon Mines Ltd.	15
Fairlie Township	52N/04SW	Minorex Ltd.	1
		Selco Mining Corp. Ltd.	1
		Sherritt Gordon Mines Ltd.	1
Gerry Lake	52K/14NE	Noranda Exploration Co. Ltd.	1
Grist Lake	53C/04NW	Cominco Ltd.	3
Heyson Township	52N/04SW	Selco Mining Corp. Ltd.	1
		Teck Corporation	6(*)
		Laverty Red Lake Mines Ltd.	4*
Karas Lake	52K/14SE	Noranda Exploration Co. Ltd.	1*
		Dixie joint venture (Selco)	
Killala Township	52L/16NE	Black Cliff Mines Ltd.	6*
Kippen Lake	53G/05SW	Eldor Resources Ltd.	5
Mitchell Township	52N/02SE	St. Joseph Exploration Ltd.	1
		Noranda Exploration Co. Ltd.	1*
		Placer Dome Inc.	4*
Seagrave Lake	52N/08SE	BP Resources Canada Ltd.	4
Shabu Lake	52N/07SW	Flint Rock Mines Ltd.	6*
Shabumeni Lake	52N/07SE	Falconbridge Ltd.	5
		Marilyn Resources Ltd.	4
Slate Lake	52K/15NE	Noranda Exploration Co. Ltd.	7
South of Otter Lake	52K/14NW	Noranda Exploration Co. Ltd.	1*
		Dixie joint venture (Selco)	
		Selco Mining Corp. Ltd.	4
		Lightval Mines Ltd.	4*
Todd Township	52M/01SE	BHP–Utah Mines Ltd.	3*
		Noranda Exploration Co. Ltd., Assessment	
		Springpole Lake	Credit Core

**Core added during 1990.*

(*) Core temporarily stored in Red Lake.

TABLE 3.4. MAPS AND REPORTS PERTAINING TO THE RED LAKE RESIDENT GEOLOGIST'S DISTRICT ISSUED BY THE ONTARIO GEOLOGICAL SURVEY, 1990.

Miscellaneous Papers	
MP 147	Report of Activities 1989, Resident Geologists
MP 150	Geoscience Research Grant Program, Summary of Research 1989–1990
MP 151	Summary of Field Work and Other Activities 1990
Open File Report	
OFR 5718	An Evaluation of the Industrial Mineral Potential of Parts of the Districts of Kenora and Rainy River
Preliminary Maps, Geological Series	
P.3174	Precambrian Geology, Kirkness Lake
P.3175	Precambrian Geology, Nungesser River
P.3176	Precambrian Geology, Cobham Lake
P.3177	Precambrian Geology, Borland Lake
Industrial Mineral Background Papers	
IMBP 13	Developments in Building Products: Opportunities for Industrial Minerals
IMBP 14	Microwaves and Minerals: Technology Review. III. Tests of Ontario's Industrial Minerals

Noranda's Fly Lake drilling, Placer Dome's Trippier Option, and BHP–Utah Mines' Todd Township drilling intersected base metal mineralization.

Drilling specifically for industrial mineral or building stone exploration has not been reported from the Red Lake District. However, Noranda's Springpole Lake project has indicated significant fluorite mineralization. Re-evaluation of core drilled in the Red Lake camp could indicate other types of industrial mineral potential.

RECOMMENDATIONS FOR EXPLORATION

HEYSON TOWNSHIP

Mapping of Heyson Township (Atkinson, in prep.) has indicated that the stratigraphy between Snib Lake and Derlak Lake (local name) is west-trending and affected by folding. Hence, exploration in this area of high mineral potential lying between past producing mines should consider the complex structural-stratigraphic relationships. Prior to drilling exploration, the area requires very detailed structural–stratigraphic mapping control.

SETTING NET LAKE AREA

Reconnaissance geological investigations in the Setting Net Lake area of the Favourable Lake greenstone belt identified anomalous gold mineralization in the Setting Net Lake stock. Although the molybdenum potential of the stock has been evaluated, its potential to host gold mineralization should be investigated.

A second, smaller stock southeast of the Setting Net Lake stock hosts auriferous polymetallic mineralization. Exploration should focus on this and other felsic intrusions in the area for similar mineralization.

The base metal occurrences appear small and of limited potential. However, previously undocumented pyritic felsic metavolcanics were identified at the waterfall in Setting Net Creek. These felsic metavolcanics should be investigated for base metal potential similar to the Berens River Mine.

BASE METALS

Sulphide mineralization occurs within 3 different geological settings in the south Confederation Lake area of the Birch–Confederation greenstone belt.

Sulphide mineralization at the Copper Lode A prospect (Figure 3.7, number 3) and the Gerry Lake occurrences (Figure 3.7, numbers 1 and 2) is closely associated with interflow horizons of chert-magnetite-amphibole iron formation interlayered with metamorphosed, calcareous metasediments. The interflow metasedimentary rocks occur within amphibolitized, mafic metavolcanic flows and fine-grained, intermediate to mafic pyroclastic rocks that are part of the Cycle III metavolcanic sequence (Thurston and Paktunc 1985c). Sulphides dominantly consist of pyrrhotite, pyrite, and chalcopyrite and contain abundant Cu and Ag with lesser amounts of Zn. Lithogeochemical sampling at Gerry Lake conducted by Noranda Exploration Company, Ltd., detected alteration zones of MgO enrichment and Na_2O depletion.

The Copper Lode B, C, D, and E prospects (Figure 3.7, numbers 4, 5, 6, and 7) are hosted by amphibolitized, fine-grained, intermediate metavolcanic and metasedimentary rocks which are part of the Cycle III metavolcanic sequence (Thurston and Paktunc 1985c; Wallace et al. 1986). Sulphide mineralization consists of disseminated and massive pyrrhotite, pyrite, sphalerite, and chalcopyrite hosted by coarse-grained, amphibolitized rocks. The sulphides contain abundant Zn and Ag with lesser amounts of Cu. Lithogeochemical sampling by Closs and Colvine (1980a, 1980b) detected enrichments of Al_2O_3 and Sn in the rocks at the prospect.

The Horseshoe Lake, Triangle Lake, and Fly Lake prospects (Figure 3.7, numbers 8, 9 and 10) are hosted by intermediate to felsic tuff, lapilli tuff, and quartz and quartz-feldspar-phyric felsic flows of the Cycle III metavolcanic sequence (Thurston 1985). Sulphide mineralization dominantly consists of disseminated pyrrhotite, pyrite, sphalerite, and chalcopyrite which are also concentrated along thin layers and laminations. The sulphides contain abundant Zn and Ag with lesser amounts of Cu and Pb. The geological setting of mineralization at Horseshoe, Triangle, and Fly lakes is similar to the geology at the South Bay Mine. Alteration zones in the vicinity of Horseshoe Lake are enriched in MgO, B, and Sn and depleted in Na_2O and Ba.

Exploration in the south Confederation Lake area should be focussed on the 3 types of sulphide mineralization recognized in the belt. The metavolcanic–metasedimentary rocks of the belt extend west to the Red Lake greenstone belt and southwest into the Bruce and Pakwash lakes area, providing an extensive area for base metal exploration.

The majority of base metal occurrences and prospects in the south Confederation Lake area have only been explored to average vertical depths of less than 150 m; however, the area may have the potential for hosting deeper massive sulphide deposits. Deep mineral exploration may be required in the south Confederation Lake area to find more significant base metal deposits.

Exploration for base metals at Red Lake should be concentrated within intermediate to felsic metavolcanic rocks in Byshe and Willans townships in the vicinity of the Hermiston–Keg Lake and Fox Farm sulphide occurrences. The metavolcanic rocks in this area have been correlated with lithologies that host the South Bay Mine (Wallace et al. 1986) and may host similar mineralization.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

G.P. Beakhouse commenced 1:15 840 mapping of the portion of the Birch Lake greenstone belt north of the 10th baseline. This includes the Casummit and Mink lakes area (Figure 3.2).

D. Stone continued 1:50 000 scale mapping of the Berens River Subprovince and bordering supracrustal rocks of the Uchi and Sachigo subprovinces. Mapping was completed on the Red Lake and Pipestone Bay map sheets in the south and on Gorman, Varveclay, Favourable, and Whiteloon lakes map sheets in the northern part of the Berens River Subprovince (Figure 3.2).

Table 3.4 list maps and reports pertaining to the Red Lake District issued by the Ontario Geological Survey in 1990.

RESEARCH BY OTHER AGENCIES

R. Stevenson, Geochronology and Paleomagnetism Division of the Geological Survey of Canada, sampled plutonic and supracrustal lithologies from the North Spirit Lake area for Sm/Nd and Rb/Sr isotopic research.

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—— 1968b. Trout lakes area, South Trout Lake sheet, District of Kenora (Patricia portion); Ontario Department of Mines, Preliminary Map P.422, scale 1:15 840.

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4. Sioux Lookout Resident Geologist's District—1990

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INTRODUCTION

The decline in claim staking, mineral exploration and assessment work submitted in the Sioux Lookout Resident Geologist's District, first noted in the second quarter of 1989, continued on into 1990. Accompanying this decline was a shift in the focus of exploration activity from the 3 northern belts to the 2 most southern belts within the district. Exploration activity for the year is given in Table 4.1 and Figure 4.1. Table 4.2 is a summary of claim staking and assessment credits received in 1990 in the Sioux Lookout Resident Geologist's District. Claim staking has dropped somewhat from the levels of 1989 and the amount of reported assessment work has also dropped off slightly. While exploration in general is down from the boom period of 1984 to 1988, exploration still remains well above levels recorded prior to 1981.

The groups conducting exploration in the district have changed over the past 2 years. Before 1989, well over half of the exploration was done by junior exploration companies. Because of the difficulty these companies are having in funding exploration programs, the larger established mining and exploration companies are now responsible for well over 60 percent of the exploration activity within the district. The difficulty in financing grass roots exploration has changed the focus of exploration to the southern areas of the district, where costs are lower. Prospectors have assumed a more significant role in generating new programs due to funding from the Ontario Prospectors Assistance Program.

The mining situation in Sioux Lookout District remains unchanged from 1989. The 2 gold mines continued production in 1990. The Golden Patricia Mine of Bond Gold Canada Inc. has completed a second successful year of production. The Dona Lake Mine of Placer Dome Inc. is also into its second year of production. The Sturgeon Lake camp continues with 1 producing mine, the Lyon Lake Mine of Noranda Inc. The Lyon Lake Mine is sending ore to the Mattabi Mine Limited mill, where it is milled on a periodic basis. Production will continue into 1991.

The Ontario Ministry of Northern Development and Mines has introduced incentive programs for prospectors and junior exploration companies in 1989. These programs have been improved and broadened in the past year and now fund much of the grass roots exploration in the southern portion of the district.

MINING ACTIVITY

As stated above, mining operations were carried out in 3 locations within the Sioux Lookout Resident Geologist's District in 1990. Figure 4.2 gives the locations of the active mines.

In the Sturgeon Lake mining camp, the Lyon Lake Mine, owned by Noranda Inc., is the sole producing mine. The mine produces broken ore which is trucked to the nearby mill of Mattabi Mines Limited. Mattabi Mines Limited is owned by Noranda Inc. (60 percent) and Abitibi–Price (40 percent). The mill runs periodically to produce copper, zinc and lead concentrates using flotation processes.

The Lyon Lake Mine produced 307 286 short tons (dry) in the first 10 months of 1990. The grade of Lyon Lake ore has averaged 8.91% Zn, 1.06% Cu, 1.24% Pb and 4.88 ounces Ag per ton. The mine-mill complex presently employs 230 workers and is working on a two-year operating plan that ends in December 1992 (M. Patterson, Mattabi Mines Ltd., personal communication, November 1990).

The Golden Patricia Mine of Bond Gold Canada Inc. is located near Muskegsagagan Lake approximately 70 km west-southwest of Pickle Lake. Lac Minerals Ltd. now controls Bond Gold Canada Inc. by its 65 percent interest in Bond International Gold Inc. The mine produces gold from a narrow zone accessed by 2 declines approximately 1 km apart. The site has no road access but has its own airstrip. Presently 220 workers are employed of which half are on site at any given time (R. Little, Bond Gold Canada Inc., personal communication, 1990). The mill uses conventional grinding, gravity separation and cyanidation with zinc precipitation to recover gold. The mill presently operates at 350 tonnes per day (tpd) to produce 125 000 tonnes per year. The grade is 20.5 g/t Au and gold recovery is 96 percent. The Golden Patricia Mine is projected to produce 75 000 ounces of gold in 1990. Gold production for 1991 is projected to be 75 620 ounces of gold from 135 000 short (dry) tons at an average

TABLE 4.1. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure 4.1	Individual or Company	Activity
1	007 Precious Metals Inc.	Diamond drilling and geological mapping in the Squaw Lake area.
2	Adam Benderite	Trenching in the Dunne Lake and Hilltop Lake areas.
3	Allan Best	Prospecting and trenching in the Squaw Lake, Vista Lake, Beckington Lake and Evans Lake areas.
4	R. Angrove	Prospecting and trenching in Smye and Jutten townships.
5	Argyle Ventures Inc.	Diamond drilling, prospecting and geological mapping on the Dorothy Lake property in the Meen Lake area.
6	Ken Bernier	Prospecting, trenching, line cutting and geophysical surveys around the Wright–Hargraves occurrence in Drayton Township.
7	BHP–Utah Mines Ltd.	Prospecting and sampling on the McVicar Lake Property in the McVicar Lake area; HL-EM, magnetometer and IP surveys on the Misehkow River property in the Achapi Lake area; geological mapping,, and lithogeochemical sampling in the Evans Lake area.
8	Bond Gold Canada Inc.	Diamond drilling in the August, Caron, Heather, Kawashe, Lowry, Meen, Pashkokogan and Wright Lakes areas, and Matapesatakun Bay area; rock geochemical surveys in the Caley, Drum and Kawashe lakes and Matapesatakun Bay areas; ground magnetometer and electromagnetic surveys in the Duffell, Heather and Wright Lakes areas; air magnetometer and electromagnetic surveys in the Fry, McVicar, Meen, Stoughton, Wesleyan lakes and Zionz River areas.
9	Broda Construction Inc.	Quarrying at the Watcomb Quarry.
10	Chester J. Kuryliw	Diamond drilling on the Neepawa Island and Burnthut Island prospects on Minnitaki Lake.
11	Cominco Ltd.	Diamond drilling in the Cannon Lake area; geological mapping in the Evans Lake area.
12	Cream Silver Mines Ltd.	Hughes-Lang Corporation did an air magnetometer and electromagnetic survey in Tarp Lake area. Cream Silver Mines Ltd. did geological mapping in the Zarn Lake and Sharron Lake areas.
13	Dr. George Wahl	Diamond drilling around King Bay of Sturgeon Lake in the Fourbay Lake area.
14	R. Fairservice	Prospecting around the July Falls occurrence in the Collishaw Lake area.
15	George Gorzynski	Prospecting around Savant Lake.
16	Gossan Resources Inc.	Prospecting in the Armit Lake area.
17	Guinet Management	Diamond drilling around Stillar Bay of Savant Lake in Poisson and Jutten townships.
18	Homestake Mineral Development Co.	Diamond drilling in the Tarp Lake area.
19	Krigold Resources Ltd.	Line cutting and geophysical surveys around McEdwards Lake in the Squaw Lake area.
20	Major General Resources Ltd.	Diamond drilling on the Dorothy Lake property in the Meen Lake area; geochemical survey in First Loon Lake area.
21	Milner Consolidated Silver Mines Ltd.	Line cutting, magnetometer, VLF-EM and HL-EM surveys and stripping around Duffel Lake.
22	Minova Inc.	Diamond drilling in the Beidelman Bay area of Sturgeon Lake and in the Tarp Lake area.
23	Moss–Power Resources Inc..	Diamond drilling in the Keeyask Lake area; geological mapping, prospecting, lithogeochemical sampling and stripping in the Karl Lake and Meen Lake areas.
24	Noramco Explorations Inc.	Diamond drilling around Twinflower Lake in the Parnes Lake area south of Minnitaki Lake.

TABLE 4.1. CONTINUED.

Number on Figure 4.1	Individual or Company	Activity
25	Noranda Exploration Co. Ltd.	Prospecting, geological mapping, lithogeochemical sampling and an IP survey on the Best option in the Squaw Lake area; relogging of drill core and lithogeochemical sampling around the Mattabi Mine.
26	Norman Lee	Line cutting, geophysical surveys, prospecting and trenching around the East Bay gold occurrence in the Squaw Lake area.
27	Placer Dome Inc.	Geological mapping and lithogeochemical sampling on the July Falls property in the Collishaw Lake area and on the Fry Lake property in the Fry Lake area; diamond drilling on the Second Loon Lake property in the First Loon Lake area.
28	Raymond Ramsey	Trenching in the Armit Lake and Grebe Lake areas and in McCubbin Township.
29	J. W. Redden	Trenching in the Kimmiwin Lake area for H. Lundmark.
30	Rio Algom Exploration Inc.	Diamond drilling on the Abitibi area 15 option in the Bell Lake area.
31	Teck Explorations Inc.	Geological mapping, line cutting and geophysics in the Evans Lake area and Boucher Township.
32	Tri Origin Explorations Inc.	Diamond drilling and an IP survey on the Pickerel Arm project in Echo Township and Pickerel Township; ground magnetometer and electromagnetic surveys on the Farrington Lake property in the Watin Lake area.

TABLE 4.2. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total (Man Days)
1974	1 011	3 223	5 659	38 049.0	6 255	102	44 604
1975	1 019	2 489	3 903	38 492.7	18 953	1 858	59 503.7
1976	1 185	1 120	3 958	27 111.0	11 555	185	38 851
1977	1 261	1 320	3 760	17 880.1	13 931	946	32 757.1
1978	2 018	765	5 084	33 371.3	57 501	600	91 472.3
1979	1 012	1 061	5 045	30 869	27 605.4	1 949	60 423.4
1980	3 485	1 391	7 068	42 633	13 524	10 800	66 957
1981	2 861	1 582	8 303	42 588	232 184	4 866	287 626
1982	842	1 766	7 737	35 486	73 486	13 900	167 289
1983	4 398	1 164	10 971	69 563.8	85 536.5	27 730	197 223.1
1984	5 009	4 074	10 625	42 425	113 830	24 941.1	205 214.64
1985	2 513	3 972	9 166	92 051	148 105	10 376	294 891
1986	7 815	3 046	13 935	109 952.4	263 118.4	29 245.4	429 481.5
1987	5 540	1 918	18 786	255 334.04	345 747.6	49 750	691 581.8
1988	2 400	2 424	18 855	179 235.2	279 066.4	66 973.3	556 154.7
1989*	1 558	4 192	16 646	190 775	77 070	46 485	344 610
1990**	2 047	5 778	12 915	129 271	53 010	6 299	199 335

* Revised totals for 1989 year end ** Totals to the end of November 1990

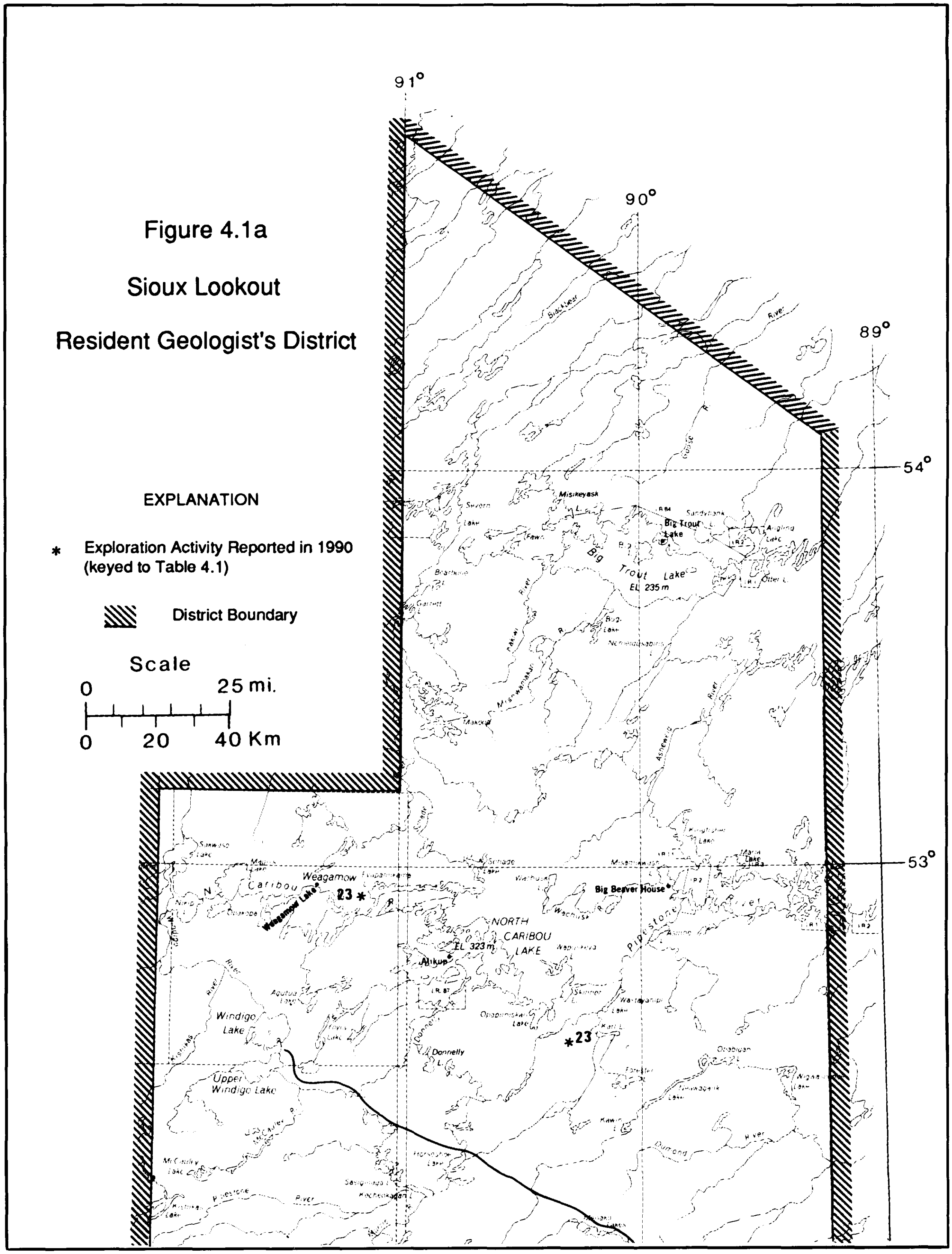

Figure 4.1a
Sioux Lookout
Resident Geologist's District

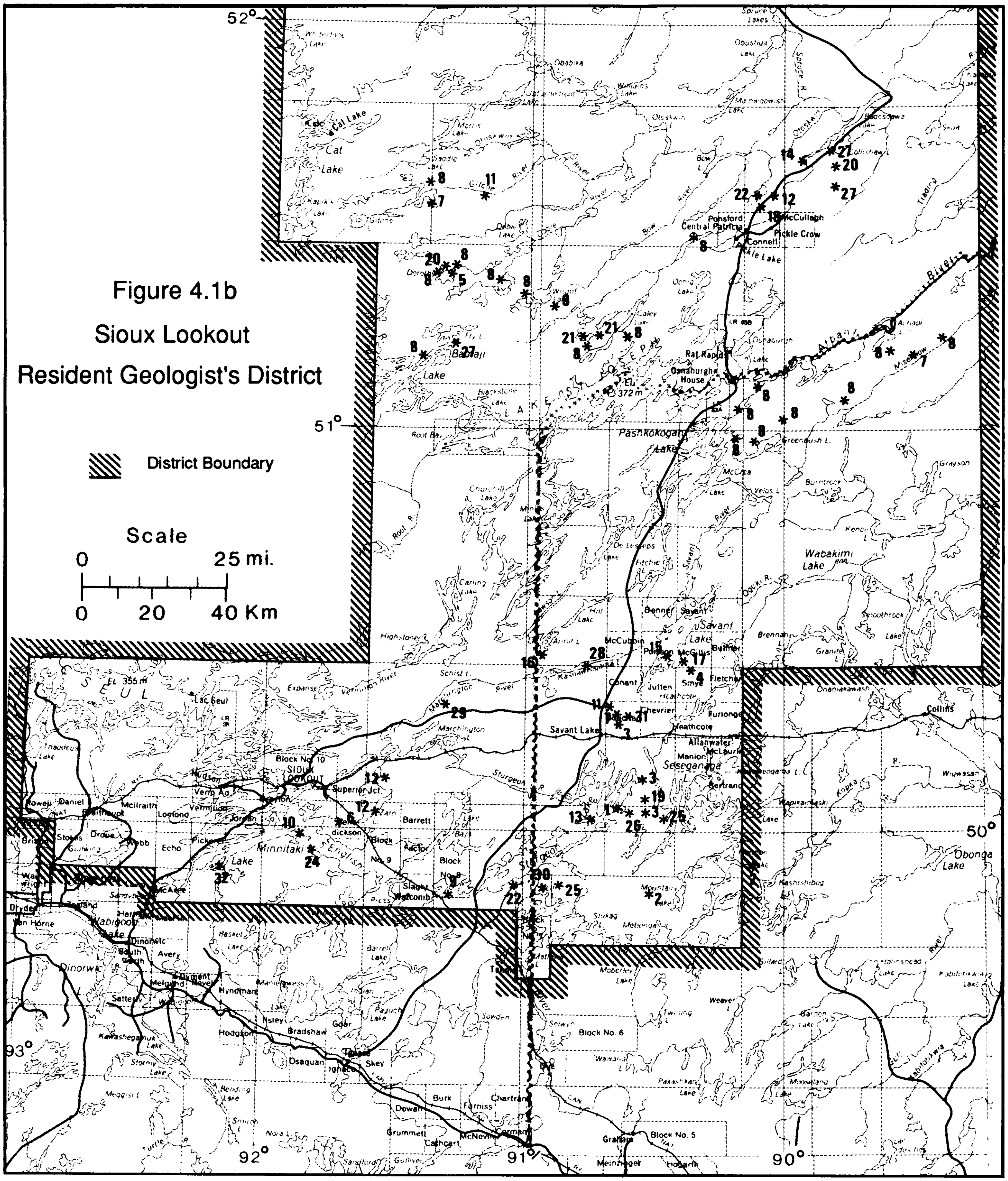
Figure 4.1b
Sioux Lookout
Resident Geologist's District
District Boundary
Scale
0 25 mi.
0 20 40 Km
52°
51°
50°
93°
92°
91°
90°
Cat Lake
Pickle Crow
Central Patricia
Pashkokogan Lake
Savant Lake
Savant Lake
Sturgeon R.
Sioux Lookout
Superior Jct.
Minnitaki Lake
Dinorwic
Wabakimi Lake
Obonga Lake
Collins
Graham
Block No. 5
Block No. 6
Ignace
Osaquan
Bradshaw
Hodgson
Sesegananga
Lac Seul
Lake St. Joseph
Albany River
Block No. 10
Barrett
Echo
Drope
Daniel
McIlraith
Lomond

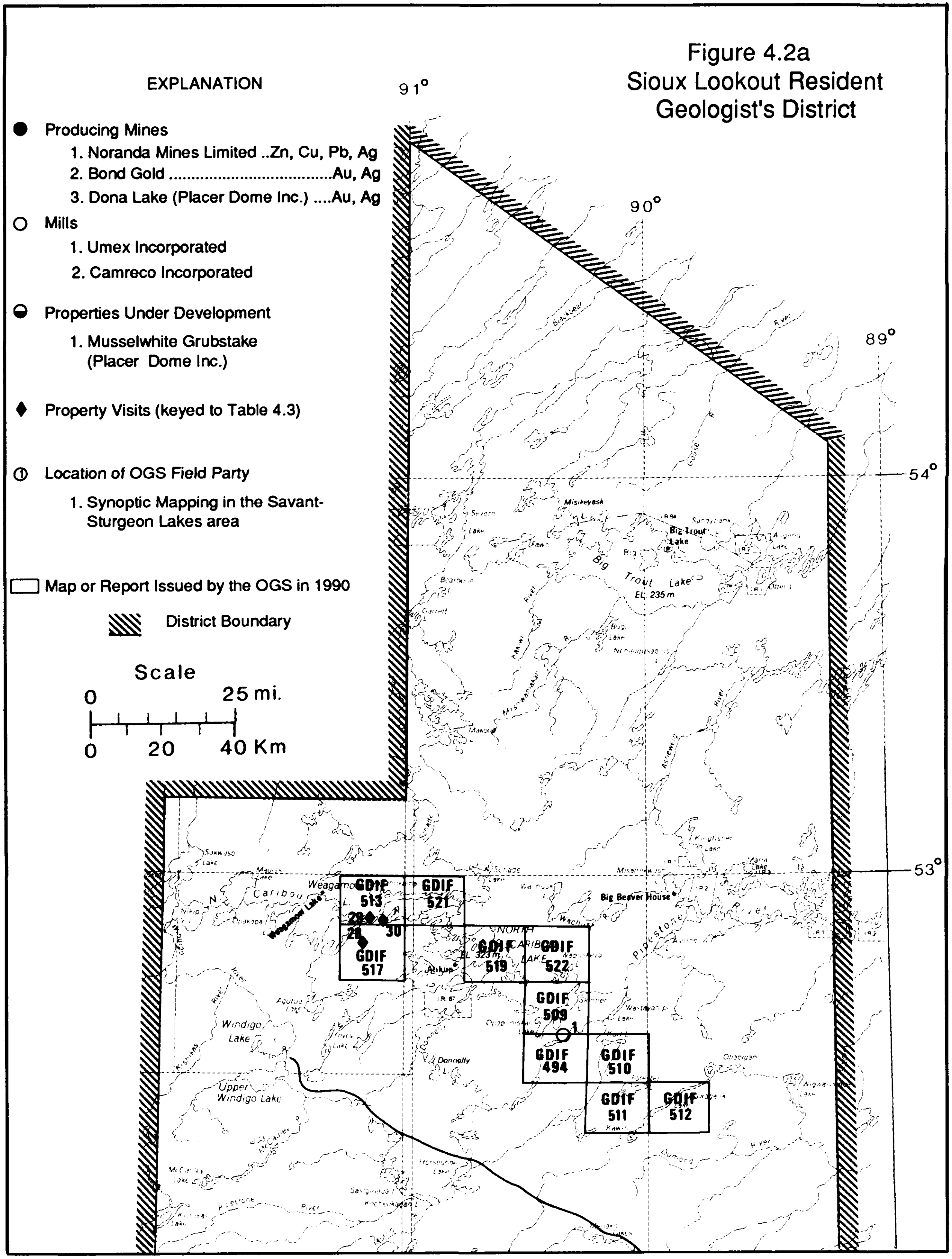
Figure 4.2a
Sioux Lookout Resident Geologist's District
EXPLANATION
Producing Mines
1. Noranda Mines Limited ..Zn, Cu, Pb, Ag
2. Bond Gold ....Au, Ag
3. Dona Lake (Placer Dome Inc.) ....Au, Ag
Mills
1. Umex Incorporated
2. Camreco Incorporated
Properties Under Development
1. Musselwhite Grubstake (Placer Dome Inc.)
Property Visits (keyed to Table 4.3)
Location of OGS Field Party
1. Synoptic Mapping in the Savant-Sturgeon Lakes area
Map or Report Issued by the OGS in 1990
District Boundary
Scale
0 25 mi.
0 20 40 Km
91°
90°
89°
54°
53°
Big Trout Lake
EL 235m
Big Beaver House
Weagamow Lake
Caribou
NORTH CARIBOU LAKE
Windigo Lake
Upper Windigo Lake
Donnelly L.
GDIF 513
GDIF 521
GDIF 517
GDIF 519
GDIF 522
GDIF 509
GDIF 494
GDIF 510
GDIF 511
GDIF 512
29
28
30
1

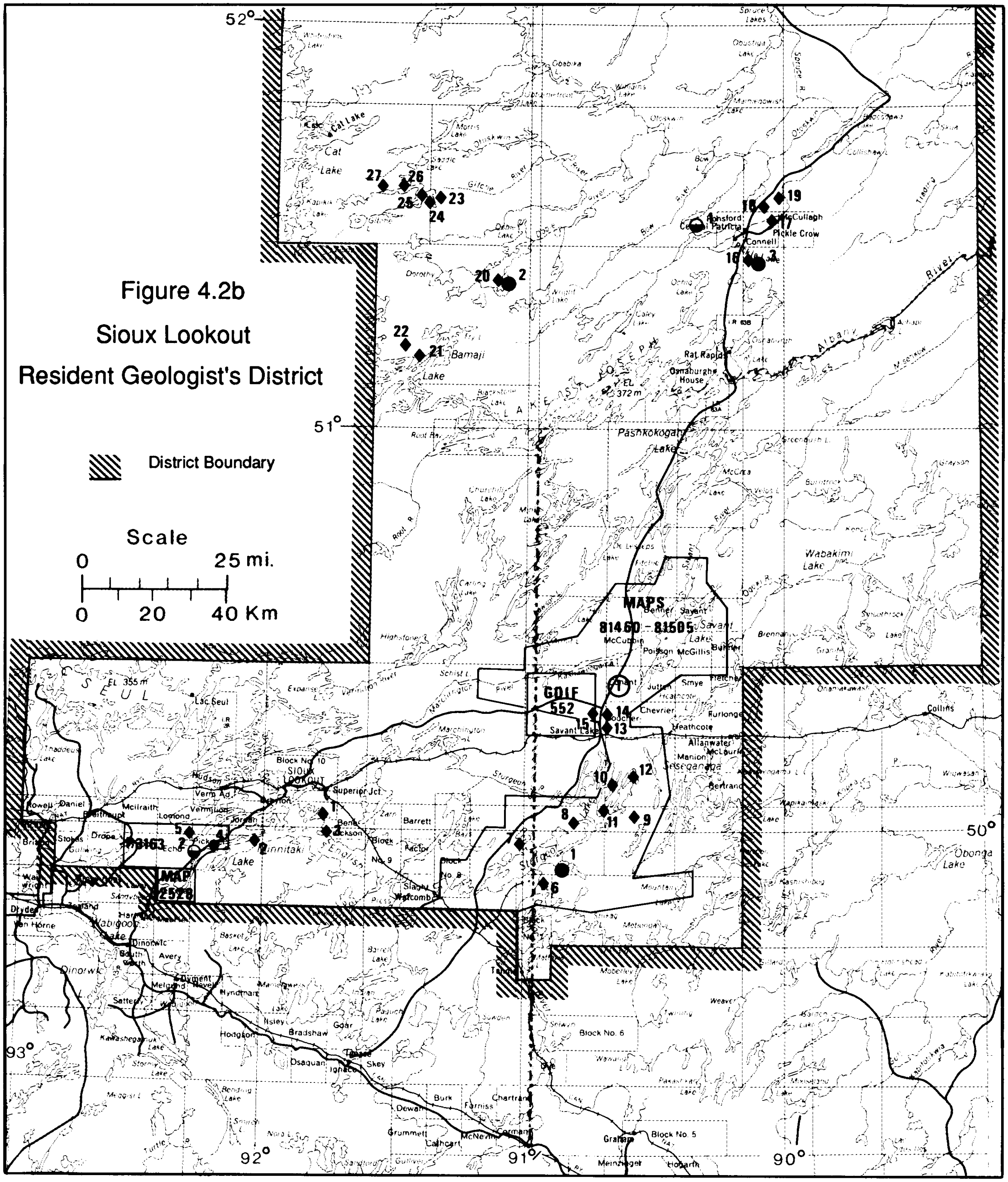
Figure 4.2b
Sioux Lookout
Resident Geologist's District
District Boundary
Scale
0
25 mi.
0
20
40 Km
52°
51°
50°
93°
92°
91°
90°
Cat Lake
Bamaji Lake
Pickle Crow
Savant Lake
Sioux Lookout
Lac Seul
Lake St. Joseph
Pashkokogan Lake
Wabakimi Lake
Osnaburgh House
Albany River
Obonga Lake
MAPS 81460 - 81505
GOLF 552
MAP 2528
Dryden
Wabigoon Lake
Dinorwic
Ignace
Block No. 6
Block No. 5

TABLE 4.3. LIST OF PROPERTY EXAMINATIONS DURING THE YEAR.

1.	Wright Hargreaves Occurrence
2.	Tak Occurrence
3.	Whalen Occurrence
4.	Tri Origin's Pickerel Arm Property
5.	Crossecho Lake Graphite Property
6.	Mattabi Mine–Lyon Lake Mine
7.	Cobb Bay JRJ Occurrence
8.	Wahlex King Bay Property
9.	Noranda Best Option
10.	St. Anthony Mine Site
11.	007 Precious Metals Sturgeon Lake Properties
12.	Northern Lights Occurrence
13.	Mr. Art Mousseau's Savant Lake Property
14.	N-H (Near Hadley) Occurrence
15.	Sabin Occurrence
16.	Dona Lake Mine
17.	Pickle Crow Mine Site
18.	Mitchell Occurrence
19.	Metcalfe Occurrence
20.	Golden Patricia Mine
21.	Bamaji Lake Gold-Uranium Occurrence, Showings 1 and 2
22.	FTM Gold Occurrence
23.	Altered Zone Gold Occurrence
24.	Hoey Syndicate Cu-Ni Occurrence
25.	BHP–Utah Mines Ltd. McVicar Lake Property, Showing No.8
26.	Lang Lake–Belore Cu-Zn Occurrence
27.	Nose Lake Occurrence
28.	Teal Occurrence
29.	Pyrotex Occurrence
30.	Centre Lake Occurrence

grade of 0.59 ounce Au per ton (J. Ackert, Bond Gold Canada Inc., personal communication, 1990).

Exploration and development is continuing at the mine. At present, drilling beneath the developed ore reserves is under way to establish the presence of additional ore to support sinking a shaft. The mine is testing backfill methods using mine waste. Bond Gold Canada Inc. is continuing exploration to find and develop additional gold deposits on the large property surrounding the mine.

The Dona Lake Mine of Placer Dome Inc. is located 12 km southeast of the town of Pickle Lake. The Dona Lake deposit is unusual in that gold is found in highly deformed, sulphide replaced banded iron formation. The mine is a 550 tpd underground operation accessed by a 235 m shaft. The mill uses semiautogenous grinding, a flotation circuit followed by cyanidation with gold recovery by carbon-in-pulp and electrotwinning. Published reserves as of December 31, 1989 were 500 000 tons proven and probable at 0.31 ounce Au per ton (*Canadian Mines Handbook*, 1990-91, Northern Miner Press Inc., p.361). The Dona Lake Mine is projected to produce 41 790 ounces of gold in 1990 (D. Drake, Placer Dome Inc., personal communication, 1990).

ADVANCED EXPLORATION AND DEVELOPMENT

One project falls into this classification within the Sioux Lookout Resident Geologist's District. It is the Musselwhite Grubstake project on Opapimiskan Lake. Placer Dome Inc., operator of the project, announced that development of a mine on the East Bay zones was being shelved as of December 1989. Lack of infrastructure and the high cost of supplying electrical power to the site were cited as the main reasons for not proceeding with development. The East Bay zones host geological reserves of 7.4 million tons grading 0.20 ounce Au per ton (*The Northern Miner*, December 25, 1990, p.1).

EXPLORATION ACTIVITY

The level of exploration activity in the Sioux Lookout Resident Geologist's District continued to decline in 1990. This decline started in the second quarter of 1989. There was no activity in the Big Trout Lake area and only 3 exploration programs were noted in the North Caribou Lake greenstone belt. Exploration activity in the Central Uchi greenstone belt was, once again, focussed on the search for gold. Several exploration companies examined the base metal potential of the Savant Lake–Sturgeon Lake greenstone belt.

Highlights of the year include:

Major General Resources Ltd. acquired all of the Umex Inc.'s exploration properties outside the area of the Thierry Mine at Pickle Lake early in the year. Major General Resources announced a drill-indicated reserve of 284 000 tons grading 0.179 ounce Au per ton for the main zone on the Dorothy Lake property located 14 km west of the Golden Patricia Mine (*George Cross News Letter*, January 22, 1990). This figure was revised in June to a geological reserve of 240 000 tons grading 0.18 ounce Au per ton (*George Cross News Letter*, June 6, 1990, p.3; *The Northern Miner*, June 11, 1990, p.13).

Bond Gold Canada Inc. made a new discovery on their ground near the Dobie River in July (*Vancouver STOCKWATCH*, July 5, 1990). They have tested the new zone, called the Tonsil Lake deposit, with 12 diamond-drill holes (*The Northern Miner*, October 15, 1990).

Also in July, Etruscan Enterprises Ltd. reached an agreement in principle to acquire Umex Inc. Thierry Mine and surrounding properties. With a reserve of 7 000 000 tonnes averaging 1.88% Cu and 0.23% Ni remaining in the Thierry deposit and large low-grade tonnages in 3 other deposits, Etruscan Enterprises Ltd. has engaged a consultant to examine the viability and cost of recommencing operation (*Vancouver STOCKWATCH*, July 12, 1990).

In September, Consolidated Gold Hawk Resources Inc. entered into a joint venture with Minnova Inc. on their Tarp Lake property. They announced a new gold zone with a best intersection of 0.21 ounce Au per ton over 15 feet (Consolidated Gold Hawk Resources Ltd., news release dated September 18, 1990).

COMPANY ACTIVITIES BY AREA

North Caribou Lake Area

Moss–Power Resources Inc. completed a diamond drilling program on the Keeyask Lake property, west of Eyapamikama Lake, in January and February 1990. The plan at the commencement of the operation was to drill 2500 feet in 5 holes to test an iron formation and adjacent magnetic high in mafic metavolcanics (H. Hodge, Moss–Power Resources Inc., personal communication, 1990). The results of this program were not published.

Moss–Power Resources Inc. performed geological mapping, prospecting, lithogeochemical sampling and overburden stripping on the Norman Lake property, east of the Pipestone River in the North Caribou Lake greenstone belt during the summer months. Rocks with anomalous gold contents were discovered (H. Hodge, Moss–Power Resources Inc., written communication, 1990).

The third company working in the North Caribou Lake area wished to have their name and details withheld.

McVicar Lake Area

BHP–Utah Mines Ltd. continued to prospect and sample on its McVicar Lake claim block (R. Thomas, BHP–Utah Mines Ltd., written communication, 1990). The Altered Zone gold occurrence discussed later in this report is part of this property.

Bond Gold Canada Inc. reported an airborne magnetometer and electromagnetic survey over the McVicar Lake area where they staked approximately 800 claims (de Carle 1990).

Cominco Ltd. conducted a 4 hole diamond drilling program on their Cannon Lake property that totalled 406 m (M. Smith, Cominco Ltd., personal communication, 1990).

Meen–Dempster Lakes Area

Bond Gold Canada Inc. continued to explore their massive holdings in the Meen–Dempster lakes and Pickle Lake areas. The work consisted of diamond drilling on several targets, ground geophysical surveys and rock geochemical surveys. Significant results include the discovery of the Tonsil Lake deposit, located about 12 km west of the Golden Patricia Mine site and several intersections on the Magpy option which was optioned from Moss–Power Resources Inc. and is located northwest of Dorothy Lake. The best intersection from the Magpy option is 0.32 ounce Au per ton over 5.9 feet (H. Hodge, Moss–Power Resources Inc., written communication, 1990).

Moss–Power Resources Inc. completed a $50 000 program of geological mapping, prospecting, lithogeochemical sampling and stripping on their Dorothy Lake property immediately east of the Magpy option (H. Hodge, Moss–Power Resources Inc., written communication, 1990).

Argyle Ventures Inc. did a 6 hole diamond drilling program totalling 685 m on a 36 claim property that touches on the north shore of Dorothy Lake. Low, but anomalous gold values were intersected. Argyle Ventures Inc. followed up on the drill results by doing additional geological mapping and prospecting in the fall of 1990 (D. Lowrie, Argyle Ventures Inc., written communication, 1990).

Major General Resources Ltd. continued the testing of the Dorothy Lake deposit with a 7 hole, 2150 m diamond drilling program. The 7 drill holes tested the 700 m long main zone over a 550 m strike length at a depth about 100 m beneath previous drilling (actual depth is estimated at 250 m). The main zone is associated with strongly sheared, sulphidic zones within a diorite sill. Gold mineralization was intersected in 6 of the 7 drill holes. Drill hole number 43 encountered a new, subparallel, 0.5 m wide zone containing visible gold that assayed 13.8 ounce Au per ton. Major General Resources Ltd. conducted detailed line cutting and a multifrequency electromagnetic survey over the southeastern block of the Dorothy Lake property near Bond Gold Canada Inc.'s Tonsil Lake discovery (*Vancouver STOCKWATCH*, August 22, 1990).

Milner Consolidated Silver Mines Ltd. conducted 2 exploration programs on properties around Duffel Lake. The first program consisted of line cutting, magnetometer, very low frequency electromagnetic (VLF-EM) and horizontal loop electromagnetic (HL-EM) surveys at the east end of Duffel Lake. The other program consisted of stripping overburden over geophysical anomalies along the south shore of Duffel Lake (E. Bazinet, consulting geologist, personal communication, 1990).

Bamaji–Fry Lakes Area

Bond Gold Canada Inc. reported an airborne magnetometer and electromagnetic survey over the Bamaji–Fry lakes area (de Carle 1990).

Placer Dome Inc. did a geological mapping and lithogeochemical sampling program on their 33 claim property in the Fry Lake area. The geological mapping revealed a 50 m wide, east-trending shear zone on the property. The shear zone is hosted by intermediate to mafic metavolcanics which are cut by several felsic dikes and stocks (P. Brown, Placer Dome Inc., personal communication, 1990).

Pickle Lake Area

Minnova Inc. did a 4 hole diamond drilling program that totalled 760 m on their Tarp Lake property. The target was a silicified, pyrite-rich, quartz-chlorite-carbonate schist within the Tarp Lake deformation zone. One drill hole intersected 15 feet of mineralization grading 0.211 ounce Au per ton. Consolidated Gold Hawk Resources Inc. entered into a joint venture on the property in September 1990. Additional drilling and an induced polarization (IP) survey are planned for late 1990 or early 1991 (P. Lewis, Minnova Inc., written communication, 1990).

Placer Dome Inc. explored 2 properties northeast of Pickle Lake. A 6 hole, 971.8 m diamond drilling program was completed early in 1990 on the Second Loon Lake property. The drill program tested 2 iron formations for gold-bearing zones. On the July Falls property, Placer Dome Inc. did a geological mapping and lithogeochemical sampling program (P. Brown, Placer Dome Inc., written communication, 1990).

Homestake Mineral Development Company completed a 6 hole, 886.8 m diamond drilling program in their Crow property in the Tarp Lake area. An additional 8 hole, 1120 m diamond drilling program was in progress at the time of writing (D. McIvor, Homestake Mineral Development Co., written communication, 1990).

Pashkokogan Lake–Misehkow River Area

Bond Gold Canada Inc. holds several smaller properties in the Pashkokogan Lake–Misehkow River area which they lump into the Webb Lake project. In 1990, geological, HL-EM and magnetometer surveys were done on the properties. A 14 hole, 1514 m diamond drilling program was completed on the Webb Lake project (J. Calder, Bond Gold Canada Inc., written communication, 1990). BHP–Utah Mines Ltd. completed HL-EM, magnetometer and IP surveys on their Misehkow River property (R. Thomas, BHP–Utah Mines Ltd., written communication, 1990).

Savant Lake Area

BHP–Utah Mines Ltd. performed semidetailed geological mapping and lithogeochemical sampling on their Evans Lake claims and the surrounding area (R. Thomas, BHP–Utah Mines Ltd., written communication, 1990).

Teck Explorations Ltd. conducted line cutting, geological mapping and geophysical surveys on their claims in the Evans Lake area and Boucher Township (K. Thorsen, Teck Explorations Ltd., written communication, 1990).

Gossan Resources Ltd. staked ground in the Armit Lake area and did prospecting and geological mapping on the claims. J. Campbell (Gossan Resources Ltd., personal communication, 1990) reported finding chemical metasediments in an interesting structural setting.

R. Ramsay completed a program of trenching on property in the Armit Lake and Grebe Lake areas and McCubbin Township.

Guinet Management supervised a diamond drilling program around Stillar Bay on Savant Lake.

Tri Origin Explorations Ltd. did magnetometer and electromagnetic surveys on their Farrington Lake property in the Watin Lake area.

B. Valiant (Tri Origin Explorations Ltd., personal communication, 1990) reports finding a sulphide zone on the property.

Sturgeon Lake Area

007 Precious Metals Inc. did a 5 hole, 2000-foot diamond drilling program on their Sturgeon Lake property in the Squaw Lake area. One hole, testing the Johnson showing, intersected 0.75 ounce Au per ton over 5.5 feet. In July 1990, Iskut Gold Corporation entered into a joint venture on part of 007 Precious Metals Inc.'s holdings in the Sturgeon Lake area. Further work is planned (R. Mitterer, 007 Precious Metals Inc., personal communication, 1990; R. Bernatchez, consulting geologist, personal communication, 1990).

Wahlex Ltd. conducted a diamond drilling program on the south shore of King Bay on Sturgeon Lake. The drill program was designed to test for fault splays trending northeast, off the main east-trending fault direction, within King Bay (G. Wahl, Wahlex Ltd; personal communication, 1990). Krigold Resources Ltd. continued to explore their McEdwards Lake property, east of Sturgeon Lake. Additional line cutting and an electromagnetic survey was conducted (P. Sarkar, Krigold Resources Ltd., personal communication, 1990).

Noranda Exploration Company Ltd. optioned several claims from A. Best, east of the East Bay of Sturgeon Lake in the Squaw Lake area. A. Best had rediscovered gold mineralization on his claims and Noranda has conducted prospecting, geological mapping, lithogeochemical sampling and an IP survey on the claims. In November 1990, Noranda completed a trenching program on the property (W. Reid and A. Smith, Noranda Exploration Company Ltd., personal communication, 1990).

Noranda Exploration Company Ltd. also conducted a program of lithogeochemical sampling and relogging of drill core around the Mattabi Mine (W. Reid, Noranda Exploration Company Ltd., written communication, 1990).

Minnova Inc. conducted an 8 hole, 2828 m diamond drilling program on their West Sturgeon Lake project, which was centred around Beidelman Bay of Sturgeon Lake. Previous work had encountered sulphide stringer mineralization in an altered, quartz-porphyritic rhyolite. This program was designed to further evaluate EM-37 anomalies associated with the sulphide mineralization (P. Lewis, Minnova Inc., written communication, 1990).

Rio Algom Exploration Inc. optioned the Abitibi "Area 15" ground, within Block 7, west of the Mattabi Mine. The previous diamond-drill core was relogged over the summer months. A 3000 m diamond-drill program was started in November to test the Mattabi horizon at depth across the property (I. Downie, Rio Algom Exploration Inc., personal communication, 1990).

Sioux Lookout Area

Cream Silver Mines Ltd. contracted W.C. Hood Geological Consulting to review past exploration and to examine the gold occurrences on their property in the Split Lake area east of the town of Sioux Lookout (W.C. Hood, consulting geologist, personal communication, 1990).

Noramco Explorations Inc. did a 5 hole, 601 m diamond drilling program on their Twinflower Lake property, south of the town of Sioux Lookout (D. Laderoute, Noramco Explorations Inc., personal communication, 1990). The property straddles the contact between the Minnitaki Group metasediments and the Southern Metavolcanic belt.

Tri Origin Exploration Ltd. carried out an IP survey over their Pickerel Arm property at Minnitaki Lake. This was followed by a 3 hole diamond drilling program that totalled 565 m. The drilling intersected interesting stratigraphy, but samples returned only low gold values (B. Valliant, Tri Origin Exploration Ltd., personal communication, 1990).

PROSPECTOR ACTIVITY

Several prospectors worked in the Sioux Lookout Resident Geologist's District in 1990. Most concentrated on prospecting for and advancing gold occurrences in the Savant Lake and Sturgeon Lake areas. A few prospected in the Sioux Lookout area and several worked at base metal prospects.

Sixteen prospectors in the district received Ontario Prospectors Assistance Program (OPAP) grants to assist them in their work. The OPAP funding has helped 2 of the prospectors to option 2 properties, and other prospectors have reported having exploration companies interested in their prospects. For reasons of confidentiality, the authors are not able to provide more detailed information on prospector activity than is included in Table 4.1.

GEOLOGICAL DATA INVENTORY FOLIO PROGRAM

In 1990, 4 Geological Data Inventory Folios (GDIFs) were completed for areas in the Sioux Lookout Resident Geologist's District. These were done over a four-month period by a contract technician. At year end, there were a total of 59 GDIFs for areas in the Sioux Lookout Resident Geologist's District (Table 4.4). Four of these and an updated version of the Dona Lake area GDIF are "in press". An updated version of the Kawashe Lake GDIF is in manuscript form.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The Sioux Lookout Resident Geologist's Office is presently staffed by D.A. Janes, Resident Geologist and G.W. Seim, Staff Geologist. M. Roy is the Geological Secretary. During the year, C. Proctor completed a four-year compilation project for Geological Data Inventory Folios for the district. K. Carroll assisted the Staff Geologist in the field.

G.W. Seim completed the third year of a property and prospect examination program for the Central Uchi and North Caribou Lake greenstone belts. Many of the prospects were discovered during the past 6 years and are located in remote areas without road access.

D. Janes continued an evaluation of mineral deposits in the Wabigoon Subprovince portion of the district. All active mines within the district were visited at least once. Several visits were made to the Ontario Geological Survey field crew in the area and a joint field trip with industry was held at the end of the field season. G.W. Seim, assisted by the Resident Geologist and other Ministry of Northern Development and Mines staff, conducted an 18 hour long intermediate level prospecting course. This course was held in Sioux Lookout over 6 weeks in the spring of 1990. D. Janes contributed to the Weekend Events program at Sandbar Provincial Park in Ignace. Staff of the office conducted 30 property examinations during the year. A number of other visits to properties, mainly in the Wabigoon and Central Uchi volcanic belts, were done to examine additional exploration done and to assess potential hazards on the properties.

During the first 11 months of 1990, 375 consultations with industry personnel took place in the office. An additional 680 telephone requests for assistance were received and answered.

M. Roy and other staff have spent a considerable amount of time upgrading exploration and mineral deposit files for input into the various Geological Exploration Databases (GED). In particular M. Roy did an exceptional job in collating and organizing the Historical Mineral Deposit Files for GED input. Due largely to her efforts, the contracted task of

TABLE 4.4. LIST OF GEOLOGICAL DATA INVENTORY FOLIOS.

Area	NTS Area	GDIF No.	Area	NTS Area	GDIF No.
ACHAPI LAKE	52P/04NE	212	KEEYASK LAKE	53B/14NE	513
AKOW LAKE	53B/16SW	522	LITTLE OCHIG LAKE	52O/08SW	278
ARMIT LAKE	52J/07NW	IN PRESS	LOWRY LAKE	52P/04SW	215
ATIKOKIWAM LAKE	52P/04NW	211	MATAPESATAKUN BAY	52O/02NE	339
AUGUST LAKE	52P/04SE	216	MCAREE TOWNSHIP	52F/16SW	219
BAGGY LAKE	52O/12NE	362	MCVICAR LAKE	52O/11SW	365
BECKINGTON LAKE	52J/02NE	355	MEEN LAKE	52O/06NW	371
BELL LAKE	52G/15SW	438	NABEMAKOSEKA LAKE	52O/06SW	372
CALEY LAKE	52O/07SE	326	NEAWAGANK LAKE	53A/05NW	512
CARON LAKE	52O/01SE	214	NORTH CARIBOU LAKE	53B/15SE	519
COLLISHAW LAKE	52P/12NW	430	OSNABURGH LAKE	52O/01NE	210
COUCHEEMOSKOG LAKE	52O/08SE	276	PASHKOKOGAN LAKE	52J/16NW	217
DONA LAKE	52O/08NE	279	PENASSI LAKE	52G/14NE	465
		(UPDATED/IN PRESS)	PONSFORD LAKE	52O/09SW	274
DRUM LAKE	52O/03NE	337	PRESS LAKE	52G/14SW	455
DUFFELL LAKE	52O/02NW	338	QUEST LAKE	52G/15NE	384
ECHO TOWNSHIP	52F/16SW	318	RANDALL LAKE	52O/01SW	213
ERICHSEN LAKE	53B/15NE	IN PRESS	SADDLE LAKE	52O/11NW	363
EVANS LAKE	52J/07SE	IN PRESS	SEESEEP LAKE	53B/15NW	521
FIRST LOON LAKE	52P/12SW	431	SHARRON LAKE	52J/04NE	481
FORESTER LAKE	53B/08NE	511	SIXMILE LAKE	52G/15NW	328
FOURBAY LAKE	52J/02SW	348	SKINNER LAKE	53B/09NW	509
FRY LAKE	52O/03NW	373	SMOCK LAKE	52G/13NE	319
GREBE LAKE AND	52J/07NE	IN PRESS	SQUAW LAKE	52J/02SE	327
MCCUBBIN TP.			STOUGHTON LAKE	52O/12SE	364
GREENBUSH LAKE	52J/16NE	218	TARP LAKE	51O/09SE	275
HOUGHTON LAKE	52J/07SW	552	VALORA LAKE	52G/14SE	439
JOHNSTON BAY	52O/03SE	374	WRIGHT LAKE	52O/07SW	325
KAPKICHI LAKE	52O/08NW	277	ZARN LAKE	52J/04SE	475
KARL LAKE	53B/09SE	510	ZEEMEL LAKE	53B/09SW	494
KAWASHE LAKE	52O/06SE	324 (UPDATED)			

building the GED started up in October of this year and is on schedule.

PROPERTY EXAMINATIONS

THE PYROTEX OCCURRENCE

Location and Access

The Pyrotex occurrence is located on the southeast shore of the northern part of Agutua Arm of Weagamow Lake approximately 160 km north-northwest of Pickle Lake (Figure 4.3). Summer access to the Pyrotex occurrence is either by float plane or boat from the settlement on the Weagamow Indian Reserve (No. 87). During winter, access may also be gained via a diamond-drill site access trail that joins the Weagamow winter road.

Exploration History

Prior to 1966, an unknown party discovered and performed limited work on sulphide-bearing quartz veins in sheared mafic metavolcanics located along the southeast shore of the northern part of Agutua arm of Weagamow Lake (*Canadian Mines Handbook*, 1967–1968, p.275).

Pyrotex Mining and Exploration Company Ltd. staked 12 claims on the showing in 1966 and did a surface exploration program consisting of trenching and 4 diamond-drill holes totalling 264 m in 1967 (Tyson 1967). Pyrotex Mining and Exploration Company Ltd. did not report assays from this property.

In 1984, 428226 Ontario Limited staked 15 claims to cover the Pyrotex occurrence. Moss Resources Ltd. subsequently optioned the 15 claims and staked 12 additional

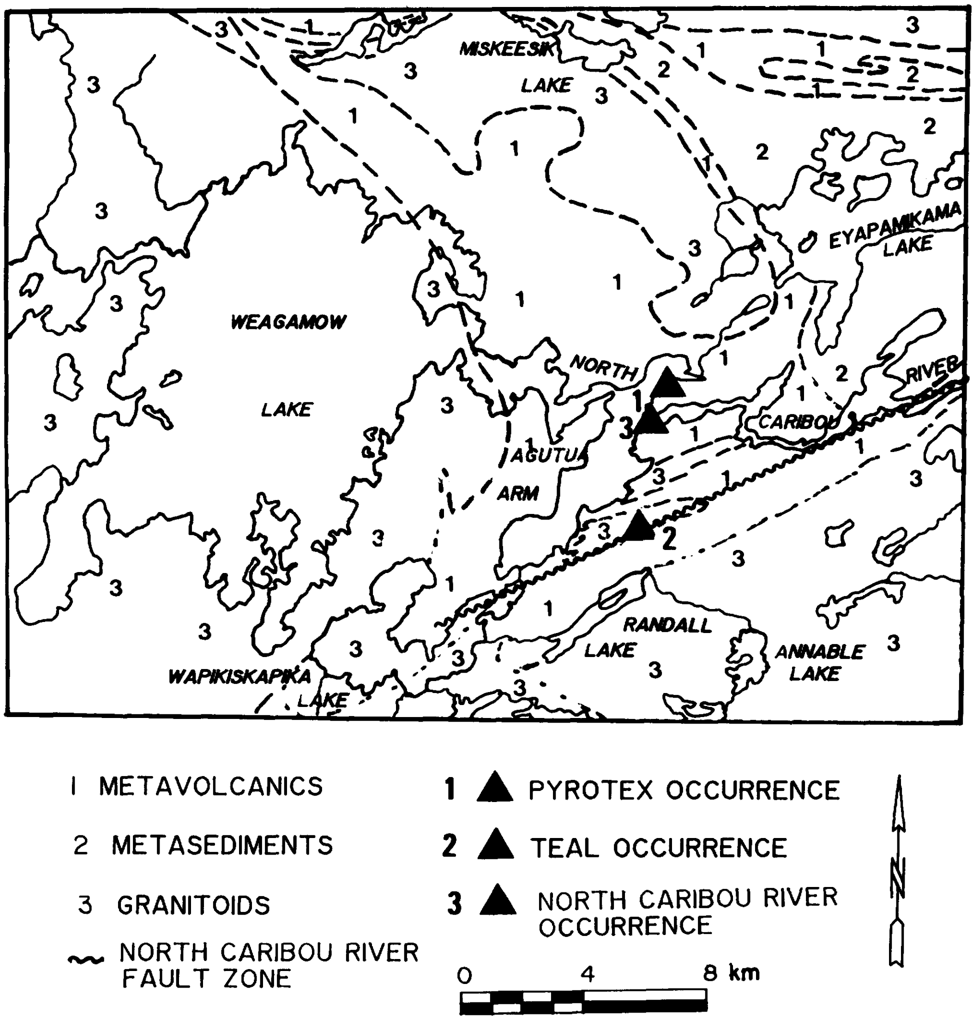

Figure 4.3. Location map for the Pyrotex and Teal occurrences.

claims in 1985 to cover the North Caribou River occurrence (Figure 4.3). The same year Moss Resources Ltd. contracted Geocanex Ltd. to do an exploration program consisting of line cutting, magnetometer and VLF-EM surveys, geological mapping, rock and soil sampling, trenching and prospecting (North 1985).

In 1986, Oracle Resources Ltd. entered into a joint venture on the 27 claim property. A 14 hole diamond drilling program totalling 1146.3 m started in December 1986 and ended in February 1987. Drill hole AG-86-3 tested on strike of the Pyrotex occurrence. The hole intersected a quartz-sulphide vein that graded 0.205 ounce Au per ton over 1.0 feet. Drill hole AG-87-6 was collared approximately 150 m north of the North Caribou River on claim 823399. This drill hole intersected a zone of quartz-carbonate stringers in intermediate metavolcanics. The quartz-carbonate stringer zone contained traces of pyrrhotite and chalcopyrite. The zone assayed 50.01 ounces Ag per ton over 3 feet (Elliott 1987).

No work has been recorded on the property since 1987.

Regional and Local Geology

The Pyrotex occurrence is located at the northwestern end of the North Caribou Lake greenstone belt. Satterly (1939) mapped this greenstone belt for the Ontario Department of Mines in 1938 at a scale of 1:63 360. The greenstone belt was remapped in 1971 at a reconnaissance scale by Thurston et al. (1979). The northwestern end of the North Caribou greenstone belt was mapped in 1984 at a scale of 1:31 680 by Bartlett et al. (1985).

The North Caribou Lake greenstone belt is structurally a large synclinorium with a rim of mafic metavolcanics and a core of clastic metasediments. A unit of iron formation and/or chemical metasediments is commonly found along the contact of the metavolcanics with the metasediments (Bartlett et al. 1985).

The area surrounding the Pyrotex occurrence is underlain by a succession of mafic to intermediate metavolcanics with local lenses of felsic metavolcanics. The metavolcanics are locally cut by biotite trondhjemite and mafic dikes (Piroshco et al.1989). Mapping by North (1985) and magnetometer surveys over the area indicate that the metavolcanic units strike east and dip from 20° to 80° south.

Property Examination

The Pyrotex occurrence is located on the southeast shore at the northeast end of Agutua Arm of Weagamow Lake. The occurrence is hosted by massive, intermediate to mafic metavolcanics. *En échelon* quartz-arsenopyrite-pyrite (quartz- sulphide) veins occur in a zone of iron carbonate altered mafic metavolcanics that is at least 5 m wide (Figure 4.4). Samples of the quartz-sulphide vein material yield high gold and silver assay values.

The main quartz-sulphide vein, which is found near the centre of the altered zone, is traceable in outcrop and trenches for approximately 27 m. This vein averages 30 cm in width. Coarse crystals of arsenopyrite, pyrite and chalcopyrite occur in stringers and pods within the vein. These sulphides locally compose up to 50 percent of the vein. The wall rock to the vein is highly sheared, carbonatized, silicified and weakly mineralized with fine disseminated sulphide crystals. Both the wall rock and the vein yield gold values where they contain sulphides. The shearing strikes 090° and dips 82° south.

At the west end of the trenches that expose the main vein, are 2 smaller quartz-sulphide veins. They are 2 and 3 m north of the main vein. Both veins occupy open z-shaped structures within more intense zones of shearing parallel to that which hosts the main vein. The northern vein averages 10 cm in width and can be traced for approximately 6 m. The other vein is less than 2 m in length and 10 cm in width. Both veins pinch out to the east.

Approximately 12 m south of the main vein, and subparallel to it, is a second intensely sheared zone. This zone is filled with ankerite and is only locally anomalous in gold. Surrounding the ankerite-filled shear zone is a broader zone of iron carbonate alteration.

A narrow, flat quartz vein is exposed on a near-vertical rock face at the shoreline of Agutua Arm. This vein has a maximum thickness of 10 cm and contains 1 percent pyrite. There is a 15 cm iron carbonate alteration zone around the flat quartz vein.

The second author took 16 grab samples from the Pyrotex occurrence. These samples were assayed by Temiskaming Testing Laboratory. The results are listed in Table 4.5. All samples containing quartz-sulphide vein material carry significant gold. The sulphide-bearing wall rock adjacent to the quartz-sulphide veins is generally anomalous in gold and assays up to 1268 ppb Au (North 1985).

THE TEAL OCCURRENCE

Location and Access

The Teal occurrence is located approximately 155 km north-northwest of the town of Pickle Lake. The occurrence is 900 m north of Randall Lake and 630 m east of Agutua Arm of Weagamow Lake (Figure 4.3). Access is by float- or ski-equipped aircraft to either Agutua Arm or Randall Lake and then overland to the occurrence.

Exploration History

Prospectors representing the "Mosher interests" of Toronto discovered the Teal occurrence in the summer of 1957. They stripped the area to expose the discovery and drilled 3 shallow X-ray holes. The prospectors did not stake claims to cover the Teal occurrence, nor did they report their assay results (Harris 1959).

A prospector named Max Levine rediscovered the Teal occurrence in 1958. He did additional stripping, trenching and sampling on the discovery. He received encouraging assay results. This led to the staking and optioning of the claim group to Teal Exploration Ltd. in 1959 (Harris 1959).

A mini staking rush ensued and several hundred claims were staked by J.E. Ayrhart and Associates along strike of the Teal occurrence. Ayrhart and Associates had Lundberg Explorations Ltd. carry out a 5 mile by 36 mile airborne geophysical survey over their property and the Teal property. The Anaconda Co. (Canada) Ltd. optioned the Ayrhart claims (Harris 1959).

In 1959, Teal Exploration Ltd. did additional trenching and stripping on the occurrence. Horizontal coil electromagnetic and magnetometer surveys were done over the entire claim group.

Harris (1959) reports the assay results from the main showing (Table 4.6).

In 1960, Teal Exploration Ltd. drilled 15 diamond-drill holes totalling 1148.7 m to test the occurrence, its strike extensions and other geophysical anomalies. Ingham (1966) reports assay results for intersections for the first 7 diamond-drill holes that tested the showing (Table 4.7). The locations of the 7 diamond-drill holes with respect to the Teal occurrence are shown in Figure 4.5.

There is no record of activity on the Teal occurrence from 1960 to 1967. Pyrotex Mining and Exploration Co. Ltd. is reported to have acquired the property and carried out a 1067 m diamond drilling program in 1967. However, this program was not reported for assessment credits. The claims covering the occurrence eventually lapsed.

R. Knappett staked 17 claims to cover the Teal occurrence in 1976 and optioned the property to St. Joseph Explorations Limited.

St. Joseph Explorations Limited commissioned a Questor Mark V Input electromagnetic and magnetometer survey to cover the property in 1977 (Pollock 1977). They followed up the results with reconnaissance geological mapping the same year. Ground electromagnetic, magnetometer and geological surveys followed in 1978 (Papertzian 1978). The last report of work done on the Teal occurrence is the drilling of 3 diamond-drill holes totalling 365 m by St. Joseph Explorations Limited in 1979. These 3 drillholes tested the showing in the vicinity of the Teal drill holes, but did not cut significant intersections (Rayner 1979).

Novamin Inc., a successor to St. Joseph Explorations Limited, brought 11 claims covering the Teal occurrence to lease in June 1988.

Regional and Local Geology

The Teal occurrence is located at the northwestern end of the North Caribou Lake greenstone belt, a large arcuate synclinorium that extends from Neawagank Lake in the southeast to Weagamow Lake in the northwest. The synclinorium has a rim of mafic metavolcanics and a core of clastic metasediments. Iron formation and/or chemical metasedimentary units commonly occur along the contact between the mafic metavolcanics and clastic metasediments (Bartlett et al. 1985).

The North Caribou River fault zone is a major structural feature in the northwest part of the North Caribou Lake greenstone belt. Osmani and Stott (1988) show the fault extending along the south margin of the greenstone belt. Bartlett et al. (1985) mapped the fault only from the West Lake northeast to Seeseep Lake. West Lake is a local name used by Piroshco et al. (1989). The Teal occurrence is located within the North Caribou River fault zone.

Property Examination

The Teal occurrence is exposed in an outcrop on the northwestern side of the North Caribou River fault zone, midway between East Lake and West Lake (Piroshco et al. 1989). The outcrop, which was hydraulically stripped and mapped by Ontario Geological Survey personnel in 1984, exposes from

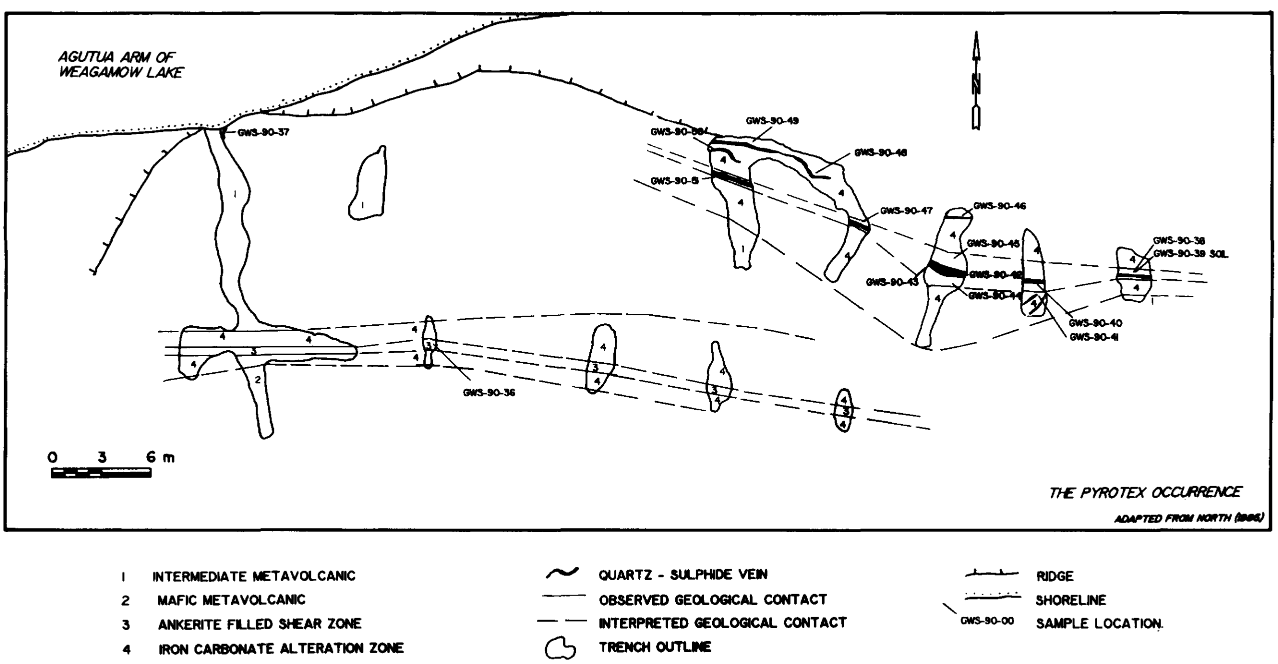

Figure 4.4. Trench map of the Pyrotex occurrence.

TABLE 4.5. ASSAY RESULTS FOR THE PYROTEX OCCURENCE.

Sample No.	Description	Au (ppb)	Ag (oz./t)	Cu (ppm)	Pb (ppm)	Zn (ppm)	As (ppm)
GWS90-37	4" wide quartz vein with 1% pyrite	2 263	nil	--	--	--	--
GWS90-38	quartz-arsenopyrite-pyrite vein	105 875	0.95	3 080	<10	36	113 750
GWS90-39	rusted soil/basal till above sample GWS90-38	9 445	0.27	2 344	<16	60	18 460
GWS90-40	quartz-pyrite-arsenopyrite (±chalcopyrite) vein	2 468	tr	1 924	<10	12	41 550
GWS90-41	carbonatized wall rock with quartz-carbonate vein	1 268	nil	8	<10	52	408
GWS90-42	quartz-sulphide rubble, 1-5% sulphides (pyrite)	651	nil	300	<10	20	402
GWS90-43	quartz-sulphide rubble, 1-5% sulphides (pyrite)	19	nil	308	<10	16	1 125
GWS90-44	carbonatized andesite, <1% fine disseminated pyrite	118	nil	8	<10	36	2 067
GWS90-45	carbonatized andesite, 1% fine disseminated pyrite	28	nil	168	<10	48	304
GWS90-46	carbonatized andesite, 1% pyrite, 1-2 mm euhedral crystals	533	nil	92	<10	68	2 154
GWS90-47	quartz-arsenopyrite vein	19 886	3.11	3 088	100	44	115 500
GWS90-48	quartz and carbonate rock	651	tr	1 072	<10	40	781
GWS90-49	quartz-sulphide vein	15 463	tr	3 280	<10	44	171 250
GWS90-50	quartz-sulphide vein	583	nil	68	12	20	24 100
GWS90-51	quartz-sulphide vein	960	nil	308	<10	16	10 630
GWS90-52	ankerite vein	16	nil	24	<10	56	1 077

tr = trace

TABLE 4.6. TEAL EXPLORATIONS LTD.'S ASSAY RESULTS FROM TRENCH SAMPLING (*from* Harris, 1959).

Sample type	Au (oz./t)	Ag (oz./t)	Cu (%)
39-inch channel sample	0.99	16.33	2.41
grab sample from 6-inch vein	4.56	77.8	5.78
10-pound bulk of schist	0.1	31.0	3.16
41-pound bulk over 5 feet	0.96	0.94	0.37

north to south the following rock sequence: 1) quartz diorite; 2) brownish, weathered quartz-carbonate schist; and 3) chlorite-calcite schist.

Figure 4.6 is an adapted version of Piroshco et al.'s (1989) map of the Teal occurrence.

The quartz diorite is massive, fine- to medium-grained and composed of plagioclase, quartz, hornblende, chlorite, sericite, epidote and calcite. The chlorite, sericite, epidote and calcite are alteration products of hornblende and plagioclase (Piroshco et al. 1989).

The brownish weathered quartz-carbonate schist is the unit with the largest areal exposure in the stripped area. Piroshco et al. (1989) indicate that this schist is composed of carbonates (dolomite, magnesite and calcite), quartz and chlorite with lesser amounts of muscovite, talc and epidote. Speculation as to the protolith for the quartz-carbonate schist has ranged from sheared and altered quartz diorite to altered rhyodacite. The quartz-carbonate schist is very fissile. The schistosity strikes approximately 050° and dips 75° north. A second, much less prominent planar fabric strikes 030° and dips 55° north. Mineral lineations measured by the second author plunge 40° to 52° at approximately 355° while local s-type drag folds plunge 50° at 020°.

The quartz-carbonate schist is host to 4 different types of quartz veins. The most abundant are quartz-carbonate-chlorite veins. These veins, some of which contain sulphides, are found throughout the Teal occurrence outcrop area, but are concentrated in the area east of the trench. Many of these veins trend 030° and appear to fill tension gashes. They are, however, highly deformed, contorted and interconnected in a

TABLE 4.7. TEAL EXPLORATIONS LTD.'S ASSAY RESULTS FROM DIAMOND-DRILL CORE (*from* Ingham 1966).

Drill Hole	From	To	Length	ounce Au per ton	ounce Au per ton	% Cu
No. 1	--	--	--	--	--	--
No. 2	52.2	54	1.8	2.44	10.16	1.84
No. 3	30	33	3	--	--	3.08
	124	127	3	--	--	1.52
No. 4	98.5	103	4.5	0.27	7.63	4.92
No. 5	506.5	507.5	1	0.8	3.24	--
No. 6	249	253.5	4.5	0.59	7.5	1.21
No. 7	190	200	10	1.17	7.02	1.22

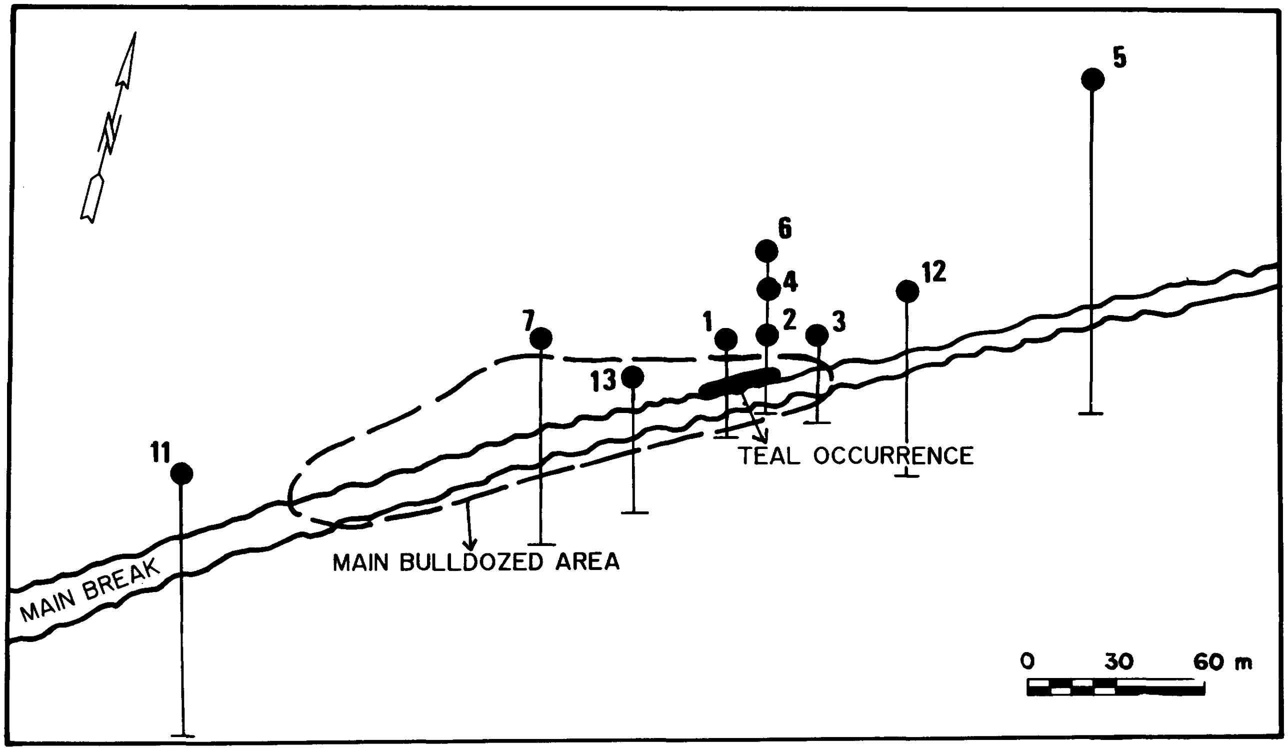

Figure 4.5. Drill hole location map for Teal Explorations Ltd.'s 1960 drill program.

stockwork-like manner. These veins average 5 cm in width and 1 m in length. The sulphide content of the veins is low, usually less than 1 percent.

Two massive white quartz veins cut the Teal occurrence outcrop. One occurs near the contact between the quartz diorite and the quartz-carbonate schist. It is up to 10 cm in width and over 15 m in length. This vein is composed of white quartz with minor fuchsite and carbonate. The other vein is approximately 15 cm wide and is found near the contact of the quartz-carbonate schist with the chlorite-calcite schist. This vein was mapped by Piroshco et al. (1989) as a quartz-sulphide vein. The second author, however, did not observe sulphides in this vein.

The third type of vein found in the Teal occurrence outcrop area is a single 1 m by 10 cm quartz-sulphide boudin found at the mouth of the trench on the southwestern side.

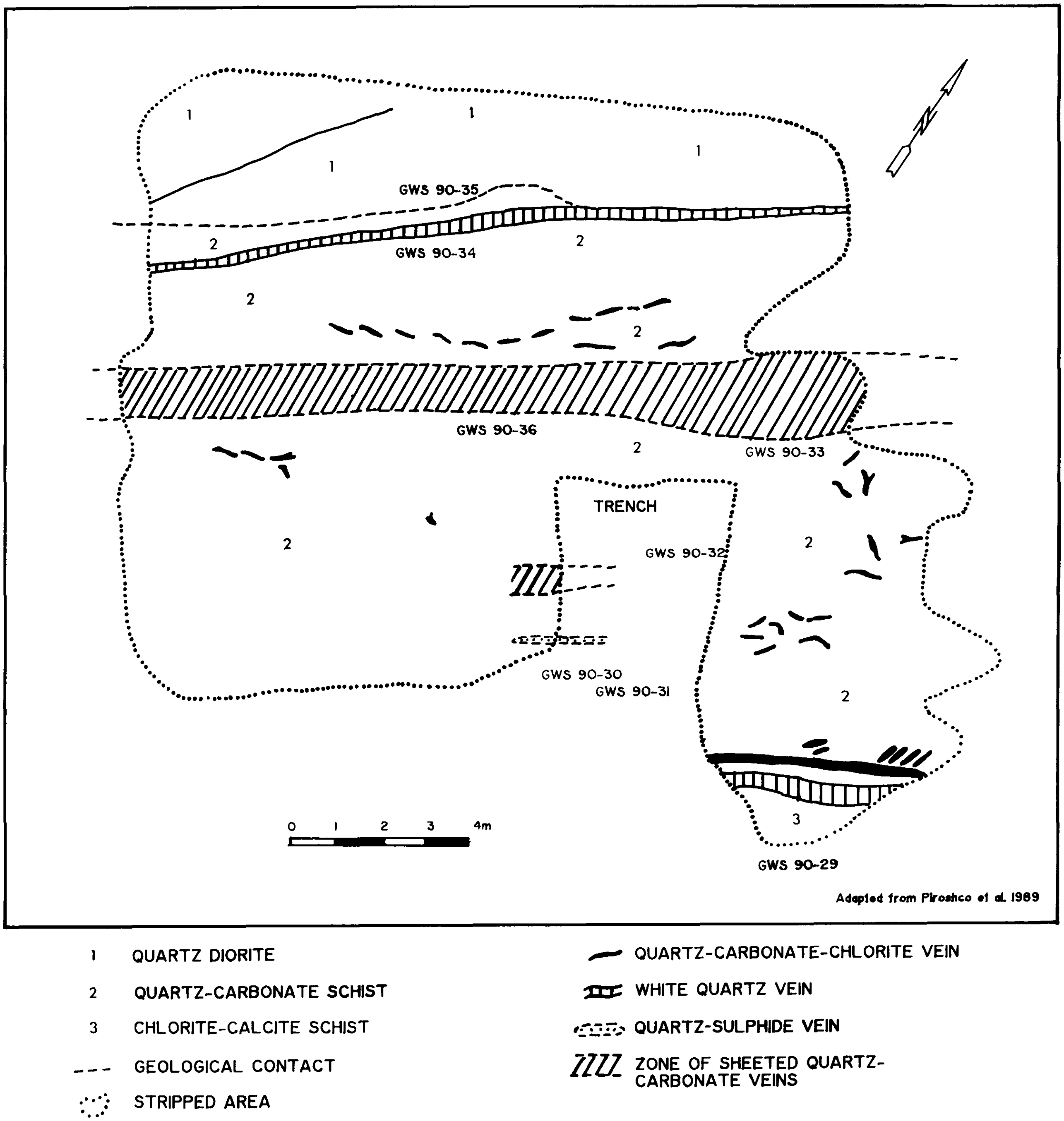

***Figure 4.6.** Geology of the Teal occurrence.*

Piroshco et al. (1989) mapped this vein as extending to the northeastern side of the trench, but the second author could find no evidence of this. It is possible that this portion of the vein could have been removed by sampling. The quartz-sulphide vein is composed of white to grey quartz, with 30 to75 percent arsenopyrite, tetrahedrite and chalcopyrite with small amounts of pyrite and pyrrhotite. Piroshco et al. (1989) observed native gold in a polished section of this vein.

The fourth type of vein observed in the occurrence outcrop area is referred to by Piroshco et al. (1989) as zones of sheeted quartz-carbonate veins. These zones are chlorite schists with

TABLE 4.8. ASSAY RESULTS FOR THE TEAL OCCURRENCE.

Sample No.	Description	Au (ppb)	Ag (oz./t)	Cu (ppm)	Pb (ppm)	Zn (ppm)	As (ppm)
GWS90-29	chlorite-calcite schist	86	nil	--	--	--	--
GWS90-30	boudined quartz-sulphide (pyrite, chalcopyrite, sphalerite, arsenopyrite) vein	30 309	7.37	10 500	<10	500	500
GWS90-31	quartz-carbonate vein	14	nil	28	24	32	683
GWS90-32	quartz-carbonate vein	10	nil	--	--	--	--
GWS90-33	chlorite schist from sheeted quartz vein zone	158	nil	--	--	--	--
GWS90-34	chlorite schist "dike"	269	nil	--	--	--	--
GWS90-35	quartz-carbonate rock	12	nil	--	--	--	--
GWS90-36	sheeted quartz-chlorite schist	32	nil	--	--	--	--

millimetre-thick quartz-carbonate laminae parallel to the schistosity. The chlorite schists are very fissile and have a low gold content.

South of the quartz-carbonate schist is a chlorite-calcite schist. The chlorite-calcite schist occupies the central portion of the North Caribou River fault zone (Piroshco et al. 1989). The schist, which is beige on the weathered surface, is bright light green on the fresh surface. Piroshco et al. (1989) interpret the schist to have a pyroclastic origin, based on elongated bleached clasts found in several outcrops, southwest of the Teal occurrence.

Temiskaming Testing Laboratory assayed 8 grab samples taken by the second author from the Teal occurrence. The results are presented in Table 4.8.

Discussion

The exploration history of the Teal occurrence indicates that the gold mineralization is more extensive than suggested by the small boudin of quartz-sulphide vein currently exposed in outcrop. Exploration and the presence of the boudin suggest that the gold mineralization may be in a larger, boudinaged, quartz-sulphide vein, located along the north side of the North Caribou River fault zone. This does not necessarily make the vein an uneconomic target. To test the vein properly will require more extensive surface stripping to re-expose the original work and to extend the vein. It will also require a tightly spaced diamond-drill hole pattern similar to that used by Teal Exploration Limited.

BHP–UTAH MINES LTD.'S ALTERED ZONE GOLD OCCURRENCE

Location and Access

BHP–Utah Mines Ltd.'s Altered Zone (AZ) gold occurrence on McVicar Lake (Figure 4.7) is located approximately 80 km west of Pickle Lake. The AZ is contained within a deformation zone that BHP–Utah Mines Ltd. traced with diamond drilling, for more than 3 km southeast from the east shore of McVicar Lake.

Access to McVicar Lake is by float- or ski-equipped aircraft.

Exploration History

Prospectors discovered gold in the McVicar Lake area in 1928. Much of the Lang Lake greenstone belt was staked in the ensuing staking rush (Laird 1931). Interest in the area quickly faded and most of the claims were allowed to lapse.

Kenlew Mines Ltd. staked claims covering the AZ gold occurrence in 1959. This was part of a larger exploration project in the Lang Lake belt. Kenlew Mines Ltd. stripped and trenched 3 areas of gold mineralization within the AZ. Four diamond-drill holes totalling 225 m tested the gold mineralization, but Kenlew Mines Ltd. reported no assay results (Fancy 1959).

Kerr Addison Gold Mines Ltd. optioned the Kenlew Mines Ltd. property in 1962. Kerr Addison concentrated its exploration efforts on a zone of copper-nickel mineralization, located a few kilometres west of the AZ gold occurrence (Wilton and Crone 1962). Eventually the claims were allowed to lapse.

During the base metal boom of the early to mid-1970s, Umex Inc., Cominco Ltd. and New Jersey Zinc Explorations Co. (Canada) Ltd. held claims in the area. They did not explore the AZ gold occurrence.

In the spring and summer of 1985, BHP–Utah Mines Ltd. conducted a reconnaissance mapping and sampling program in the McVicar Lake area. A quartz vein sampled during this program assayed 42 550 ppb Au (1.24 ounces Au per ton) (Allen 1985). BHP–Utah Mines Ltd. subsequently staked 28

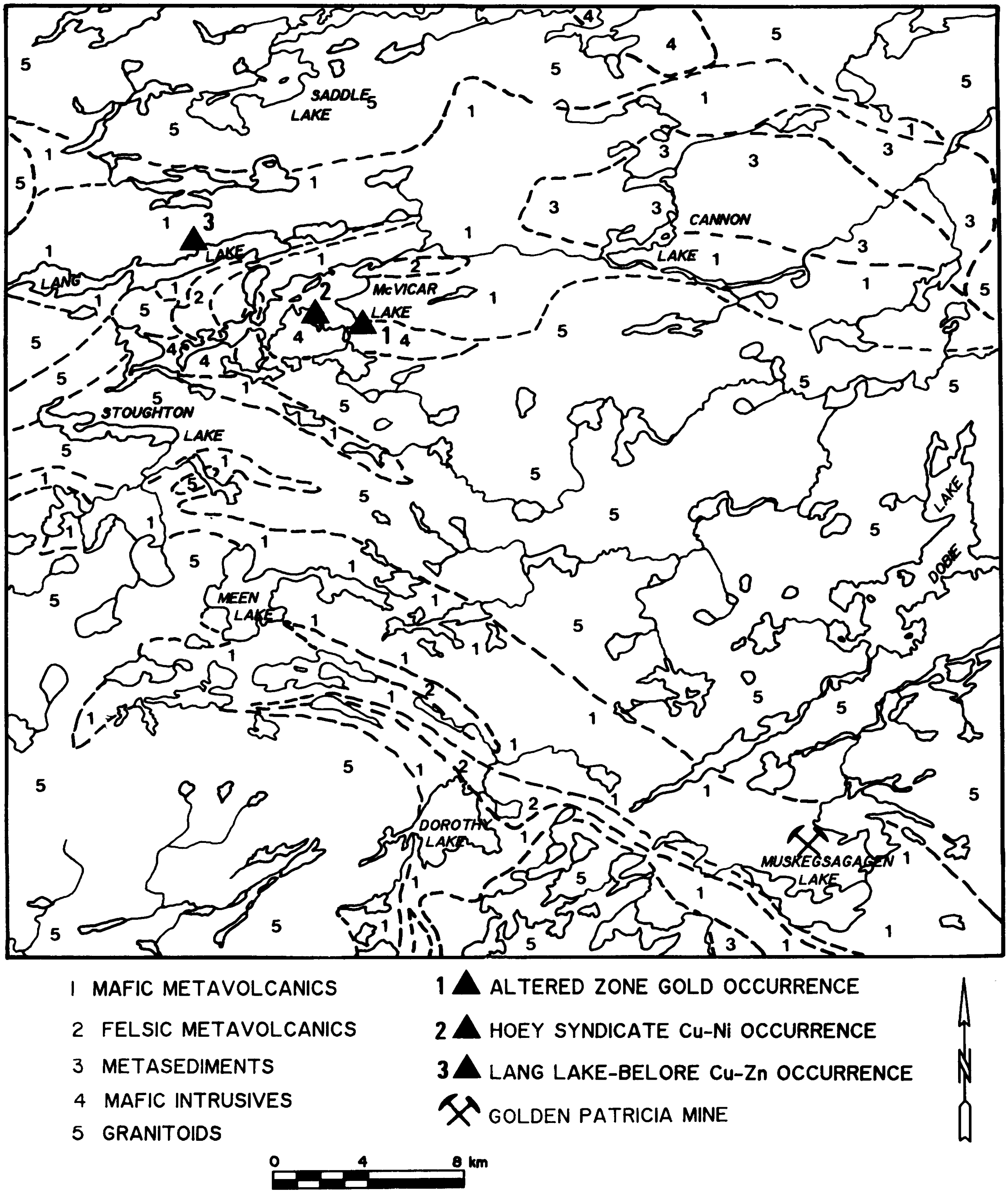

Figure 4.7. Location map for the Altered Zone, Hoey Syndicate Cu-Ni and Lang Lake–Belore Cu-Zn occurrences.

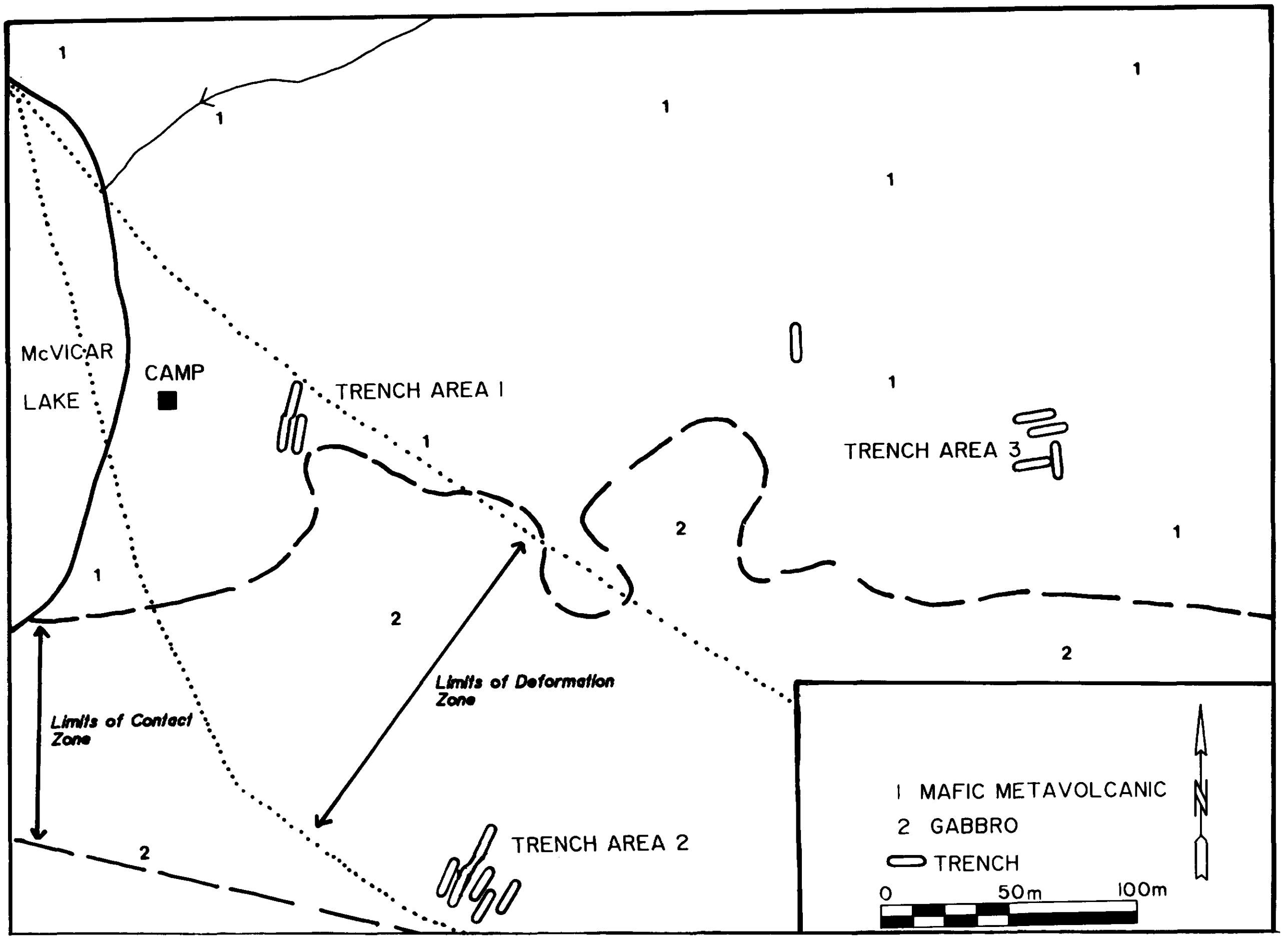

Figure 4.8. Trench location map for BHP-Utah Mines Ltd.'s Altered Zone gold occurrence.

claims over their "new" showing (Allen 1985). BHP–Utah Mines Ltd. evaluated the gold mineralization in the fall of 1985 by conducting geological, geochemical and geophysical surveys over the new claims. Diamond drilling followed in 1986 and tested many geophysical anomalies and the "new" showing which was part of the Altered Zone (AZ). Several of the diamond-drill holes that tested the AZ intersected gold mineralization. The AZ became the focus of BHP–Utah Mines Ltd.'s exploration effort on the property (Thomas 1988a, 1988b). BHP–Utah Mines Ltd. completed 51 diamond-drill holes totalling 5547.5 m by November 1989.

Regional and Local Geology

The AZ gold occurrence is situated in the western part of the Lang Lake greenstone belt. This area was mapped by Laird (1931) and Fenwick (1969, 1971).

The western part of the Lang Lake greenstone belt is underlain by dominantly mafic to felsic metavolcanics with subordinate clastic and chemical metasediments. An elongated (15 km by 2 km) gabbroic stock intrudes the metavolcanics along the south side of the greenstone belt. A lobe of a late external granitoid bisects the gabbroic body and extends into the middle of the greenstone belt.

The deformation zone that contains the AZ gold occurrence trends southeast and transects the contact between the gabbro and the mafic metavolcanics. The mafic metavolcanics trend north-northeast and consist of massive basalt flows. Thin bands of iron formation are interlayered with the basalt flows. The contact between the gabbro and the mafic metavolcanics trends east. Mapping by BHP–Utah Mines Ltd. suggests an intrusive contact. The contact is marked by a zone over 100 m wide where gabbro is found both as dikes in the mafic metavolcanics and as a mixed zone containing xenoliths of mafic metavolcanics (Thomas 1988a).

Property Examination

The second author examined and sampled the 3 areas trenched by Kenlew Mines Ltd. and retrenched by BHP–Utah Mines Ltd. He also examined some of the better gold intersections in drill core. The second author briefly examined Trench

TABLE 4.9. ASSAY RESULTS FOR THE ALTERED ZONE GOLD OCCURRENCE.

Sample No.	Description	Au (ppb)	Ag (oz./t)
GWS90-53	carbonatized rock, trace to 1% pyrite	94	nil
GWS90-54	quartz vein, trace pyrite	214	nil
GWS90-55	carbonatized rock, trace pyrite	296	nil
GWS90-56	silicified gabbro, trace to 1% pyrite	10	nil
GWS90-57	quartz vein, trace pyrite	99	nil
GWS90-58	quartz-carbonate vein, trace pyrite	2 263	0.92
GWS90-59	quartz-carbonate vein, trace pyrite	220	nil
GWS90-60	carbonatized, sheared mafic rock, trace pyrite	77	nil
GWS90-61	carbonatized, sheared mafic rock, trace pyrite	10	nil
GWS90-62	carbonatized, sheared, silicified mafic rock, trace pyrite	128	nil
GWS90-63	quartz-carbonate vein, trace pyrite	651	0.36
GWS90-64	silicified mafic rock	230	nil
GWS90-65	quartz-carbonate vein, trace pyrite	377	tr

tr = trace

Area 1 located less than 40 m east of BHP–Utah Mines Ltd.'s camp on the shore of McVicar Lake (Figure 4.8). There are 2 trenches, but outcrop is exposed only in the western trench. Allen (1985) mapped 2 narrow shear zones in the massive mafic metavolcanics exposed in this trench. The shear zones strike southeast and dip 30° to 40° northeast. BHP–Utah Mines Ltd. did not obtain significant assays from Trench Area 1 (Allen 1985).

Trench Area 2 is located approximately 300 m southeast of the BHP–Utah Mines Ltd. camp site (Figure 4.8). The trench area consists of 5 subparallel trenches, 3 of which cut a partially stripped outcrop. A sketch of the trenches and the geology as interpreted by the second author is given in Figure 4.9. Trench Area 2 is located in the contact zone between the gabbro and the mafic metavolcanics where it is transected by the deformation zone. Allen (1985) mapped the rock exposed in the trenches as mafic metavolcanics which he subdivided into 5 units on the basis of intensity of shearing and alteration. The second author identified the host rock as gabbro and simplified the subdivision into 2 units: weak to moderately sheared and altered (silicified and carbonatized) gabbro, and intensely sheared and altered gabbro with trace to 3 percent fine disseminated pyrite. The shearing strikes 110° to 115° and dips 40° to 65° northeast. A lineation in the shear plane plunges 40° at 335°. The difference in the intensity of the shearing and alteration is more difficult to discern in the southeastern part of the trench.

The second author observed 3 sections of quartz-carbonate vein in Trench Area 2 (Figure 4.9). They are for the most part contained in the more intensely sheared and altered zones, but pass into the less sheared and altered host rock. Allen (1985) mapped additional quartz-carbonate veins in the trenched area. These were covered by slumping and debris at the time of the examination. The second author did not discern whether or not the quartz-carbonate veins were a single vein, torn apart by the deformation, or separate infillings of dilatant zones within the intensely sheared and altered zones. Thomas (1988a) reports that the bulk of the mineralization is located in a dilated portion of the altered zone.

Allen (1985) reports that BHP–Utah Mines Ltd. took 37 channel samples from Trench Area 2. These samples ranged from 1.0 to 2.5 m in length and assayed from nil to 1620 ppb Au. Allen (1985) also reports that assay results for 4 grab samples of quartz vein material ranged from 500 ppb Au to 6990 ppb Au. Temiskaming Testing Laboratory assayed all grab samples taken by the second author from Trench Area 2. The sample locations are shown in Figure 4.9 and the assay results are listed in Table 4.9.

Trench Area 3 is located 300 m to the northeast of Trench Area 2 (Figure 4.8). This trench area is to the north of the contact zone between the gabbro and the mafic metavolcanics. The trenches expose a silicified shear zone within mafic metavolcanics (Figure 4.10). The shear zone strikes 160° and dips 70° to 90° east. It cuts a cleavage in the mafic metavolcanics that strikes 125° and dips 87° north. The cleavage fractures are bleached near the shear zone.

The shear zone is intermittently exposed for a length of approximately 27 m in the trenches. It averages 60 cm in width and is approximately 2 m wide at the south end of the trenched area. The sheared rock is grey due to the silicifica-

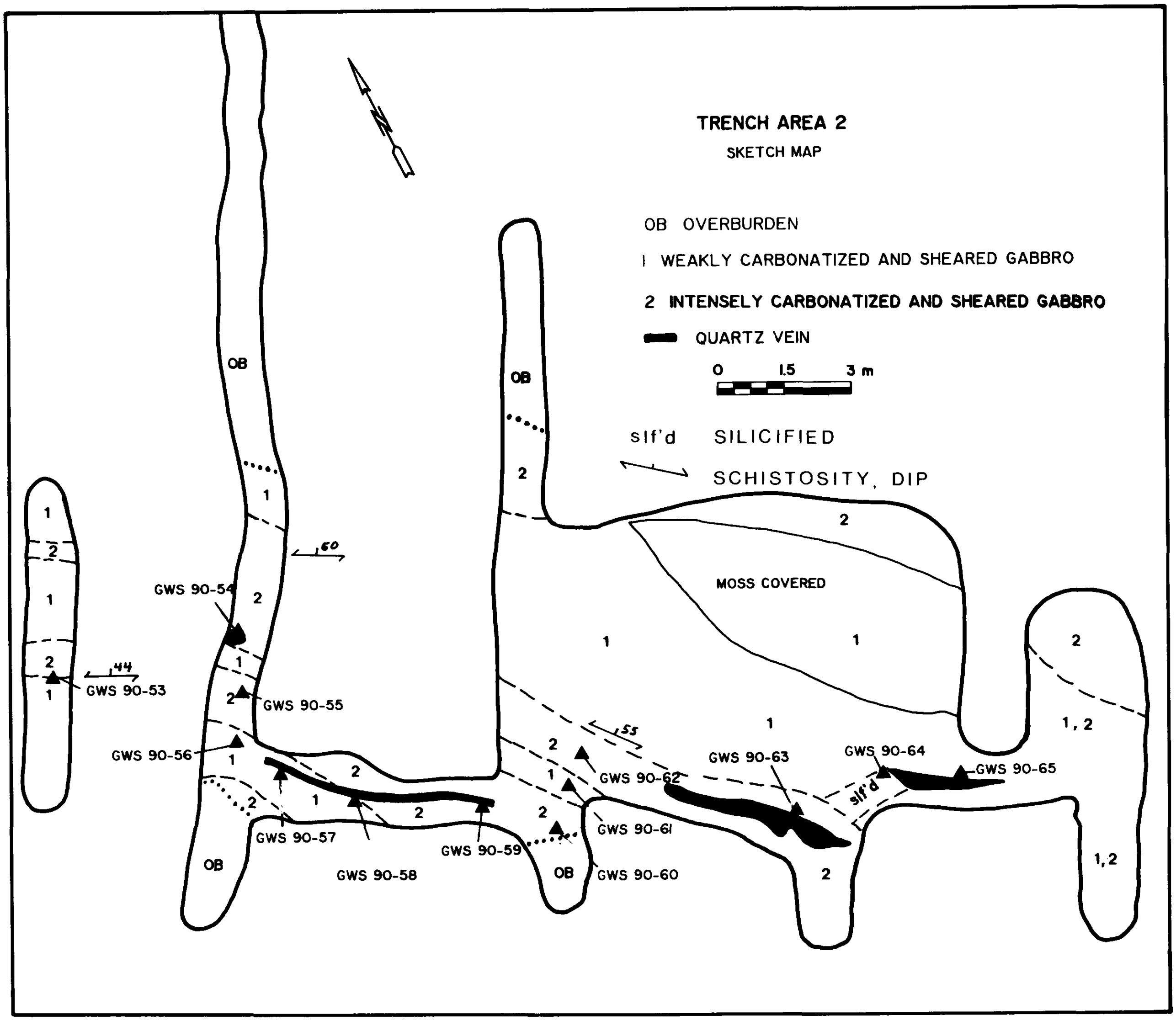

Figure 4.9. *Trench sketch of the Altered Zone gold occurrence, Trench Area 2.*

TABLE 4.10. ASSAY RESULTS FOR THE ALTERED ZONE GOLD OCCURRENCE, TRENCH AREA 3.

Sample No.	Description	Au (ppb)	Ag (oz./t)
GWS90-66	carbonatized mafic metavolcanics	206	nil
GWS90-67	quartz vein 4-6" wide, trace pyrite	1 577	nil
GWS90-68	carbonatized mafic metavolcanics	75	nil
GWS90-69	quartz vein and wall rock	328	nil
GWS90-70	silicified shear zone	10	nil
GWS90-71	silicified mafic metavolcanics	29	nil
GWS90-72	quartz vein	10	nil
GWS90-73	silicified mafic metavolcanics	967	nil

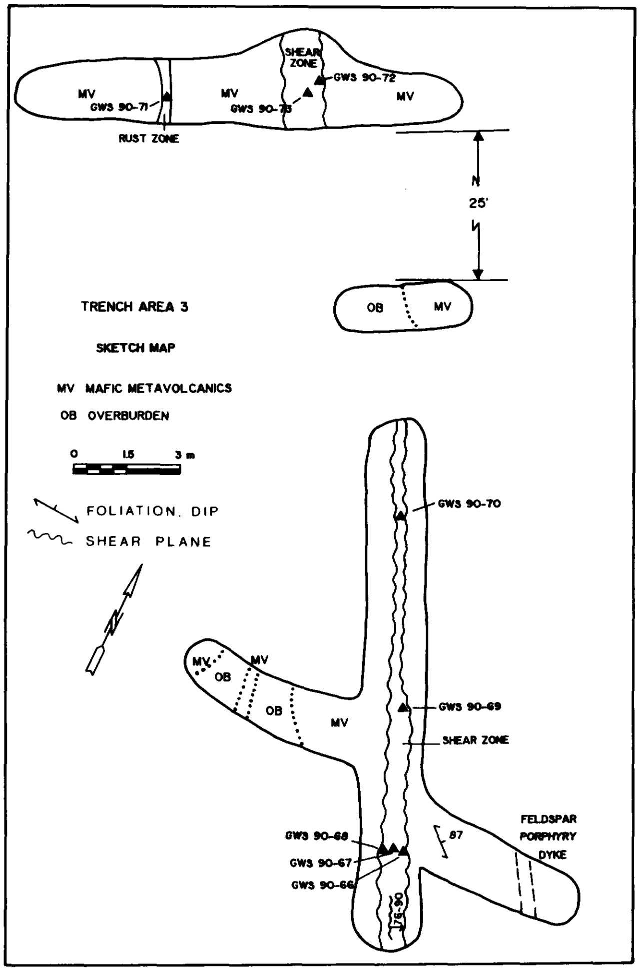

Figure 4.10. *Trench sketch of the Altered Zone gold occurrence, Trench Area 3.*

tion. It weathers into a rubbly mass and carries up to 3 percent fine disseminated pyrite. Locally the shear zone contains boudins of a grey to white quartz vein that averages less than 15 cm in width. In the north trench the shear zone is displaced approximately 3 m west.

A grab sample taken by the second author of a rusty quartz vein boudin returned an assay of 1577 ppb Au. Allen (1985) reports that assay values for 14 channel samples from 1.0 to 2.5 m wide ranged from nil to 1710 ppb Au. Allen (1985) also reports that grab samples of quartz vein material ranged from 30 ppb Au to 48 550 ppb Au. Temiskaming Testing Laboratory assayed all the grab samples taken by the second author from Trench Area 3. The sample locations are shown in Figure 4.10 and the assay results are listed in Table 4.10.

The diamond-drill core examined by the second author exhibited a different rock sequence associated with gold mineralization than is exposed in any of the trenches. Thomas (1988a, 1988b) describes, in detail, this different rock sequence and reports on the results of the diamond drilling along the AZ gold occurrence. The mineralization consists of disseminated pyrite in the altered and sheared mafic host rocks and of sulphide-rich boudinaged quartz-carbonate veins. The best intersection reported by Thomas (1988a) is 14 g/t Au over 4.63 m from a quartz-carbonate-sulphide vein.

THE HOEY SYNDICATE Cu-Ni OCCURRENCE

Location and Access

The Hoey Syndicate Cu-Ni occurrence at McVicar Lake (Figure 4.7) is located approximately 80 km west of Pickle Lake. The occurrence consists of 6 trenches blasted into a layered anorthositic gabbro complex on a point of land on the south shore of McVicar Lake.

Access to McVicar Lake is by float- or ski-equipped aircraft depending upon the season.

Exploration History

Idziszek (1972) is the only record of work performed on the Hoey Syndicate Cu-Ni occurrence. Frank Hoey, a prospector from Willowdale, Ontario, staked 16 claims to secure the occurrence in June 1971. Geophysical Engineering and Surveys Ltd. performed geological and geophysical surveys over the claims in September 1971. Subsequently 6 trenches were blasted and sampled.

Regional and Local Geology

The Hoey Syndicate Cu-Ni occurrence is situated in the western part of the Lang Lake greenstone belt. This area was mapped by Laird (1931) and Fenwick (1969, 1971).

For a description of the regional geology refer to the Regional and Local Geology section of the Altered Zone gold occurrence.

The elongated gabbroic stock is the host to the Hoey Syndicate Cu-Ni occurrence as well as other zones of copper-sulphide mineralization (Thomas 1988a). Idziszek (1972) notes that this gabbroic body is a layered gabbro-anorthosite complex. Individual layers/lenses within the gabbro-anorthosite complex strike southeast subparallel to a foliation that dips steeply south. The sequence of rock types across gabbroic stock does not indicate a classic layered mafic-ultramafic complex.

Property Examination

Idziszek (1972) located 6 zones of copper-sulphide mineralization on the Hoey Syndicate property. The 6 zones were trenched and sampled by Geophysical Engineering and Surveys Ltd. Only the No. 1 zone produced assays of possible economic interest. Idziszek (1972) reports averaged assay

TABLE 4.11. ASSAY RESULTS FOR THE HOEY SYNDICATE Cu-Ni OCCURRENCES.

Sample No.	Description	Cu (ppm)	Ni (ppm)	Pd (ppm)	Pt (ppb)
GWS90-74	coarse-crystalline gabbro with 1-3% disseminated/stringers pyrrhotite, chalcopyrite	1 760	840	200	63
GWS90-75	medium-crystalline gabbro, 1% disseminated pyrrhotite, chalcopyrite	748	560	101	23
GWS90-76	medium-crystalline gabbro with 1-3% disseminated pyrrhotite, chalcopyrite	2 768	1 032	345	94

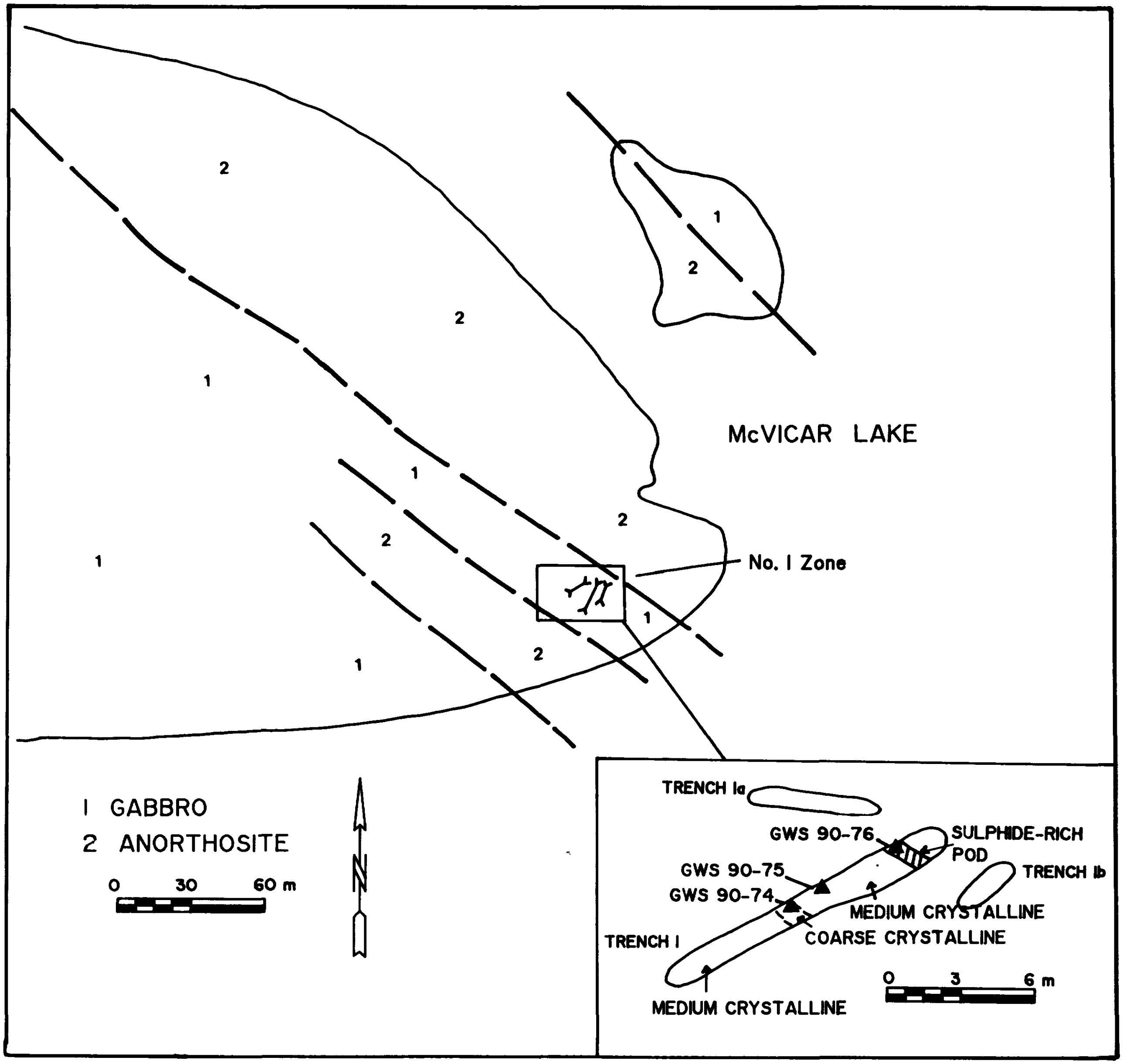

Figure 4.11. Geology of the Hoey Syndicate Cu-Ni occurrence.

values of 0.15% Cu, 0.08% Ni over 35 feet and 0.36% Cu, 0.26% Ni over 5 feet from continuous sampling of trench 1 on the No. 1 zone. The second author examined and took 3 grab samples of the No. 1 zone mineralization.

The No. 1 zone mineralization is hosted by medium- and coarse-crystalline phases of the gabbro (Figure 4.11). The gabbro does not exhibit a foliation, but is penetrated by a fracture set that strikes 155° and dips 80° southwest. The gabbro changes gradationally from the medium-crystalline to the coarse-crystalline phase. The second author did not observe anorthosite or anorthositic gabbro in the 3 trenches exposing the No. 1 zone mineralization. Chalcopyrite and pyrrhotite are disseminated in the medium- and coarse-crystalline phases of the gabbro. The concentration of the sulphides averages 1 percent, but reaches 5 to 7 percent through 1 section of trench 1. Idziszek (1972) notes that the best

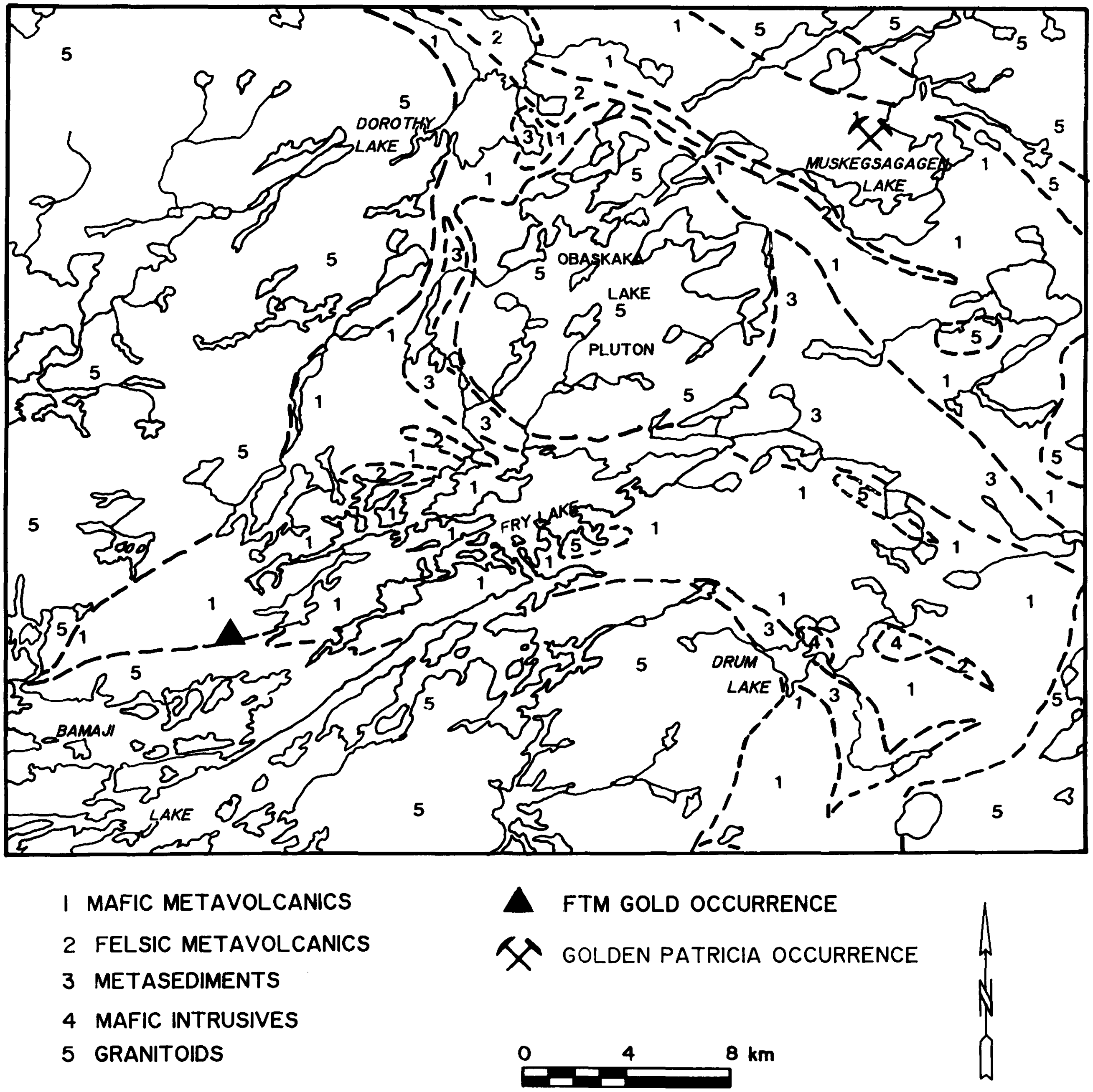

Figure 4.12. Location map for the FTM gold occurrence.

TABLE 4.12. ASSAY RESULTS FOR THE FTM GOLD OCCURRENCE.

Sample No.	Description	Au (ppb)	Ag (oz./t)
GWS90-89	quartz-tourmaline vein, trace pyrite	41	nil
GWS90-90	quartz-tourmaline vein, trace pyrite	548	nil
GWS90-91	quartz-tourmaline vein, trace pyrite, chalcopyrite	33 394	1.21
GWS90-92	quartz-tourmaline vein, trace pyrite, chalcopyrite	76 837	2.54
GWS90-93	mylonitized quartz-feldspar porphyry	274	nil
GWS90-94	mylonitized quartz-feldspar porphyry cut by quartz-tourmaline vein	205	nil
GWS90-95	mylonitized quartz-feldspar porphyry with quartz-tourmaline vein on fractured surface	363	nil
GWS90-96	quartz-tourmaline vein	194	nil
GWS90-97	quartz-tourmaline vein in quartz-feldspar porphyry	18 308	0.42

mineralization occurs in a 20-foot long by 1.5-foot wide lens that is exposed in trench 1 and trench 1a. Lichen cover presently obscures this lens.

The 3 grab samples taken by the second author were assayed by Temiskaming Testing Laboratory for Cu, Ni, Pt and Pd. The assay results are given in Table 4.11. The sample locations are indicated in Figure 4.11.

THE FTM GOLD OCCURRENCE

Location And Access

The FTM gold occurrence is located 1.6 km north of North Bamaji Lake (Figure 4.12) which is 122 km north-northeast of Sioux Lookout. The Ear Falls to Pickle Lake power corridor runs approximately 1 km south of the gold occurrence. The native community of Slate Falls is 10 km to the west of the gold occurrence.

Access to Bamaji Lake is by float- or ski-equipped aircraft depending on the season. In winter, it may be possible to gain access to Bamaji Lake by following the Ear Falls to Pickle Lake power corridor.

Exploration History

The Bamaji Lake area has had a long mineral exploration history. Gold, base metals, uranium and molybdenum have all been explored for and found in a number of small deposits and showings. The first record of mineral exploration around the FTM gold occurrence is an airborne geophysical survey commissioned by Canadian Onex Mines Limited in 1971. Canadian Onex staked a 16 claim property to protect some airborne anomalies and conducted an induced polarization survey as ground follow-up (Bell 1971). There is no record of further work on the anomalies and the claims were allowed to lapse.

Rodney Knappett staked 4 claims centred on the FTM gold occurrence late in 1981. The claims were optioned to D. Bell in 1983 who dealt the claims to FTM Resources Inc. D. Bell also commissioned Aerodat Ltd. to fly a 110 line-mile magnetometer and electromagnetic survey over the claims and surrounding area. David R. Bell Geological Services Inc. performed geological mapping on the 4 Knappett claims (Simunovic 1984).

FTM Resources Inc. changed its name to First General Mine Management and Gold Corporation in 1985 and commissioned Norontex Exploration Ltd. to conduct a rock geochemical survey on the 4 Knappett claims. Norontex Exploration Ltd. collected 100 samples. Gold contents of the samples ranged from less than 2 ppb to 4.340 ounces Au per ton. Gold mineralization is associated with a late generation of grey tourmaline-bearing quartz veins and veinlets (van Enk 1985). The Knappett claims lapsed in 1986.

Gold Fields Canadian Mining Ltd. performed humus geochemistry on a large group of claims covering the showing in 1988 (Lougheed 1989).

Regional and Local Geology

Wallace (1979) mapped the bedrock geology of the Bamaji Lake area in 1977 and 1978 at a scale of 1:15 480.

The FTM gold occurrence is situated in the Bamaji Lake–Fry Lake greenstone belt, part of the Uchi Subprovince. Mafic metavolcanics underlie most of the area around the gold occurrence. The Bamaji Lake granitoid complex (Sage and Breaks 1982) intrudes the mafic metavolcanics 500 m to the south of the FTM gold occurrence. The contact of the granitoid complex with the metavolcanics trends east. van Enk (1985) states that the "volcanic formations are steeply dipping at generally east-west strike". Several lenses or dikes of quartz-feldspar porphyry occur within the mafic metavolcanics on the 4 claims surrounding the showing. Simunovic (1984) suggests that the quartz-feldspar porphyries are intercalated metavolcanic tuffs. van Enk (1985) suggests the porphyries are intrusive.

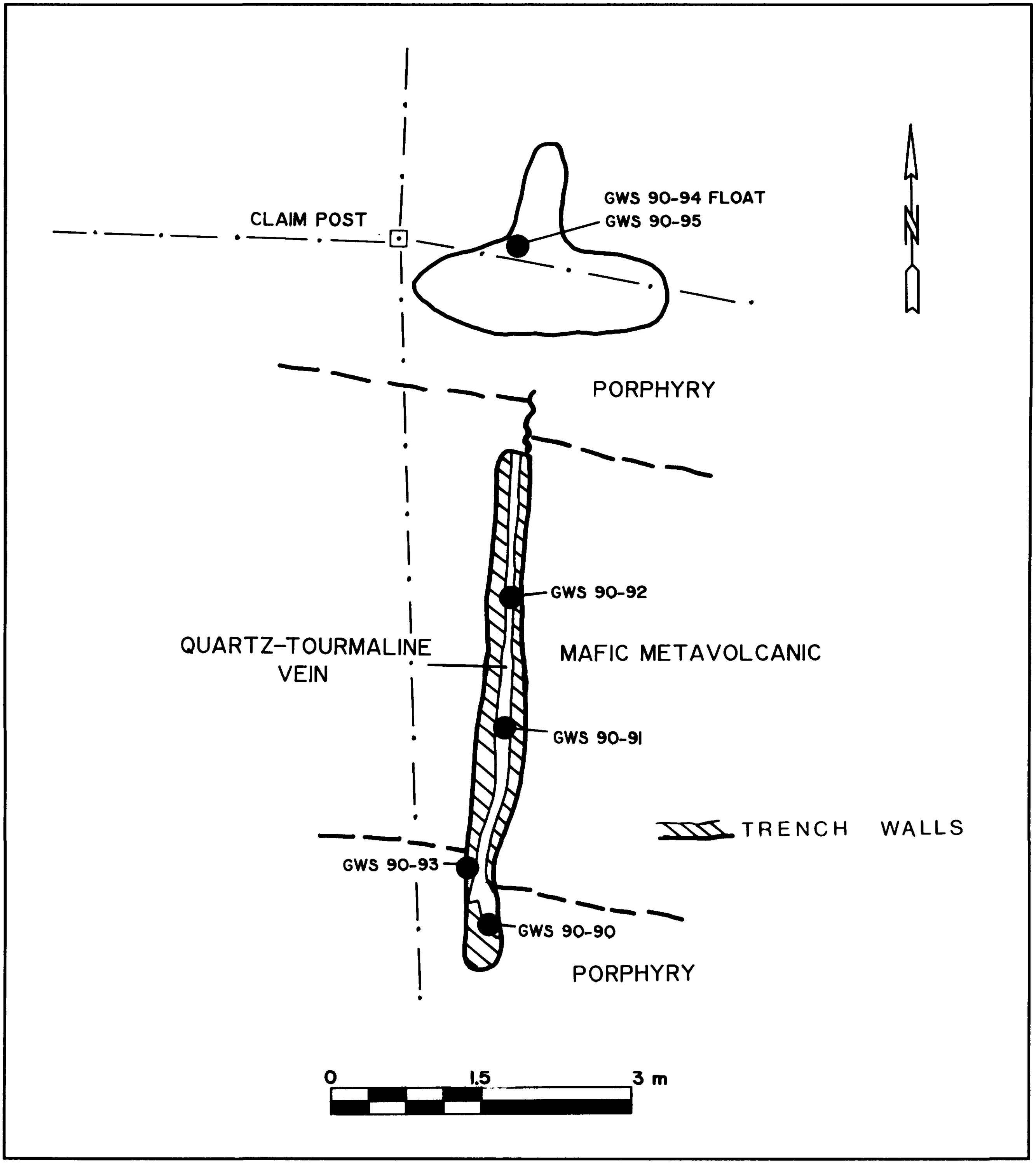

Figure 4.13. Geology of the FTM gold occurrence.

TABLE 4.13. ASSAY RESULTS FOR THE LANG LAKE–BELORE Cu-Zn OCCURRENCE.

Sample No.	Description	Au (ppb)	Ag (oz./t)	Cu (ppm)	Zn (ppm)	Pb (ppm)
GWS90-79	0.5 m chip sample, sheared mafic metavolcanics	10	nil	1 092	240	10
GWS90-80	grab sample, sheared mafic metavolcanics	10	nil	1 084	328	12
GWS90-81	1.0 m chip sample, sheared mafic metavolcanics	14 126	tr	363	207	18
GWS90-82	1.0 m chip sample, chlorite schist with quartz lenses	10	nil	88	182	54
GWS90-83	1.0 m chip sample, chlorite schist with quartz lenses	362	nil	40	725	54
GWS90-84	grab sample, feldspathic schist	56	nil	46	565	10
A	Belore Mines Ltd. grab sample *	--	0.07	45%	0.08%	--
B	Belore Mines Ltd. grab sample *	--	0.01	0.30%	0.01%	--

tr = trace

* Belore Mines Ltd. 1969.

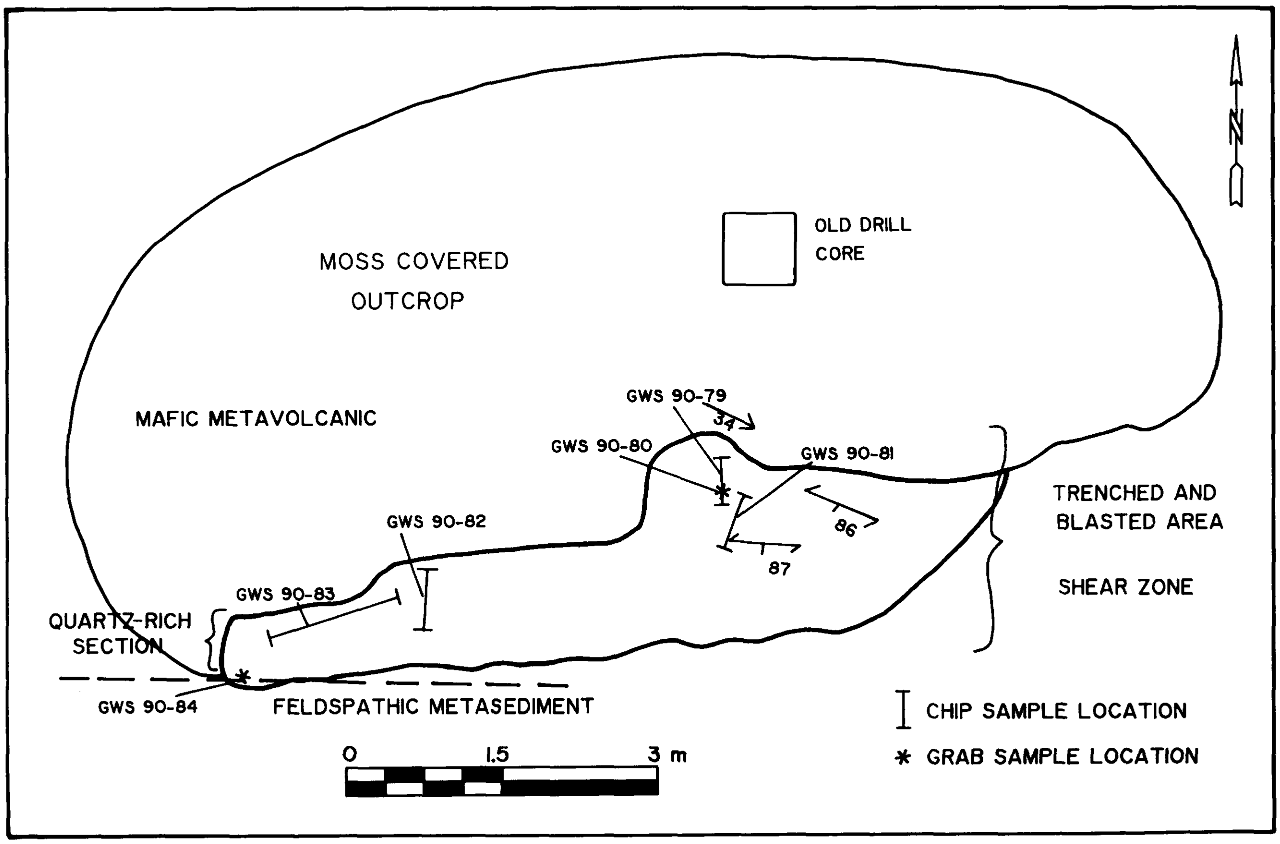

Figure 4.14. Sketch map of the Lang Lake–Belore Cu-Zn occurrence.

Wallace (1979), Simunovic (1984) and van Enk (1985) all record little structural data in the area around the FTM gold occurrence. Wallace (1979) mapped an east-trending synclinal axis approximately 2 km to the north of the occurrence. Wallace (1979) also indicated 2 lineaments intersecting in the vicinity of the FTM gold occurrence. One lineament trends northeast and the other trends north-northeast.

Property Examination

Gold mineralization occurs in 2 modes at the FTM gold occurrence. The first is in a white to smoky grey quartz-tourmaline-sulphide vein hosted in a north-trending brittle shear zone cutting mafic metavolcanics. The second mode of occurrence is in quartz-tourmaline stringers and veins cutting the quartz-feldspar porphyries.

The quartz-tourmaline-sulphide vein is exposed intermittently in a shallow trench over a length of approximately 10 m. The vein is up to 30 cm in width and is hosted by a brittle shear zone marked by a well defined cleavage in the mafic metavolcanics. The vein and shear zone cut a quartz-feldspar porphyry at the south end of the trench, but do not extend to the porphyry 2 m north of the trench. The vein and the cleavage strike 350° and dip 73° east. The contact between the porphyry and the mafic metavolcanics at the south end of the trench is offset 30 cm, in a right-handed manner, by the shear zone.

The sulphides in the quartz-tourmaline-sulphide vein are principally pyrite. Traces of chalcopyrite, galena and sphalerite have all been observed in the vein. The sulphides occur in stringers and in pods, but concentrations rarely exceed 1 percent. Tourmaline is present in the vein as stringers and as disseminations in the quartz.

The second author sampled the vein in 4 places as indicated in Figure 4.13. These and other grab samples were assayed by Temiskaming Testing Laboratory and the results are given in Table 4.12.

The second mode of gold mineralization at the FTM gold occurrence is associated with quartz-tourmaline stringers and veins in the quartz-feldspar porphyries. Both Simunovic (1984) and van Enk (1985) mapped the quartz-feldspar porphyries as east-trending lenses. The porphyries exhibit a 080° foliation that dips 73° north. The quartz-tourmaline stringers and veins follow generally northeast- to southeast-trending fractures and shears in the porphyries. These stringers and veins have widths up to 15 cm, but average less than 1 cm in width. A number of the stringers and veins interconnect to form a stockwork. Trace to 1 percent pyrite is found in the porphyry next to the quartz-tourmaline stringers and veins.

The second author took 5 grab samples of quartz-tourmaline stringer mineralization in porphyry. Four returned assay values between 193 ppb Au and 363 ppb Au. The fifth sample returned an assay value of 18 308 ppb Au with 0.42 ounce Ag per ton. This last sample came from a shear-hosted vein cutting a porphyry 150 m east of the main quartz-tourmaline-sulphide vein. The shear zone strikes 100° and dips 68° north. The vein ranges from 2 to 7 cm in width.

THE LANG LAKE–BELORE Cu-Zn OCCURRENCE

Location and Access

The Lang Lake Belore Cu-Zn occurrence (Figure 4.7) is located 91 km west-northwest of Pickle Lake. The occurrence is exposed in a trench located 50 m north of the west end of a small unnamed lake which is some 500 m north of Lang Lake. The unnamed lake drains into Boyes Creek.

Access to Lang Lake is by float- or ski-equipped aircraft. Boyes Creek is passable by canoe to within 50 m of the unnamed lake.

Exploration History

H.W. Hauf and J. Minoletti discovered the Lang Lake Belore Cu-Zn occurrence in 1968. The discovery was staked and the claims were subsequently acquired by Belore Mines Ltd. Belore contracted Ross Kidd to perform electromagnetic and magnetometer surveys over the claims in 1969 (Belore Mines Ltd. 1969). Belore tested the occurrence with 2 diamond-drill holes totalling 171.3 m in 1970. The drill hole that tested the downdip extension of the surface mineralization encountered 12 m of mineralized metatuff (Tagliamonte 1970). Surface sampling yielded grab samples that assayed 45% Cu and 0.30% Cu (Belore Mines Ltd. 1969). No assays were reported with the diamond drilling. Eventually the claims were allowed to lapse.

BHP–Utah Mines Ltd. staked claims covering the occurrence in 1985 and commissioned an airborne geophysical survey over the area in 1986 (Kilty 1986). BHP–Utah Mines Ltd. reported a geological survey over the occurrence in 1988 and allowed the claims to lapse in 1989.

Regional and Local Geology

The Lang Lake Belore Cu-Zn occurrence is situated in the western part of the Lang Lake greenstone belt. This area was mapped by Laird (1931) and Fenwick (1969, 1971).

For a description of the regional geology refer to the Regional and Local Geology section of the Altered Zone gold occurrence.

In the vicinity of the occurrence, a dominant feature of the Lang Lake greenstone belt is an east-trending isoclinal syncline. The Lang Lake Belore Cu-Zn occurrence is located on the southern, north-facing limb of this syncline. The area around the occurrence is underlain by mafic metavolcanics containing discontinuous thin horizons of magnetic iron formation and clastic metasediment. Fenwick (1971) mapped several lineaments in the vicinity of the occurrence that are subparallel to the axis of the syncline. These may indicate shear zones similar to the one that hosts the occurrence.

Property Examination

The Lang Lake Belore Cu-Zn occurrence is exposed in a outcrop approximately 50 m north of the west end of the unnamed lake. The occurrence consists of a 3 to 5 m wide, mineralized shear zone that cuts mafic metavolcanics (Figure 4.14). A trench on the south side of the outcrop exposes the shear zone along strike for 8 m. The shear zone strikes 090° and dips 86° south. A lineation in the shear plane plunges 34° at 115°. The north edge of the shear zone is weakly silicified and competent. The central portion of the shear zone is a fissile chloritic schist which locally contains narrow lenses of grey to white quartz. The mineralization consists of stringers of pyrite along the shear planes. The concentration of pyrite is locally as high as 10 percent but averages less than 3 percent. The second author did not observe other sulphides. On the south side of the trench the shear zone continues into a feldspathic metasediment which has an exposed thickness of 15 cm.

The second author took 3 chip samples and 3 grab samples from the exposed mineralized shear zone. These samples were assayed by Temiskaming Testing Laboratory and the results are given in Table 4.13. The copper values are not as high as those reported by Belore Mines Ltd. (1969). However, sample GWS90-81 returned 14 126 ppb Au over approximately 1 m. This changes the complexion of this mineral occurrence and makes it a target worth further work for gold. At the time this report was written this occurrence was not staked.

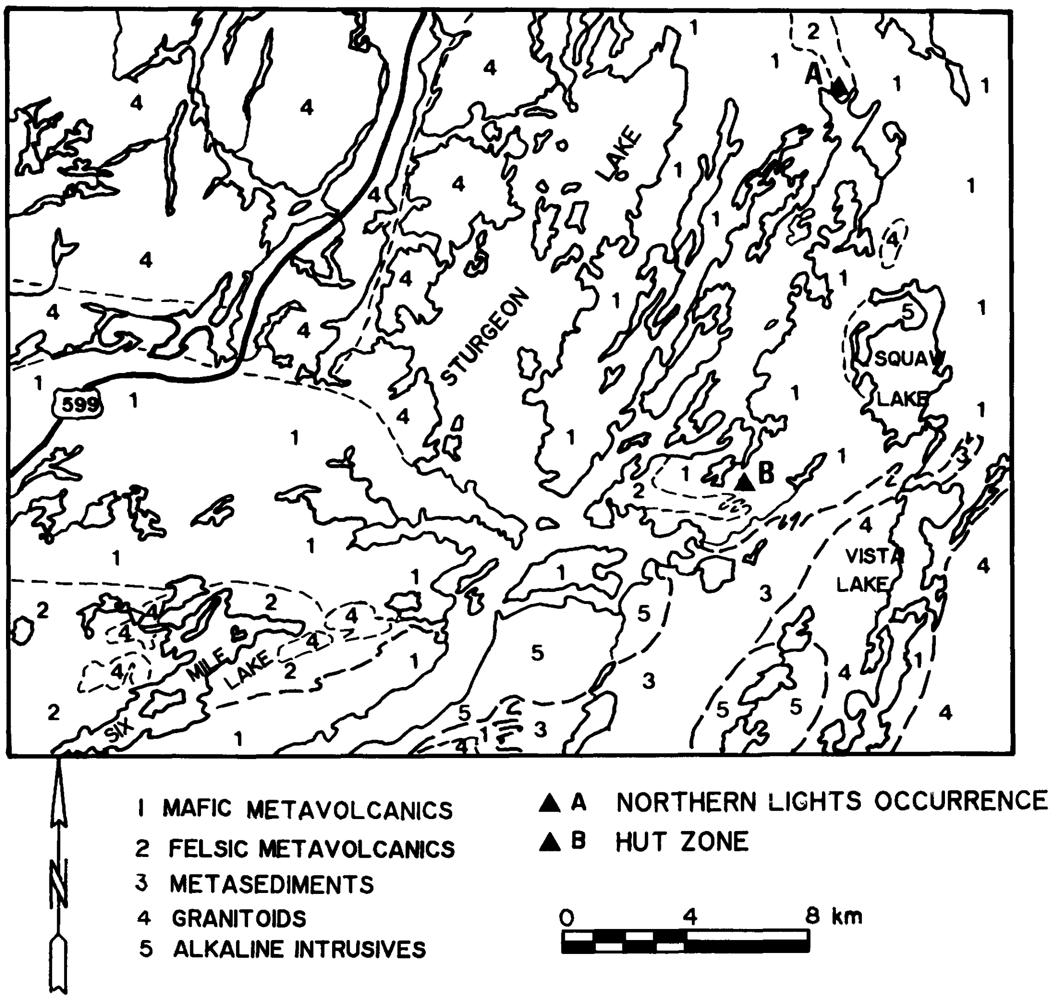

Figure 4.15. Location map of Northeast Arm-East Bay occurrences.

STURGEON LAKE AREA

INTRODUCTION

Sturgeon Lake is located in the southern part of the Patricia Mining Division close to the boundary with the Thunder Bay Mining Division. The lake is approximately 70 km long and from 1.5 to 10 km wide. Gold exploration has been carried out there for more than 90 years. In the early 1970s, base metal mineralization was found at the south end of the lake. Three mines were developed and 1 of them, the Lyon Lake Mine of Noranda Minerals Inc., is still in production. One successful gold mine, the St. Anthony Mine, was developed on the northern end of the lake. This mine operated periodically between 1909 and 1941, producing 63 000 ounces of gold from several quartz veins.

Over the past 2 years, M. Sandborn-Barrie of the Ontario Geological Survey has mapped at 1:50 000 scale the Savant Lake and northern Sturgeon Lake area (Sandborn-Barrie 1989). This study used structural techniques together with detailed mapping in selected areas to examine complex stratigraphic relationships. This study is expected to lead to a better understanding of the stratigraphy of the area as a whole.

One aspect of the study was the outlining of a structural domain on the southeast of Savant Lake which extends south to Sturgeon Lake with north-trending bedding directions (S_0) and parallel cleavage direction (S_1). An overprinting schistosity (S_2) has an easterly trend and frequently crenulates the S_1 fabric. A number of strongly deformed zones, commonly with associated carbonate-silica alteration and quartz veining, parallel the S_2 fabric and host gold mineralization. It is unclear at the moment how far south this S_2 fabric extends into Sturgeon Lake. The control for gold mineralization on north Sturgeon Lake recognized previously has been a north- to northeast-trending shear direction. This has hosted carbonate-silica alteration with associated gold-sulphide quartz veins, especially when the shear direction coincided with bedding or intrusive contacts. A number of gold occurrences on north Sturgeon Lake, with easterly trends to the mineralized zone, do not fit into this category and could be related to an S_2 fabric. In particular, several gold occurrences on King Bay and East Bay of Sturgeon Lake are associated with easterly-trending carbonate-silica alteration zones. The Armstrong–Best gold deposit on King Bay is an example of this group. Two other occurrences of this type will be described in this section.

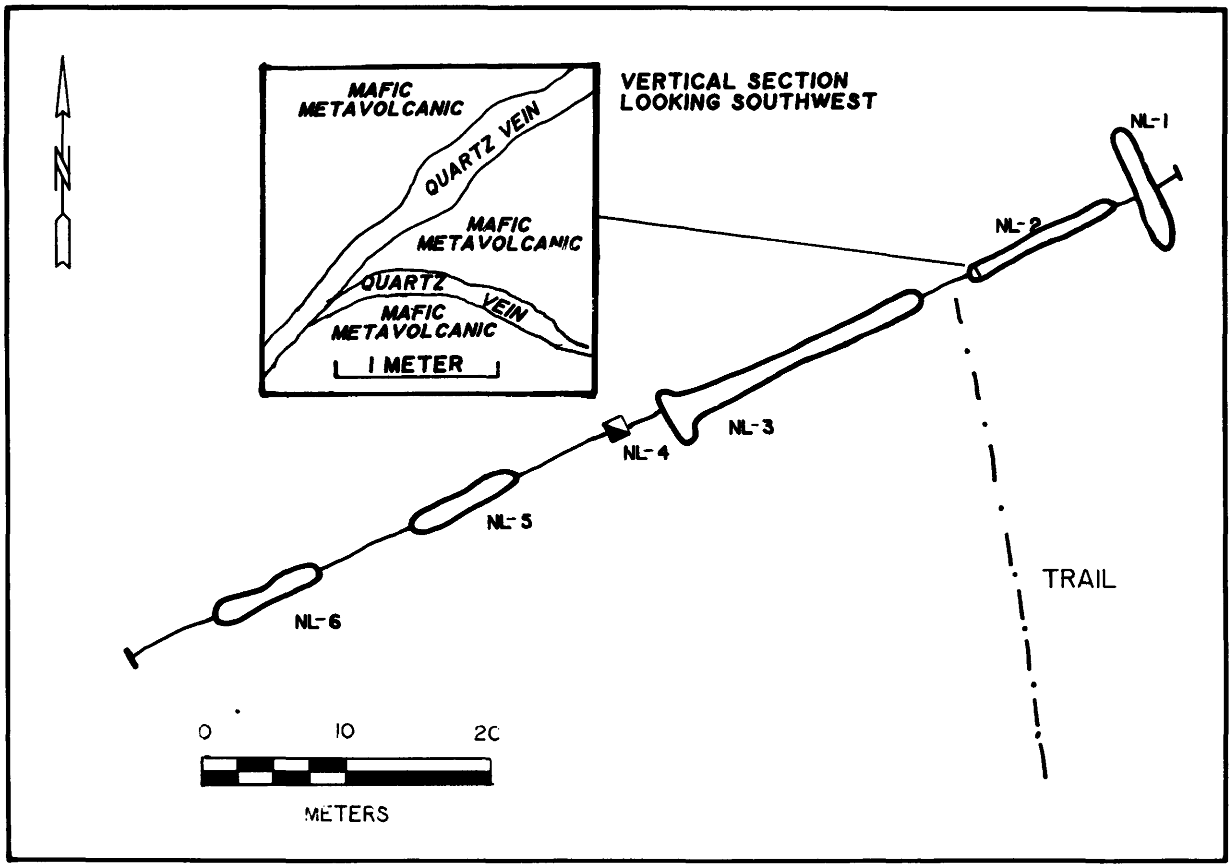

Figure 4.16. Sketch map of Northern Lights trenches.

REGIONAL GEOLOGY

The portion of Sturgeon Lake referred to in this report was most recently mapped by Trowell (1983). A summary of the geology of the area, from Blackburn and Janes (1983), follows.

> "The northern portion of the lake hosts more than 20 gold occurrences, aligned along several structural trends. The area is underlain by a roughly north-trending band of mafic to felsic volcanic extrusive and intrusive rocks with trends roughly parallel to the belt boundaries. This trend is truncated at East Bay and King Bay where the foliation and formational boundaries swing to an east-west direction. The section exposed between North and Northeast bays of Sturgeon Lake consists of a basal basaltic unit overlain to the east by an andesitic to felsic tuffaceous assemblage. A major fault with a well-defined mylonitic zone extends down Northeast Bay and may extend the length of Sturgeon Lake. A secondary fault or shear zone extends through East Bay and is host to a sulphide zone. Shearing is widespread in King Bay but is not localized in a defined zone. The volcanic rocks have been intruded by sills and stocks of alkalic syenite and nepheline syenite to the south of East Bay. Minor ultramafic sills and at least 1 possible ultramafic extrusive or fragmental rock has been found in Northeast Bay. The base of the mafic section has been intruded by the Lewis Lake Batholith along North Bay. The batholith is a composite body containing migmatitic, gneissic and leucocratic-equigranular granodiorite phases."

THE NORTHERN LIGHTS OCCURRENCE

Location and Access

The Northern Lights occurrence is located at the northern tip of Northeast Arm of Sturgeon Lake. The approximate location is given as location A on Figure 4.15. The occurrence is located on claim HW694 approximately 460 m north of the base of a small peninsula trending southwest into a bay of the lake. The foundations of several old cabins mark a grown-over trail to the site.

Access to this portion of the lake is best achieved in summer by boat from any of the access points to north Sturgeon Lake off Highway 599. In winter, a forestry road eastward from a point 1800 m south of the railroad crossing near Savant Lake can be used to access a drill road, to the Richelieu showing, which passes close to the Northern Lights

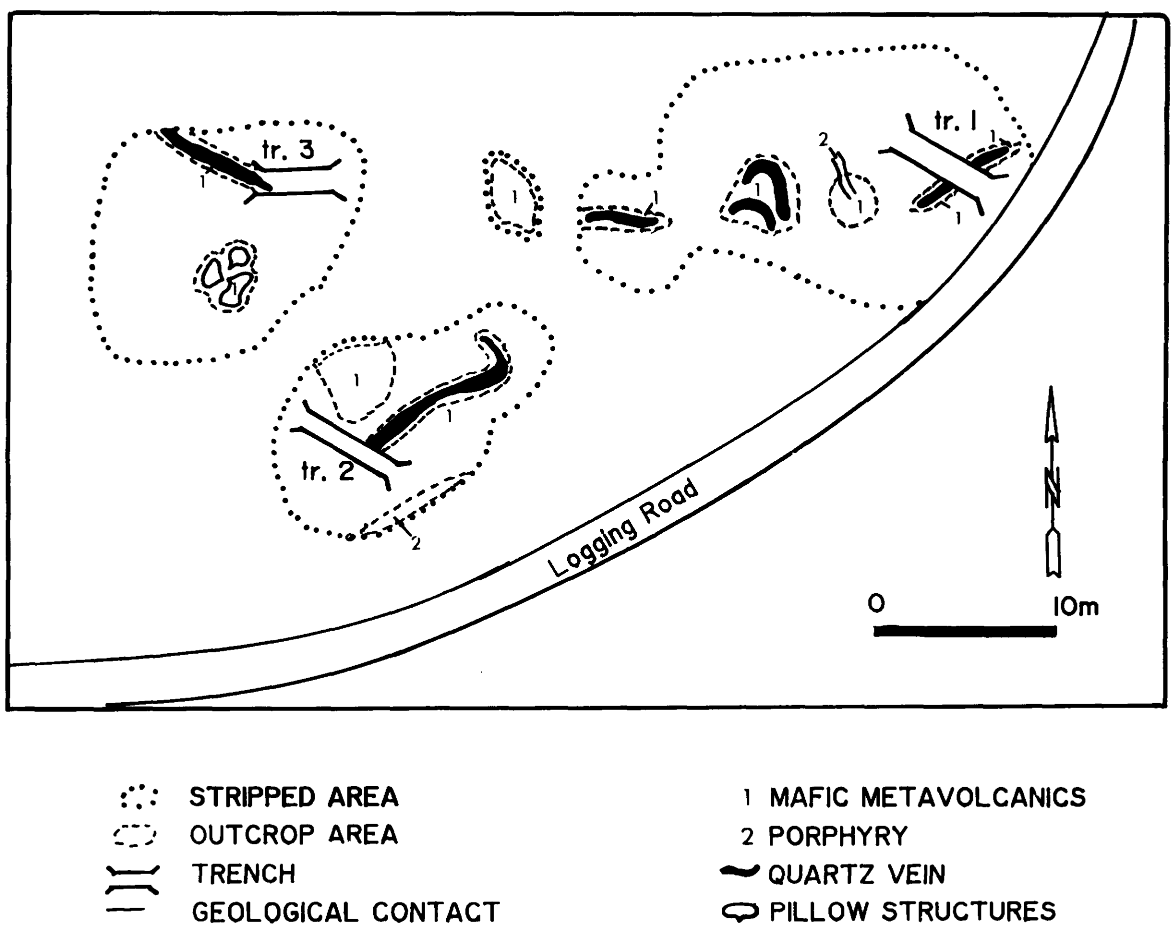

Figure 4.17. Sketch map of the East Bay Hut zone trenches.

occurrence. The bay near the occurrence is too restricted for aircraft under most conditions.

Exploration History

The first report of this property was given in Moore (1911) as follows.

> "What is known as the Northern Lights Mine is situated on location HW694, near the northern end of Northeast Bay. There are a number of old camps at the lakeshore and the shaft is a little over a quarter of a mile to the north. This shaft, which is timbered, was nearly full of water and its depth could not be ascertained. The vein is not exposed on the surface, so nothing could be learned beyond the fact that the quartz from the shaft varies from dark to almost pure white, and is mineralized to a small extent with pyrite and chalcopyrite. About 50 paces to the west a pit 12 feet deep exposes a vein 6 feet wide. The veins here are in schist and diorite. This property has not been worked for some years. Last year it was restaked."

The earliest mention of the property was in an article of *The Daily Times Journal* (*The Daily Times Journal*, February 19, 1904, p.1). Mr. Fawatt, representing the Northern Light Gold Company, was arranging for supplies to be shipped to the site.

In 1910, an article refers to the same property as the Bell Prospect (*The Daily Times Journal*, September 10, 1909).

The next mention of activity on the site was in September 1926 when Mr. J. Rogers of Toronto, the claim holder, visited the site to examine the work done by a gang of men, including mining engineers and geologists (*The Daily Times Journal*, September 17, 1926, p.3).

Property Examination

The Resident Geologist has visited the property several times in the last 10 years. The latest visit was in July 1990. Trowell (1983) mapped the geology at the site as mafic pillowed flows facing and dipping west. The north-trending flows host several comformable gabbro dikes or sills. A number of lineaments in the area trend 070°.

Very little outcrop occurs near the occurrence. One outcrop 200 m south of the trenches exposed mafic metabasalts with a 40 cm wide barren quartz vein striking 020° and dipping 80° south. At the site a series of trenches with 2 crosscuts trend 070°. Figure 4.16 shows the trends and the numbering used for description.

Trench NL-1 is a 20-foot long crosscut trench trending 140°. It exposes slumped debris of a mafic-hosted breccia with a few angular quartz fragments containing 2 to 3 percent pyrite. A fire assayed sample returned a trace of Au.

Trench NL-2 is an open cut along the dip of a vein trending 250° and dipping 50° south. The vein is 10 cm wide and contains 1 to 3 percent chalcopyrite. To the west end of the trench, the vein splits and 1 portion (or another vein) rolls to the horizontal with a slight rake to the southeast. The horizontal vein thickens to 25 cm at the end of the trench. The vein with the 50° dip is slightly sheared and returned an assay of 0.3 ounce per ton Au. The flat vein returned trace Au.

Trench NL-3 is a long open cut along the dip of the 50° dipping vein. The vein varies from 6 to 10 cm and is very sparsely mineralized with pyrite. No samples were taken.

NL-4 is an 8-foot square timbered shaft with water to 6 m from the surface.

Trench NL-5 is a wide open cut on a flat to slightly dipping white quartz vein. The vein is 20 cm thick and has a few chlorite slips and less than 1 percent sulphides.

Trench NL-6 was slumped and exposed no outcrop at the time of the visit.

The only vein that appears to carry significant gold values is the 50° dip vein which is somewhat sheared and has chalcopyrite and pyrite mineralization. The flat vein has little to trace gold where sampled and appears to have limited potential.

The significance of the occurrence is that the east-trending structures appear to persist into north Sturgeon Lake and carry gold in at least 1 instance.

EAST BAY OCCURRENCES

Location and Access

There are a number of occurrences in pits and trenches on the north shore of East Bay of Sturgeon Lake. Many of these showings are located between Pup and Magee lakes south of Belmore Bay of Sturgeon Lake. The East Bay occurrences discussed are located at point B ("Hut Zone") on Figure 4.15.

Access during summer is by traverse from the south end of McEdwards Lake, a small lake south of Belmore Bay of Sturgeon Lake. A forestry road, which joins Highway 599 1800 m south of the Savant Lake, can be followed to the east of Sturgeon Lake to a terminus near Pup Lake. A network of cutting trails allows access to many of the showings.

Exploration History

Very little is known about the early exploration of the East Bay area. Moore (1911) states only that on East Bay are a number of abandoned prospects.

Graham (1930) reported on the Davidson Jarvis group of 15 claims which covered the area between McEdwards and Pup lakes.

The Davidson Jarvis group of 15 claims is situated north of East Bay. A number of quartz porphyry dikes penetrate schisted Keewatin acid and basic flows. Quartzites and con-

TABLE 4.14. SUMMARY OF SIOUX LOOKOUT DISTRICT CORE IN THE LIBRARY.

Area	NTS	Company	Holes
Beckington Lake	52J/02NE	Coastoro Resources Ltd.	2*
		Grandad Res. Ltd.	1
		Mine Lake Res. Ltd.	8
		Villeneuve Res. Ltd.	1*
Bell Lake	52G/15SW	Minnova Inc.	5
Conant Township	52J/07NE	Noranda Inc.	1
Connell Township	52O/08NE	Gallant Gold Mines Ltd.	9
	52O/09SE	Kerr Addison Mines Ltd.	3
		Silverside Resources Inc.	3
Coucheemoskog Lake	52O/08SE	Power Explorations Inc.	22
Drayton Township	52J/04SW	Nahanni Mines Ltd.	2*
Echo Township	52F/16NW	Braeswood Expl. Ltd.	11
		Rio Tinto Canadian Expl.	7
Fourbay Lake	52J/02SW	Riverton Resources Corp.	4
		Steep Rock Res. Ltd.	3*
		(Wahlex Ltd.)	
Fry Lake	52O/03NW	Umex Inc.	12
Johnston Bay	52O/03SE	Kerr Addison Mines Ltd.	7*
Jutten Township	52J/07SE	Westmin Resources Ltd.	3*
Kawashe Lake	52O/06SE	Ateba Mines Ltd.	5
Kecheokagan Lake	52B/02NW	Great Plains Dev. Co.	3
Lomond Township	52K/01SW	Nahanni Mines Ltd.	1
Nemeigusabins Lake	53H/12SW	Platinum Expl. Can. Inc.	9
Parnes Lake	52G/13NW	Denison Mines Ltd.	2
Penassi Lake	52G/14NE	Noranda Inc.	1
Pickerel Township	52F/16NE	Quyta Gold Mines Ltd.	10
		Realmont Red Lake Gold Mines Ltd.	3
		Tarbush Lode Mining Inc.	7
		Tri Origin Expl. Ltd.	2*
	52F/16NW	Tri Origin Expl. Ltd.	1*
Sixmile Lake	52G/15NW	Noranda Inc.	2
		Santana Petroleum Corp.	10
Smock Lake	52G/13NE	BHP–Utah Mines Ltd.	3
Squaw Lake	52J/02SE	Alotta Resources Ltd.	3*
		MPH Consulting Ltd.	3
		Villeneuve Res. Ltd.	1*
Tarp Lake	52O/09SE	H.J. Hodge Inc.	9
		Kerr Addison Mines Ltd.	2
Vermilion Township	52K/01SE	Moneta Porcupine Mines Ltd.	6
Whipper Lake	52K/01SW	Nahanni Mines Ltd.	1
Zarn Lake	52J/04SE	Goldwinn Resources	3
		Kerr Addison Mines Ltd.	2

** Indicates core added since November 23, 1989.*

glomerate are also found on the property. Three gold-bearing quartz veins on claim HW679 have widths from 4 to 6 feet and lengths from 600 to 1000 feet. There are also 2 other smaller veins on claims AL535 and HW737.

Property Examination

Previous property examinations have recorded the longer veins on HW679. These showings have been staked recently. Unfortunately, heavy blow-down of mature pine stands is hindering exploration of these very interesting targets.

A. Best of Savant Lake bought a group of patented claims in the area. While salvaging blow-down timber, a number of old pits were rediscovered and several new pits excavated. These are most likely on the smaller veins referred to in Graham (1930).

A problem in examining these showings is that all surface control has been lost. A number of showings, 7 in total, were examined but only 1 pit had a reliable location due to its proximity to a cutting road. Location 1 is called the "Hut Zone" because of its location near a hut on a road. The trenches are shown diagramatically on Figure 4.17. The series of 3 trenches are located in a 27 m by 48 m stripped area to the west of a cutting road.

The eastern trench is called trench 1, the central trench 2, and the western trench 3. All 3 trenches expose sheared mafic metavolcanics cut by quartz porphyry dikes and highly deformed quartz veins carrying pyrite, rare chalcopyrite and local visible gold. Shearing is variable but trends easterly and dips 70° north. The mafic rocks are sheared, silicified and carbonatized in part. Three grab samples, 1 from each trench, gave assays of 0.88, 2.76 and 0.92 ounce Au per ton. The samples are selected grabs and by no means representative of the overall grade of the outcrop. A. Best has continued working on the area and has recently optioned most of the area to a major company.

Again this is a gold prospect associated with east-trending shear zones. The challenge now is see if this is a regional feature or related to local events in the King Bay–East Bay area of Sturgeon Lake.

DIAMOND-DRILL CORE STORAGE PROGRAM

The Kenora drill core library serves 3 of the 6 Resident Geologist's districts in Northwestern Ontario: Kenora, Patricia (Sioux Lookout) and Red Lake. Core stored consists of core from entire drill holes from both exploration and mine development drilling, incomplete core recovered from old drill sites, and short samples of core submitted for credit under section 77(6) of the Mining Act, Revised Statutes of Ontario, 1980. The current contents of the library consist of 55 408.3 m of core stored inside the building and an additional 22 332.9 m of core on pallets in secure outdoor storage for a total of 77 741.2 m. Core in outdoor storage consists of excess core from several drilling projects that were collected in their entirety, core removed from inside the building when core in better condition became available, and surplus core after some holes were relogged and reduced.

The library holds 18 797.6 m of core from 184 drill holes in the Sioux Lookout District, 13 595.5 m (136 holes) inside the building and 5 202.1 m (48 holes) in outdoor storage. A total of 9 898.2 m of core from 78 drill holes was added to the collection from November 23, 1989 to November 20, 1990. Of this, 2 694.2 m from 25 holes is from the Sioux Lookout District (Table 4.14). Core was collected from 9 properties. All assessment credit core from all 3 districts is now stored at the Kenora core library.

There were 107 visitors to the library during the year. This compares to 193 visitors in 1989. A total of 42 man-days were spent by industry personnel in examining and logging drill core and sample rock suites. The reduced exploration activity in 1990 is responsible for the 45 percent reduction in visitors and the 54 percent reduction in man-days of use over 1989 figures. More exploration geologists enquired about the use of stored pulps and rejects from previous sampling programs. Re-evaluation of base metal properties and re-evaluation of gold properties for their potential has continued.

Gold remained the primary exploration target in all 3 districts, and most of the core collected during 1990 was from gold exploration. Much of the core collected from the Sioux Lookout District came from the North Arm of Sturgeon Lake. Drilling in this area was directed at gold targets.

Core from definition drilling of the Pidgeon Molybdenum deposit in Echo Township is stored at the library but has not yet been completely processed. The mineralized parts of the Lateral Lake intrusion are represented in the core. Selective storage prior to the library obtaining the core meant that much of the metavolcanic host rock was not available for collection.

Drilling in the Honderich Lake area southwest of Pickle Lake by Kerr Addison Mines Ltd. was directed toward gold hosted in sulphide-replaced iron formation. Significant copper and zinc assays were also reported (assessment files, Resident Geologist's office, Sioux Lookout). Core from other parts of the district may have combined gold and base metal potential.

Drilling directed specifically toward building stone or industrial minerals has not been reported in the Sioux Lookout District in recent years.

RECOMMENDATIONS FOR EXPLORATION

BASE METALS

The Ontario Ministry of Northern Development and Mines released a new Aerodat Ltd. airborne electromagnetic and total intensity magnetic survey for the Sturgeon Lake/Savant Lake areas, on November 26, 1990. The Sturgeon Lake/Savant Lake survey covers several areas with known base metal potential. The authors suggest that the results of this survey be compared with past exploration. This may result in the discovery of new targets that warrant follow-up on the ground.

GOLD

The discoveries of gold mineralization at Tonsil Lake and Tarp Lake this past year underline the importance of recognizing and exploring regional deformation zones. The authors wish to re-emphasize the recommendations contained in Janes et al. (1990). Again, further gold exploration should be directed to areas of dilatancy within deformation zones and splays off the main trend of the regional deformation zones. In this report, the potential of easterly-trending structures on Savant and Sturgeon lakes is described.

The property examination report on the Lang Lake Belore Cu-Zn occurrence gives a gold assay of 14 126 ppb gold from a chip sample of approximately 1 m. The authors do not know of any previous gold values from this occurrence. It is recommended that further work be done on the Lang Lake Belore Cu-Zn occurrence in light of the gold assay.

PLATINUM GROUP ELEMENTS

The Pt and Pd assays received from samples taken from the Hoey Syndicate Cu-Ni occurrence on McVicar Lake (Table 4.11) are not economic, but may be anomalous. The McVicar Lake Cu-Ni occurrence is located approximately 8 km east of the Hoey Syndicate occurrence. It is reported to be a minor occurrence of Pd (MDI #KP0258) as well. The McVicar Lake occurrence is found in mafic metavolcanics at the contact with the gabbro-anorthosite complex. The authors recommend that additional exploration be carried out to further evaluate the platinum group element potential of the gabbro-anorthosite complex at McVicar Lake.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

The Ontario Geological Survey fielded 1 summer mapping party in the Patricia Mining Division in 1990. M. Sanborn-Barrie conducted the second year of a synoptic mapping project in the Marchington River–Sturgeon Lake area. This project has a strong structural emphasis and is designed to examine stratigraphic problems in this area, which has excellent gold and base metal potential. The first year of this project covered the Savant Lake area and is reported in Sanborn-Barrie (1989).

The mapping area falls within the bounds of an airborne geophysical survey conducted by Aerodat Ltd. in the spring of 1990 for the Ontario Geological Survey. This survey was released November 26, 1990.

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5. Thunder Bay Resident Geologist's District—1990

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INTRODUCTION

Mineral exploration activity in the Thunder Bay Resident Geologist's District has declined in 1990, in comparison to 1989. Junior mining companies were nearly absent. Activity by prospectors increased as a result of the Ontario Prospector Assistance Program (OPAP). Central Crude Limited is carrying out the only advanced exploration project in the district. Madeleine Mines Ltd. completed construction of their mill at Lac des Iles. INCO Limited's Shebandowan copper-nickel mine was in production all year. Amethyst was quarried from 5 sites and diabase from 1 site.

MINING ACTIVITY

The Shebandowan Mine, owned by INCO Limited and operated by MacIsaac Exploration Ltd., produced nickel-copper concentrates (plus cobalt, platinum) and shipped them to Copper Cliff for smelting. The annual average mill rate was 2000 tons per day, producing 308 tons of concentrate per day. An employment level of 310 was increased to 390 at mid year due to increased development from the 2000- to 2600-foot levels (G. Willock, INCO Limited, personal communication, 1990). The mine is located 75 km west-northwest of Thunder Bay, underneath Lower Shebandowan Lake.

Amethyst is quarried from 5 sites in McTavish Township. The product is sold as specimens, decorative stone, aquarium stone, landscaping stone, slabbing and tumbling stone, jewellery and giftware, and faceted gem stones. Diabase is sold for landscaping, riprap and as raw material for rock wool insulation. Table 5.1 summarizes local production of these materials.

ADVANCED EXPLORATION ACTIVITY AND DEVELOPMENT

Madeleine Mines Ltd., Lac des Iles Property

Construction of Madeleine Mines mill, which began in the summer of 1987, was completed in December 1990. The pace of construction activity in 1990 was much greater than previous years due to an increased workforce which was approximately 30 for the first half of the year and 60 for the second half. Foundations for the mill were poured in 1987, with the building being erected in January 1988. Installation of the grinding circuit began in January 1989. This site is located 75 km north of Thunder Bay. The mineralization is hosted by the Lac des Iles Gabbroic Complex which intrudes Wabigoon Subprovince tonalite.

The mill consists of a large outdoor jaw crusher, an outdoor mobile crushing circuit with a small jaw crusher, and 2 cone crushers, powered by two 450 to 500 kilowatt, 600 volt truck-mounted generators. This crushing circuit was in operation in the fall of 1990, when it produced 8000 tons of minus 3/4" stockpile. This stockpile sits over a feeder tunnel and conveyer which feeds the two-stage grinding circuit. The grinding circuit consists of 1 rod mill, 3 ball mills and a 4 cyclone cluster mounted above mills. The cyclone overflow proceeds to Rougher flotation cells (via conditioner tank) where primary concentrates are floated off. This concentrate is purified in cleaner cells the concentrate of which is then processed on riffle tables. The concentrates are then dewatered in a disc filter to achieve an 8 percent moisture level. The slurry is conditioned with the following reagents: $NaCO_3$, Carboxy Methyl Cellulose, $CuSO_4$, Potassium Anyl Xantrate, A208, Dowfroth 250C and NaS. Rougher flotation tails are further processed in scavenger cells. All tails end up in an outdoor, in-ground sand thickener, where the mill water is decanted and recirculated (closed circuit). This mill is expected to have a 3000 tons per day capacity and may be tested before year's end. The mill is powered by three 1750 kilowatt, 480 volt truck-mounted generators.

In addition to minesite activity, Madeleine Ltd. Mines also began preparations for overburden removal on other mineralized zones.

Central Crude Limited, Moss Lake Project

In December 1989, Tandem Resources Ltd. and Storimin Exploration Limited signed a letter of intent with Central Crude Limited concerning their Moss Lake joint venture gold project. Under the terms of the letter of intent, Central Crude can spend up to $4 million in stages over a period of 5 years to earn a 51 percent interest in the project. Noranda Exploration Company Ltd. is the projects operator and is an indirect major share holder of Central Crude through its 50 percent

TABLE 5.1. INDUSTRIAL MINERAL AND SEASONAL PRODUCERS, 1990.

Producer	Location	Commodity	Products/Production
A.J. Wing and Sons Construction Ltd./ Contracting Ltd.	MacGregor Township	diabase	raw material for rock wool, L.T.L. construction material
Grann Diamond Willow Mine	McTavish Township	amethyst	specimens, decorative stone, aquarium stone, 35 tons produced
Grieve, M.	north of MacGregor Township	amethyst	specimens; small amount produced
Noyes Diamond Willow Mine	McTavish Township	amethyst	specimens, decorative stone, aquarium stone, 35 tons produced
Ontario Gem Company Ltd.	McTavish Township	amethyst	specimens, slabbing and tumbling stone; 25 tons produced
Pearl Lake Amethyst Mines Inc.	McTavish Township	amethyst	decorative stone, slabbing/tumbling stone, specimens; 70 tons produced
Thunder Bay Amethyst Mine Panorama	McTavish Township	amethyst	slabbing and tumbling stone, specimens, fireplace stone, landscaping pieces, faceting material, 4000 tons produced

owned subsidiary, Hemlo Gold Mines Inc., which in turn controls 41.2 percent of Central Crude's issued and outstanding common shares.

Drilling began immediately on this property which is located 110 km west of Thunder Bay. Seventeen holes totalling 19 610 feet were drilled in the winter drill program. This confirmed that the low-grade gold mineralization had a minimum strike extent of 5000 feet. Also, metallic assays, done in addition to the normal fire assays, indicated that the grade of the gold mineralization was 20 to 30 percent higher than the results of the fire assays. On May 11, 1990 a Central Crude press release contained the following grade and tonnage information:

	Tons	Au (oz./ton)
North Zone West	595 100	0.11
North Zone East	255 394	0.23
South Zone West	330 358	0.12
South Zone Centre	299 133	0.17
South Zone East	562 124	0.21

These high-grade zones are within a halo of low-grade material, which, as indicated by released drill results, could be as wide as 998 feet, grading 0.025 to 0.050 ounce Au per ton (fire assay results).

In May 1990, Central Crude expanded its property holdings by entering into an option agreement with INCO Limited, on their Span Lake claims. This 26 claim group adjoins Central Crude's claims to the northeast. Central Crude also entered into an option agreement with Broad Horizon Inc. on 3 additional claim groups totalling 50 claims. These are located immediately east and north of their property.

During mid-spring, Central Crude began construction of an exploration camp, stripping, line cutting, geophysical surveying, geochemical sampling, geological mapping and prospecting. A 24 hole summer drill program tested the QES zone. This zone has now been defined for a strike length of 2600 feet to a depth of 600 feet, over a width of 350 to 450 feet. Assays over these widths ranged from 0.023 to 0.040 ounce Au per ton.

In late September 1990, Central Crude entered into a second option agreement with Tandem Resources Ltd. and Storimin Exploration Limited. Central Crude can now earn up to a 60 percent interest in this project by spending $2.5 million, in addition to the previously committed $4 million.

A widely circulated report by Alan Ferry of Goepel Shields and Partner on October 31, 1990 (Resident Geologist's files, Thunder Bay District, Thunder Bay, 3p.), indicates that the reserves estimate of 60 million tons to a depth of 600 feet and along a 6500- foot strike length, is an underestimate, as the latest drilling has extended the strike length to 8500 feet (Main and QES zones) and the depth to 800 feet. Assays from the 600- to 800-foot depth are higher than those above 600 feet and an overall grade of 0.035 ounce Au per ton is estimated. It is probable that this deposit contains 3 to 4 million ounces of gold.

This report also indicates that roughed out mining parameters suggest optimum milling capacity in the 15 000 to 20 000 tons per day range, to produce 150 000 to 200 000 ounces of gold per year. Capital cost could be as high as $200 million and operating costs would be around US$6 per ton of rock, or under US$240 million per ounce.

A November 28, 1990 Central Crude Limited press release contains the result of the ongoing drilling program. It confirms that the mineralization has a strike length of 8000 feet.

The gold mineralization is hosted by an altered diorite stock, the dimensions of which are continually being expanded by Noranda Exploration Company, Ltd. On ODM Map 2204 (1970), the host diorite is less than one-quarter mile long. Currently Noranda has the length as 10 miles long, the result of more detailed mapping and interpretation. Within the diorite, gold is concentrated in metre(s) wide shear zones and in fracture sets in more competent diorite in between the abundant shear zones. The overall strike of the mineralized zone within the diorite is 070°, while the regional strike of the foliation is 045° to 050° as is the strike of the diorite. The mineralized deformation zone appears to transect the diorite at a shallow angle. Late deformation of this intrusive rock appears to be the control on the localization of this mineralization.

EXPLORATION ACTIVITY

Exploration activity in the Thunder Bay Resident Geologist's District declined in 1990. It also declined in the Thunder Bay Mining Division which includes the Beardmore–Geraldton and Schreiber–Hemlo Resident Geologists' districts. An indirect measure of this decline in the Thunder Bay Mining Division is the number of active claims (Table 5.2); it has decreased from 36 911 (in 1989) to 31 202 (in 1990), a 15.5 percent decline. Claim staking has declined from 6856 (1989) to 5558, an 18.9 percent decline. In the Thunder Bay Resident Geologist's District, active claims have declined from 12 414 (1989) to 10 527 (1990), a 15.2 percent decline.

The decrease in the level of exploration activity for the Thunder Bay Mining Division as measured by the number of man days of assessment is 49.8 percent. With respect to man days of assessment by diamond drilling, it has decreased by 34.3 percent. These figures are considered to be low as there is a lag time in submissions from the previous year's activity.

In the Thunder Bay Resident Geologist's District, despite these indications of decreased activity, the number of active properties climbed to 89, from 65 in 1989. Exploration programs on most of these properties were modest in comparison to previous years. For example in 1989, 28 properties underwent diamond drilling in comparison to 22 in 1990 (Table 5.3). The increase in the number of active properties is a result of 2 factors, OPAP (and to a more limited extent, Ontario Mineral Incentives Program) (OMIP) grants, and the extensive exploration effort undertaken by Noranda Exploration Company, Ltd. and Central Crude Limited in the western Shebandowan greenstone belt. Noranda is carrying exploration programs on behalf of Central Crude Limited on 5 of Central Crude's options, and also, on 20 other properties in the western Shebandowan belt. In 1989, Noranda was active on only 7 properties. The distribution of claim staking, and exploration activities is plotted on Figures 5.1 and 5.2.

There are 25 approved OPAP grant applications for a total of $258 772 of expenditures, and 15 approved OMIP applications for a total grant allocation of $1 045 996, which will translate to $3 486 652.2 of exploration expenditures.

In 1990, 40 properties were explored by prospectors (24 in 1989), 17 by junior mining companies (30 in 1989, and 57 in 1988) and 31 by major mining companies (21 in 1989). If it were not for Noranda's increased activity, possibly only 13 properties would have been explored by major mining companies.

The most sought after commodity is gold, as it was the primary target on 64 properties. Eight properties were explored for amethyst, 6 for base metals, 6 for platinum group metals, 2 for quartz and 2 for uranium.

On October 31, 1990, 946 ha were opened for staking in Moss Township. Many of these parcels of land (a total equivalent of 56 claims) are adjacent to the Jackfish Mine, also known as the Ardeen, Huronian, Moss or Kerry Mine. The Jackfish is a lode gold deposit which produced 29 628 ounces of gold and 170 463 ounces of silver. It is the second oldest gold mine in Ontario, with production having first taken place in 1882. Belore Mines Ltd., which owns the minesite, sold the adjacent patented claims to the province of Ontario in 1976 under a joint federal-provincial program called the Agricultural Rehabilitation and Development Act. Depatenting of this land could only proceed after amendments to the Public Lands Act came into effect 2 years ago. Once stripped of title, the land was temporarily withdrawn from staking. Despite being within a few kilometres of Central Crude's Moss Lake project, and being adjacent to a past gold producer, the land acquisition activity on the opening day could hardly be called a staking rush, with only 2 competitors vying for these claims. This is a measure of the current ill health of the exploration industry.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The office of the Resident Geologist was staffed by Maurice Lavigne Jr., Resident Geologist and John Scott, Staff Geologist. Staff of the Resident Geologist's office handled 1000 inquiries, conducted 18 property visits and 1 prospecting course. Staff in the assessment file office handled 800 inquiries. Two field trip guidebooks were completed [Aubut et al. (1990) and Lavigne and Scott (1990)]. One was prepared for a one-day field trip of base metal mineralization in the She-

TABLE 5.2 SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDITS.

Year	Recorded Claims	Cancelled Claims	Active Claims	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total (Man Days)
1970	5 830	4 192	10 417	103 559	83 389	6 078	198 791
1971	4 627	5 211	9 833	63 774.25	53 028	7 456	131 962.72
1972	3 442	5 091	8 184	61 512.2	53 757.5	4 776	131 393
1973	2 253	5 515	4 922	49 575	24 320	7 450	93 308.6
1974	3 305	3 391	5 837	37 130.5	26 061	4 300	80 559.2
1975	3 436	2 869	6 404	38 652	52 020	4 700	105 388
1976	2 364	3 552	6 079	52 551.6	29 504	4 600	101 025.8
1977	1 964	2 966	5 077	24 879	25 601	4 870	68 727
1978	3 517	1 982	6 612	20 182	20 589	6 206	51 299
1979	3 099	2 139	7 554	11 528	69 612	14 727	101 799
1980	5 527	1 836	11 245	53 418	57 483	5 372	127 288
1981	6 768	4 162	13 851	55 256	172 366	13 863	256 686
1982	10 266	4 613	19 349	133 035	114 805	24 437	292 273
1983	15 835	1 537	33 547	113 554.3	439 992.8	64 789.1	664 891.3
1984	8 389	7 206	34 904	142 488.6	551 863.9	90 107.6	992 977.6
1985	4 353	10 222	29 035	170 022.8	475 736.7	65 802.1	794 099
1986	15 959	13 900	32 097	110 246.86	281 786.04	24 769.64	462 796.44
1987	16 269	7 712	41 568	205 369.2	724 924	54 631.9	1 070 214.4
1988	10 548	10 796	41 994	291 548.7	633 285.2	77 031.8	1 116 338.4
1989	6 856	10 608	36 911	193 135	370 506	39 505	709 178
1990	5 558	12 283	31 202	126 918	106 335	51 440	356 134.5

bandowan greenstone belt. This guidebook was published by the Institute on Lake Superior Geology in conjunction with their annual meeting held in Thunder Bay, May 9-12, 1990. A second guidebook was prepared for a three-day field trip of the Shebandowan greenstone belt. This guidebook was published by the Canadian Institute of Mining and Metallurgy and the field trip was conducted in conjunction with the Twelfth Annual District Four Meeting held in Thunder Bay, September 11-13, 1990. Overburden stripping and detailed geological mapping was carried out on several mineral occurrences.

PROPERTY EXAMINATIONS

Puddy Lake (Knut Kuhner) Cu, Ni, PGM Property

Puddy Lake is 180 km north of Thunder Bay. It is underlain by a 7 km long, 1 km wide ultramafic intrusion which is host to a number of nickel and chromite occurrences. Elevated platinum group metal (PGM) values have also been reported. This intrusion is the host to Ontario's only chromium mine. Bulk samples were removed from underground workings in the 1930s.

Prospector and president of Obonga Precious Metals Inc., Knut Kuhner, is currently exploring the eastern half of the south shore of Puddy Lake. This area was explored by Falconbridge Nickel Mines Ltd. in 1971. They carried out a 2-hole diamond drilling program. From 1965 to 1968 Commerce Nickel Mines Limited carried out geochemical and geophysical surveys and diamond drilling. Recent stripping and surface sampling by Knut Kuhner have revealed elevated values of Ni, Cu, Au and PGM. Samples collected by the staff of this office, as well as samples submitted to this office by Knut Kuhner have revealed analyzed values as high as 5.02% Cu, 2.1% Ni, 415 ppb Au, 1500 ppb Pt and 3750 ppb Pd.

The authors examined this property in September. The host rock is ultramafic in composition, dominantly fine grained with a buff-green weathered surface and very dense. Locally, within irregular shaped domains that are less than 1 m in size, this rock is coarse grained. Here, pyroxene laths are set in a soft light green, aphanitic matrix. Regular layering was not observed.

Sampling, which generated anomalous metal values, came from areas within the ultramafic host that are pervasively fractured and altered. Fracturing is intense enough to

TABLE 5.3. EXPLORATION ACTIVITY IN THE THUNDER BAY RESIDENT GEOLOGIST'S DISTRICT.

ABBREVIATIONS

AEM	Airborne electromagnetic survey	IP	Induced polarization survey
AMag	Airborne magnetometer survey	Mag	Magnetometer survey
ARad	Airborne radiometric survey	Res	Resistivity survey
DDH	Diamond-drill hole	Rad	Radiometric survey
EM	Electromagnetic survey	UG	Underground work
HL-EM	Horizontal-loop electromagnetic survey	VLF	Very low frequency electromagnetic survey

	Company/Individual (Property Name)	Claim Map Sheet (Commodity)	Exploration Activity
1)	Aubut, Alan (Moose Occurrence)	Shillabeer Lake area (U)	geology, Rad
2)	Bumbu, Costy	Ruffo Lake area (Cu-Zn), Hays Lake area (quartz)	mechanical, stripping, sampling
3)	Calvert, Dan	Conmee Township (Au)	stripping
4)	Calvert, Dan	Hagey and Conacher townships (Au)	trenching
5)	Calvert, Dan	Firefly Lake area (Au)	DDH
6)	Central Crude Limited	Burchell Lake area (Au)	IP, stripping, DDH
7)	Central Crude Limited (JET Option)	Burchell Lake area (Au)	geology, IP, stripping, prospecting
8)	Central Crude Limited (Broad Horizons)	Burchell Lake area (Au)	IP, geology, prospecting
9)	Central Crude Limited (INCO Option)	Burchell Lake area (Au)	geology, prospecting
10)	Central Crude Limited (Tandem–Storimin Option)	Burchell Lake area (Au)	mapping, stripping, DDH, IP, geochemistry
11)	Chapman, Lawrence	Hanniwell Township (Cu-Ni)	stripping, sampling, DDH
12)	Christianson, Dave	Greenwich Lake area (U)	stripping, sampling, assays
13)	Cox, Nolan	O'Connor Township (barite)	mechanical, stripping, blasting
14)	Cumberland Resources Ltd.	Wabikon Lake area (Cu-Zn-Au)	geology, geophysics
15)	Curran Bay Resources Inc.	Saganagons Lake area (Au)	1 DDH (46.9 m)
16)	Curran, Mike/Enger, M.	Max Lake area (Au, Zn)	trenching, VLF, Mag, geology, soil sampling
17)	Dumas, Lawrence	Onion Lake area (quartz, feldspar)	stripping, trenching
18)	Durocher, P.	McTavish Township (amethyst)	power stripping
19)	Exploration Laminco Inc.	Pikitigushi Lake area (Cr, Pt)	VLF, Mag
20)	Falconbridge Limited (Hammond Reef Mine)	Sawbill Bay area (Au)	7 DDH (1448.75 m)
21)	Fleck Resources Ltd. (Isotalo Option)	Pardee Township (Pt-Ni)	power strippping, geophysics, DDH
22)	Grand Portage Resources	Moss Township (Au)	power stripping, assays
23)	Grieve, Mike	Tartan Lake area (amethyst)	stripping, trenching, mapping, geophysics
24)	Hackl, J.	Duckworth Township (Au)	stripping, sampling
25)	Harty, Richard	MacGregor Township (amethyst)	stripping
26)	Hicks, Clifford	Crooked Pine Lake area (Au)	prospecting, trenching
27)	Holzem, M.H./Holzem, J.K.	Titmarsh Lake area	trenching
28)	Home Lake Resources	Powell Lake area (Cu-Zn)	stripping, trenching, DDH

TABLE 5.3. CONTINUED.

	Company/Individual (Property Name)	Claim Map Sheet (Commodity)	Exploration Activity
29)	INCO Ltd.	Ruffo Lake area (Au)	geophysics, geology
30)	INCO Ltd. (Stewart Option)	Conmee Township (Au)	DDH
31)	INCO Ltd. (Ternowesky Option)	Duckworth and Laurie townships (Au)	prospecting, DDH
32)	INCO Ltd.	Hagey Township (Au, Cu)	DDH
33)	International Geoventures Inc.	Moss Township (Au)	5 DDH (634.3 m), assays
34)	International Geoventures Inc.	Burchell Lake area (Au)	power stripping
35)	Inwood Forest Products	Hanniwell Township (Au)	power stripping, trenching, EM, Mag
36)	Kuhner, Knut	Puddy Lake area (Pt, Ni)	power stripping, assays
37)	Kukkee, Ken	Moss Township (Au)	stripping, wash, trenching
38)	Kukkee, Ken	McTavish Township (amethyst)	stripping, assays
39)	Lacana Exploration (1981) Inc.	Crayfish Lake area (Au)	4 DDH (1641 m)
40)	Lukosius-Sanders, J.	Burchell Lake area (Au)	prospecting, geochemistry, geological mapping
41)	Luski, M.	Pardee Township (Pt, Cu, Ni)	DDH
42)	Maki, M. (Greenpike Lake Occurrence)	Gorham Township (Au)	stripping, trenching
43)	McLeod, Gordon	MacGregor Township (amethyst)	trenching
44)	Mingold Resources Inc.	Wabikon Lake area (Au)	6 DDH (592.5 m)
45)	Minnova Inc. (Vanguard Occurence)	Kashabowie Lake area (Cu-Zn)	2 DDH (693 m)
46)	Monopros Ltd.	Highway 527 — Lake Nipigon (diamonds)	sampling
47)	Morehouse, W.	Crooked Pine Lake area (Au)	stripping, trenching
48)	Myslicki, J. (Powell Occurrence)	Saganaga Lake area (Au)	stripping, trenching
49)	Noranda Exploration Company Ltd. (Sanders Option)	Burchell Lake area (Au)	IP, prospecting, 4 DDH (440 m)
50)	Noranda Exploration Company Ltd. (Coldstream Option)	Burchell Lake area (Au)	prospecting
51)	Noranda Exploration Company Ltd. (Olcott Occurrence)	McCaul Township (Au)	stripping, trenching
52)	Noranda Exploration Company Ltd. (Schoor Option)	Burchell Lake area (Au)	geology, stripping, prospecting
53)	Noranda Exploration Company Ltd. (Rainbow Resources Option)	Burchell Lake area (Au)	geology, prospecting
54)	Noranda Exploration Company Ltd. (Lookout Property)	Burchell Lake area (Au)	geology, prospecting
55)	Noranda Exploration Company Ltd. (Waverly Property)	Burchell Lake area (Au)	geology, prospecting
56)	Noranda Exploration Company Ltd. (Grand Portage–Wawiag Resources Option)	Moss Lake area (Au) (Au)	geology, stripping, prospecting, geochemistry, IP

TABLE 5.3. CONTINUED.

	Company/Individual (Property Name)	Claim Map Sheet (Commodity)	Exploration Activity
57)	Noranda Exploration Company Ltd. (Grand Portage Option)	Moss Lake area (Au)	geology, stripping, prospecting, geochemistry, IP
58)	Noranda Exploration Company Ltd. (Deaty's Property)	Moss Lake area (Au)	geology, IP, geochemistry
59)	Noranda Exploration Company Ltd. (Windblown Property)	Powell Lake area (Au)	geology
60)	Noranda Exploration Company Ltd. (Powell Lake Property)	Powell Lake area (Au)	prospecting
61)	Noranda Exploration Company Ltd. (Wawiag East Property)	Moss Lake area (Au)	prospecting
62)	Noranda Exploration Company Ltd. (Cyprien Poirier Option)	Tilly Lake area (Au)	geology, prospecting, IP, stripping, 4 DDH (450 m)
63)	Noranda Exploration Company Ltd. (Obadinaw Property)	Moss Lake area	geology, prospecting
64)	Noranda Exploration Company Ltd. (Lookout Property)	Moss Lake area	geology, prospecting
86)	Noranda Exploration Company Ltd.	Moss Township (Au)	stripping, prospecting, geology
87)	Noranda Exploration Company Ltd. (Band Ore Option)	Hagey and Conacher townships (Au)	3 DDH (400 m)
88)	Noranda Exploration Company Ltd.	Kabigon Lake area (Au)	geology
65)	Noyes, Clark	McTavish Township (amethyst)	stripping, trenching
66)	Placer Dome Inc.	Norway Lake area (Au)	Mag, VLF
67)	Placer Dome Inc.	Richardson Lake area (Au)	Mag, VLF
68)	Placer Dome Inc.	Oldman Lake area (Au)	rock geochemistry
69)	Ross, R.D.	Big Ghee Lake area	trenching, sampling
70)	Sanders, T.	Burchell Lake area (Au)	2 DDH (374.5 m)
71)	Sanders, T.	Burchell Lake area (Au)	Mag, VLF
72)	Schoor, Manfred	Haines Township (Zn, Au)	stripping, trenching
73)	Schoor, Manfred	Tib Lake area (Pt)	stripping, trenching
74)	Seargeant, Dennis	MacGregor Township (Au)	geology, geophysics, sampling
75)	Smith, Basil	MacGregor Township (amethyst)	power stripping
76)	Societe Minere Mimiska Inc.	Miranda Lake area (Au)	6 DDH (698 m)
77)	Societe Minere Mimiska Inc. (Fern Elizabeth Option)	Freeborn Township (Au)	22 DDH (3060 m)
78)	Starr, E.	Saganaga Lake area (Au)	stripping, trenching
79)	Tandem Resources Ltd.	Moss Township (Au)	geology, power stripping
80)	Terraphysics Ltd.	Saganaga Lake area (Au)	stripping, DDH
81)	Total Energold (Sandy–Stewart Option)	Sawbill Bay area (Au)	prospecting, geochemistry
82)	Twomey, T.	McTavish Township (amethyst)	power stripping, sampling, line cutting
83)	Wicheruk, M.	Hutchinson Township (Au)	geophysics
84)	Wilson, George	Niobe Lake area (Cu, Ni, Pt)	stripping, trenching, sampling
85)	Wing, A.J.	Dawson Road Lots (Au)	

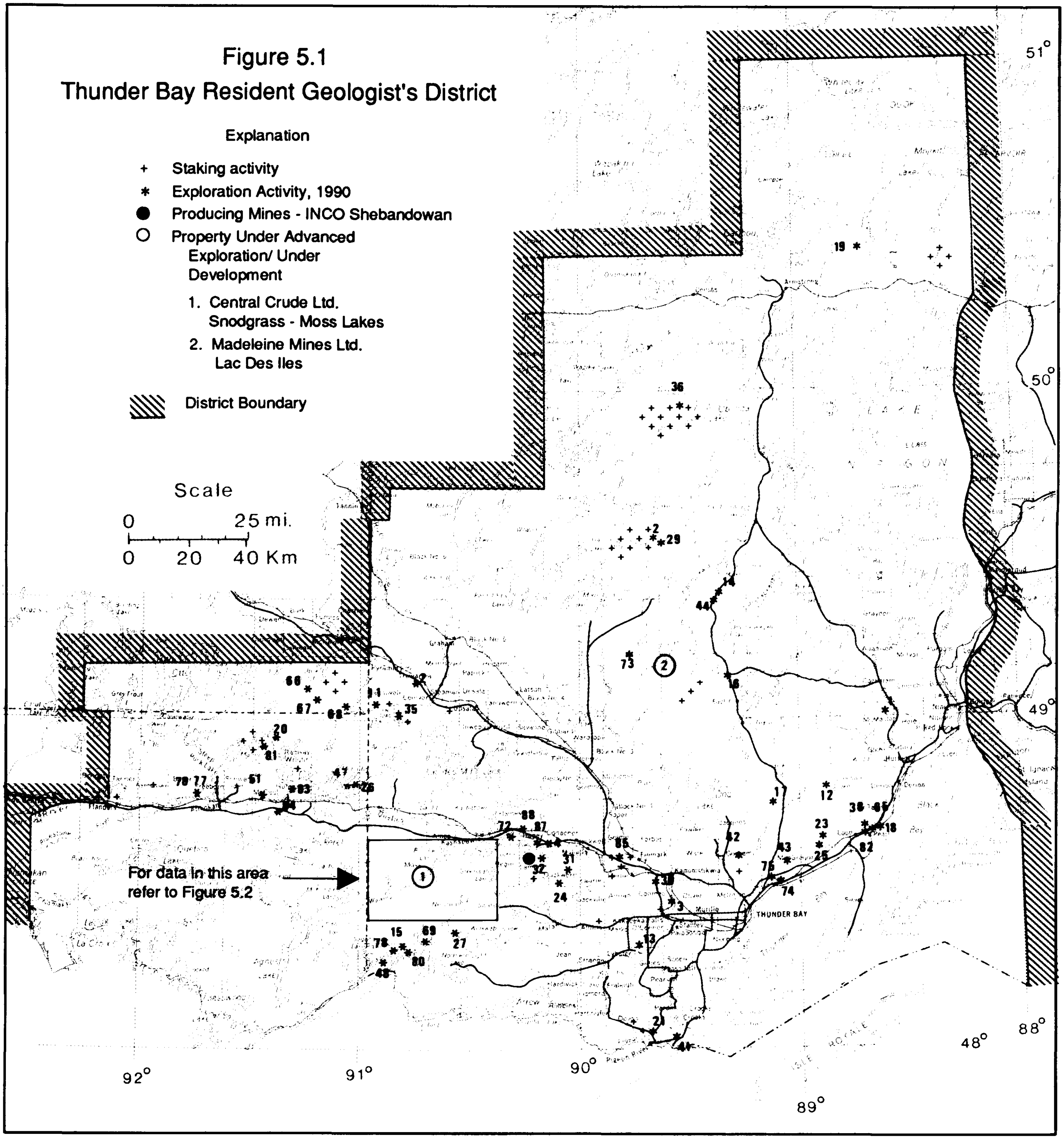
Figure 5.1
Thunder Bay Resident Geologist's District
Explanation
+ Staking activity
* Exploration Activity, 1990
● Producing Mines - INCO Shebandowan
○ Property Under Advanced Exploration/ Under Development
1. Central Crude Ltd. Snodgrass - Moss Lakes
2. Madeleine Mines Ltd. Lac Des Iles
District Boundary
Scale
0 25 mi.
0 20 40 Km
For data in this area refer to Figure 5.2
THUNDER BAY
51°
50°
49°
48°
88°
89°
90°
91°
92°

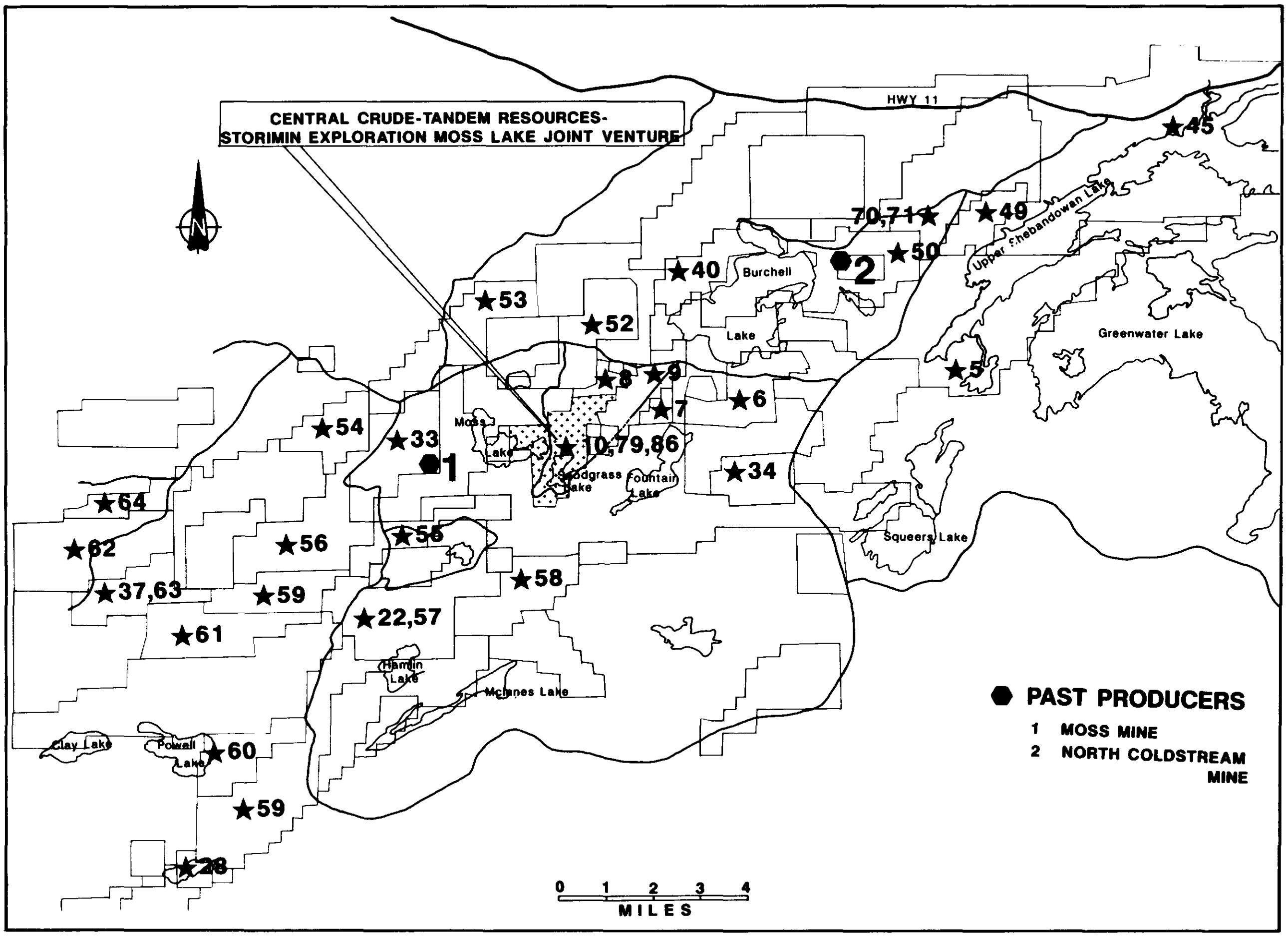

Figure 5.2. Exploration activity in the Moss Township area.

locally produce breccia. The fractures are generally 1 mm in width and filled with magnetite. In some locations the fractures are up to 5 mm in width. The magnetite also occurs as disseminated grains that occupy 5 percent of the rock volume. The colour of the alteration is variable. In the fractured area, it is reddish, and the coatings on the fractures are reddish orange (iddingsite). Apple-green alteration (serpentinization) is common at the east end of the lake.

In several locations, stripping has revealed that these alteration zones are 20 to 30 m wide and are cored by 2 m wide shear zones. High base and precious metal values are associated with magnetite localized in fracture zones that are spatially related to shear zones.

One possible mechanism for the generation of these high metal values is related to serpentinization. Water-rich hydrothermal solutions accessed the ultramafic via the shear zones. Hydration of olivine resulted in the formation of magnetite, talc and serpentine. Magnetite was mobilized within the shear zones and also permeated the wall rock to form the fracture zones. This process scavenged other metals from within the ultramafic. High background values of both chromium and nickel within the ultramafic (Whittaker 1986) provided an enriched source of metals. This facilitated the generation of high metal concentrations during serpentinization. The background content of platinum group metals is unknown and primary magmatic concentrations have not been discovered. The high platinum group metal values found to date are in the secondary mineralizing environment just described. The gold mineralization is localized in sheared and altered iron formation. A detailed understanding of this intrusion could lead to the discovery of primary, magmatic, platinum group metals mineralization. To date, the only magmatic layering identified is at the north end of Chrome Lake. Bedded chromitites strike north, tangential to the long axis of this intrusion and the intuitive strike direction.

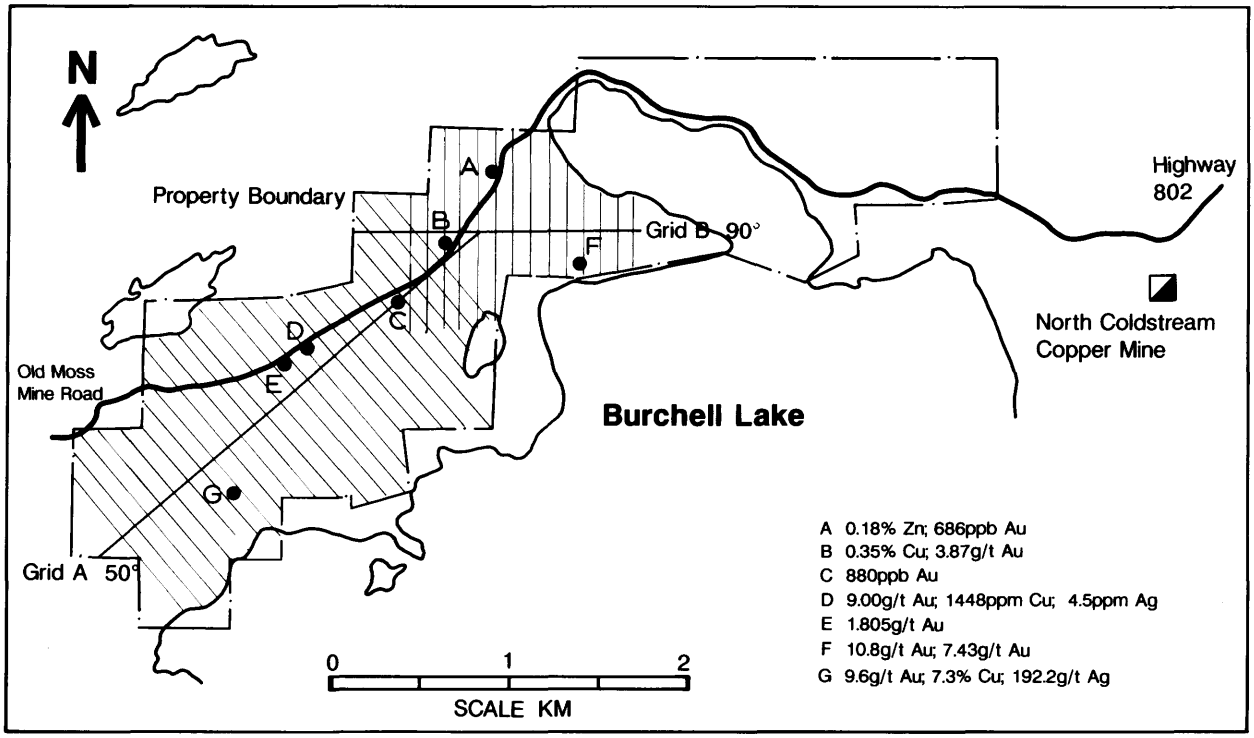

Figure 5.3. Distribution of gold occurrences on the Lukosius–Sanders property.

Homestake–Saganaga Lake Gold Occurrence

During the course of geological mapping and lithogeochemical sampling in the fall of 1989, Homestake Mineral Development Company discovered a gold-bearing horizon in close proximity to the north shore of Saganaga Lake (between line 34E 6 + 00S and 39E 4 + 50S; Resident Geologist's files, Thunder Bay District, Thunder Bay). Saganaga Lake is 120 km west-southwest of Thunder Bay, straddling the international border. The property was under option from James Myslicki. Since then, the option agreement has been cancelled and the property returned to the vendor James Myslicki (Rose Garden Inn). The gold-bearing horizon strikes 070° and has been traced for 500 m along the south wall of an east-northeast-trending valley. This valley forms a prominent topographic lineament. As a result of being exposed along the ridge, many of the mineralized exposures are in fact subcrop of locally derived talus.

The mineralization is well exposed at Homestake's sample location 29711 (which assayed 3.2 g/t Au). A sample taken by the authors assayed 0.011 ounce Au per ton. The mineralization is hosted by an oxide facies banded iron formation which has a maximum thickness of 3 m. Bedding is defined by 1 cm thick bands of magnetite and grey chert. Bedding is transposed parallel to a strong foliation which strikes 070°, and dips 30° south. This iron formation is locally pyritized. The iron formation itself is hosted by a mylonite zone which is more than 6 m but less than 15 m thick. Country rock is mafic in composition (hornblende-phyric) and of variable grain size ranging from fine to medium. These rocks may be recrystallized flows, the result of amphibolite-grade metamorphism. Some may also be later intrusive rocks. Within and in proximity to the mylonite zone, feldspathic dikes are common. The mafic rocks are locally altered to pink colour resulting in a mottled to wispy red and green weathered surface.

This gold mineralization is the result of the shearing and alteration of the iron formation. This particular shear zone is coincident with a narrow linear topographic depression. Numerous other, similarly oriented topographic depressions in the area may also be controlled by shear zones, which may contain gold mineralization. Coincidence of these with iron formation is a favourable condition for gold mineralization.

Lukosius–Sanders Gold Property

The Lukosius–Sanders gold property was staked in 1984 and 1985 by Todd Sanders and Jurate Lukosius–Sanders. It is adjacent to and along the northwest shore of Burchell Lake, 100 km west of Thunder Bay. Other than a mention of gold and platinum along the northwest shore of Burchell Lake (Round Lake then) in an 1895 Ontario Bureau of Mines report, this property did not contain any known gold occurrences at the time of staking. This property is known to contain 8 gold occurrences over an area 0.5 km wide by 2.4 km long. Only a minor amount of exploration is on record as having taken place prior to the 1980s.

In 1952, Hermes Mines Limited carried out geological mapping and prospecting on the southern part of the property. In 1956, New Alger Mines Ltd. carried out self potential and vertical loop electromagnetic surveys over the northern part of the property. In 1957, Arcadia Nickel Corp. Ltd. undertook magnetic and vertical loop electromagnetic surveys, and drilled 1 short hole on the western portion of the claim group (assessment files, Resident Geologist's office, Thunder Bay District, Thunder Bay).

The current exploration program consisted initially of prospecting, a VLF survey and geological mapping in 1985 and 1986. In 1987 the Sanders also carried out magnetic and radiometric surveys. Later that year the property was optioned to Discovery West Corp. They carried out induced polarization , resistivity and magnetic surveys. Many of the geophysical anomalies were either drilled or stripped and sampled from 1987 to 1989. The initial 14 hole, 7500-foot drill program intersected anomalous gold values. The average gold tenor of 709 samples taken from this drill core is over 47 ppb Au and 232 ppm Cu. None of the values from either the drill core or from surface sampling can be called a new gold occurrence (less than 1000 ppb). Subsequent to the expiry of the option agreement in September 1989, Jurate Lukosius–Sanders carried out a prospecting and sampling program which included resampling of the stripped areas. Jurate Lukosius–Sanders received OPAP funding for this program. Gold was discovered in the stripped areas as a result of resampling. Grab samples taken during the initial exploration program did not contain significant gold values.

Gold was not only discovered by resampling the stripped areas, but also during grass roots prospecting by Jurate Lukosius–Sanders. A new gold occurrence, called "Power of Dreams", produced values as high as 10.8 g/t Au from grab samples. This occurrence and others located on Figure 5.3 are described below, based on information provided by Jurate Lukosius–Sanders and some observations by the authors:

Trench A: Chlorite-sericite schist in porphyritic intermediate volcanic; 0.18% Zn and 686 ppb Au

Trench B: Intermediate to felsic volcanics at south end of trench have variable pyrite-chalcopyrite and epidote alteration. Grab samples contain 325 ppb Au and 0.12% Cu. Near the middle of the trench, the sheared east-west contact between the intermediate volcanic and a diorite is a pyritic chlorite-biotite schist with gold values as high as 3.38 g/t Au. The north part of the trench is altered sheared diorite. One metre channel samples are in the 100 to 500 ppb Au range, with a high of 560 ppb Au and 0.35% Cu. A grab sample at the north end returned 3.87 g/t Au.

Trench C: Intermediate to felsic volcanics and dikes with numerous shear zones striking 050° (sericite schist) with pyrite, fuchsite and malachite. Grab samples contain up to 880 ppb Au (similar trenches 1000 m to southwest).

Trench D: Sanders Gold Porphyry—sheared, altered intermediate quartz-feldspar porphyry. Two dominant shear directions: northeast (early) and east (late). Assay from northeast set: 100 to 900 ppb Au. Assay from east set as high as 9.00 g/t Au, 1448 ppm Cu and 4.5 ppm Ag.

Trench E: Complex mixture quartz-feldspar porphyry, intermediate volcanics and what appears to be a zone of disrupted tectonic layering and subsequent annealing during amphibolite-grade metamorphism. Grab sample from a 2 to 5 cm wide chlorite seam with pyrite and magnetite assayed 1.805 g/t Au. Grab sample of porphyry with 1 percent pyrite assayed 560 ppb Au.

Trench F: Power of Dreams—rhyolite and feldspar porphyry with local strong foliation striking 106° and steep northerly dip. Two grab samples from shear zone assayed 10.8 g/t Au and 7.43 g/t Au. A 25 cm chip sample assayed 1.74 g/t Au. Gold-bearing shear zones are abundant in the area. This may be the same deformation zone that hosts the North Coldstream Mine. Grab samples from this area are always anomalous in gold content.

Trench G: Goldfields Gold Showing—rhyolite and feldspar porphyry with east-trending (100°-120°) shear zones typically less than 0.1 m wide. Pods of massive pyrite, chalcopyrite and minor sphalerite in shear zones assayed 9.6 g/t Au, 7.3 Cu, 192.2 g/t Ag and 607 ppm Zn.

Dawson Road Lots, West Trenches

The occurrence known as the Dawson Road Lots, West Trenches, was mapped in the fall of 1990 to properly document the geology of the occurrence since it was stripped by the owners in 1989. The property is located in Concession A near the western portion of the Dawson Road Lots. Access is by Highway 11-17 west from Thunder Bay. A 400 m south-trending bush trail leads to the property from the highway. The trail–Highway 11-17 intersection is approximately 1500 m east of the gas station at Shabaqua and near the east end of the highway passing lane.

Gold has been reported from this occurrence since the 1930s. In 1948, Mattawin Gold Mines Limited estimated the gold content to be 0.19 ounce Au per ton over a strike length of 73.1 m and an average width of 3.2 m (Resident Geologist files, Thunder Bay District, Thunder Bay).

Previous workers have interpreted that the property is underlain by intermediate to felsic volcanic rocks consisting

TABLE 5.4. LITHOGEOCHEMISTRY, DAWSON ROAD LOTS.

	DRL-395	DRL-396	DRL-397	DRL-398	DRL-399	DRL-400
	Spinifex- Textured Basalt	Spinifex- Textured Basalt	Feldspar-Phyric Flow	Spinifex- Textured Basalt	Mafic Volcanic	Peridotite
SiO_2	49.51%	49.11%	52.13%	49.81%	45.62%	36.60%
Al_2O_3	12.67%	12.28%	13.73%	12.42%	1.43%	4.33%
K_2O	0.16%	0.08%	0.32%	0.06%	0.21%	0.04%
MgO	9.31%	10.27%	7.77%	9.06%	8.72%	2.90%
Na_2O	1.96%	1.83%	2.77%	2.73%	1.18%	0.19%
CaO	8.75%	9.39%	8.44%	11.38%	9.60%	4.10%
BaO	0.03%	<0.01%	0.03%	<0.01%	<0.01%	0.03%
MnO	0.28%	0.23%	0.26%	0.26%	0.22%	0.18%
Fe_2O_3	11.10%	10.41%	9.72%	10.11%	9.08%	13.58%
P_2O_5	0.02%	0.03%	0.04%	0.02%	0.01%	<0.01%
TiO_2	0.76%	0.76%	0.82%	0.74%	0.68%	0.29%
LOI	4.62%	4.84%	4.18%	2.94%	11.71%	15.29
Cr	900 ppm	910 ppm	335 ppm	750 ppm	750 ppm	1210 ppm
TOTAL	99.17	99.22	100.2	99.54	98.47	97.53

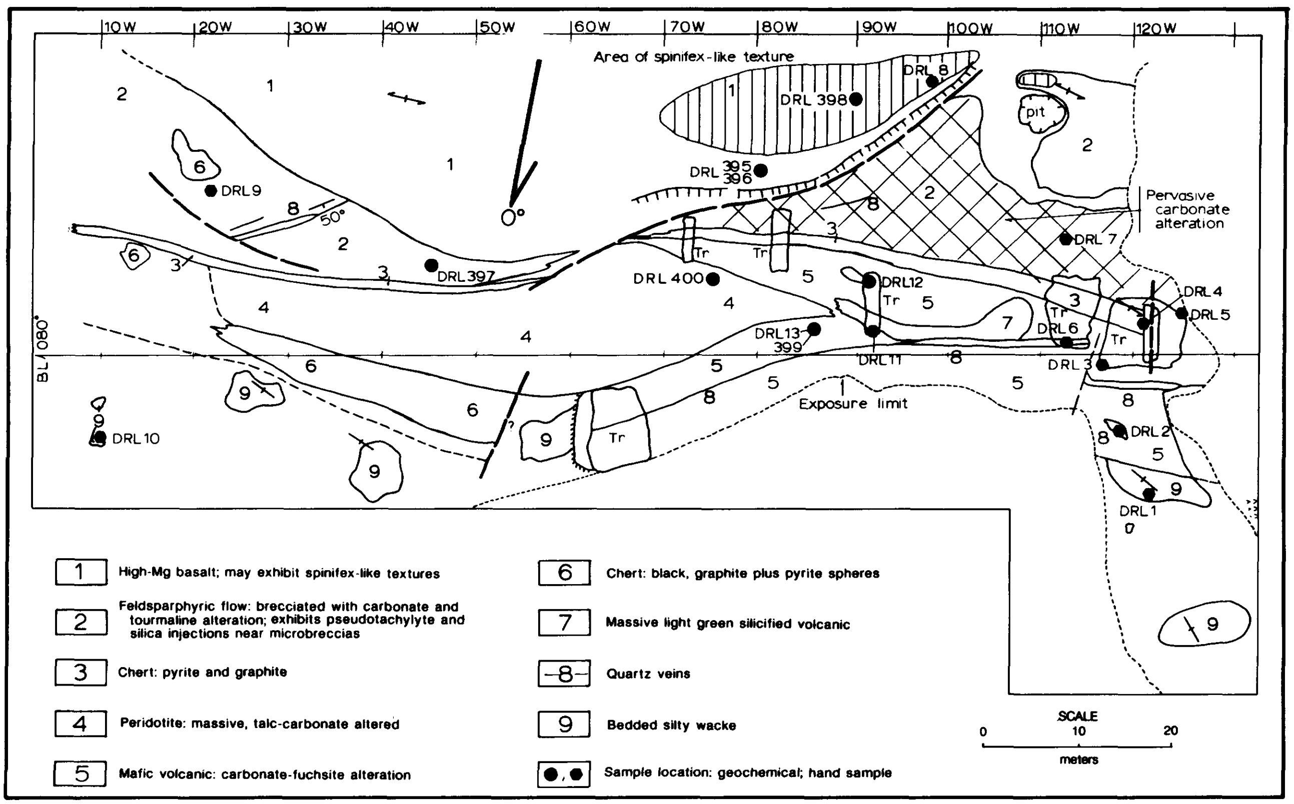

Figure 5.4. Geology of the Dawson Road Lots–West Trenches gold occurrences.

of massive to pillowed andesite flows, porphyritic dacitic flows and massive to tuffaceous rhyolite units. Chert, chert breccia and iron formation occur intercalated with the rhyolite units (Bryant 1972; Schnieders and Dutka 1985).

The results of current mapping and geochemical analysis has shown the need for reinterpretation of the geology. Stripping has exposed a complexly faulted sequence of intermediate to ultramafic flow units, most likely early Neoarchean in age (Keewatin), which are unconformably overlain by chemical and clastic Timiskaming-type metasedimentary rocks, most likely late Neoarchean in age (Figure 5.4). Intense carbonatization has altered the flow rocks at the unconformity, although the Timiskaming-type metasedimentary rocks (unit 9 on Figure 5.4) show no sign of intense carbonate alteration. Narrow quartz veins have developed within the altered rocks. While there appears to be an angular discordance between the bedding orientation of the Timiskaming-type metasedimentary rocks and the Keewatin volcanics, no evidence of the east-trending fold axis reported by Schnieders and Dutka (1985) was seen in the stripped area. One must realize however that the current preliminary mapping is confined to an area 60 m by 160 m and this fold axis might be a regional scale structural feature.

High-magnesium basalts with spinifex-like textures are exposed in the western sector of the large rock hill that dominates the stripped area (unit 1 on Figure 5.4). This unit weathers to a dark green/brown crinkly surface. Within the spinifex-like textured rock, individual fernlike blades can be up to several centimetres long. Layering within the rock unit can be discerned by the configuration of the spinifex-like textured portions. The south end of the rock hill is marked by a small scarp.

The central portion of the area is underlain by a talc-carbonate rock that is interpreted to be an ultramafic submarine flow (unit 4 on Figure 5.4) based on juxtaposition with other flow units (unit 5 on Figure 5.4) and draping by chemical and clastic sediments. This ultramafic flow consists of dark green to black talc with rusty-coloured carbonate patches throughout. Primary textures have been obliterated by alteration. The unit appears to pinch out at 0 + 80W, 0 + 5S near the west-central portion of the stripped area. This ultramafic rock is partially enveloped by a mafic volcanic flow unit (unit 5 on Figure 5.4). Green fuchsite plus intense carbonate alteration typifies this rock. Weathered surfaces are a brownish colour characteristic of carbonate altered rock; fresh surfaces are pale green to bright green and because of the abundance of carbonate, appear granular. The larger trenches at the western end of the mapped area are in this unit.

Geochemical analyses of the mafic units are shown in Table 5.4. Three analyses (DLR-395, DLR-396, DLR-398) from the spinifex-textured flow confirm its magnesium-rich composition. An analysis of unit 5 indicates that it is an altered magnesium-rich basalt, identical in composition to the spinifex-textured flow. The talc-carbonate unit, with 22.9% MgO, is ultramafic in composition. Most surprising is an analysis of the feldspar-phyric unit which is only slightly more felsic in composition, and despite its field appearance of intermediate composition than the other analyzed samples, and despite its field appearance is basaltic.

An intermediate feldspar-phyric dacitic flow (unit 2 on Figure 5.4) is in contact with the high-magnesium basalt and is exposed on the eastern flank of the hill. This unit is carbonate altered and is severely brecciated. Wispy cherty injections, black tourmaline and small quartz veins are typical of this flow unit. Severe small-scale breccias occur throughout this flow. Brecciation intensifies eastward as similar rock in the Bylund Trenches 1600 m to the east exhibits breccia fragments several centimetres across. This unit pinches out westward in the central portion of the stripped area. Quartz veins within this flow are truncated by a fault that strikes southeasterly.

Three main types of cherty chemical sediments exist on the property. The most continuous unit is a relatively narrow (1 m or less) zone consisting of chert, pyrite and graphite (unit 3 on Figure 5.4). The colour of this unit is rusty brown. A deep reddish-brown gossan reminiscent of arsenopyrite gossan is present. This unit is exposed both in the eastern and western sections of the stripped area; it appears to be absent or attenuated in the central portion of the area so that following it through the outcrop rubble is difficult. Most of the old trenches have been blasted in this horizon.

The second type of chemical sediment exposed in the showing area is black, graphitic chert with disseminated pyrite crystals and spherical pyrite nodules (unit 6 on Figure 5.4). This unit, or a rock similar to it, is exposed on Highway 11-17 west of the occurrence. Within the stripped area the black chert is only exposed in the northeast sector where it lies between the ultramafic flow and Timiskaming-type metasedimentary rocks. The western contact with the Timiskaming-type rocks is presumed to be a fault contact. The actual contact is not exposed.

The third type of chemical sediment is a pale green siliceous rock that is exposed between lines 0 + 90W and 1 + 00W just south of the baseline (unit 7 on Figure 5.4). Outcrop conditions did not permit sampling.

Quartz veins that crosscut the altered rocks are reported to carry visible gold (Bartley 1980). Gold was not seen during the current mapping. One quartz vein near line 1 + 10W/BL contained 1 percent galena. Actual assays yielded 6475 ppm Pb.

Timiskaming-type metasedimentary rocks crop out along the northern edge of the stripped area. These rocks are bedded wackes and siltstones and are similar to outcrops located just

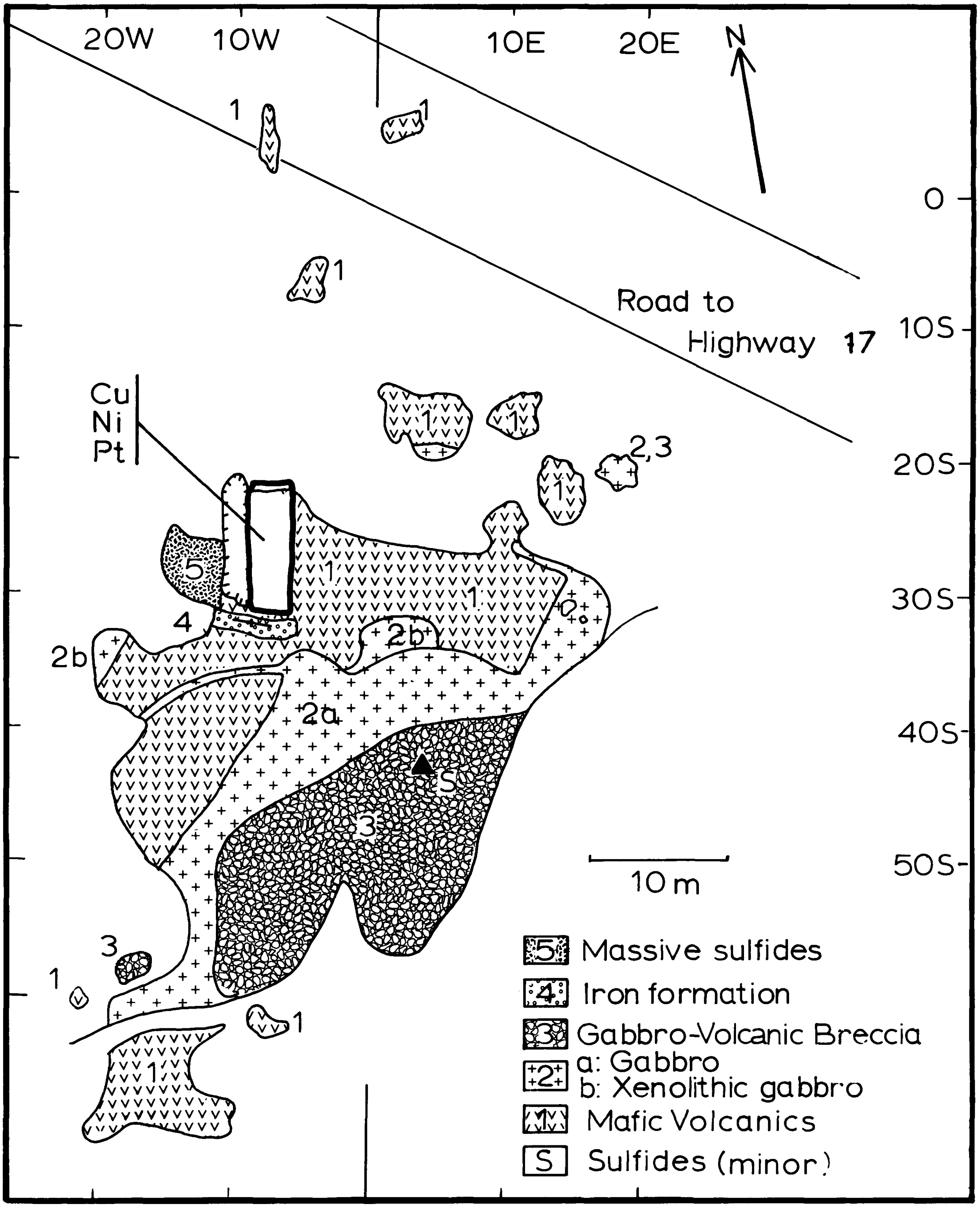

Figure 5.5. Geology of the Chapman Cu-Ni occurrences, Hanniwell Township.

to the north on Highway 11-17. These rocks have been described by Parker (1980) and Carter (1990).

A preliminary assessment would suggest that the gold mineralization was emplaced as a very late stage Keewatin event. This assumes that the carbonate/fuchsite alteration is associated with the gold mineralization. Because the Timiskaming/Keewatin unconformity is exposed on the property and the alteration has only affected rocks of presumed Keewatin age, and if the Timiskaming rocks are truly unaffected (as based on visual inspection) then the timing of the mineralizing event can be constrained. It must have happened after the formation of the Keewatin volcanics and before the deposition of the Timiskaming sediments. A factor that must be taken into account is the ability of the sedimentary rock to absorb CO_2, and visually appear altered as the result of carbonate alteration.

The presence of chemical sediments such as chert does imply some sort of fumerolic activity on the seafloor. Its relationship to the gold mineralization and the exact timing of this event(s), are unknown. However, prospecting along this horizon should further expose the gold mineralization. There are gold occurrences to the east (Byland Trenches), and trace amounts of gold occur on Highway 11-17 west of the zone in a pyritic, black, cherty graphite.

Chapman Ni-Cu Occurrence. Hanniwell Township

The Chapman occurrence is situated in Hanniwell Township west of Upsala, Ontario. Access is by a logging road that intersects Highway 17 at a point approximately 16 km west of Upsala, at the Graham Road–Highway 17 intersection. Proceed west along this road for about 16 km and then northwesterly 2 km on a bush road to the occurrence.

The property is currently owned by L. Chapman of Thunder Bay, Ontario.

Limited previous work is known to have been done on the property; the area was staked in the past and old newspaper clippings refer to a nickel occurrence in the general vicinity (Resident Geologist's files, Thunder Bay District, Thunder Bay).

Some diamond drilling was conducted in the area by Canadian Nickel Company Ltd. and Noranda Mines Ltd. The occurrence is located in the Lumby Lake metavolcanic belt and is just east of mapping conducted by Woolverton (1960). Sage et al. (1974) mapped the area as part of "Operation Ignace–Armstrong" Project and the regional geology is depicted on Ontario Division of Mines Map P.964.

At the property (Figure 5.5), mafic volcanic flows and iron formation have been intruded by porphyritic gabbroic dikes. The emplacement of these northwest-trending dikes has resulted in the brecciation and partial assimilation of the volcanic host rock. Outcrop at the property consists of relatively undeformed mafic volcanic flows and pyroclastics, brecciated volcanic rocks, porphyritic gabbroic rock, gabbro with volcanic xenoliths and volcanic/gabbro breccia. A small vestige of banded iron formation is exposed immediately south of the trench.

Mineralization occurs as massive to disseminated pyrrhotite, pyrite and chalcopyrite in a pyroclastic rock. Dimethylglyoxine field test indicates that nickel is also present, although the nickel mineral was not identified. Assays from grab samples yielded results lower than anticipated. These: are: Cu, 0.185%; Ni, 0.10%; Pt, 5 ppb; Pd, 16 ppb; Au, 17 ppb; Ag, trace.

To date Mr. Chapman has stripped an area equivalent to about 3600 m^2. One trench has been dug to examine the disseminated mineralization. The more massive sulphide portion was uncovered during outcrop washing. Two vertical Winkie holes were drilled into the zone; the results are not yet available.

While ultramafic units have been identified in the Lumby Lake belt to the east of the Chapman occurrence (Woolverton 1960; Sage et al. 1974) no known ultramafic rocks have been identified in the immediate showing area. This would suggest that the source of the nickel mineralization might be the intruding gabbroic dikes. The sulphide iron formation associated with the volcanic rocks is an excellent source of sulphur for the precipitation of nickel sulphides in the gabbro/iron formation contact zone. Geological maps (Map 2065, Map P.964) as well as the geophysical maps (G113, G114, Map 80533) suggest additional areas of search for mineralization of this type.

If one accepts the premise that the gabbroic dikes are responsible for the addition of nickel to the system, then the area of search should be restricted to the contact area between the dikes and the host volcanic/sedimentary rocks. This contact area within the metavolcanic belt would have the best chance of containing similar mineralization. Chances would be enhanced if the volcanic belt rocks have high sulphur components, such as sulphide iron formation.

THUNDER BAY DRILL CORE LIBRARY

Officially opened in 1986, the Thunder Bay Drill Core Library is 1 of a network of 7 core libraries across Ontario. Each drill core library collects, stores, catalogues and preserves drill core and associated material, mainly from Ontario's mineral exploration and mining industry.

In 1990, the Thunder Bay Drill Core Library was staffed by Perry Sarvas (Drill Core Library Geologist), Doug McKay (Assistant Drill Core Library Geologist), Kelly Busniuk (Receptionist, January to March), and Derrick Rietdyke (Summer Assistant, June to August). Staff activities were supervised by Maurice Lavigne Jr. (Thunder Bay Resident Geologist).

TABLE 5.5. DRILL CORE STORED AT THE THUNDER BAY DRILL CORE LIBRARY, 1990.

	Company/Individual	Property/Location	Year Drilled	Number of Holes	Metres of Core Stored
1)	Premier Lake Resources Inc.	Lumby Lake/Norway Lake area	1988	3	495
2)	Mingold Resources Inc.	Powell Lake area	1989	8	856
3)	Cumberland Resources Ltd.	Portage Bay/Henderson Lake area	1989	6	335
4)	Wing, A.	Wing–Wallace/Dawson Road Lots	1990	2	200
5)	Luski, M.	Pardee Township	1990	2	167
6)	Fourstar Petroleum Resources Limited*	Swede Creek/Pic Township	1990	6	3.5

* *Core specimens submitted for assessment credit, as per Section 77(6) of the Ontario Mining Act.*

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

CORE EXAMINATION

All core stored at the Thunder Bay Drill Core Library (except that core under a period of confidentiality—*see* below) is available to the public for examination, free of charge.

A 45 m^2 core examination room is available for the study of drill cores and related material.

In addition to drill core, the Thunder Bay Drill Core Library stores an extensive collection of related material, including sample pulps, core specimen sections and data files. Data files contain drill hole location maps, drill logs, drill sections and assay results.

The Thunder Bay Drill Core Library staff members are available for technical assistance during examinations.

ANALYSIS AND SECTIONING REQUESTS

The analysis and sectioning of drill core stored at the Thunder Bay Drill Core Library is allowed, at the discretion of Drill Core Library staff. Terms and conditions are:

A. Assays (and other destructive tests):

Costs of all assays, tests and shipments of samples will be borne by the client.

Assays and/or test results will be released to the client and the core library at the same time.

The assays and/or test results may be kept "confidential" for up to 3 months from the time of sampling if the client requests. The results will then be released to the general public.

Pulps and rejects must be returned to the Drill Core Library.

B. Sectioning (and other nondestructive tests):

Costs of all sections, tests and shipment of samples will be borne by the client.

Sections and/or test results will be the property of the Drill Core Library. The sections and/or test results may be kept "confidential" for up to 3 months if the client requests. The sections and/or results will then be released to the general public.

Sections are to be examined at the Drill Core Library.

Cutoff and remaining samples are to be returned to the Drill Core Library.

Transmitting light and reflected light microscopes are available at the Drill Core Library for examination of sections.

CONFIDENTIALITY OF DRILL CORE

Upon request of the donating party, the Drill Core Library will place a "confidentiality period" of up to 1 year on donated drill core. Under the terms of the "confidentiality period", drill core and associated material will be withheld from public examination for a specified period of time after the drill core arrives at the Drill Core Library.

TABLE 5.6. DRILL CORE STORED AT THE THUNDER BAY DRILL CORE LIBRARY FOR WHICH THE "CONFIDENTIALITY PERIOD" EXPIRED IN 1990. The drill core is presently available for public examination.

	Company/Individual	Property/Location	Year Drilled	Number of Holes	Metres of Core Stored
1)	Home Lake Resources Ltd.	Home Lake/Powell Lake area	1989	5	744.7
2)	Red Fox Resources Inc.	Redfox Lake/Powell Lake area	1989	5	594.6
3)	Mingold Resources Inc.	Blackwater Lake/Clist Lake area	1988	1	105.2
4)	Mingold Resources Inc.	Colter Township	1988, 1989	2	211.9
5)	Mingold Resources Inc.	Legault Township	1988	3	355.4
6)	Mingold Resources Inc.	Undersill/Maryjane Lake area	1988	2	247.1
7)	Mingold Resources Inc.	Meta Lake/Sollas Lake area	1989	1	122.5

DRILL CORE LIBRARY CATALOGUES

Each drill core library prints and distributes a drill core library catalogue. The catalogue is a complete, up-to-date listing of drill core stored at the core library and available for public examination. The Thunder Bay Drill Core Library Catalogue is divided into the 3 Resident Geologist districts. Individual drill holes are listed according to the claim map area in which they are located and the company that drilled them.

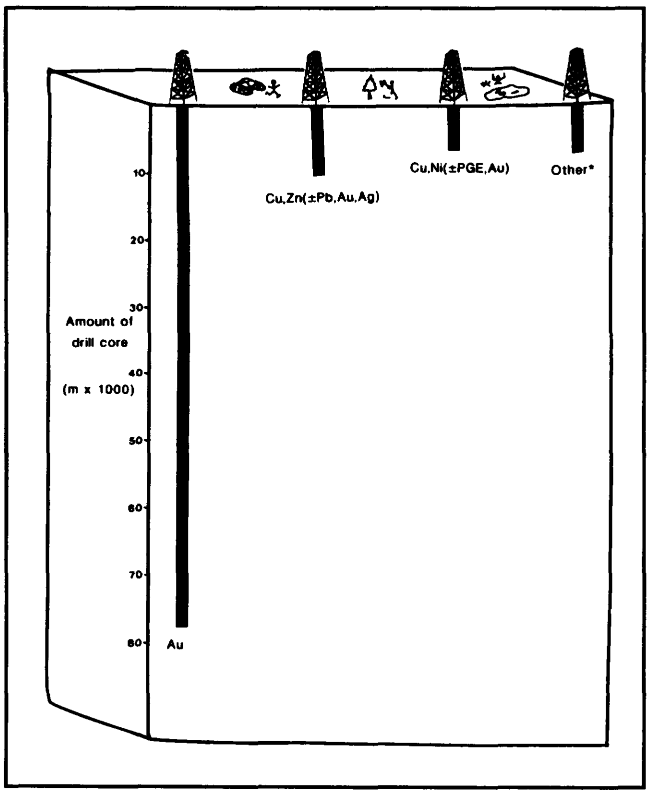

Figure 5.6. Drill core stored at the Thunder Bay Drill Core Library according to target commodity

CORE STORAGE

Presently, there are approximately 108 000 m of drill core available for examination at the Thunder Bay Drill Core Library. This includes:

38 200 m from 72 properties in the Thunder Bay Resident Geologist District.

32 500 m from 49 properties in the Beardmore–Geraldton Resident Geologist District.

37 300 m from 47 properties in the Schreiber–Hemlo Resident Geologist District.

Most of the drill core originates from exploration programs searching for metallic mineral deposits, with the majority of these being gold exploration programs (Figure 5.6).

Table 5.5 lists drill core collected and stored between December 1, 1989 and November 30, 1990.

Table 5.6 lists stored drill core recently made available for public examination due to expiry of requested confidentiality periods.

Table 5.7 lists requests for analyses and/or sectioning of stored drill core. Analytical results are available in the files of the Thunder Bay Drill Core Library.

If you would like more information on drill core stored at Ontario's drill core libraries, please phone (807) 475-1331 or fax (807) 475-8809, or write to:

Thunder Bay Drill Core Library
Ministry of Northern Development and Mines
435 South James Street
Thunder Bay, Ontario
P7C 5G6

Ontario's other drill core libraries are:

Drill Core Library	Contact
Kenora	Mr. Carmen Storey (807) 468-3658
Sault Ste. Marie	Mr. John Walmsley (705) 949-1231
Timmins	Mr. Chris Hamblin (705) 268-8274
Kirkland Lake	Mr. David Guindon (705) 642-3222
Bancroft	Mr. V. Chris Papertzian (613) 478-3161
Tweed	Mr. Chris Papertzian (613) 478-3161

RECOMMENDATIONS FOR EXPLORATION

INTRODUCTION

While it is difficult to recommend areas for mineral exploration when most of the major occurrences and high mineral potential areas are staked, there are nevertheless some areas that deserve to be mentioned, and indeed explored. Currently, property turnover is high and acquisition is possible by keeping track of numerous cancellations.

NORTH OF MacGREGOR TOWNSHIP

With the advent of new road systems north of MacGregor Township, the unmapped volcanic terrane located northwest of Loon Lake, McTavish Township and south of Greenwich Lake should be explored for base metals and gold. Sulphide iron formation in volcanics are known to exist. In the 1950s Wright–Hargreaves Mines Limited conducted a drilling program on a property known as the "Beck Creek Group". This property is located 8 km west of Loon Lake and 4 km north of MacGregor Township. Drilling intersected massive to disseminated sulphides associated with wackes and diorite. Gold values of up to 0.08 ounce per ton, up to 0.82% Cu and up to 0.7% Zn were reported by Wright–Hargreaves Mines Limited (Resident Geologist's files, Thunder Bay District, Thunder Bay). The property has merit, especially considering the limited amount of work done on the site. For instance, the only geophysical survey mentioned is a dip needle survey. No comprehensive geological survey has ever been undertaken on the property. Copper, gold, zinc, lead and molybdenum occur on the property. Based on the drill logs, large sections of mineralized core were not assayed at all. The ground is not staked as of November 30, 1990.

McTAVISH TOWNSHIP BASE METALS

In 1947, Little Long Lac Gold Mines Limited drilled a series of diamond-drill holes to explore a large breccia zone in the Silver Lake area, McTavish Township. The structure was 213 m wide; sections within this zone assayed up to 9.57% Zn and 0.55% Pb.

Other sections in the zone assayed up to 2.3% Pb. Values up to 1.3 ounces Ag per ton were reported (Resident Geologist's files, Thunder Bay District, Thunder Bay). The breccia is within Sibley Group sedimentary rocks. Structures of this type might contain significant amounts of polymetallic sulphides.

MUD LAKE BASE METALS

The felsic volcanic portion of the Thunder Bay–Shebandowan volcanic belt east of the Kaministikwia River should be explored for volcanogenic massive sulphide deposits. The Cu-Zn-Ag-Au occurrence on Highway 102 at Mud Lake would be an excellent starting point. Sphalerite, chalcopyrite and pyrite occur in a finely laminated, semimassive zone that is approximately 1 m wide. The zone occurs in felsic pyroclastic rocks that exhibit strong alteration. Mafic pillowed lava occurs several hundred metres to the east at the Highway 102–Mud Lake Road intersection. MacDonald (1939), Kustra (1973) and Scott (1990) have delineated this felsic metavolcanic belt.

It extends from the Kaministikwia River in the west to Silver Harbour, Lake Superior in the east.

In Gorham Township, on the 2nd Concession Road west of Hazelwood Lake Road, felsic pyroclastic rocks of this belt have sulphide fragments as a component of the rock. One major hindrance to the exploration of this belt is the preponderance of patented land in the form of old homesteads and private lots. A preconception about the difficulty of assembling parcels of land for the purpose of mineral exploration has deterred exploration by mining companies, even though the mineral potential is very high for gold and base metals.

GARDEN LAKE BASE METALS

The Garden Lake metavolcanic belt, which is 130 km north of Thunder Bay, has good potential for volcanogenic massive sulphide base metal deposits. Pervasive garnet alteration associated with sulphide horizons north of Garden Lake indicate possible target areas for VMS exploration. Felsic pyroclastic rocks and chert horizons south of Kearns Lake suggest that the area of search could be large. No known mineral exploration has been done in the area south of Kearns Lake. New road systems enhance the attractiveness of the area.

WEST SHEBANDOWAN GOLD

Two salient features can be deduced from the discussion of Central Crude Limited's Moss Lake property and the Lukosius–Sander's gold property. Gold mineralization in the western Shebandowan greenstone belt is not typical Archean

TABLE 5.7. DRILL CORE FROM THE THUNDER BAY DRILL CORE LIBRARY ANALYZED AND/OR SECTIONED DURING 1990. Analytical results available upon request.

	Company/Individual	Property/Location	Type of Work
1)	Chaschuk, M.	Blake Township	Analytical
2)	Wing, A.	Wing–Wallace/Dawson Road Lots	Assay (Au)
3)	Luski, M.	Pardee Township	Assay (Cu, Ni, Pt, Pd, Au, Ag)
4)	Noranda Exploration Company Ltd.	Headway–Coulee/Coughlan Lake area	Assay (Cu, Zn, Ag, Au, whole rock)
5)	Canamax Resources Inc.	Max Lake area	Assay (Zn, Cu, Au), thin section preparation
6)	Corporate Oil and Gas Ltd.	Dawson Road Lots	Assay (Au, As)
7)	Lynx–Canada Explorations Limited	Dawson Road Lots	Assay (Au, As)
8)	Gold Fields Mining Corporation	Youngman/Lecours Township	Thin section preparation
9)	Cumberland Resources Ltd.	Portage Bay/Henderson Lake area	Assay (Cu, Zn, Au)

lode gold mineralization, as on both properties gold is widely dispersed, of low grade and often inconspicuous. The discovery of wide, low-grade zones of mineralization requires a strong preconceived commitment to carry out the type of exploration that is specifically designed to delineate low-grade, high tonnage deposits. This results in bringing together dispersed low-grade gold assays into a cohesive large volume deposit. Central Crude Limited has demonstrated that large volume, low-grade gold deposits do exist in Archean greenstone belts and attention to this style of mineralization will lead to many more discoveries.

The second salient feature of these new discoveries in the western Shebandowan greenstone belt is that they are controlled by off-trend structures. While the dominant foliation and lithological strikes are 045° to 050° , the Moss Lake mineralization strikes 070° and the Lukosius–Sander's gold mineralization strikes 090° to 110° . This latter mineralization appears to be in the same east-west deformation zone that hosts the North Coldstream Mine and additional gold mineralization to the east.

ELIZABETH GOLD MINE

The recent difficulties in raising capital has resulted in many junior mining company funded projects being put on hold. One such project was being carried out by Mimiska Mining Company Inc. on the old Elizabeth Mine, west of Atikokan. The current drill-indicated reserves at the Elizabeth Mine are 275 000 tons, grading 0.14 ounce Au per ton. To the south, the newly discovered Zephir Zone has 50 000 tons grading 0.21 ounce Au per ton. In addition, this 600 claim property has numerous untested surface showings.

INDUSTRIAL MINERALS

Industrial minerals is one economic mineral sector that has generally been overlooked in the Thunder Bay area. In recent months many queries regarding the availability of white quartz have been received by this office. White quartz and white feldspar have been in demand for the manufacturing of tile material. White quartz veins were reported by Scott (1990) in MacGregor Township. Exploration in the vicinity of Lot 20Z, MacGregor Township, should uncover more veins, or delineate the extensions of the known vein systems in the area. Feldspar in pegmatites between mileage 22 and mileage 35, Highway 527, should be assessed as source material for ceramics.

The Penassen Lakes Stock in northern MacGregor Township, and the MacKenzie Granite should be explored for building stone. Both granitoids are very attractive; phases within the Penassen Lakes Stock exhibit blue quartz eyes. The MacKenzie Granite has been quarried in the past for building stone. New road systems in the area add to the viability of these potential stone producing areas.

RESEARCH BY OTHER AGENCIES

LAKEHEAD UNIVERSITY ACTIVITIES

S. Burgess: The geology and mineralogy of the Silver Mountain Mine (HBSc)

S. Craig: Sedimentation models for glacial deltaic successions in the Thunder Bay area (MSc)

J. Dehls: Magnetic fabrics and deformation of the Seine Conglomerate, NW Ontario (MSc)

A. MacTavish: The Quetico intrusions (MSc)

B. Polk: Chemical sedimentology of the Gunflint Formation (HBSc)

R. Spark: Magnetic fabrics and petrofabrics along the Quetico–Shebandowan Subprovince boundary (MSc)

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6. Beardmore–Geraldton Resident Geologist's District—1990

J.K. Mason[1] and G.D. White[2]

[1]Resident Geologist, Beardmore–Geraldton Resident Geologist's Office, Northwestern Region.

[2]Staff Geologist, Beardmore–Geraldton Resident Geologist's Office, Northwestern Region.

INTRODUCTION

The Beardmore–Geraldton Resident Geologist's office completed its fourth year of operation since the January 1, 1987 subdivision of 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. Exploration activity in the Beardmore–Geraldton Resident Geologist's District was reduced from 1989 levels. Approximately 83 exploration programs, including company and prospector projects, were undertaken in the Beardmore–Geraldton Resident Geologist's District and 13 320 claims were active (November 21, 1990).

The Ontario Prospectors Assistance Program (OPAP) funded 56 programs in the Beardmore–Geraldton District accounting for 14 percent of the provincial total. OPAP funding for the 56 programs totalled $540 000 of the $4 million provincial total. The Ontario Mineral Incentive Program provided 11 grants totalling $361 657 for exploration in the district.

EXPLORATION ACTIVITY

Exploration activity has declined for the second straight year, in terms of total dollars spent. The number of company exploration programs has dropped while the number of prospector exploration programs has risen. Cumulative diamond-drill footage for the district has dropped significantly for 1990. Approximately 75 percent of exploration dollars were expended on gold exploration and 25 percent on base metal exploration. Gold exploration was undertaken mainly in the Beardmore–Onaman Lake–Jellicoe area. Base metal exploration was concentrated in the Marshall Lake and Onaman Lake areas. Gold is anticipated to be the main metal explored for into the early 1990s.

Placer Dome Inc. announced new preliminary reserve estimates for the Brookbank Deposit, Irwin Township, of 1.38 million tons of 0.23 ounce Au per ton (*The Northern Miner*, October 8, 1990).

Wawa Assaying Inc. opened the Beardmore Assay Lab in April. The facility is located on the Ateba Mines Inc. (Pan–Empire Mill) site immediately east of Beardmore and provides full assay facilities for area explorationists. The Ateba Mines Inc. mill was converted to a "care and maintenance" status as of April 17, 1990.

Assessment work and claims summaries for the Thunder Bay Mining Division is given in Table 5.2 of Lavigne et al. (this volume). A summary of exploration programs carried out in the Beardmore–Geraldton Resident Geologist's District is found in Table 6.1.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

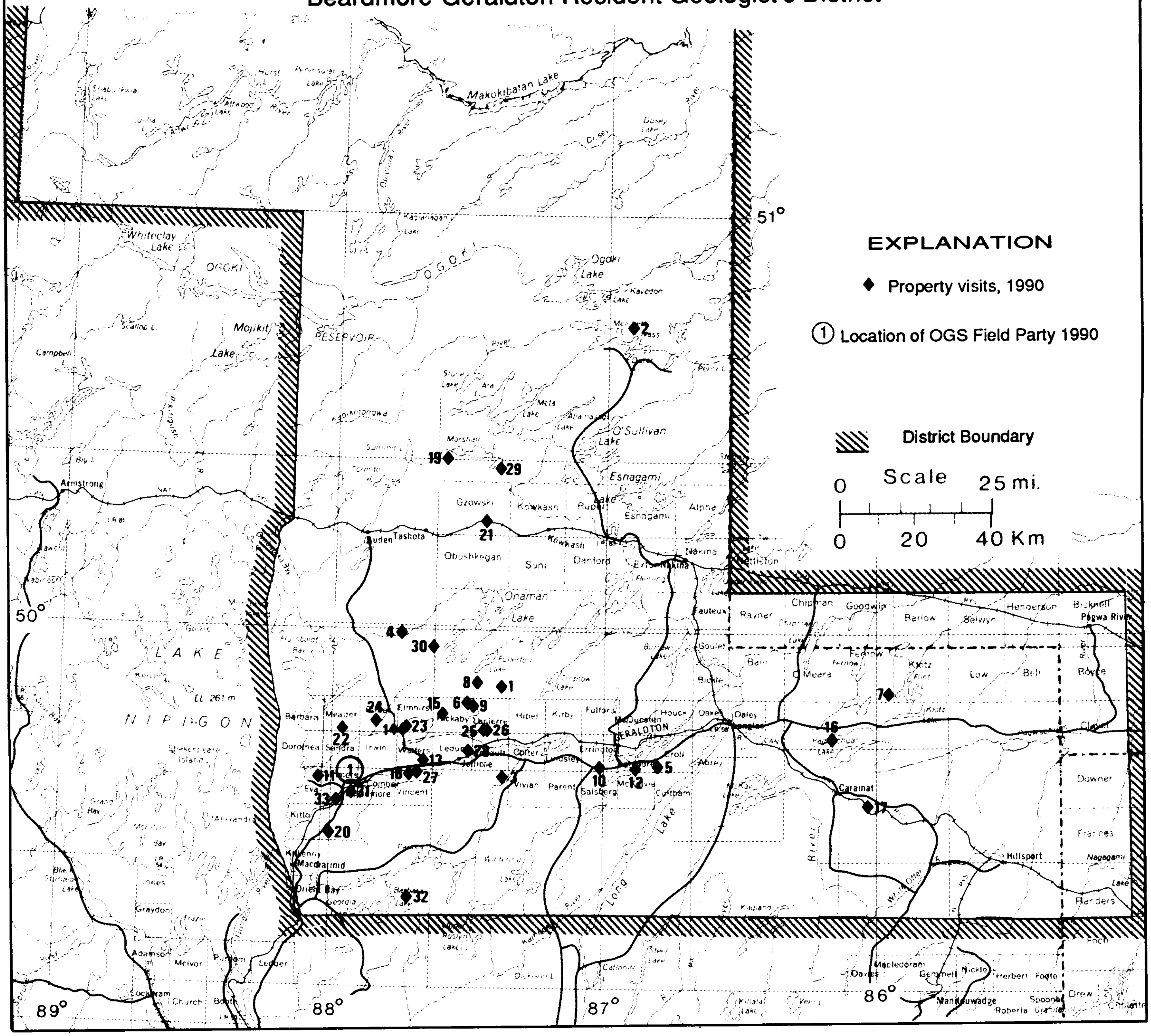
Staff of the Beardmore–Geraldton Resident Geologist's District includes John Mason, Resident Geologist; Gerry White, Staff Geologist; C. Komar, Secretary; S. Warren, Secretary and Assessment File Clerk; and A. White, Assessment File Clerk.

A. Speed and S. Gaudino, Resource Geologists, staffed the Beardmore–Geraldton Historical Research Project to completion on March 30, 1990. The project was funded by the Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the Governments of Canada and Ontario.

The Beardmore–Geraldton Resident Geologist's staff provided consultation and information to prospectors, mining company geologists, and consultants active in mineral exploration. Property visits, field trips, prospector classes, geology talks and seminars were also undertaken.

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

Figure 6.1
Beardmore-Geraldton Resident Geologist's District



EXPLANATION

♦ Property Visits, 1990

1. Bieber Lake Property (G. Bruce)
2. Colpitts Lake Occurrence (C. Bumbu)
3. Colter Lake Property (J. McMahon, M. Rentz, L. Cox)
4. Côté Property (R. Côté)
5. Crow Occurrence (M. Swereda)
6. Dikdik Mine (Kidd Resources Ltd.)
7. Fernow Township Occurrence (T. Head)
8. Final Lake Occurrence (N. Cox and D. Thorsteinson state)
9. Foisey Occurrence (F. Houghton)
10. Goldfields Road Occurrence (T. Johansen)
11. Gustafson Ag Occurrence (H. Goodman Jr.)
12. Hardrock Extension Prospects (Hardrock Extension Inc.)
13. Houghton 801 Occurrence (Freewest Resources Inc.)
14. Kengate Prospect (Orient Resources Inc.)
15. Kenty Prospect (745714 Ontario Ltd.)
16. Len Morrow Occurrence (J. Shields)
17. Little Charon Lake Graphite Occurrence
18. Maki Occurrences (N. Maki)
19. Marshall Lake Cu-Zn-Ag Prospect (Granges Inc.)
20. Mary Jane Lake Property (E. Rentz)
21. McFarlane–Manion Occurrence (G. Milks, C. Paul)
22. Meader Township Occurrence (G. Bruce)
23. Milestone Prospect (Orient Resources Inc.)
24. Minefinders Occurrence (H. Goodman Jr.)
25. Missing Link Extension Occurrence (Freewest Resources Inc.)
26. Missing Link Occurrence (N. Cox)
27. Pichette Occurrence (G. Pichette)
28. Savage Occurrence (J. Savage, L. Savage)
29. Sollas Lake Property (B. Mehaffey)
30. South Onaman Occurrence (Noramco Explorations Inc.)
31. Spooner Prospect (N. Cox)
32. Squaw Lake Property (E. Thorsteinson, H. Hein)
33. Summers Township Property (A. Lafontaine)

TABLE 6.1. EXPLORATION PROGRAMS IN THE BEARDMORE–GERALDTON DISTRICT.

ABBREVIATIONS

AEM	Airborne electromagnetic survey	IP	Induced polarization survey
AMag	Airborne magnetometer survey	Mag	Magnetometer survey
ARad	Airborne radiometric survey	Res	Resistivity survey
DDH	Diamond-drill hole	Rad	Radiometric survey
EM	Electromagnetic survey	UG	Underground work
HL-EM	Horizontal-loop electromagnetic survey	VLF	Very low frequency electromagnetic survey

	Company/Individual	Township/Area	Exploration
1)	Asarco Exploration Co. Canada Ltd.	Conglomerate Lake	reverse circulation drilling, geochemistry
2)	Bay Resources and Services Inc.	Summers Township	IP
3)	Brinklow, Rachel	Coltham Township	prospecting
4)	Brinklow, William	Oakes and Daley townships	line cutting, Mag, EM
5)	Bruce, Gerry	Leduc Township	stripping
6)	Callisto Minerals Inc.	Metcalfe Lake	geochemistry
7)	Cayuga Syndicate	Ashmore Township	DDH
8)	Cessland Corporation Limited	Walters and Leduc townships	geology
9)	Checkley, Fred	Hipel Township	stripping
10)	Checkley, Fred	Legault Township	stripping
11)	Cote, Robert	Elbow Lake, Martin Lake	stripping
12)	Cox, Nolan	Castlewood Lake	geology, Mag, VLF
13)	Cox, Nolan	Coughlan Lake	power stripping
14)	Cox, Nolan	Irwin Township	stripping
15)	Douglas, Arthur	Gzowski Lake	prospecting, trenching
16)	Douglas, Arthur	Kaby Lake	trenching, VLF
17)	Douglas, Arthur	Kowkash Township	trenching, VLF
18)	Enders, Cam	Summers Township	stripping
19)	Falconbridge Limited	Kawitos Lake	geology, HL-EM, Mag, stripping
20)	Founder Resources Inc.	Leduc Township	power stripping
21)	Founder Resources Inc.	Summers Township	power stripping
22)	Freewest Resources Inc.	Legault Township	stripping, geology, geochemistry
23)	Freewest Resources Inc.	Meader Township	stripping, geochemistry, geology
24)	Freewest Resources Inc.	Summers Township	line cutting, geology
25)	Gionet, Reginald	McKay Lake	trenching, geochemistry, Mag, VLF
26)	Goodman, Herb	Metcalfe Lake	manual, power stripping
27)	Goodman, Herb Jr.	Pifher Township	stripping, trenching, geochemistry
28)	Goodman, Herb Jr.	Eva Township	prospecting, stripping
29)	Gorzynski, George	Toronto Lake	stripping, geology, geochemistry
30)	Granges Inc.	Marshall and Gripp lakes	DDH
31)	Granges Inc.	Summit, Sollas and Willet lakes, Gzowski Township, O'Sullivan Lake, Kirby Township	geology, prospecting, geophysics
32)	Greenstone Enterprises	O'Sullivan Lake	EM
33)	Hardrock Extension Inc.	Shmore Township	stripping
34)	Harte Resources Corporation	Walters Township	DDH
35)	Hein, Harold	Arrell Lake	DDH
36)	Highlander Minerals Limited	Irwin and McComber townships	DDH
37)	Holt, Lyle	Fullerton Lake	stripping
38)	Holt, Mona	Rickaby Township	stripping

TABLE 6.1. CONTINUED.

	Company/Individual	Township/Area	Exploration
39)	Homestake Mineral Development Company	Lapierre and Legault townships	stripping, line cutting, geochemistry, geology
40)	Houghton, Frank	Walters Township	stripping
41)	Houghton, Frank	Walters Township	stripping, geochemistry
42)	Johansen, Thorwald	Errington Township	stripping, trenching
43)	Joutel Resources Limited	Norton Lake	Mag, EM
44)	Koroscil, William	Ashmore Township	stripping, trenching
45)	Koski, John	Coughlan Lake	stripping
46)	Kowalski, Barbara	Leduc Township	Mag, VLF
47)	Lafontaine, Amede	Fairloch Lake	stripping, trenching
48)	Lafontaine, Amede	Summers Township	stripping, trenching
49)	Laminco Exploration Inc.	Junior and Toronto lakes	AEM, AMag
50)	Maki, Neil	Vincent Township	stripping, trenching, geochemistry
51)	Megan, Andrew	Muriel Lake	trenching, geochemistry, line cutting
52)	Megan, Angus	Muriel Lake	trenching, geochemistry
53)	Mehaffey, Robert	Sollas Lake	prospecting, stripping, trenching, geochemistry
54)	Metalore Resources Limited	Irwin Township	DDH
55)	Milner Consolidated Silver Mines Ltd.	Pagwachuan Lake	DDH, Mag, EM
56)	Morning Dew Exploration Ltd.	Leduc Township	Mag, EM, power stripping
57)	Nelson, Ben	Hipel Township	line cutting, geology, stripping, geochemistry
58)	Nelson, Myron	Legault Township	stripping
59)	Nelson, Myron	Castlewood Lake	stripping
60)	Noramco Mining Corporation	Onaman Lake	line cutting, geology, Mag, EM, DDH, litho/humus/soil geochemistry
61)	Noranda Exploration Company Ltd.	Elmhirst Township	DDH, stripping
62)	Noranda Exploration Company Ltd.	Rickaby Township	DDH, stripping
63)	N.W.T. Copper Mines Limited	Kaby Lake	power stripping
64)	Ohio Resources Corporation	Fort Hope	DDH
65)	Parres, James	Elmhirst Township	VLF
66)	Paul, Charles	Gzowski Township	manual
67)	Pettit, Cyril	Irwin Township	stripping
68)	Pettit, Cyril	Walters Township	trenching
69)	Pichette, Gordon	Vincent Township	stripping
70)	Placer Dome Inc.	Irwin, Walters and Sandra townships	geology
71)	Placer Dome Inc.	Lindsley Township	DDH, geology
72)	Placer Dome Inc.	Talbot Lake	geology, geochemistry
73)	Rapski, John	Colter Township	stripping, trenching
74)	Reid, R.J.	Rich Lake	DDH
75)	Rentz, Melvin	Colter Township	stripping, geochemistry
76)	Ruderex Ltd.	Lapierre Lake	power stripping
77)	Savage, James	Leduc Township	stripping, trenching
78)	Shields, Jay	Castlebar Lake	DDH
79)	Shields, Jay	Pagwachuan Lake	mechanical stripping and trenching
80)	Starr, Eugene	Poplar Point	DDH
81)	Swereda, Mel	Croll Township	DDH, stripping
82)	Thorsteinson, Edward	Arrell Lake	power stripping
83)	Wilson, Alexander	Ashmore Township	DDH

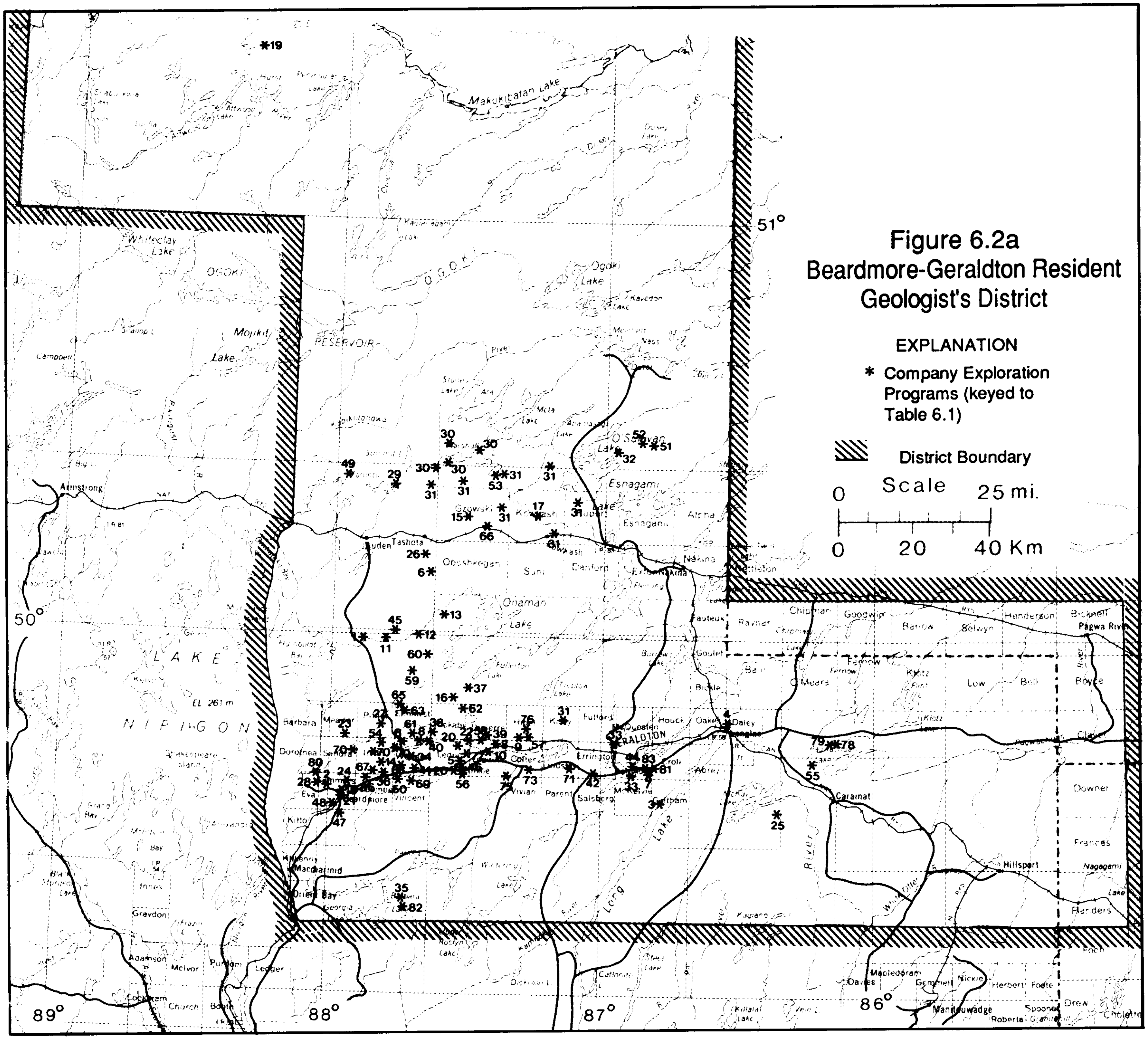


Figure 6.2a
Beardmore-Geraldton Resident
Geologist's District
EXPLANATION
* Company Exploration
Programs (keyed to
Table 6.1)
District Boundary
Scale
0 25 mi.
0 20 40 Km
51°
50°
89°
88°
87°
86°
Makokibatan Lake
Whiteclay Lake
OGOKI
RESERVOIR
Ogoki Lake
Mojikit Lake
Esnagami Lake
O'Sullivan Lake
Onaman Lake
LAKE NIPIGON
GERALDTON
Long Lake
Armstrong
Caramat
Hillsport
Pagwa River
Manitouwadge

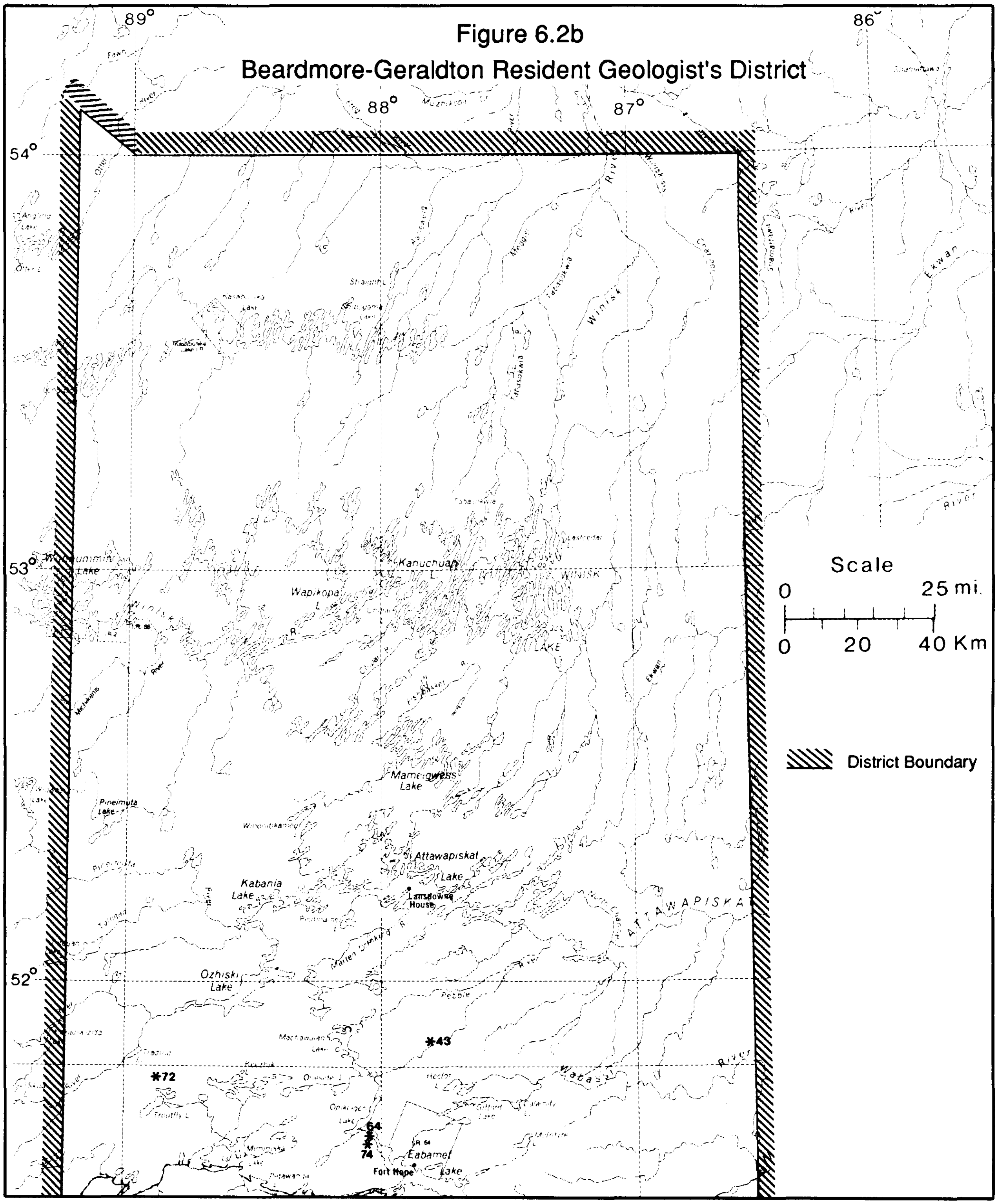


Figure 6.2b
Beardmore-Geraldton Resident Geologist's District
89°
88°
87°
86°
54°
53°
52°
Winisk
Kanuchuan L.
Wapikopa L.
WINISK
LAKE
Ekwan
River
Mameigwess Lake
Pineimuta Lake
Attawapiskat Lake
Lansdowne House
Kabania Lake
ATTAWAPISKA
Ozhiski Lake
Pebble
*43
*72
Webasquai
River
64
74
Eabamet Lake
Fort Hope
Scale
0 25 mi.
0 20 40 Km
District Boundary

Personal consultations totalled 1284 people and phone inquiries totalled 543 persons for the Beardmore, Geraldton and Thunder Bay offices.

One major field trip was given in the Beardmore–Geraldton area to industry personnel. A total of 42 property visits were undertaken.

The Resident Geologist's Program and the Greenstone Economic Development Corporation cohosted 2 events in Beardmore: 1) Prospector's Information Night; and 2) Ontario Prospectors Assistance Program (OPAP) Workshop.

The authors co-ordinated the geological and exploration portion of the Canadian Institute of Mining, Metallurgy and Petroleum District Four Geology Society meeting hosted in Thunder Bay (technical program, displays, core shack and trade show).

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.

An exploration talk was delivered at the Northwestern Ontario Mines and Minerals Symposium in Thunder Bay. Poster displays depicting exploration activity were presented in Thunder Bay and Geraldton during Mining Week and in Toronto and Thunder Bay at Mines and Minerals symposia.

Geological information was inputted into a number of planning issues including the Geraldton Self Government (Annexation) and Sustainable Forest Initiatives.

The senior author attended the Ministry of Northern Development and Mines Management Development Seminar.

Staff attended the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Annual Meeting, Ottawa and the annual meeting of the Institute for Lake Superior Geology, Thunder Bay.

PROPERTY EXAMINATIONS

GENERAL GEOLOGY AND STRUCTURE

The geology of the Beardmore–Geraldton area, the east portion 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 metavolcanics and metasediments 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.

A detailed description of the geology and the gold mineralization of the Beardmore–Geraldton belt and Onaman–Tashota metavolcanic belt is provided in Mason and White (1986), Mason and White *in* Patterson et al. (1984, 1985), Mason et al. (1988, 1989) and Stott (1989).

BEARDMORE–GERALDTON BELT

Houghton 801 Occurrence

The Houghton 801 occurrence is located in south-central Walters Township west of Highway 801 (Paint Lake Road). The property consists of an east-trending group of 14 contiguous claims accessible by travelling 1.8 km north on Highway 801 from its junction with Highway 11. In October 1990, Freewest Resources Inc. optioned the property from Frank Houghton, a Beardmore prospector, and began an extensive stripping and sampling program.

There is no record of activity in the specific area of the Houghton occurrence prior to 1984, although a series of old pits and trenches are located on the property. The workings are estimated to have been developed in the 1940s. Laird (1936) documented the existence of an iron formation that strikes through the present area of interest. From 1984 to 1987, M.F. Cowan conducted geological mapping, stripping and a ground magnetometer survey over a small area covering the eastern portion of the Houghton claim group (Cowan 1983). In 1987 Blue Falcon Mines Limited cut a grid over a 22 claim block covering much of the present day Houghton property. Detailed very low frequency electromagnetic (VLF-EM) and magnetometer surveys, in addition to geological mapping, were completed by the company. The old pits and trenches, where the present day Houghton 801 occurrence is located, were documented at this time and sampled. Samples of a cherty, purple weathered iron formation within these pits contained from less than 0.01 to 0.058 ounce Au per ton (Bankowski 1987). Blue Falcon Mines Limited (Novak 1987) also located a strong VLF-EM conductor just south of the main occurrence which is coincident with what appears to be a splay fault off of the main Watson Lake fault to the north. During the 1990 field season, Freewest Resources Inc. undertook a major stripping, sampling and mapping program over the occurrence.

The Houghton claim group lies entirely within metasediments, consisting mainly of greywacke to argillitic sandstone and siltstones, of the main Beardmore–Geraldton belt (Mackasey 1976). Extensive stripping over the occurrence has exposed an area 75 m by 140 m in size. Mapping by

Freewest Resources Inc. personnel has delineated 4 zones along an east-trending strike. The central (zone 2) and south-central (zone 3) zones occupy the main shear horizon, 20 to 25 m wide, which contains a silicified iron formation unit(s), quartz-carbonate veining and sulphide mineralization.

Zone 1 bounds the area of interest to the north and consists of a banded magnetite iron formation. This is part of the unit originally mapped by Laird (1936) and subsequently mapped by Mackasey (1976).

The central zone, known as zone 2, contains 30 to 50 cm wide (narrowing to 2 cm in places) conformable silicified or cherty, purple weathered iron formation unit(s) (Resident Geologist's files, Beardmore–Geraldton District, Thunder Bay) hosted in highly sheared and carbonate-altered greywacke. The iron formation unit can have a high magnetite content, exhibit an overall massive character relative to the surrounding rock and contain prominent "spider" or radially controlled quartz-carbonate veining (1 to 2 cm in width) irregularly along its strike length. Arsenopyrite and pyrite mineralization are often associated with these "spider" veins. Grab samples collected by Freewest Resources geologists assayed up to 0.23 ounce Au per ton (Mike Atkins, Freewest Resources Inc., personal communication, 1990). Discontinuous quartz-carbonate veining within the surrounding highly altered metasedimentary host rock appears to be of the same age as those contained within the iron formation. Extensive channel sampling across this zone was recently completed.

Zone 3 (south-central) to the south can be observed in many of the old trenches and consists of sheared, chloritic altered greywacke displaying a high concentration of quartz-carbonate veining (up to 4 cm wide). The unit exhibits prominent local folding and has a definite shallow western plunge. Grab samples taken by the owner, Frank Houghton, in this area assayed up to 0.06 ounce Au per ton. Zone 3 is separated from the most southerly unit of interest (zone 4) by massive unaltered argillitic metasediments.

Zone 4 consists of highly sheared greywacke intruded by prominent blue-grey quartz veining. A selected grab sample collected from the quartz vein assayed 1.34 ounces Au per ton (Frank Houghton, Prospector, personal communication, 1990).

Grab samples collected by the authors at selected locations across the central and south-central zones (zones 2 and 3) returned assays ranging from less than 0.01 to 0.56 ounce Au per ton (Resident Geologist's Files, Beardmore–Geraldton District, Thunder Bay).

ONAMAN–TASHOTA BELT

Colpitts Lake Property

The Colpitts Lake property consists of an irregular group of 127 contiguous claims held by Costy Bumbu, Thunder Bay, and located approximately 60 km north of Nakina, Ontario. The property may be reached by float- or ski-equipped aircraft from Nakina or O'Sullivan Lake to 1 of 3 lakes — Nass Lake, Colpitts Lake or Bury Lake — which bound the property to the north and west. Overland access to the Colpitts Lake claims can be gained by travelling on the Highway 643 extension north (permission and a key must be obtained from Dominion Foundries and Steel Company Limited (Dofasco) to pass through a gate on the road) from O'Sullivan Lake for 35 km to the south end of Briarcliffe Lake. A boat can then be used to reach the north bay of Nass Lake at the south end of the property.

The immediate region in and around the Colpitts Lake property has seen extensive exploration activity beginning in the mid-1950s and continuing to the present day. The Anaconda Co. (Canada) Ltd. initiated work in the area and from 1955 to 1961 drilled off 2 magnetite iron deposits (total reserves estimated at 384.5 million tons of beneficiating open pit magnetite ore) (Shklanka 1968) at Briarcliffe and Jungfrau lakes. The property occupies a large east-trending block of patented mining claims along the southern boundary of the Colpitts Lake claims (following a major iron formation unit). A recent compilation of previous work conducted was completed by Placer Dome Inc. (North and Keech 1989).

"Rio Tinto Exploration conducted geophysical, geochemical and geological surveys in the Melchett–Nass Lakes area in 1970. The 62 claim Group I project covered most of the current property, with the exception of the areas near Bury Lake. Geological mapping, soil geochemistry for Cu, Pb, Zn, and magnetometer and EM surveys were carried out. It was concluded that the potential of the area for base metal mineralization is limited since no rhyolitic sequences were identified, and the results of the soil and rock geochemistry were disappointing. The claims were allowed to lapse.

Kerr Addison Mines Limited held a block of 86 claims (Colpitts Lake Group) covering most of the present property, and conducted a reconnaissance geological exploration program in 1983. Kerr Addison did not, however, hold the Au showing which was the main focus of this program. Claim line mapping and traversing were carried out in conjunction with B horizon soil sampling at 100 m intervals. A thick sequence of quartzofeldspathic schists, felsic volcaniclastic rocks, and garnetiferous amphibolites was defined in the area however the Cu, Zn, and Au assays from 85 rock, and 235 soil samples were low, and no further work was recommended for the property.

A similar program of mapping and soil and rock geochemistry was carried out on the Bury Lake Property of Kerr Addison which is located across strike to the north of the present Nass Lake property.

A six hole, 1 129 m diamond drilling program was carried out on the 100 claim Melchett Lake Property of Kerr Addison Mines Limited in January and February, 1987. The property is located along strike immediately to the west of the Nass Lake Property. This drilling was carried out on three mineralized zones which were defined by earlier mapping, rock sampling and soil sampling surveys which were carried out by Kerr Addison in 1983 and 1986. Their

> surface assays were not duplicated in drill core, and no further work has been recorded to date."

In 1988, Placer Dome Inc. optioned the Colpitts Lake property and staked an additional 48 claims. Placer Dome Inc. conducted detailed geological mapping, magnetometer and VLF-EM surveys. Four large trenches were excavated and 6 holes were drilled for a total of 934 m (North and Keech 1989).

The Colpitts Lake property lies within a small isolated east-trending lens of metasedimentary and minor metavolcanic rocks, a portion of the Onaman–Tashota metavolcanic belt. North and Keech (1989) describe the property geology:

> "The regional geology in the immediate vicinity of the property consists of a thick, east-west trending sequence of polymictic conglomerate, greywacke, argillite, and siltstone with at least one continuous, sinuous band of magnetite iron formation. Subordinate granitoid intrusives, and Proterozoic diabase dikes transect the sedimentary rocks.
>
> The property stratigraphy is tightly folded about a steeply-dipping, east-west (E-W) trending axes. The ground geophysical data suggests that the folds plunge moderately east. E-W trending shear zones, parallel to regional fold axes, transect the property stratigraphy, and are the locus for many of the base and precious metal occurrences in the area."

Although the entire property was geologically mapped and sampled in detail, the majority of the Placer Dome Inc. follow-up work (i.e. trenching and drilling) was concentrated in the extreme northwest portion of the claim block during 1989. The area of exploration interest is centred along a southeast-trending "zone" of highly sheared pyritic (in places) quartzofeldspathic (sericite) schist. This zone can be traced for approximately 450 m along strike and ranges from 40 to 200 m in width. The rocks often exhibit a highly bleached or altered weathered surface and in places vary from a primarily sericite-rich to a biotite-rich felsic schist (knotty biotite "books" range from 1 to 3 mm in size). The biotite-rich schist is garnetiferous in places. Pyrite is generally pervasive throughout an altered zone, 10 to 20 m wide, noted within the Placer Dome trenches and occurring in fine-grained disseminations along shear planes in amounts from 7 to 10 percent. It should be noted that coincident with this altered horizon are electromagnetic and magnetic anomalies discovered by Rio Tinto in 1971.

A second area of interest is located in what is known as the northern iron formation (a southern iron formation unit was observed by the authors) 200 to 500 m north and roughly parallel to the main schist zone. At a location just south of Colpitts Lake, a sulphide horizon was observed. It is highly weathered with prominent large vugs (up to 1 m) and contains massive pyrite and pyrrhotite.

Assays of grab samples collected by the property owner within the pyritic sericite schist were reported as high as 0.29 ounce Au per ton. Channel samples from Placer Dome's trenches in the same area returned gold assays up to 7.38 g/t Au over 47 cm, and 1.35 g/t Au over 2.72 m (North and Keech 1989). Samples of mineralized schist collected by the authors assayed up to 0.03 ounce Au per ton. In most cases Zn and Cu values were elevated above background ranging up to 0.5% (Resident Geologist's files, Beardmore–Geraldton District, Thunder Bay).

Final Lake Occurrence

The Final Lake occurrence is located 23 km north-northeast of Jellicoe, Ontario. The property is located immediately west of Final Lake, the southern portion of the Fullerton Lake drainage system, and is accessible by travelling north on the Kinghorn Road for approximately 15 km from Highway 11 to the start of the Altitude Lake–Fullerton Lake Road. The main occurrence can be reached by proceeding north from that point for 14.5 km on the Fullerton Lake portion of the road to the road's termination at Final Lake. The Final Lake property is located on claims TB 907636 to TB 907645 and held by Nolan Cox, prospector, Beardmore, Ontario, and the estate of David Thorsteinson. Stripping, trenching and sampling have been undertaken during 1990 with the help of the Ontario Prospectors Assistance Program (OPAP).

Previous work in the area was performed by the Canadian Nickel Co. Ltd. in 1970 to 1973 which held a group of 18 claims at Oases Lake 1.6 km west of Final Lake. A limited diamond-drill program was conducted to test geophysical and geological targets. Pyrrhotite and chalcopyrite totalling up to 8 percent was intersected over short drill intercepts (assessment files, Beardmore–Geraldton District, Thunder Bay). In 1971 and 1972, Hudson Bay Exploration and Development Company Limited conducted geological surveys, geophysical surveys, geochemical surveys and diamond drilling on a claim block in the Altitude Lake area (assessment files, Beardmore–Geraldton District, Thunder Bay).

The Final Lake occurrence is located within the southeastern portion of the Onaman–Tashota metavolcanic belt. Geology of the Altitude Lake–Final Lake area consists of massive mafic metavolcanics, amphibolite, fine- to coarse-grained gabbro and banded chert-magnetite iron formation. Minor quartz-feldspar porphyry and tonalite dikes intrude the gabbro (Kresz 1989).The main occurrence, exposed by stripping, is composed of a prominent shear zone striking 308° and contains crack-seal quartz veining and massive sulphide mineralization. Bedrock exposure, noted during a property visit undertaken in late 1990, covered an area of approximately 20 m by 30 m. In the southeastern portion of the exposure, a highly sheared (exhibiting well-formed slickensides) and altered black porphyritic rock was observed which contains 2 to 3 percent distinctive blue quartz eyes up to 5 mm in size. Along strike 6 m to the northwest, a gossanous grey vitreous banded quartz vein has intruded the shear zone. The quartz vein widens from 2.4 to 3.6 m in this direction before disappearing under deep overburden. The unit exhibits a well-developed crack-seal and recrystallized (sugary) texture locally containing quilts and patches of 15 to 25 percent sulphides. The sulphide minerals, in decreasing order of abundance, include galena, molybdenite, pyrrhotite, pyrite and chalcopyrite. Molybdenite, although not readily seen, does occupy a large percentage of the sulphide content and occurs as very fine disseminations on shear and fracture surfaces. The wall rock in the immediate vicinity of the vein, in addition to being highly sheared, contains dark green chlorite and fibrous asbestos-like alteration. Quartz veinlets with 1 to 2 percent fine disseminations and streaks of chalcopyrite, pyrrhotite and pyrite were also noted.

Unaltered host rock, observed at limited exposures within a 100 m area, consists of medium- to coarse-grained hornblende gabbro. The black porphyritic wall rock within the main shear zone may be the highly altered equivalent of this gabbro or possibly a unit of altered quartz-rich mafic metavolcanic tuff.

Grab sample assays of mineralized quartz vein within the main shear zone indicate values up to 0.032 ounce Au per ton (N. Cox, Prospector, personal communication, 1990). Peak results for samples tested for additional elements from the same location are indicated in Table 6.2.

TABLE 6.2. ASSAY VALUES FROM THE FINAL LAKE OCCURRENCE.

Ag (oz./ton)	Cu (%)	Pb (%)	Zn (%)	Mo (%)	Ni (%)
4.84	0.5	8.95	0.08	0.6	0.01

Two grab samples of coarse-grained hornblende gabbro containing fine-grained chalcopyrite, pyrrhotite and pyrite collected from a site approximately 100 m south of the main occurrence returned 867 and 1467 parts per billion platinum respectively (Resident Geologist's files, Beardmore–Geraldton District, Thunder Bay).

Minefinders Occurrence

The Minefinders property is located in south-central Pifher Township approximately 22 km northeast of Beardmore. The property is accessible from Highway 801 via the Sturgeon River Road (72 Road) at a point roughly 15 km north of Highway 11. The southeastern portion of the claim group can be reached by travelling 5.8 km west on the 72 Road to Crooked Green Creek. Herb Goodman Jr. of Beardmore, Ontario staked 14 claims to cover the Minefinders gold occurrence. Stripping, trenching and detailed sampling were completed with a grant from the 1990 Ontario Prospectors Assistance Program (OPAP).

Past exploration activity in the area dates back to 1935 when the original occurrence was discovered. Laird (1936) reported the following:

> "Minefinders, Limited, holds a group of 9 unsurveyed claims (T.B. 13,733 to 13,741) just west of the third rapids upstream on Crooked Green creek. A trail leads north from the rapids to the workings, less than half a mile distant. A quartz vein, 3 feet wide, is exposed on the east side of a hill and in the bed of a stream; it strikes N.10°W. and dips 45° W. The quartz contains a little pyrite and ankerite, and is reported to have yielded spectacular gold specimens."

In 1959, J. Pollock and R. Newman (assessment files, Resident Geologist's office, Beardmore–Geraldton District, Thunder Bay) completed a three-hole diamond-drill program for a total of 110 m in the Minefinders occurrence. The most extensive work was performed in 1983–84 by Northern Concentrators Limited over a group of claims covering much of the present day ground. Detailed geological mapping, trenching and a ground magnetometer survey were completed and many of the old trenches were located, including the original Minefinders occurrence (Cowan 1983).

The property is located in the southern portion of the Onaman–Tashota metavolcanic belt. Immediately underlying the Minefinders occurrence are a series of intermediate to felsic metavolcanic tuffs and agglomerate (Kresz and Zayachivsky 1989). Fragments within the agglomerate are subrounded, green-white, massive to porphyritic in nature, and range from 5 to 30 mm in size. This host rock material is highly sheared and chlorite-altered in the vicinity of the 2.4 to 3.0 m wide Minefinders quartz vein. The vein strikes 355° and is exposed in a trench 18 m long by 4.5 m wide. In places, the vein is highly fractured and brecciated (wall-rock fragments up to 30 cm) with prominent green malachite and pink to red hematite staining. Generally, it varies in character from east to west from massive grey-white quartz to sheared or banded quartz exhibiting good recrystallized textures along the western edge. Pyrite and chalcopyrite mineralization occurs as irregular seams, vug fillings and as fine patches up to 3 cm in size (total sulphide content ranges from less than 1 to 5 percent). Ankerite and calcite are common throughout. At one end of the trench, the quartz vein is covered by overburden but can be traced in a creek bed roughly 60 m north along strike. Assay results from numerous grab samples collected by G. White and the property owner ranged from 0.01 to 0.48 ounce Au per ton (Resident Geologist's files, Beardmore–Geraldton District, Thunder Bay; H. Goodman Jr., Prospector, personal communication, 1990).

Approximately 500 m northeast of the Minefinders showing a new gold occurrence was uncovered by the property owner. Known as the Pond occurrence, it consists of a discontinuous "stockwork" system of blue-grey quartz veins from 5 to 30 cm wide hosted in silicified, very fine-grained, aphanitic to almost cherty intermediate to felsic metavolcanics. Both the quartz vein material and surrounding wall rock contain rusty patches and fine disseminations of chalcopyrite with lesser amounts of pyrite and pyrrhotite. Prominent malachite stain was noted in places. Grab samples collected by the property owner assayed up to 0.12 ounce Au per ton and 1.65% Cu (H. Goodman Jr., Prospector, personal communication, 1990).

RECOMMENDATIONS FOR EXPLORATION

Water and lake sediment geochemical data for portions of the Beardmore–Geraldton belt were released in 1990 by the Geological Survey of Canada (Friske et al. 1990, Hornbrook et al. 1990). Follow-up is recommended for pathfinder metals associated with gold, and for base metals. Previous surveys conducted in the Lake Superior area have been successful in delineating new base metal occurrences.

Follow-up work recommended as the result of the Tashota–Geraldton–Longlac airborne electromagnetic survey (Ontario Geological Survey 1989) is the targetting of base metals including volcanogenic massive sulphide (VMS) and magmatic type. Isolated conductor(s) in the Onaman–Tashota metavolcanic belt hosted in metavolcanic rocks (particularly those of felsic to intermediate composition) should be prospected. Formational conductors (iron formation) can be discerned from the more high-potential, isolated or "clustered", high-priority conductors. Copper, zinc, nickel and lead would be the main targets sought.

Two large data bases underused in the district are the Drill Core Library and Historical Research files. The potential of both data bases is unlimited.

Within the Beardmore–Geraldton belt, major transcurrent faults, including the Bankfield–Tombill lithotectonic zone (Bankfield–Tombill fault), Watson Lake fault, Sandra Lake fault, Jellicoe fault, and the Paint Lake fault and associated splay faults, should be examined. These deformation zones (which may appear as lineaments in geological maps on aerial photographs) have the potential for hosting gold mineralization, and should be explored by prospecting, magnetometer surveys, VLF-EM surveys, satellite imagery and aerial photographs. Large volumes of fluids can be pushed along and through the deformation zones resulting in alteration zones of carbonate, silica, potassium and/or hematite associated with pyrite, arsenopyrite and gold. Fault-generated feldspar-porphyry and gabbro intrusive rocks should be explored. Gold can be associated with disseminated pyrite and arsenopyrite and/or stockwork-vein systems within the intrusions. Examples of these fault-generated intrusions include the MacLeod–Cockshutt Mine albite porphyry and the Talmora gold mine gabbro, both situated near Geraldton. The west and central portions of the Beardmore–Geraldton belt should therefore be re-examined following the guidelines of this metallogenic model. As the youngest host lithology to gold, these late tectonic intrusions define the maximum relative age of mineralization.

Mineral suites containing the elements B, W, Sb, Te, Mo and As have been documented throughout the Archean as being directly associated with gold (Colvine et al. 1988). Systematic investigation for these minerals within the Beardmore–Geraldton belt is recommended on the property scale.

Older silica-undersaturated intrusions, as well as quartz-bearing intrusions, must be considered as potential sources of gold mineralizing fluids.

With respect to stripping and diamond drilling at a property scale, as in many Archean gold situations, mineralized zones are often elongate and plunging. Mineralized zones plunge parallel to the stretch lineation or to an intersection lineation. Also, careful documentation of the mineralogy and alteration may present a guide to mineralization in a stripping and/or drill program (Colvine et al. 1988).

Where channel saw sampling is used to sample veins or shear zones, problems may arise if gold is "clotty" (grouping of gold grains) or "nuggety" (coarse). A large enough volume of material must be collected to properly represent the grade of gold mineralization present and therefore meet the sampling requirement. Less material is collected in most saw channels per metre than in NQ or BQ core. Wide and deep channels must be cut to increase the volume of material sampled and therefore improve the odds of meeting the sampling requirement of the mineralized zone. It is also strongly recommended that conventional trenching (blasting) also be performed and 5 to 10 kg samples be collected across mineralized zones (J. Tilsley, J. Tilsley and Associates, personal communication, 1990).

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

The Ontario Geological Survey conducted 2 programs in the district in 1990:

1. W. Shanks (Precambrian Geology Section, Ontario Geological Survey) mapped Eva and Summers townships.
2. P. Money (Precambrian Geology Section, Ontario Geological Survey) continued with the preparation of 1:250 000 scale compilation maps of the geology and mineral occurrences of the Long Lake–White River area.

COMDA-FUNDED ACTIVITIES

The Beardmore–Geraldton Historical Research Program, funded by the Canada–Ontario 1985 Mineral Development Agreement (COMDA), was completed by A. Speed and S. Gaudino (Beardmore–Geraldton Resident Geologist's Program). Open File Report release is scheduled for 1991.

RESEARCH BY OTHER AGENCIES

B. Kowalski, Lakehead University, Thunder Bay continued with research toward an MSc thesis entitled "Brookbank-Golden Highway Au Deposit, Beardmore, Ontario"

ACKNOWLEDGMENTS

Gerry White wrote a major section of the report. Susan Warren (secretary) typed the report. Ken Fenwick (Manager, Mineral Resources, Northwestern Region, Ministry of Northern Development and Mines, Thunder Bay) edited the manuscript. Prospectors and company personnel, exploring in the Beardmore–Geraldton District, provided data and are thanked for their contributions.

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7. Schreiber–Hemlo Resident Geologist's District—1990

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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 Roslyn Lake and Kagiano Lake (Figure 7.1). The area includes the communities of Rossport, Schreiber, Terrace Bay, Marathon, Heron Bay and Manitouwadge and is adjacent to the communities of Nipigon and White River. The district incorporates the Schreiber–Winston Lake, Hemlo and Manitouwadge mining camps, which presently host 5 producing mines. 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 metal mines include the Noranda Inc., Geco Division mine in Manitouwadge, and the Minnova Inc., Winston Lake Division mine located northwest of Schreiber.

Mining highlights for 1990 include the estimated production of over 1.3 million ounces of gold from the Hemlo mines, representing approximately 50 percent of Ontario's total gold production and 23 percent of Canada's total gold production. The Williams Mine was Canada's top gold producer once again in 1990 with a forecasted production of over 550 000 ounces of gold, while the David Bell Mine was again one of Canada's largest and highest-grade producing gold mines, producing at a grade of 0.711 ounce Au per tonne (0.645 ounce Au per ton)(P. Desautels, David Bell Mine, personal communication, 1990).

Exploration activity if measured as dollar expenditures is forecasted to have decreased in 1990 compared to 1989 in the Schreiber–Hemlo District. The total number of exploration programs within the district, however, increased in 1990 partially due to Ontario Prospector Assistance Program (OPAP) grant funding to prospectors and increased activity in the Manitouwadge camp. 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 6 years (H. Lockwood, Geco Division, personal communication, 1990).

Minnova Inc. drilled an encouraging intersection on their Pick Lake deposit, located 1.5 km southwest of the Winston Lake headframe. Hole 67 returned 13.4 m grading 25% Zn, 2.6% Cu, 106.1 g Ag per tonne and 0.4 g Au per tonne (*The Northern Miner*, August 27, 1990). Follow-up drilling will test for downplunge and along-strike extensions of this zone.

This year 1990 again saw prospectors and major companies dominate the exploration activity, demonstrating the lack of junior company involvement and programs. Exploration for gold, base metals, platinum group elements (PGE) and industrial minerals was active in 1990, with gold remaining the most sought-after metal in terms of number of exploration programs.

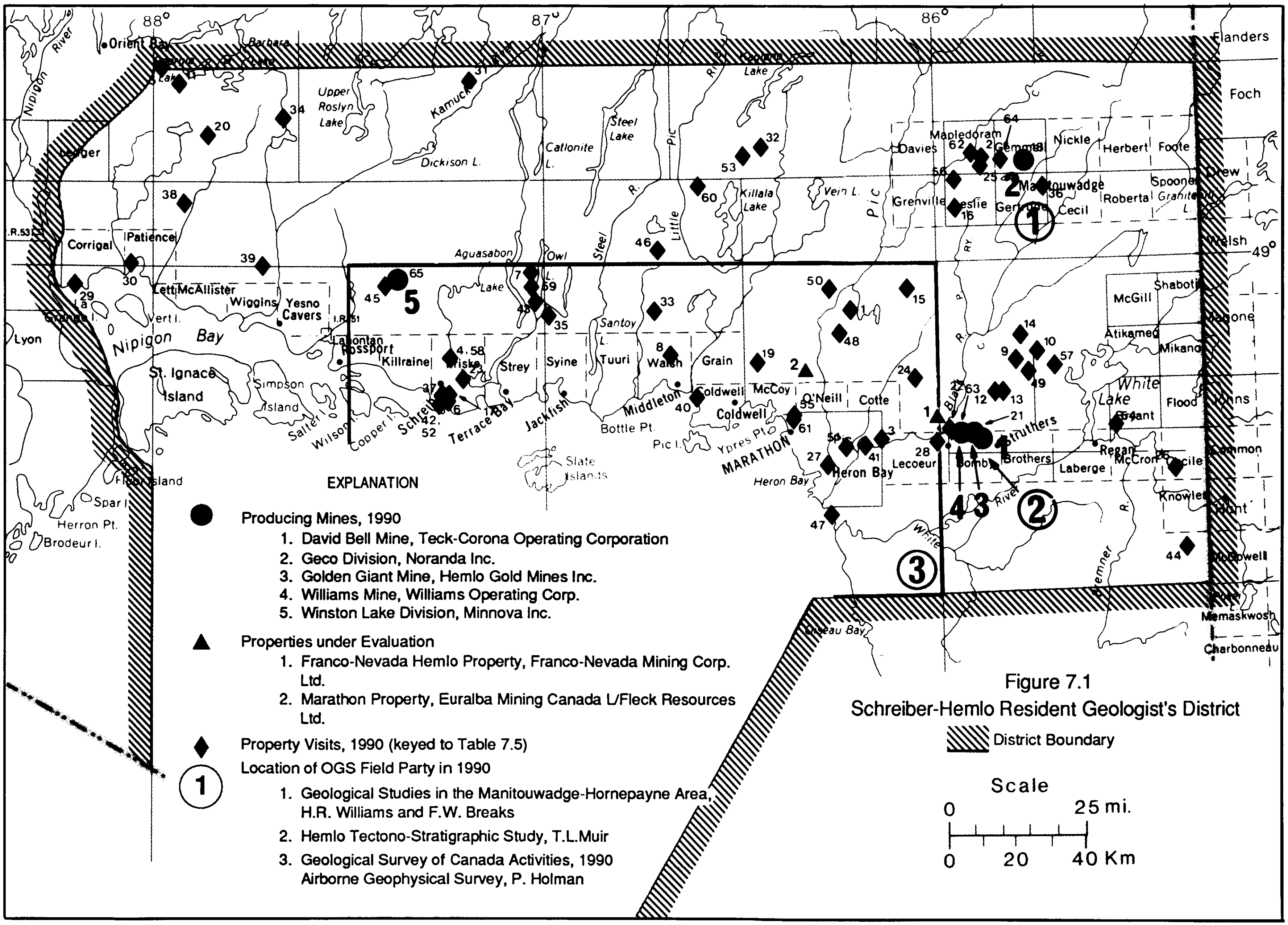
Over 1350 inquiries from the mining sector and general public were dealt with by the Schreiber–Hemlo program at the Thunder Bay office, Marathon field office and in the field. Sixty-five property visits and 8 field trips were conducted in 1990. The Ontario Prospector Assistance Program (OPAP) designated approximately $238 125 to 24 applicants in the Schreiber–Hemlo District, and the Ontario Mineral Incentives Program designated $79 441 towards 2 exploration programs. Several new and interesting occurrences were discovered and further explored by prospectors including the W3 vein near Schreiber by Walter Acker and Russell Otto, occurrences in the Worthington Creek area by Jerry Courtney and George Daniels, and the Swill Lake Occurrence near Manitouwadge by Albert Turner.

ACKNOWLEDGMENTS

Technical support and assistance for this report were provided by A. White and S. Warren who prepared assessment file data. S. Warren provided typing and word processing support and K. Fenwick reviewed the manuscript.

As always, numerous prospectors, geologists and individuals from the exploration and mining sector provided valuable information and discussion throughout 1990 and many are referred to throughout the text.

All analytical work reported unless otherwise noted was performed by the Geoscience Laboratories Section, Ontario Geological Survey, Toronto, and Temiskaming Testing Laboratory, Ministry of Northern Development and Mines, Cobalt.



Producing Mines, 1990

1. David Bell Mine, Teck-Corona Operating Corporation
2. Geco Division, Noranda Inc.
3. Golden Giant Mine, Hemlo Gold Mines Inc.
4. Williams Mine, Williams Operating Corp.
5. Winston Lake Division, Minnova Inc.

Properties under Evaluation

1. Franco-Nevada Hemlo Property, Franco-Nevada Mining Corp. Ltd.
2. Marathon Property, Euralba Mining Canada L/Fleck Resources Ltd.

Property Visits, 1990 (keyed to Table 7.5)

Location of OGS Field Party in 1990

1. Geological Studies in the Manitouwadge-Hornepayne Area, H.R. Williams and F.W. Breaks
2. Hemlo Tectono-Stratigraphic Study, T.L.Muir
3. Geological Survey of Canada Activities, 1990 Airborne Geophysical Survey, P. Holman

Figure 7.1
Schreiber-Hemlo Resident Geologist's District

District Boundary

Scale
0 25 mi.
0 20 40 Km

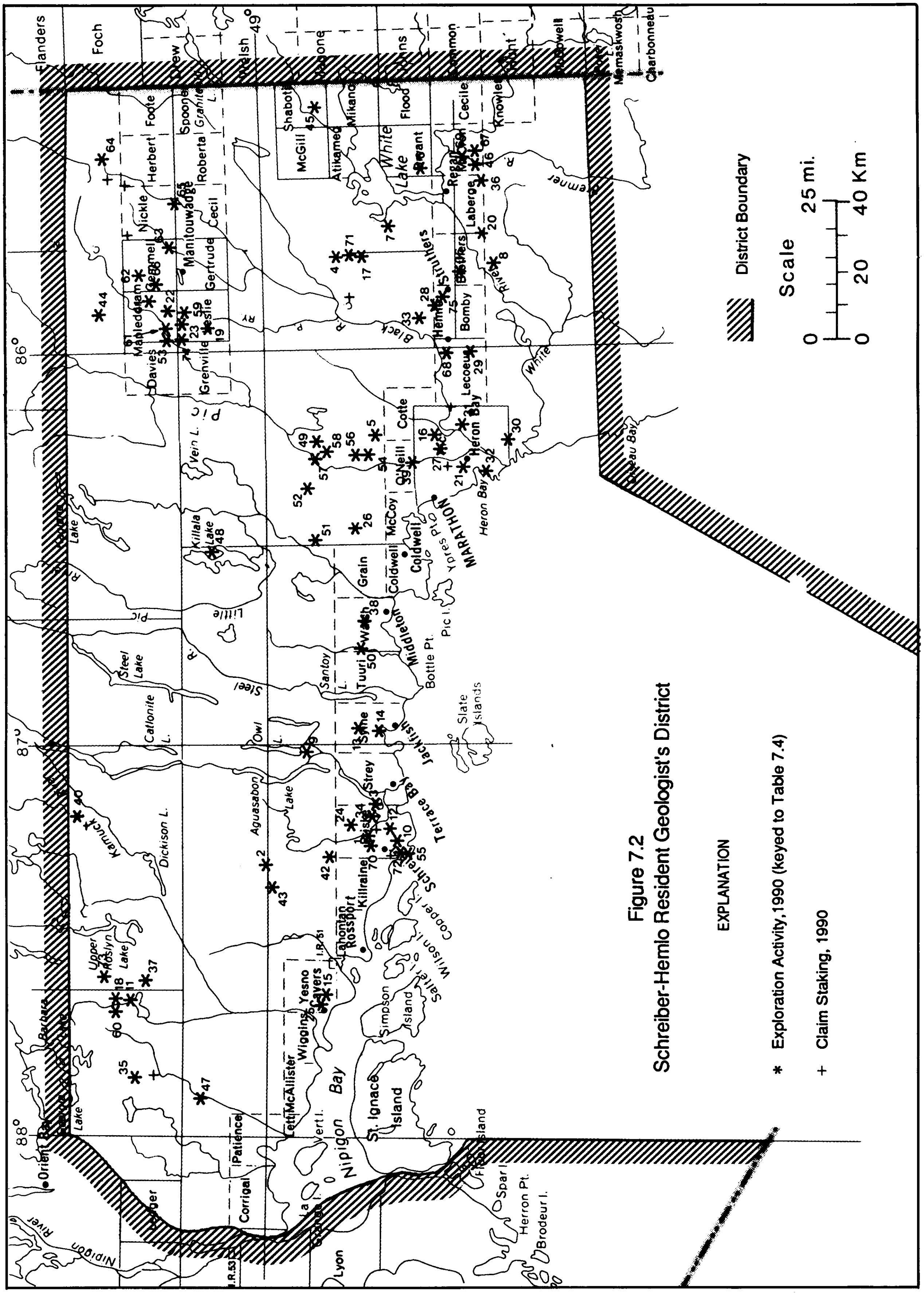


Figure 7.2
Schreiber-Hemlo Resident Geologist's District

TABLE 7.1. ORE RESERVES AND GRADES, GECO DIVISION, NORANDA INC.

	Tons	Cu (%)	Zn (%)	Ag (oz./ton)
Main Orebody	7 777 905	1.67	2.87	1.2
4-2 Copper	1 434 125	2.1	0.7	0.7
8-2 Zinc	473 918	0.25	5.02	0.94
Zinc in Iron Formation (ZIF)	267 216	0.04	6.72	1.2
Total	9 953 164	1.62	2.76	1.11

(H. Lockwood, Geco Division, personal communication, 1990)

MINING ACTIVITY

Geco Division (Noranda Inc.)

Production from the Geco Division mine, Manitouwadge, from January 1990 to October 31, 1990, involved milling of 1 090 298 tons (short) of ore at a grade of 2.00% Cu, 4.47% Zn and 1.54 ounces Ag per ton (H. Lockwood, Geco Division, personal communication, 1990).

Diluted ore reserve and grade estimates as of July 30, 1990, are listed in Table 7.1.

Winston Lake Division (Minnova Inc.)

The Minnova Inc. Winston Lake Division mine completed its second full year of production in 1990. Production for the period January 1990 to October 31, 1990, was 294 652 t milled at a head grade of 1.07% Cu, 16.37% Zn, 35.35 g/t Ag and 1.38 g/t Au (R. Sim, Winston Lake Division, personal communication, 1990). Production for 1990 will likely slightly exceed the 1989 estimated production figure of 340 000 t.

Reserve estimates which include proven, probable, possible and potential ore with a 20 percent dilution at 0 percent grade are indicated at 2 377 106 t at a grade of 1.08% Cu, 14.7% Zn, 31.21 g/t Ag and 1.2 g/t Au (R. Sim, Winston Lake Division, personal communication, 1990). Estimated production in 1991 is 340 000 t.

HEMLO AREA MINES

Combined gold production from the 3 Hemlo mines in 1989 was 1 184 317 ounces (*Canadian Mines Handbook* 1990–91) which represented approximately 50 percent of Ontario's total gold production and 23 percent of Canada's total gold production.

Combined gold production in 1990 from the 3 Hemlo Mines is estimated to be approximately 1 300 000 ounces or greater. This 1990 estimated production figure may represent peak yearly production for the Hemlo camp.

David Bell Mine (Teck–Corona Operating Corporation)

Production from the David Bell Mine from January 1990 through October 31, 1990 consisted of 275 687 feed ounces of gold from 387 745 t milled at a feed grade of 0.711 ounce Au per tonne (0.645 ounce Au per ton)(P. Desautels, David Bell Mine, personal communication, 1990).

Mineable, diluted and recoverable ore reserve estimates as of January 1, 1990, were 7 842 300 tons averaging 0.387 ounce Au per ton (*Canadian Mines Handbook* 1990–91) (7 114 584 t at 0.427 ounce Au per tonne representing 3 036 361 ounces Au; P. Desautels, David Bell Mine, personal communication, 1990).

Gold production from the David Bell Mine for 1989 was 312 190 ounces of gold from 468 648 tons at a grade of 0.689 ounce Au per ton (*Canadian Mines Handbook* 1990–91).

Golden Giant Mine (Hemlo Gold Mines Inc.)

Production from the Golden Giant Mine from January 1990 through October 31, 1990 was 376 914 ounces Au from 994 075 t milled at a grade of 12.384 g/t (B. Kusins, Golden Giant Mine, personal communication, 1990). This includes milling of 934 700 t at a grade of 12.993 g/t from the Golden Giant Deposit #1 Zone and 59 375 t at a grade of 2.806 g/t from the Sceptre North Zone.

Total ore reserve estimates as of January 1, 1990, were 16 858 074 t at a grade of 10.65 g/t (B. Kusins, Golden Giant Mine, personal communication, 1990). This figure includes tonnages from the Golden Giant Deposit #1 of 14 735 236 t at a grade of 10.58 g/t and 2 122 838 t at a grade of 11.08 g/t from the Quarter Claim. Additional reserves not included in the total reserve listed above include 178 146 t at a grade of 3.34 g/t from the Sceptre North Zone (B. Kusins, Golden Giant Mine, personal communication, 1990).

Estimated production to December 31, 1990 (for 1990) is 433 230 ounces Au from a total of 1 186 075 t milled at a grade of 12.17 g/t (B. Kusins, Golden Giant Mine, personal communication, 1990). This figure includes 1 114 700 t at a grade of 12.78 g/t from the Golden Giant and 71 375 t at a grade of 2.72 g/t from the Sceptre North Zone.

Gold production from the Golden Giant Mine for 1989 was 378 000 ounces Au from 1.02 million tonnes averaging 11.9 g/t (*Canadian Mines Handbook* 1990–91).

Williams Mine (Williams Operating Corporation)

Production from the Williams Mine from January 1990 through October 31, 1990 was 487 254 ounces Au from 1 895 017 t milled at a grade of 0.270 ounce Au per tonne (A. Guthrie, Williams Mine, personal communication, 1990).

Total proven and probable diluted ore reserves for the Williams Mine as of January 1, 1990 are estimated at 32 752 000 t at a grade of 0.194 ounce Au per tonne (A. Guthrie, Williams Mine, personal communication, 1990). Undiluted ore reserve estimates and mineralized zone/tonnage breakdowns are listed in Table 7.2.

Gold production from the Williams Mine for 1989 was 494 127 ounces Au from 2 119 246 tons milled at a grade of 0.246 ounce Au per ton (*Canadian Mines Handbook* 1990–91).

ADVANCED EXPLORATION AND DEVELOPMENT

Pick Lake Deposit (Minnova Inc.)

The Pick Lake deposit, discovered in 1984 and located 1.5 km southwest of the Winston Lake deposit, became the focal point of Minnova Inc.'s 1990 exploration program when Hole 67 intersected 13.4 m grading 25% Zn, 2.6% Cu, 106.1 g Ag per tonne and 0.4 g Au per tonne at a depth of 1050 m below surface (*The Northern Miner*, Aug. 27, 1990). Seven thousand metres of additional drilling after Hole 67 as well as borehole pulse electromagnetic surveys are planned for late 1990 and early 1991 to test for along-strike and downplunge extensions of the mineralized horizon (I. Morrison, Minnova Inc., personal communication, 1990). The upplunge and surface expression of the Pick Lake deposit was originally discovered in 1952 and identified as the Anderson occurrence (Pye 1964).

A mineral inventory for the Pick Lake deposit compiled before Hole 67 indicated 1.1 million tonnes grading 9.3% Zn, 0.46% Cu and 27 g Ag per tonne (Resident Geologist's files, Schreiber–Hemlo District, Thunder Bay).

PROPERTIES UNDER EVALUATION

Marathon Cu-PGE Property
(Euralba Mining Canada L-Fleck Resources Ltd.)

The Marathon Cu-PGE property is currently under option to Euralba Mining Canada L who can earn 51 percent interest with work commitments (*Canadian Mines Handbook* 1990–91, p.179). The 1175 ha platinum-palladium-copper-nickel prospect had a feasibility study conducted in 1989 (*Canadian Mines Handbook* 1990–91, p.179).

Mineable reserves are indicated at 30 000 000 tons averaging 0.43% Cu, 0.053% Ni, plus 0.009 ounce Pt per ton and 0.034 ounce Pd per ton (*Canadian Mines Handbook* 1990–91, p.179).

Franco–Nevada Hemlo Property
(Franco–Nevada Mining Corp. Ltd.)

The Franco–Nevada Hemlo property (formerly International Interlake Industries Inc.'s Hemlo Property) comprises 31 contiguous claims, located north and northwest of the Wil-

TABLE 7.2. WILLIAMS MINE: UNDILUTED ORE RESERVES (as of January 1, 1990).

Zone	Proven Tonnes	Proven Grade (oz./t)	Probable Tonnes	Probable Grade (oz./t)
A-Zone	623 000	0.251	147 000	0.167
B-Zone	13 599 000	0.25	12 30 000	0.191
C-Zone	354 000	0.125	1 802 000	0.127
Total	14 576 000	0.247	14 879 000	0.183

Total Undiluted Proven And Probable Ore Reserves: 29 455 000 Tonnes at 0.214 Ounce Au Per Tonne.

(A. Guthrie, Williams Mine, personal communication, 1990)

liams property. Published reserves indicate 1 758 000 ounces Au in 3 zones (*Canadian Mines Handbook* 1990–91, p.183).

Exploration is currently on hold until further exploration and development at the Williams Mine or senior company involvement occurs (P. Lassonde, Franco–Nevada Mining Corp. Ltd., personal communication, 1990).

EXPLORATION ACTIVITY

Exploration activity in the Schreiber–Hemlo District decreased in 1990, compared to 1989 in terms of total dollar expenditures. This decline reflects the larger national trend which is projected to continue as the Prospectors and Developers Association of Canada (PDAC) suggests that exploration spending will likely drop to $430 million in 1991, compared to $610 million for 1990 (*The Northern Miner*, November 26, 1990). The number of active exploration programs was more encouraging and rose to 75 programs (Table 7.3); this increase was mainly related to OPAP-funded programs and the increase in the activity by the Noranda Group and associated companies. Noranda Exploration Company, Limited, Geco Division (Noranda Inc.) and Hemlo Gold Mines Inc. were actively involved in 27 exploration programs in the Schreiber–Hemlo District in 1990. This represents approximately 36 percent of the exploration activity based on the total number of 75 exploration programs (Table 7.3).

There were approximately 6481 active mining claims in the Schreiber–Hemlo District at the time of writing, a decline from the 1989 figure of 6983. A summary of claims recorded and assessment work for the Thunder Bay Mining Division is available in Table 5.2 (*see* Lavigne et al., this volume).

Exploration for gold still predominated in 1990, representing 55 percent of the total programs and marking an increase from 1989 (Table 7.3). Exploration for base metals represented 35 percent of total programs, a slight rise in activity from 1989 and a continued rise from 1987 and 1988.

Exploration for PGE remained at the same level in 1990 as in 1989, which is still much lower than that of the mid to late 1980s. Exploration for industrial minerals decreased in 1990 to 7 percent of total programs, and exploration for the rare earth elements was inactive.

GOLD EXPLORATION

Gold exploration accounted for 55 percent of the 1990 exploration programs in the Schreiber–Hemlo District. There were approximately 20 active exploration programs in the Hemlo area in 1990 and, while the number of programs was up from 1989, the dollar expenditures for the Hemlo camp likely declined. Several of the Hemlo exploration programs were grass roots or reconnaissance in nature.

TABLE 7.3. EXPLORATION ACTIVITY IN THE SCHREIBER –HEMLO DISTRICT (expressed as percentage of programs).

Commodity	1987	1988	1989	1990
Gold/Silver (Au, Ag)	70%	61%	45%	55%
Base Metals (Cu, Zn, Ag)	14%	18%	34%	35%
Platinum Group Elements (PGE, Cu, Ni)	14%	9%	3%	3%
Industrial Minerals (Building and Dimension Stone, Amethyst, Rare Earth Elements (REE))	2%	12%	18%	7%
Total Number of Active Exploration Programs	51	60	56	75

Hemlo Gold Mines Inc. was the most active company in the Hemlo area with 6 exploration programs in 1990 (Table 7.4). Exploration programs on the Golden Sceptre, Mussy Creek and Maple Leaf properties included prospecting, line cutting, geological mapping, geophysical and geochemical surveys, and diamond drilling.

Williams Operating Corporation was involved in underground exploration from the 9175 level of the Williams Mine. Forty diamond-drill holes will likely be completed by year end.

Lac Minerals Ltd. continued exploration on its White River prospect in Bomby, Brothers and Laberge townships, conducting geophysical surveys in 1990.

Black Gregor Explorations Ltd. and Carlson Mines Ltd. continued exploration on their 255 claim block located 24 km west-northwest of Hemlo. Diamond drilling continued in 1990 and since 1982 nearly 9000 m of drilling has been completed (*The Northern Miner*, February 12, 1990). A drill intersection yielded 2.13 m grading 0.20 ounce Au per ton (*The Northern Miner*, January 15, 1990).

Fourstar Petroleum Resources Ltd. conducted diamond drilling on their Swede Creek property in Pic Township.

Golden Myra Resources Inc. optioned the 40 claim, Heron Bay Mine property (includes the former Peekongay, Bowhill Mines, Lytton Minerals and Stenlund properties) from V. Stenlund. At the time of writing Golden Myra Resources Inc. was involved in a diamond drilling program designed to test for extensions and further delineate the "C-Zone" and "Porphyry Zone" drilled by Lytton Minerals Ltd. (Patterson et al. 1986).

TABLE 7.4. SCHREIBER–HEMLO RESIDENT GEOLOGIST'S DISTRICT—EXPLORATION ACTIVITY.

ABBREVIATIONS

AEM	Airborne electromagnetic survey	IP	Induced polarization survey
AMag	Airborne magnetometer survey	Mag	Magnetometer survey
ARad	Airborne radiometric survey	Res	Resistivity survey
DDH	Diamond-drill hole	Rad	Radiometric survey
EM	Electromagnetic survey	UG	Underground work
HL-EM	Horizontal-loop electromagnetic survey	VLF	Very low frequency electromagnetic survey

	Company/Individual(s) Exploration	Property Name	Township/Area	Work Done
1	Acker, Walter/Otto, Russell	Cabin Property	Priske Township	power stripping, trenching, sampling
2	Big Duck Resources Ltd. (Minnova Inc. Option)	Big Duck Lake area	Rope Lake, Pays Plat Lake areas	IP, geophysics
3	Bond Gold Canada Inc.	Hays Lake Property	Priske and Strey townships	Mag, HL-EM, humus geochemistry, geological mapping, sampling
4	Calicchia Stone Industries	Dotted Lake Property	Wabikoba Lake and White Lake (North) areas	sampling, prospecting
5	Carlson Mines Ltd./ Black Gregor Explorations Ltd.	Wire Lake Property	Lorna Lake area	DDH
6	Carroll, Daniel	Patio Lake Property	Bryant Township and White Lake (South) area	trenching
7	Carroll, Daniel	Spruce Bay Property	White Lake (North) area	trenching
8	Carroll, Thomas	Jumbo Lake Property	Herrick Lake area	trenching
9	Christianson, David	Owl Lake Property	Upper/Lower Aguasabon Lake areas, Santoy Lake area and Cairngorm Lake area	prospecting, sampling,, trenching
10	Courtney, Jerry/ Daniels, George	Courtney–Daniels Property	Priske Township	prospecting, line cutting, geological mapping, sampling
11	Dampier, Gerard	Kabamichigama Lake Property	Kabamichigama Lake area	power stripping
12	Daniels, George/Courtney, Jerry	Daniels–Courtney Property	Priske Township	prospecting, line cutting, geological mapping, sampling
13	Ferguson, Jon/Ferguson, Audrey	Crystal Creek Property	Syine Township	prospecting, sampling, trenching
14	Ferguson, Jon/Ferguson, Audrey	Observation Point Property	Syine Township	prospecting, sampling, trenching
15	Fournier, Elwood	Wabasta Lake Property	Yesno Township and Middlefox Lake area	DDH
16	Fourstar Petroleum Resources Ltd.	Swede Creek Property	Pic Township	DDH
17	Fowler, Brian/Shumann, Mike	Armand Lake Property	Wabikoba Lake area	prospecting, sampling
18	Galarneau, Ted	Little Bear Quarry	Kabamichigama Lake area	stripping, trenching
19	Gionet, Gilles	Gaffhook Lake Property	Leslie Township	line cutting, geophysics, stripping, trenching, prospecting
20	Gionet, Reg	Pickerel Bay Property	Brothers and Laberge townships and Oskabukuta Lake area	line cutting, VLF, Mag, prospecting
21	Golden Myra Resources Inc.	Heron Bay Mine Property	Pic Township	DDH
22	Granges Inc.	Central Property	Mapledoram Township	geologicalmapping, HL-EM, Mag, rock/soil geochemistry
23	Granges Inc.	Swill Lake Property	Leslie Township	geological mapping,HL-EM, Mag, VLF, rock/soil geochemistry

TABLE 7.4. CONTINUED.

	Company/Individual(s) Exploration	Property Name	Township/Area	Work Done
24	Halonen, John	Little Bear Property	Priske Township	prospecting, trenching
25	Halonen, Lauri	Cavers Property	Yesno Township	mining
26	Hamilton, John	Coubran Lake Property	Seeley Lake area	VLF, Mag, geological mapping, geochemical sampling, assays
27	Hemlo Gold MinesI nc.	Black River Property	Pic Township	prospecting, sampling
28	Hemlo Gold Mines Inc.	Golden Sceptre Property	Bomby Township	quarry development, mapping, EM, rock/soil geochemistry, DDH
29	Hemlo Gold Mines Inc.	Gulliver Property	Lecours Township	prospecting, sampling
30	Hemlo Gold Mines Inc.	Maple Leaf Property	Pic and Lecours townships, Mussy Lake area	mapping, line cutting, EM
31	Hemlo Gold Mines Inc.	Mussy Creek Property	Pic Township and Rous Lake area	prospecting, EM, Mag, mapping, geochemistry
32	Hemlo Gold Mines Inc.	Prospect Cove Property	Pic Township	prospecting, sampling, DDH
33	Homestake Mineral Development Company	Enterprise Property	Wabikoba Lake area	geological mapping
34	Joa, Melvin	Hays Lake Property	Priske Township	prospecting, sampling
35	Kukkee, David / Kukkee, Edwin	Glacier Creek Property (Potter)	Cosgrave Lake area	power stripping, line cutting, geophysics, Rad
36	Lac Minerals Ltd.	White River Property	Brothers, Abraham, Bomby, Laberge and Knowles townships	EM, Mag, VLF
37	Laporte, Eldon	Kabamichigama Lake Property	Kabamichigama Lake area	power stripping
38	Michano, Duncan Sr.	Dead Horse Property	Walsh Township	prospecting, stripping
39	Michano, Grant	Pic River Property	Pic and O'Neill townships	prospecting, trenching, sampling
40	Minnova Inc.	Kamuck River Property	Kamuck River area	reconnaissance mapping, lithogeochem, deep EM
41	Minnova Inc.	Man–Echo Property	Mapledoram and Gemmell townships	DDH, down-hole EM
42	Minnova Inc. (Noranda/Cumberland Option)	Victoria Lake Property	Killraine and Priske townships, Pays Plat Lake area	stripping, deep EM line cutting, geological mapping, lithogeochem,
43	Minnova Inc.	Winston Lake Mine/ Pick Lake Deposit/ Gesic Occurrence	Pays Plat Lake area	DDH,, borehole pulse, deep EM pulse, quarrying
44	Nevins, Paul	Everest Lake Property	Everest Lake area	prospecting, sampling
45	Noramco Explorations Inc.	Gionet Property	Shabotik Township	DDH
46	Noranda Exploration Company, Ltd.	Bremner River Property	White Lake (South) and Oskabukuta Lake areas and McCron Township	geology, geophysics, rock/soil sampling, DDH
47	Noranda Exploration Company, Ltd.	Jackpine River Property	Blair Lake and Cosgrave Lake areas	Res, soil geochemistry, geological mapping, DDH
48	Noranda Exploration Company, Ltd.	Killala Property	Killala Lake area	DDH
49	Noranda Exploration Company, Ltd.	Louis Lake Property	Cirrus Lake and Martinet Lake areas	geology, EM, Mag, DDH
50	Noranda Exploration Company, Ltd.	Marlhill Property	Walsh and Tuuri townships	DDH
51	Noranda Exploration Company, Ltd.	Martinet Lake Property	Martinet Lake area	DDH

TABLE 7.4. CONTINUED.

	Company/Individual(s) Exploration	Property Name	Township/Area	Work Done
52	Noranda Exploration Company, Ltd.	Martinet, Huck, Goodchild properties	Martinet Lake, Cirrus Lake, Lorna Lake and Seeley Lake areas	reconnaissance
53	Noranda Exploration Company, Ltd.	Nama Creek Property	Mapledoram Township	DDH
54	Noranda Exploration Company, Ltd.	Nelson Property	Cirrus Lake area	line cutting, geological mapping, EM, Mag
55	Noranda Exploration Company, Ltd.	North Shores Mine Property	Priske Township	stripping, trenching, sampling, geological mapping, IP, Mag
56	Noranda Exploration Company, Ltd.	Page Lake Property	Seeley Lake and Lorna Lake areas, Oskabukuta Lake area	mapping, EM, Mag, rock/soil sampling, DDH
57	Noranda Exploration Company, Ltd.	Pic River Property	Martinet Lake area	line cutting, geological mapping, EM, Mag
58	Noranda Exploration Company, Ltd.	Pukatawagan Lake Property	Martinet Lake area	DDH, geology, EM, Mag
59	Noranda Exploration Company, Ltd.	Sand Lake Property	Leslie Township	DDH, geological mapping
60	Noranda Exploration Company, Ltd.	Spike Lake Property	Kabamichigama Lake area	geological mapping, soil geochemistry, EM, Mag
61	Noranda Inc. (Geco Division)	Buffalo–Canadian Prospect	Mapledoram Township	line cutting, mapping, geochemistry, EM
62	Noranda Inc. (Geco Division)	Fox Lake/Rabbitskin Property	Gemmell Township	EM, line cutting, geological mapping, geochemistry
63	Noranda Inc. (Geco Division)	Hucamp Property	Gemmell and Nickle townships	DDH
64	Noranda Inc. (Geco Division)	Mooseskull Lake Property	Loken Lake area	EM, stripping, reconnaissance
65	Noranda Inc. (Geco Division)	North Faries Property	Cecil and Nickle townships	DDH
66	Noranda Inc. (Geco Division)	Willroy Mine Property	Gemmell Township	mapping, deep EM-37, DDH
67	Noront Resources Ltd.	Bremner River Property	McCron Township	continuing exploration
68	Noront Resources Ltd. (Central Crude Limited Option)	Rous Lake Property	Lecours Township	soil geochemistry, continuing exploration
69	Northern Minerals Ltd.	Bremner River Property	McCron Township	AEM, AMag planned
70	Orevco Inc.	Johnston–McKenna Property	Priske Township	power stripping, sampling
71	Placer Dome Inc.	Theresa Lake Property	Wabikoba Lake area	prospecting, reconnaissance
72	Skalesky, Don/Lundstrom, Lloyd	Rooster Canyon Property	Priske Township	stripping, trenching, sampling, prospecting
73	Thorsteinson, Edward/Hein, H arold	Arrell LakeProperty	Arrell Lake area	DDH
74	Turner, Albert	Swill LakeProperty	Leslie Township	prospecting, trenching, power stripping, line cutting, Mag, EM
75	Williams Operating Corporation	Williams Mine	Bomby Township	DDH

Prospectors such as B. Fowler and M. Shumann were active in the Black River area and in the Armand Lake area immediately west of Theresa Lake, northeast of Hemlo.

In the Schreiber area Noranda Exploration Company, Ltd. was active on the North Shores Mine property near Worthington Bay. Line cutting, stripping, trenching, water washing, geological mapping and magnetometer and IP geophysical surveys were conducted. Diamond drilling is scheduled for late 1990 or early 1991.

Bond Gold Canada Inc. conducted geological mapping, sampling, magnetometer and horizontal loop electromagnetic (HL-EM) geophysical surveys and humus geochemical surveys on their Hays Lake property in Priske Township.

Prospectors W. Acker and R. Otto remained active in the Schreiber area exploring on the Cabin property (*see* PROPERTY EXAMINATIONS section). Gold mineralization and alteration have been discovered in several interesting settings during the past 2 years. D. Skalesky and L. Lundstrom continued prospecting and sampling on their Rooster Canyon property (*see* PROPERTY EXAMINATIONS section) just north of the North Shores property. Interesting gold values are present in both the quartz veins as well as mineralized host rocks.

M. Joa prospecting in the Hays Lake area discovered several new quartz veins up to 2 m in width, including the Stormy Creek vein from which initial grab samples assayed up to 0.03 ounce Au per ton (M. Joa, Prospector, personal communication, 1990). Prospectors G. Daniels and J. Courtney discovered and rediscovered gold occurrences in the Worthington Creek area (*see* PROPERTY EXAMINATIONS section).

D. Kukkee and E. Kukkee continued exploration on their Glacier Creek (Potter prospect) property located northeast of Nipigon. Line cutting, geophysical surveys, power stripping and sampling were conducted on the copper-gold property. At the time of writing the property had been optioned by Noranda Exploration Company, Ltd., who also held the Jackpine River (Moschuk) property located approximately 10 km to the south. Noranda conducted geological mapping, soil geochemistry surveys, geophysical surveys (resistivity) and diamond drilling on the Jackpine River property in 1990.

BASE METAL EXPLORATION

Base metal exploration displayed a slight increase in 1990 accounting for 35 percent of the active programs. Four areas were the main focus of base metal exploration including the Winston Lake–Pick Lake–Victoria Lake area, Santoy Lake–McKellar Lake area, Page Lake–Cirrus Lake area and the Manitouwadge area.

With the intersection of Hole 67 on the Pick Lake deposit (*see* INTRODUCTION section), Minnova Inc. focused much of its exploration efforts into the Pick Lake deposit (*see* ADVANCED EXPLORATION AND DEVELOPMENT section). In addition to the Pick Lake area, Minnova Inc. continued to explore at the Gesic property located 3 km south of the Winston Lake Division mine, conducting geophysical surveys including two loops of deep EM as well as approximately 1000 m of diamond drilling. Approximately 5000 m of diamond drilling was conducted on the Winston North property, testing the Winston Lake stratigraphy (I. Morrison, Minnova Inc., personal communication, 1990).

On the Victoria Lake property optioned from Noranda Exploration Company, Ltd. (50%)/Cumberland Resources Ltd. (50%), Minnova Inc. conducted line cutting, geological mapping, lithogeochemical surveys and geophysical surveys including 4 loops of deep EM. A 3000 m drill program is expected to be under way by about January 15, 1991 (News Release, Cumberland Resources Ltd., November 5, 1990, Resident Geologist's files, Schreiber–Hemlo District, Thunder Bay).

Minnova Inc. also conducted reconnaissance mapping and lithogeochemical surveys on their Kamuck River property located 60 km north of Terrace Bay. The property hosting an anthophyllite occurrence originally discovered by H. Williams of the Ontario Geological Survey (Schnieders and Smyk 1990), was optioned from prospector S. Parent. Ground geophysical (deep VLF) surveys are planned for 1991.

Noranda Exploration Company, Ltd. conducted diamond drilling on the Marlhill property in Tuuri and Walsh townships, but terminated the option on the property in 1990.

Noranda Exploration Company, Ltd. in conjunction with Geco Division (Noranda Inc.) were active in the Page Lake–Cirrus Lake area, which is 30 km northeast of Marathon, with a total of 7 properties. In 1989 a Dighem airborne geophysical survey covering the Marathon–Manitouwadge–Hornepayne area was flown by Noranda, and exploration of many of the properties in 1990 resulted from followup of this survey.

R. Renner, P. Rowe and B. Comeau continued prospecting in the Pic River and Pukatawagan Lake areas. During 1990 several occurrences assaying up to 0.42% Zn and 0.21% Cu were discovered in sulphide-rich metavolcanic rocks (R. Renner, Prospector, personal communication, 1990).

Geco Division (Noranda Inc.) and Noranda Exploration Company Ltd., were active in the Manitouwadge synform and surrounding area. Geco Division carried out surface and underground exploration on 6 properties. Underground diamond drilling was conducted on the Hucamp Mines Ltd. property east of the Geco deposit, and on the Willroy Mine property to the west. Geological mapping, deep EM geophysical surveys and diamond drilling were carried out on the Willroy property. Exploration programs in Cecil and Nickel townships included diamond drilling.

Albert Turner continued exploration on his Swill Lake property in Leslie Township, including line cutting, geophysical surveys (VLF, Mag), power stripping, trenching, prospecting and sampling. In addition to garnetiferous amphibolite discovered in 1989 (Schnieders and Smyk 1990), prospecting in 1990 resulted in the discovery of sericite schist and sulphide-bearing units. Recent sampling has indicated assay values of up to 0.29% Zn and 0.12 ounce Au per ton from occurrences discovered in 1990 (A. Turner, Prospector, personal communication, 1990).

Minnova Inc. conducted 1500 m of diamond drilling on the Man–Echo property on the north limb of the Manitouwadge synform.

Granges Inc. continued exploration on their Central and Swill Lake properties located in Mapledoram and Leslie townships respectively, within the Manitouwadge synform. Geological mapping, geophysical surveys (HL-EM, Mag and VLF) and soil and lithogeochemical surveys were conducted in 1990.

PLATINUM GROUP ELEMENTS EXPLORATION

Exploration for the platinum group elements (PGE) remained at a low level in 1990, with only several active exploration projects. The Marathon Cu-PGE property of Fleck Resources Ltd./Euralba Mining Canada L continued undergoing evaluation (*see* ADVANCED EXPLORATION AND DEVELOPMENT section).

Noramco Explorations Inc. completed diamond drilling on its Gionet PGE occurrence in Shabotik Township. The Gionet option has since been terminated in 1990.

INDUSTRIAL MINERALS EXPLORATION

Five exploration projects for industrial minerals (dimension stone and amethyst) were active in the Schreiber–Hemlo District during 1990 (see Table 7.4). Further discussion and recommendations on industrial minerals in the Manitouwadge area are presented in the section INDUSTRIAL MINERAL POTENTIAL OF THE MANITOUWADGE AREA.

RARE EARTH ELEMENTS EXPLORATION

Exploration of properties with rare earth elements was inactive during 1990.

GENERAL GEOLOGY

The Schreiber–Hemlo District is underlain by Archean and Proterozoic rocks. Neoarchean rocks represent a portion of the Abitibi–Wawa Subprovince of the Superior Structural Province in contact with the Quetico Subprovince in the extreme northern section of the area. The Abitibi–Wawa Subprovince is a supracrustal metavolcanic-metasedimentary sequence which has been intruded by granitic-syenitic plutons and metagabbroic dikes and sills.

The supracrustal rocks occur in three "main" belts within the Schreiber–Hemlo District: 1) the Schreiber–Terrace Bay–Winston Lake area, previously described by Marmont (1984), Severin and Balint (1985) and Patterson et al. (1987); 2) the Cirrus Lake–Heron Bay–Hemlo area, previously described by Milne (1967), Muir (1982a, 1982b) and Patterson (1984); and 3) the Manitouwadge area, previously described by Pye (1960), Friesen et al. (1982) and Milne (1974).

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. Sulphide-facies iron formation predominates in the Schreiber–Terrace Bay area, while oxide-silicate facies appear to predominate in the Manitouwadge area. Numerous felsic batholiths, plutons, stocks and porphyry dikes, including the Terrace Bay batholith, Heron Bay pluton and Cedar Lake pluton, intrude the supracrustal rocks. The supracrustal rocks have been metamorphosed under low-grade (greenschist facies) conditions in the Schreiber, Jackfish, Big Duck Lake and Heron Bay areas, under medium grade (amphibolite facies) in the Winston Lake and Hemlo areas, and under medium to higher grade (upper amphibolite facies) in the Manitouwadge area.

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 deformation zones have been recognized in the Hemlo area by Page (1947a, 1947b, 1948 and 1949), Bartley and Page (1958), 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 Schnieders (1987) and Williams (1987, 1989).

Paleoproterozoic rocks unconformably overlie the Neoarchean rocks. The Gunflint and Rove formations consist of conglomerate, black shale and iron formation.

Mesoproterozoic sedimentary rocks unconformably overlie the Paleoproterozoic rocks. The Sibley Group consists of conglomerate, sandstone, shale, carbonates and chert. Mesoproterozoic (Keweenawan) rocks are represented by diabase dikes and sills, and mafic to felsic volcanic and sedimentary rocks (Osler Group) in the Nipigon Bay–Schreiber Channel area. Mesoproterozoic intrusive rocks include alkalic and carbonatite complexes such as the Coldwell and Killala alkalic complexes and the Prairie Lake carbonatite, as well as mafic to felsic dikes.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The Schreiber–Hemlo Resident Geologist's office is staffed by B.R. Schnieders, Resident Geologist and M.C. Smyk, Staff Geologist. P. Hinz, Resource Geologist, started an investigation of the industrial mineral potential in the Manitouwadge area, and is the author of that section of this report. The Resident's office 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 1990. This field office was manned by a geologist every Tuesday from 1:00 to 5:00 p.m.

During 1990, the Schreiber–Hemlo Program dealt with approximately 1350 inquiries from the mining sector and general public, including 600 visitations and 750 phone inquiries. Included in this total were 100 visitations and 54 phone inquiries at the Marathon field office. In addition, the Assessment File office in Thunder Bay dealt with approximately 700 visitors and 100 phone inquiries during 1990.

A total of 65 visits to properties were conducted in 1990 (Table 7.5), including 14 properties visited while conducting field trips, and 3 underground mine tours. In addition, 8 field trips were conducted in conjunction with various conferences or for groups and organizations, including a week-long field trip run in conjunction with the International Association for the Genesis of Ore Deposits (IAGOD) conference and in association with the Geological Survey of Canada. Additional time was spent writing and preparing the field guides for these field trips; 2 of which were published in 1990 while a third of which will be published in May 1991. These field guides provide valuable assistance and facilitate the introduction of the district to the exploration industry and general public. Eight oral presentations and 2 poster displays were also conducted to various groups and organizations. M.C. Smyk assisted the Thunder Bay Resident Geologist's Program in a basic prospecting course held in Thunder Bay, involving 30 hours of classes and a prospector's field trip. Several field trips were made with Ontario Geological Survey crews: F. Breaks and H. Williams in the Manitouwadge area, and T. Muir in the Hemlo area. In addition, five conferences or seminars were attended or contributed to, and several professional development seminars were attended. Several newspaper interviews were conducted in 1990.

During August and September 1990 the Schreiber–Hemlo Program hosted and supervised geologist Jiang Xiangdong from the Shandong Bureau of Geology and Mineral Resources (BGMR), Jinan, Peoples Republic of China.

In addition B.R. Schnieders chaired a working group of Resident Geologists involved in reviewing and defining the "Role of the Resident Geologist". M.C. Smyk was appointed to the committee reviewing prospector training in the province; a standardized prospector training course is currently being proposed and evaluated.

The 1990 Northwestern Ontario Mines and Minerals Symposium was organized and hosted in Thunder Bay in February 1990 and was attended by over 450 people. Numerous Thunder Bay and Northwestern Regional staff assisted and supported the organization and delivery of the symposium.

The "Field Trip Guidebook for the Nipigon–Marathon Area" was completed by B.R. Schnieders, M.C. Smyk and A.A. Speed in 1990. The Schreiber–Terrace Bay mineral occurrence compilation is ongoing and the expected completion of this report, including more than 150 occurrences, is projected for spring or fall 1991. The Marathon–Hemlo occurrence compilation began in 1989; the report will likely take 5 years to produce.

C. Komar, S. Warren, A. White and D. Chiasson provided clerical assistance and support in Thunder Bay and Marathon.

PROPERTY EXAMINATIONS—1990

Fairservice Zinc Occurrence

The Fairservice Zinc occurrence is located on a large ridge of mafic metavolcanic rocks approximately 250 m west of the dam on the northern arm of Dotted Lake, 25 km south of Manitouwadge. The occurrence was first discovered by Bob Fairservice in 1957 while he was working his trapline (B. Fairservice, Prospector, personal communication, 1990) and has been explored only sporadically since then. It was first described by Milne (1968).

Three small pits were initially sunk over a distance of approximately 6 m on a sulphide mineralized zone in strongly foliated mafic metavolcanics. The mafic metavolcanics are foliated at 078/85° and are locally pillowed. The pillows are highly strained, with aspect ratios of approximately 4:1, and have recessive-weathered, chloritic selvages. Pillow cores are coarser grained than margins and contain plagioclase phenocrysts. The mafic metavolcanics consist of an amphibolite-facies, plagioclase-hornblende assemblage, with mi-

TABLE 7.5. PROPERTY EXAMINATIONS—1990.

1	Beggs–Currie
2	Big Nama[2]
3	Black River (Nexus)
4	Cabin Carbonate
5	Claus Lake
6	Courtney–Daniels
7	Cowan
8	Dead Horse Creek REE
9	Dead Otter Lake
10	Dotted Lake Batholith1
11	Dunning
12	East Barbara Lake Pyrite
13	East Barbara Lake Sillimanite[1]
14	Fairservice Zinc
15	Fourbay Lake Pluton[1]
16	Gaffhook Lake Road
17	Gale[2]
18	Geco Division Mine[2]
19	Geordie Lake
20	Glacier Creek
21	Golden Giant Mine[2]
22	Golden Sceptre Pit
23	Gold Range[2]
24	Gowan Lake Pluton[1]
25	Granges (Manitouwadge)
26	Green Lakes
27	Heron Bay (Peekongay)
28	Hemlo Highway Section[2]
29	Hughes Point
30	Kama Bay
31	Kamuck River
32	Kentron Lake[1]
33	Km 23
34	Little Bear Quarry
35	Magna Vein
36	Morley Lake
37	Morley Pyrite[2]
38	Moschuk (Jackpine River)
39	Nagunagisic Lake:
	Amethyst
	Burning Rock
	Salamander Point
40	Neys Provincial Park[2]
41	Northern Eagle[2]
42	North Shore
43	Owl Lake Mo
44	Perrys Lake
45	Pick Lake (Anderson)
46	Prairie Lake Carbonatite[1]
47	Pukaskwa National Park[2]
48	Pukatawagan Lake (South)
49	Qued Resources
50	Renner "Magnesium"
51	Rideau Resources
52	Rooster Canyon
53	Sandspit Lake[1]
54	Score Resources
55	Shack Lake
56	Swill Lake
57	Theresa Lake
58	W3 Vein
59	Waterfall Vein
60	Wellwood Lake
61	Wilkinson (Shack Lake)
62	Willecho[2]
63	Williams Mine[2]
64	Willroy[2]
65	Winston Lake Mine[2]

[1] visited in conjunction with Manitouwadge Industrial Mineral Potential Program
[2] visited during course of field trip conducted in 1990

nor, perhaps retrograde, biotite and chlorite. Quartz veins and pink, fine-grained felsic dikes have sharp but not straight contacts within the enclosing metavolcanics, suggesting that they may be locally folded or sheared. Assimilated, micaceous xenoliths within the dikes are folded.

The mineralized zone occurs in the mafic metavolcanics and is oriented approximately parallel to both the host rock foliation and the elongation direction of the pillows. The host metavolcanics become noticeably altered within 1 m of the mineralized zone. Garnet porphyroblasts, up to several millimetres in diameter, may compose 50 percent of this altered rock. X-ray diffraction analysis has confirmed the presence of (edenitic?) hornblende in the alteration assemblage (H. DeSouza, Ontario Geological Survey, personal communication, 1990). The mineralized zone is 50 to 80 cm wide and has developed a considerable gossan. According to Milne (1968) the mineralization and the garnetiferous alteration are exposed over lengths of less than 3 m and 20 m, respectively. Mineralization consists of disseminated grains to stringers of massive, red sphalerite with minor pyrite and hydrozincite in altered mafic metavolcanics. The mineralized zone is moderately to strongly magnetic; subhedral grains to euhedral octahedra of magnetite are disseminated throughout the zone and may locally compose up to 10 percent of the rock.

The southern contact of the zone is occupied by a fine-grained felsic dike which varies from being weakly foliated near the easternmost pit to becoming a very fissile, rusty sericite schist in the westernmost pit, where it is strongly magnetic. The dike varies in thickness on surface from less than 1 m to 2 m and may represent the folded limb of a larger intrusive body.

Grab sampling of the various rock units has returned the following assays:

Sample Number	Gold (oz./ton)	Silver (oz./ton)	Copper (%)
90 BFA-01	0.002	nil	0.002
90 BFA-02	0.011	nil	0.001
90 BFA-03	0.004	nil	0.002
90 BFA-04	0.074	nil	0.010
90 BFA0-05	0.014	trace	0.024

Sample Number	Zinc (%)	Na20 (%)	MgO (%)	Pb (%)
90BFA-01	0.028	0.058	0.508	n.a.
90BFA-02	0.013	n.a.	n.a.	n.a.
90BFA-03	0.003	n.a.	n.a.	n.a.
90BFA-04	0.024	n.a.	n.a.	n.a.
90BFA-05	12.000	n.a.	n.a.	<0.001

NOTE: n.a. - not assayed

Sample Descriptions

90 BFA - 01: garnet-altered, plagioclase-hornblende schist
- 02: felsic dike
- 03: sericitized felsic dike
- 04: rusty, magnetic sericite schist
- 05: mineralized zone (dump material)

Based on these local observations and chemical analyses, it appears that the Fairservice occurrence may be a metamorphosed volcanogenic sulphide occurrence similar to those in the nearby Manitouwadge camp. The abundance of magnetite in a fairly restricted zone and the low magnesium value suggest that the mineralization may be hosted in a narrow, banded iron formation within the mafic flow sequence.

Worthington Creek Property

Prospectors Jerry Courtney and George Daniels staked a property 4 km southeast of Schreiber straddling Worthington Creek. Assessment file research and prospecting led to the discovery and rediscovery of a number of gold occurrences throughout the property.

Overburden stripping has revealed sulphide-mineralized, locally auriferous, granitoid host rocks and quartz-carbonate veins. At the "Shovel Hill" occurrence, grey- to pink-weathered, medium-grained quartz porphyry contains fine-grained, disseminated pyrite and minor chalcopyrite. These sulphides may be concentrated along fracture surfaces and in small, quartz-filled veinlets. Frost-wedged blocks of a composite quartz-carbonate vein are also mineralized with discontinuous aggregates of chalcopyrite (+ malachite) and pyrite which occur in banded, white quartz, parallel to the vein margins. Sparry calcite locally occupies the outer margins of this 10 to 15 cm wide vein.

Nearby at the "Creek Zone", xenolith-rich, medium-grained granodiorite is crosscut by small aplite and feldspar porphyry dikes. Compositional and textural variation is common on a small scale. It is locally quartz- or feldspar-phyric and may contain up to 1 percent disseminated pyrite; plagioclase is noticeably saussuritized. Fractures and joints have narrow envelopes of potassic feldspar (+ hematite?) alteration. Chalcopyrite and pyrite occur in quartz-filled fractures.

Farther south along Worthington Creek, a gold occurrence discovered by Walter Baker in 1983 (assessment files, Resident Geologist's office, Schreiber–Hemlo District, Thunder Bay) was relocated in 1990. The "Baker" occurrence consists of a gossanous fracture zone that occurs on the east bank of the creek in a strongly jointed and fractured, red syenitic host. The fracture zone strikes approximately 060°, dips vertically, averages 25 cm in width, and has been exposed by overburden trenching for approximately 10 m. The host rock has developed subparallel joints striking at 60° to 65° and dipping 65° to 75° south, as well as orthogonal cross-fractures. Pinkish-white, high-weathered feldspars are conspicuous; quartz usually composes less than 10 percent of the rock, along with subordinate amphibole and epidote. Ubiquitous, fine-grained, disseminated pyrite occurs in amounts up to 1 percent in the host. The mineralized fracture zone consists of pyrite veinlets and anastomosing fine-grained pyrite aggregates without quartz gangue. Sections of massive pyrite may reach 15 cm in width. Coarser grained pyrite may be recrystallized into monomineralic aggregates or may occur as blebs or clots up to 1 cm in diameter in the wall rock. Much of the pyrite has been recessively weathered.

On the opposite (west) bank, quartz veins and vein breccias occur in a light grey-pink, strongly epidotized syenitic host. The host rock is variably mineralized with up to 20 percent disseminated, medium-grained, subhedral pyrite. Fractures are locally coated with fine-grained molybdenite and pyrite. Pyrite occurs as blebs in the quartz veins while molybdenite may be concentrated along the vein margins in the host itself.

Grab sampling of these various occurrences has returned the following assays:

Sample Number	Gold (oz./ton)	Silver (oz./ton)	Copper (%)	Molybdenum (%)
90 BGD - 08	0.013	trace	0.109	n.a.
90 BGD - 09	0.008	trace	0.0086	n.a.
90 BGD - 10	0.015	trace	n.a.	n.a.
90 BGD - 11	0.006	nil	0.0048	n.a.
90 BGD - 12	0.008	nil	0.00804	n.a.
90 BGD - 13	4.182	12.49	1.112	n.a.
90 BGD - 14	0.069	trace	0.00164	n.a.
90 BGD - 15	0.009	nil	n.a.	0.00463
90 BGD - 16	0.024	trace	n.a.	n.a.
90 BJC - 09	0.332	0.880	0.071	n.a.
90 BJC - 10	0.002	nil	0.004	n.a.
90 BJC - 11	0.646	4.910	1.493	n.a.
90 BJC - 12	0.002	nil	0.016	n.a.

NOTE: n.a. - not assayed

Sample Descriptions

90 BGD - 08: "Shovel Hill", chalcopyrite-rich quartz vein
- 09: "Shovel Hill", carbonatized quartz porphyry, disseminated chalcopyrite
- 10: "Creek Zone", granodiorite, disseminated pyrite
- 11: "Creek Zone", feldspar porphyry dike, chalcopyrite in quartz veinlets
- 12: "Creek Zone", quartz porphyry, disseminated and veinlet chalcopyrite
- 13: "Baker Occurrence", massive pyrite
- 14: "Baker Occurrence", syenitic host, disseminated pyrite <1%
- 15: "Baker Occurrence", sulphide-rich quartz vein, west side of creek
- 16: "Baker Occurrence", pyrite veinlets in syenitic host.

90 BJC - 09: south of "Creek Zone", chalcopyrite-rich quartz vein
- 10: "Baker Occurrence", saussuritized granitoid, <5% pyrite, west side of creek
- 11: "Baker Occurrence", pyrite veinlet in host
- 12: south of "Creek Zone", quartz fragments in pyrite-rich matrix

The Worthington Creek property is located within the Terrace Bay batholith near its southwestern margin, where it comes into contact with intermediate to felsic metavolcanic rocks. As noted by Harcourt (1939), numerous dikes occur along this contact and several larger, stock-like bodies of quartz porphyry are marginal to the main mass of syenitic rocks. Numerous gold occurrences have been found all along this contact, usually in or near fault-related structures in the metavolcanic rocks. Sulphide-rich quartz veins within the batholith itself tend to be copper- and molybdenum-rich (e.g., Pitkanen, Blanchford, McKenzie, Univex occurrences), rather than gold-rich. These new discoveries in the Worthington Creek area have shown that gold occurrences can be found well within the syenitic/granitic rocks and have dramatically increased the potential area for gold exploration. Lower grade, but significant gold mineralization has also been revealed in the quartz porphyries, raising the possibility of larger scale targets, as suggested and recommended by Patterson et al. (1987).

Salamander Point and Burning Rock Occurrences

Prospectors Bob Michon and Rob Reukl of Manitouwadge have investigated 2 vein-hosted sulphide occurrences discovered originally by Nolan Cox and Dave Thorsteinson in 1973, approximately 1.5 km northwest of Nagunagisic Lake which is 40 km northwest of Schreiber. High-quality amethyst has been documented near the west shore of the lake (Vos 1976).

The Salamander Point occurrence is found on a rocky point on the north shore of a small lake approximately 1.3 km northwest of the northern tip of Nagunagisic Lake. Virtually the entire outcrop consists of a massive, "bull-white", rusty-weathered, composite quartz vein. The vein attains a maximum exposed width of approximately 8 m. A small pit had previously been sunk on the vein. The vein consists of massive quartz and angular quartz fragments in a dark, siliceous matrix. Fine-grained, feldspathic wall-rock xenoliths up to 30 cm wide occur on the vein margins and are cut by reticulate quartz veinlets up to 2 cm wide. The granitoid wall rock is foliated near the vein margins and contains conspicuous, subhedral feldspars in a finer grained, mafic matrix. Fine-grained, disseminated pyrite occurs throughout the vein. Chalcopyrite has preferentially developed in the coarser grained portions of the vein. Narrow, younger veins have developed cockscomb textures in drusy quartz. The vein strikes at about 040° and appears to follow a narrow ravine that extends northeast toward the Burning Rock occurrence and continues across on the south side of the small lake.

The Burning Rock occurrence was so-named by Dave Thorsteinson because a sample of the sulphide-rich vein material reportedly combusted and produced a blue flame when burned (B. Michon, Prospector, personal communication, 1990). The showing occurs approximately 500 m northeast of the Salamander Point occurrence in the aforementioned ravine. The exposed outcrop consists largely of galena-rich sulphide veins, with or without quartz in a granitoid host, foliated at 015°. The veins strike between 030° and 040° and dip 65° to the northwest. Subparallel veins and veinlets ranging up to 10 cm in width compose a mineralized zone with an exposed width of 3.5 m. Fine-grained, massive galena may compose over 50 percent of a vein, followed by subordinate, blebby chalcopyrite (+ malachite) and pyrite and perhaps sulphosalts. Fine-grained, disseminated pyrite occurs in the jointed host rock. There has been some brecciation of the sulphides by quartz and related open-space filling.

Grab sampling of the two occurrences (B. Michon and R. Reukl, Prospectors, personal communication, 1990) has returned the following assays:

Sample Number	Gold (oz./ton)	Silver (oz./ton)	Copper (%)	Zinc (%)	Lead (%)
90 BBM- 01	nil	nil	0.946	nil	nil
4952	0.01	0.49	1.24	0.75	19.58
4959	nil	0.56	0.17	1.98	31.20

Sample Descriptions

90BBM -01: "Salamander Point", chalcopyrite-rich vein

4952: "Burning Rock", galena-rich vein

4959: "Burning Rock", galena-rich vein

The main control on the location of mineralized veins in the area is apparently a set of northeast-striking faults that are parallel to the large-scale Gravel River fault/deformation zone, 1 km to the northwest. Most of the faults in the area are manifested as deep, narrow ravines. The close spatial association of the mineralized veins with these faults suggests that there is a possibility of lateral continuity of the mineralized structures along strike as well as there being parallel structures nearby.

Cabin Property

This 33-claim block is contiguous with, and east of, the McKenna–McCann property, approximately 3.2 km northeast of Schreiber. A number of varied, but related, gold occurrences have been discovered and prospected in this area by Walter Acker and Russell Otto. These include the Power Creek, Cabin Carbonate and W3 Vein zones.

The Power Creek occurrence was discovered in 1989 and is described by Schnieders and Smyk (1990). It consists of a banded, jaspilitic, oxide-facies iron formation. It is pervasively carbonatized and pyritized where it is cut by several generations of quartz+carbonate+tourmaline veins and vein breccias. Values up to 0.066 ounce Au per ton were returned from this occurrence (Schnieders and Smyk 1990).

The Cabin Carbonate zone lies immediately south of the Power Creek iron formation. Considerable stripping has been undertaken on the zone with a front-end loader and a high-pressure water pump. Interest was first drawn to the area when old trenches (ca. 1935?) were discovered. The zone is characterized by pillowed mafic metavolcanics and autoclastic breccias that have been pervasively carbonatized. A rusty carbonate weathered surface has developed on virtually all outcrops. Although pillows are flattened, tops suggest that local flows young to the south. Fine-grained, dark green selvages may be recessively weathered. Pillows may have (synvolcanic?) alteration envelopes and commonly contain quartz+carbonate-filled amygdules and pipe vesicles. Rusty, chlorite-rich hyaloclastite and sulphidic chert breccia occur between pillows. Coarser grained gabbro or gabbroic flows occur within, and likely intrude, the mafic flow sequence, but contact relationships are unclear.

The mafic metavolcanics are locally brecciated and extensively mineralized with euhedral pyrite and minor chalcopyrite. Several narrow, discrete shear zones are exposed throughout the stripped area. Quartz-carbonate alteration with minor tourmaline occurs along fractures and joints in association with sulphides and mineralized, fine-grained quartz veinlets. Grab sampling has returned values up to 0.012 ounce Au per ton.

The W3 vein was discovered in late 1990 during prospecting northwest of the Power Creek zone. Overburden stripping has revealed a composite quartz vein exposed over a distance of 20 m in a medium-grained, gabbroic rock. Prospecting along strike has led to the discovery of old trenches and probable strike extensions of the vein. The orientation, texture and mineralization of the vein suggests that it may be an extension of one of the *en échelon* veins exposed on the McKenna–McCann property, 300 m to the west, or a parallel, previously undiscovered vein.

The vein strikes at 120° and dips vertically. It consists largely of "bull-white", massive quartz, with sections displaying a ribboned or "crack-seal" texture. Orientations of the mafic seams in the "crack-seal" sections are similar to the vein itself. The vein attains an exposed maximum width of approximately 2 m, but averages 1 m in width. The wider portions usually consist of variably oriented, massive, xenolith-rich veins and vein stockworks. The vein is erratically mineralized with anhedral to euhedral pyrite. The "crack-seal" sections contain significantly more chalcopyrite and have returned the high(er) gold assays. Visible gold occurs as fine grains along the seams. Calcite occurs sporadically in the vein and in the wall rock.

Grab and chip sampling of the W3 vein has returned the following assays:

Sample Number	Gold (oz./ton)	Silver (oz./ton)
90 BCC-30	0.002	nil
90 BCC-31	0.009	trace
90 BCC-32	0.003	nil
90 BCC-33	0.011	trace
90 BCC-34	0.002	trace
90 BCC-35	nil	nil
90 BCC-36	0.009	nil
90 BCC-37	0.003	nil

Sample Descriptions

90 BCC - 30: 0.75 m chip sample across "crack-seal" vein
90 BCC - 31: chalcopyrite-rich vein (grab)
90 BCC - 32: carbonatized gabbroic wall rock (grab)
90 BCC - 33: "crack-seal" vein, pyrite+chalcopyrite <2%
90 BCC - 34: massive quartz, pyrite <2%
90 BCC - 35: massive quartz, minor pyrite, "Northern Extension", 90 m northwest of main trench
90 BCC - 36: massive quartz, minor pyrite, "Farther North Extension", 110 m northwest of main trench
90 BCC - 37: massive quartz-carbonate vein, chalcopyrite-rich

Selected grab samples of the crack-seal portions of the vein returned up to 1.631 ounces Au per ton (Assay Report, Accurassay Laboratories, Thunder Bay, Resident Geologist's files, Schreiber–Hemlo District, Thunder Bay).

Rooster Canyon Occurrence

The Rooster Canyon occurrence is located in Priske Township approximately 5 km south of the town of Schreiber. It is located just north of the North Shores Mine property (mining claim B.J. 122) (*The Fort William Daily-Times Journal*, October 14, 1931, Resident Geologist's files, Schreiber–Hemlo District, Thunder Bay). The Rooster Canyon property is approximately 100 m higher in elevation than the eastern adit on the North Shore property.

The auriferous quartz vein was originally discovered by W. Longworth's son, Gilbert, in 1931 and was explored and developed during the mid-1930s. An adit, open cut, shaft and numerous trenches were developed along a strike length of approximately 200 m.

The narrow quartz vein varies in width from 5 to 20 cm. However, a historical report indicates the vein ranges up to 30 cm in width, and could be traced to a vein up to 1.8 m wide (*The Fort William Daily-Times Journal*, October 14, 1931, Resident Geologist's files, Schreiber–Hemlo District, Thunder Bay). This reportedly wider vein was not observed by the authors. In the area of the adit several veins or a composite vein are present. The quartz veins strike 090° to 105° and dip 80° south to vertically. The main vein displays a "crack-seal" texture with inclusions and seams (septa) of the host rock. The seams and vein walls display carbonatization in the form of calcite. Visible gold, locally in coarse grains up to 1 mm in size, were observed at or near the contact of these seams. Sulphide minerals include pyrite, chalcopyrite and a silver-grey to bluish mineral thought to be a telluride. Harcourt (1939) identified tetradymite, a bismuth telluride ($Bi_2(Te,S)_3$) at the North Shore property. Accessory minerals within the quartz vein include epidote, chlorite, hematite, calcite, malachite and possible fluorite.

The quartz veins are exposed along a 200 m strike length that appears to be offset 12 m to the north by a left-lateral fault striking 330° to 340°. This fault defines a 20 m high cliff and ravine into which an adit was driven for approximately 20 m. At the entrance of the adit a small pit up to 2 m deep has been excavated. In the adit area there appears to be an intersection of structures as a fault striking 040° and dipping vertically intersects the 330° to 340° structure and the 100°-striking vein. It is possible that the 100°-striking vein has been offset by the 040°-striking structure as quartz is observed at the adit portal and several metres inside the adit. The vein therefore may have been offset more than once. The adit was originally driven perpendicular to and into the cliff at about 220°, then changed attitude and followed the vein for up to 2 to 3 m at 100°, and then continued to drift at approximately 220°. Narrow quartz stringers were observed striking 220°, but were neither sampled nor assayed. It is the authors' interpretation that the past workers either drifted along this structure because they encountered gold values or they were searching for parallel vein structures. There is no evidence on the north wall of the adit that suggests that the past workers lost contact with the main 100°-striking vein. Why the past workers did not drift further along this structure is unknown.

Approximately 70 m west of the adit an open cut 35 m long by 2 to 3 m wide and up to 6 m deep has been developed on the vein. On the eastern end of the open cut, a small dump of quartz vein material is present. Visible gold was observed in numerous samples. Approximately 50 m east of the adit several trenches and a pit or shaft has been developed on an approximately 7.5 cm wide vein.

Airphoto interpretation suggests that there are several prominent and distinctive sets of lineaments in the area: 1) a 100°-striking set to which the quartz veins are presumably related; 2) a 320° to 340°-striking set; 3) a prominent 000° to 010°-striking set; and 4) a 040°-striking set which parallels the Schreiber Point and Worthington Bay faults. While the exact relationships of these lineament sets (faults) to gold mineralization and each other is unclear, these structures should be thoroughly prospected and explored for gold.

The quartz veins are commonly hosted by a rock that on surface weathers to pink-white, and contains 5 to 10 percent hornblende phenocrysts within an aphanitic groundmass. Cut and polished slabs display a darker coloured rock consisting of interlocking crystals of feldspar and hornblende, in places containing up to 2 to 3 percent disseminated pyrite. In addition, a more mafic and locally hornblende-phyric rock was also observed. While the authors were unable to determine the genetic relationships of the host rocks, a field name of hornblende syenite was used to describe the host rocks. Past workers such as Harcourt (1939) described the host rocks of the area as syenite as well as intermediate to felsic volcanic rocks. An interesting observation is that cut slabs of the hornblende-phyric rock resemble "Timiskaming"-type volcanic rocks present in the Shebandowan area. The first reference to "Timiskaming"-type rocks in the Schreiber area was by Hopkins (1922) in reference to a conglomerate unit.

Grab samples of the main quartz vein collected by the authors (excluding samples with visible gold) taken from the north wall of the adit assayed up to 0.843 ounce Au per ton, 0.16 ounce Ag per ton and 0.03% Cu. Grab samples collected by D. Skalesky and L. Lundstrom from the quartz vein on the north wall of the adit assayed up to 1.803 ounce Au per ton and 0.35 ounce Ag per ton. A chip sample over 0.5 m from the far western extension of the vein indicated 0.002 ounce Au per ton. Assays of hornblende-phyric host rock containing 1 to 2 percent disseminated pyrite collected from new trenches on top of the adit assayed up to 0.039 ounce Au per ton. Samples collected by D. Skalesky and L. Lundstrom assayed up to 0.351 ounce Au per ton. Historical reports indicate that selected samples assayed up to $1800 per ton in 1931, equivalent to approximately 83 ounces Au per ton (Resident Geologist's files, Schreiber–Hemlo District, Thunder Bay).

RECOMMENDATIONS FOR EXPLORATION

At the Twelfth District Four Meeting of the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) held in Thunder Bay in September 1990, speaker Howard Poulsen of the Geological Survey of Canada highlighted the value of exploring for unconventional, larger tonnage, lower grade deposits in the Canadian Shield using models from younger terrane. Further emphasizing this point, the authors suggest that the Schreiber–Hemlo District contains mineral deposits that for long periods of time were not considered to represent "conventional" deposit types or settings. Examples such as the Hemlo deposit and Manitouwadge mining camp need only be mentioned to stress this point. While geological and genetic models are important, especially as guidelines, explorationists must keep an open mind.

Exploring for these "unconventional" deposits is a sound recommendation and the Schreiber–Hemlo District offers a variety of unconventional mineral occurrences. In addition to the Hemlo deposit, occurrences such as the MacRae or Geordie Lake copper-palladium-tellurium-bismuth occurrence (Mulja 1989; Mulja and Mitchell 1990), first described by Patterson et al. (1987), and the Glacier Creek–Jackpine River copper-gold occurrences (Schnieders and Smyk 1990) are examples of unique types of mineralization.

The authors also highly recommend the data bases available at the Resident Geologist's offices throughout the province. Not only are the geologists and their staff themselves sources of information, but the assessment files, mineral deposit files, historical research files, rock specimen suites and drill core library data bases and facilities are considered invaluable. For example, while researching the exploration history of the Hemlo area, the authors came across assessment files containing numerous reports written by consulting geologist Trevor Page, one of the earlier workers in the Hemlo camp. Several of Page's observations from reports written on the Lake Superior Mining Corporation Limited and the "Ollmann–Williams" properties at Hemlo include:

> The main mineral-bearing structure consists of a quartz-porphyry that has undergone intense alteration through shearing, silicification and sericitization (Page 1947b).
>
> While this property is still in the prospect stage, sufficient evidence has been obtained to indicate the possible existence of an ore-bearing structure of considerable size (Page 1947b).
>
> Lake Superior Shear Zone: To date this shear zone has been definitely traced on the surface for over seven miles (Page 1948).
>
> The Hemlo Fault is first encountered as a definite structure two miles east of Hemlo on Highway 17. It has been located fairly continuously to a point south of Treudeau (sic) some eight miles distant (Page 1948).
>
> The Hemlo Fault is considered to be the most important structural feature as it appears to bear a close relationship to the Lake Superior Shear Zone in which all present gold discoveries of economic interest have been found. With it also are associated porphyries similar to those of the Shear Zone. Probably the greatest feature to date has been the use of this fault in locating the projection of the gold bearing zone (Page 1948).
>
> The 'Hemlo Break' is probably part of the Heron Bay Break which is recognized as one of the large structural features associated with the Precambrian geology in this section of the Canadian Shield. Porphyry bodies with which mineralization of economic importance is associated have been guided in their emplacement by this regional structural pattern (Page 1949).
>
> It appears feasible to expect that deeper drilling may extend the value zone to the western boundary of the property as structural features of the district in the form of numerous examples of drag folds indicate a rake to the west (Page 1948).
>
> The section from Hemlo to Struthers has received considerable prospecting attention to date, and its potential depends mainly on further exploration... (Bartley and Page 1958).

While such observations are open to interpretation, they are considered by the authors to represent valuable and accurate information available to the explorationist. One interesting observation is that during the past decade of Hemlo exploration and production, the geological thinking (i.e., models, genesis) has come somewhat full circle, now resembling Page's earlier observations. Statements such as "there are many yet undiscovered mines written up in the assessment files" are commonly used to express the value of researching such data bases. The authors recommend that for those interested in further researching the exploration history of Hemlo, such information is available in the Schreiber–Hemlo mineral deposit files.

These data bases, which include the historical research files compiled by K.G. Fenwick and periodically incorporated into the Schreiber–Hemlo District mineral deposit files, are excellent sources of information. Often these data bases include locations and descriptions of previously discovered occurrences that have been forgotten. Therefore, these varied data bases are enlightening for the prospector and explorationist.

GOLD

Hemlo–Heron Bay–Manitouwadge Area

Quartz-porphyritic felsic intrusive and volcanic rocks, as well as structural and deformation zones in the Hemlo–Heron Bay area appear to have a genetic association with gold mineralization. This relationship was recognized early in the Hemlo–Heron Bay area by such workers as Thomson (1931, 1933) and Page (1947a, 1947b). Metavolcanic-metasedimentary contacts, deformation zones and porphyry contacts, together with the presence of sericite schists, disseminated pyrite, molybdenite, green mica, barite and pervasive potassic alteration (microcline and muscovite-sericite) are considered to be important in characterizing gold mineralization in the Hemlo area.

In the Hemlo area, gold deposits are hosted by sericite-muscovite-pyrite schists in amphibolite facies rocks. Such rocks are also present in the Manitouwadge area, and thus these more traditional base metal targets should be explored for their gold potential.

Theresa Lake – Dead Otter Lake Area

Exploration activity in this part of the Hemlo greenstone belt, sometimes referred to as the "North Limb" or "North Rim", has waned since the mid-1980s. The belt had been staked solidly and explored in the wake of the Hemlo rush (Patterson et al. 1985, 1986), but a significant portion has since become open to staking.

Resident Geologist's staff undertook reconnaissance study and sampling of outcrops along the newly linked Dotted Lake–Twist Lake forest access road that transects the metavolcanic sequence. The sequence consists largely of massive to pillowed mafic flows and autoclastic breccias with narrow interflow sedimentary units, including banded iron formation. Some felsic metavolcanic rocks have been mapped by Siragusa (1985, 1986) between Theresa Lake and the Black River. A variety of quartz- and feldspar-porphyritic sills intrude the volcanic rocks and are typically highly sheared along these contacts.

Gold occurrences have been documented in a variety of rocks, including deformed chert-pyrite-magnetite banded iron formation and mafic volcanic rocks (Patterson et al. 1985), and carbonatized interflow sedimentary rocks (Resident Geologist's files, Schreiber–Hemlo District, Thunder Bay). Recent assays of grab samples by Resident Geologist's staff returned 0.03 and 0.05 ounce Au per ton, respectively, in a rusty shear zone crosscutting amphibolitic metavolcanics, and in a quartz porphyry with up to 4 percent disseminated pyrite.

Based upon past exploration and more recent analysis, this area has demonstrated a potential for gold mineralization in a variety of environments. Prospecting activity should focus on strongly deformed and altered (silicified, carbonatized, seriticized, pyritized) rocks. Quartz- and feldspar-phyric rocks, especially those that are mineralized with sulphides, also warrant investigation. The contact of the metavolcanic rocks with the Dotted Lake batholith (to the north) should be explored. Narrow, discrete shear zones, some hosting mineralized quartz veins, have been noted in relatively massive, undeformed granodiorite. In much of this area, recent logging and road construction has greatly facilitated prospecting and exploration.

Schreiber–Terrace Bay Area

The northwest contact aureole at the Terrace Bay batholith is considered an excellent gold exploration target. The exploration model and targets presented in Patterson et al. (1987) first suggested these targets and one possible approach to this area. The model and targets relate to structural controls and contact relationships within and near the contact of this high-level intrusion (Terrace Bay batholith) and additional intrusions. The model and targets challenge the explorationist to consider potentially larger tonnage targets in an area that has been known for numerous, small, high-grade occurrences. Exploration targets and models presented in Patterson et. al. (1987) have helped in increasing the level of exploration activity in 1990, as well as assisting in new discoveries such as the Joa–Walton vein in 1989, Power Creek occurrence in 1989 and W3 vein in 1990. Further prospecting and exploration is recommended in the Schreiber Point–Hays Lake area, especially in the area surrounding previously discovered occurrences on properties such as the North Shore, Rooster Canyon, Longworth Silver, Morley, Harkness Hays, Gold Range, Otisse, Jeddar, Johnston–McKenna, McKenna–McCann and Schreiber–Pyramid.

Felsic intrusive rocks, including syenite, quartz porphyry and aplite dikes, are abundant adjacent to the contact of the

Terrace Bay batholith. Such units may display potassic alteration and elevated gold levels, and may be genetically related to the production and emplacement of the gold-bearing solutions within deformation zones.

The Glacier Creek–Jackpine River Fault located 40 km east-northeast of Nipigon remains an attractive exploration target for large-tonnage, low-grade, copper-gold mineralization. Further prospecting and exploration is recommended.

Recommendations for Historical Research

In describing the geology and gold occurrences south of Schreiber, Hopkins (1922) relayed the report of Mr. Mudge who stated that ca. 1900, an Indian named Ogamah found gold approximately 2 km northwest of the McKellar–Longworth (now North Shores) property. On an accompanying sketch map, it is marked as a visible gold discovery in hornblende biotite and syenite, near the contact with metavolcanic rocks. No other references to this occurrence have yet been found.

BASE METALS

Schnieders and Smyk (1990) recommended 5 main areas for base metal exploration in the Schreiber–Hemlo District: 1) Winston Lake area; 2) Lyne Lake–Victoria Lake area; 3) Santoy Lake–McKellar Lake area; 4) Pic River area; and 5) Manitouwadge area.

Lithogeochemical surveys to detect sodium and calcium depletion, and magnesium, potassium, zinc and copper enrichment, are considered valuable exploration tools for identifying hydrothermal alteration zones associated with volcanogenic massive sulphide base metal deposits.

The authors consider the Lyne Lake–Victoria Lake metavolcanic-metasedimentary rocks 10 km north-northwest of Schreiber to represent an extension of the Winston Lake stratigraphy. Calc-alkalic, felsic to intermediate, fragmental metavolcanic rocks are considered excellent exploration targets, as are areas of metamorphosed hydrothermal alteration characterized by cordierite, anthophyllite, sillimanite and garnet.

Reconnaissance investigations in 1989 in the Page Lake area, 8 km southwest of Goodchild Lake, identified sulphide gossans on the north shore of a small lake situated approximately 750 m west of the north end of Page Lake. Further prospecting and sampling is warranted in this area.

In the Louis Lake area, approximately 4 km northwest of Goodchild Lake, sampling by the authors indicated sulphide horizons with values up to 0.006 ounce Au per ton, 0.28 ounce Ag per ton, 0.13% Cu and 0.08% Zn. While initial assay values are low, further prospecting is warranted.

The limbs of the Manitouwadge synform and the extensions of the Manitouwadge stratigraphy into Nickle and Herbert townships, as well as to the north of those townships, are considered high potential areas for base metals. Preliminary reconnaissance by Resident Geologist's staff and Ontario Geological Survey staff during 1988 and 1989 identified areas of metasedimentary and metavolcanic gneisses, or "ghost greenstone", previously denoted as granitic rocks on the compilation map in the Manitouwadge area (Milne et al. 1972). The metavolcanic-metasedimentary limbs have been extremely disrupted and intensely deformed, and subjected to amphibolite-grade metamorphism and hydrothermal alteration. Consequently, high-potential rocks may be obscured and are difficult to identify as exploration targets.

In addition, the mineralized showings are generally not very spectacular. However, caution and a fair amount of patience are required when assessing showings in amphibolite-facies terranes, as the discovery of Manitouwadge and Hemlo mining camps has proven.

The presence of sillimanite, cordierite, garnet and anthophyllite (gedrite) is indicative of hydrothermal alteration and/or high-grade metamorphism. Most known ore deposits in the Manitouwadge area are hosted by muscovite-quartz schist. Gedrite was discovered on the north limb of the Manitouwadge synform near Rabbitskin Lake in 1988 (Schnieders and Smyk 1989).

Theresa Lake – Dotted Lake – Black River Area

A number of diverse base metal occurrences are situated in the mixed metavolcanic-metasedimentary sequence extending from Theresa and Dotted lakes west and south to the Black River. The individual occurrences have been documented by Milne (1968) and warrant further investigation in the context of new structural, stratigraphic and ore deposit models. The Fairservice Zinc, Caravelle and Kusins occurrences display zinc, copper-nickel/copper-lead-zinc and lead-zinc mineralization, respectively. The Fairservice Zinc (*see* PROPERTY EXAMINATIONS) and Kusins showings are hosted by amphibolite-facies mafic metavolcanic rocks, while those on the Caravelle property are hosted by intermediate to felsic pyroclastic and metasedimentary rocks. The intermediate to felsic metavolcanic rocks form a discrete, narrow, arcuate band that extends west and southwest from the southern end of Theresa Lake to northwest of Amwri Lake, bifurcating to the north along the west side of Highway 614 in the vicinity of Pinegrove Lake (Milne 1968; Siragusa 1985, 1986). The pyroclastic rocks consist dominantly of tuff and tuff breccia with highly strained, lenticular fragments.

Preliminary field observations suggest that many of these base metal occurrences are syngenetic, but may have vein-like features because of the high degree of deformation and subsequent remobilization. The high degree of strain may also impede the explorationist in the determination of the protolith, and in the interpretation of contacts and continuity of mineralized zones. A potential exists for the occurrence of volcanogenic massive sulphide deposits similar to those in the Manitouwadge and Winston Lake camps. It is therefore suggested that all sulphide occurrences, regardless of size or lateral extent, be fully investigated. Occurrences of alteration minerals, or their metamorphic equivalents, such as garnet, anthophyllite and sericite, merit investigation, whether or not they occur with sulphides.

A sulphide occurrence, first noted by Milne (1968), was revisited in 1990. It occurs in a railway rock cut approximately 425 m north along the tracks from the railway crossing on Highway 614 near the north end of Barbara Lake, 3 km southeast of Amwri Lake. The host rocks consist of intercalated, foliated, massive to gneissic, dark grey metasedimentary rocks and laminated, paragneissic amphibolite, interpreted to be metamorphosed mafic volcanic rocks. Pyrite occurs in a narrow (1 to 2 m) zone as fine-grained, disseminated crystals and crystalline aggregates, somewhat concentrated in the more mafic, chlorite- and amphibole-rich laminae. Although originally noted as a gabbro-hosted, copper-nickel prospect (Milne 1968), a recent grab sample assayed only trace amounts of base metals, but returned 0.024 ounce Au per ton. It is also interesting to note that sillimanite and garnet, minerals commonly ascribed to hydrothermal alteration near base metal deposits, occur in nearby metasedimentary rocks. This area should be investigated for both its base metal and gold potential.

PLATINUM GROUP ELEMENTS

Exploration for platinum group element (PGE) mineralization in the Schreiber–Hemlo area could be concentrated in 7 major areas: 1) the Coldwell alkalic complex; 2) the Killala Lake alkalic complex; 3) the Goodchild Lake area; 4) the Rhea Lake–Hornblende Lake area, located 13 km northwest of Schreiber; 5) the Jackfish area; 6) the Shabotik Township area; and 7) near Manitouwadge.

With the recent discovery of PGE in the Shabotik Township area, which is 20 km northeast of White Lake, further prospecting and exploration is warranted in this region. The Kwinkwaga Lake Map 2179G (ODM-GSC 1963) displays high magnetic anomalies in the southeastern and northwestern corners of Shabotik Township as well as central Mikano Township, northern Flood Township, northeastern Bryant Township and central Hambleton Township, which should all be investigated. The high magnetic anomalies normally indicate the presence of mafic rocks, such as diabase, gabbro or serpentinite, which have a relatively high iron content and in special instances, may be due to concentrations of magnetic minerals such as pyrrhotite and magnetite. Soil and rock geochemical surveys, combined with geophysical surveys (induced polarization and magnetometer), can be effective exploration tools.

Exploration for platinum group elements (PGEs) should focus on mafic to ultramafic intrusive rocks which occur in a number of areas in the Schreiber–Hemlo District. Gabbroic, dioritic, peridotitic and serpentinitic rocks occur in a variety of settings, in association with many different rock types.

These intrusive rocks occur within metavolcanic-dominated greenstone belts, such as at Goodchild Lake, northeast of Marathon, in the Rhea–Maude lakes area 15 km north of Schreiber, and in the belt extending eastward from Winston Lake toward Owl Lake. Copper-nickel occurrences, with which PGEs are most closely associated, and their host rocks, have been documented in these areas by Milne (1967), Bartley (1939, 1942), and Pye (1964) and Walker (1967), respectively. Similar occurrences are associated with copper-zinc and gold mineralization in the Black River–Dotted Lake area (Milne 1968). A small, previously unmapped, serpentinite body has been uncovered by road construction and is exposed on the Petrant Lake road, 300 m north of the Amwri Lake road junction.

In the eastern part of the district, peridotite, gabbro and anorthosite occur in gneissic, tonalitic rocks surrounding the greenstone belts. Williams and Breaks (1989, 1990) have identified a mafic layered intrusive rock suite that occurs as the Moshkinabi and Faries lakes complexes, 22 km east of Manitouwadge. This suite of rocks occurs discontinuously as far east as Hornepayne. Lenses of these rocks are also found northeast of Manitouwadge (adjacent to the Hillsport road) and northwest of Manitouwadge from near Manitou Falls (Pic River) to Fox Lake, north of Wowun Lake. Remarkably similar rocks have recently been the target of exploration in Shabotik Township, 40 km southeast of Manitouwadge. Sulphide occurrences, although patchy and sporadically distributed, are widely noted. Copper, nickel and PGE values vary widely in absolute and relative amounts.

The Proterozoic alkalic igneous rocks that compose the Coldwell and Killala Lake complexes have been the most extensively explored for copper, nickel and PGE. Sulphide occurrences are generally associated with gabbroic rocks in which disseminated iron and copper sulphides and platinum group minerals occur. The two most significant deposits are the Marathon deposit (Euralba Mining Canada L/Fleck Resources Ltd.) and the Geordie Lake occurrence, 12 km northeast and 15 km northwest of Marathon, respectively. The Marathon deposit has most recently been documented by Dahl, McGoran *et al.* (1987) and Dahl, Watkinson *et al.* (1987), while Geordie Lake has been studied by Good and Crocket (1989), Mulja (1989) and Mulja and Mitchell (1990).

Regardless of geologic setting, all copper-nickel-PGE occurrences share common characteristics. The host mafic to ultramafic rocks commonly display variations in grain size, layering, and have features indicative of disruption and/or magma mixing, including breccias, pegmatitic patches and pegmatitic dikes and veins. PGE-rich sulphide assemblages may typically compose less than 5 percent of the rock. Such rocks typically present a high magnetic anomaly due to the presence of magnetite, ilmenomagnetite, pyrrhotite and ilmenite. Any mafic to ultramafic rocks displaying such features, especially those that are sulphide-bearing, should be thoroughly investigated. Many small intrusive bodies, missed by regional-scale mapping due to lack of exposure and other factors, may be located by prospecting and magnetic surveys.

Previously unreported occurrences of ultramafic, spinifex-textured, metavolcanic rocks, termed komatiite, have been noted south of Goodchild Lake, within typical greenstone belt rock assemblages (P. DeGagne, Noranda Exploration Company, Ltd., personal communication, 1990). Nickel sulphide + PGE deposits occur in komatiitic sequences at Kambalda, Australia, and near Timmins, Ontario. A model for "Kambalda-type" deposits has recently been presented by Duke (1990). The occurrence of these relatively rare komatiitic rocks in this belt is noteworthy, and their nickel-PGE potential should be investigated.

INDUSTRIAL MINERALS

There is a variety of industrial mineral and dimension stone possibilities in the Schreiber–Hemlo District. Opportunities in the Manitouwadge area are discussed further in this report.

Dimension Stone

Quarrying of dimension stone in the past has focussed on syenites of the Coldwell alkalic complex ("red" and "black granite") and on sandstone on the offshore islands between Rossport and Nipigon. The basic criteria are usually homogeneity of colour and texture and regularity of fractures or joints. Recent trends in stone use have expanded the viability of nontraditional sources such as gneisses and breccias.

Spectrolite

Portions of ferro-augite syenite (commercially known as "black granite") in the eastern part of the Coldwell alkalic complex near Marathon are coarse grained to pegmatitic. Large feldspar crystals may display yellow-orange to blue schillerescence and have been locally termed "spectrolite". Two properties near Shack Lake, 2 km northwest of Marathon, have undergone limited exploration in the past but are being re-examined by owners Don Wilkinson, and Jon and Audrey Ferguson, respectively. The main potential usage of the "spectrolite"-rich syenite is as decorative or ornamental stone for use in cabochons, bookends and perhaps tiles. Pegmatitic zones are commonly deeply weathered and are not amenable to large block quarrying. Hand picking and sorting can be undertaken on a small scale. Prospectors should investigate any coarse-grained to pegmatitic sections of syenite or dikes for feldspars that display this characteristic schiller effect. In deeply weathered outcrops, the feldspars commonly remain intact and retain their schiller colours. Stripping and blasting may be required to obtain "fresher", unfractured material.

X-ray diffraction analysis of the "spectrolite" shows the presence of plagioclase and minor K-feldspar (antiperthite). Examination of the mineral in oils shows that it is oligoclase. The schiller effects may be brought about by diffraction that occurs at the boundary of the exsolution lamellae (H. DeSouza, Ontario Geological Survey, personal communication, 1990).

Rare Earth Elements

Exploration for rare earth elements (REE) should concentrate on syenite dikes, diatremes and related structures in and around the Coldwell alkalic complex. Recent research in the Dead Horse Creek complex has been presented by Schnieders and Smyk (1989). Potential targets are invariably radioactive and are most easily detected using a portable scintillometer or Geiger counter. Pervasive hematitization and silicification are usually associated with REE mineralization locally. Calcite and epidote are common accessory minerals.

Amethyst

Recent property examinations by the authors in the Nagunagisic Lake–Cavers Lake area indicated the presence of high-quality amethyst occurrences. Further prospecting and exploration is warranted and recommended, even though these areas remain remote and access is difficult. An occurrence of amethystine quartz was discovered in 1990 at the Km 23 occurrence on the Dead Horse forest access road (*see* PROPERTY EXAMINATIONS below).

INDUSTRIAL MINERAL POTENTIAL OF THE MANITOUWADGE AREA

INTRODUCTION

The "Industrial Mineral" project was initiated in August 1990 to study the industrial mineral potential of the Manitouwadge area. It is an eight-month project jointly funded by the Canada-Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario, and the Northwestern Region of the Mines and Minerals Division, Ontario Ministry of Northern Development and Mines. The project is staffed by Peter Hinz, under the general supervision of the Schreiber–Hemlo Resident Geologist Program. The primary goal of the study is to document and create a data base of all known industrial mineral occurrences within 50 km of the town of Manitouwadge and visit as many occurrences as possible. All findings to date were presented in display format at the Mines

Figure 7.3
Schreiber-Hemlo Resident Geologist's District

Manitouwadge Industrial Mineral Study.
◆ Property Visits, 1990 (keyed to Table 7.6)

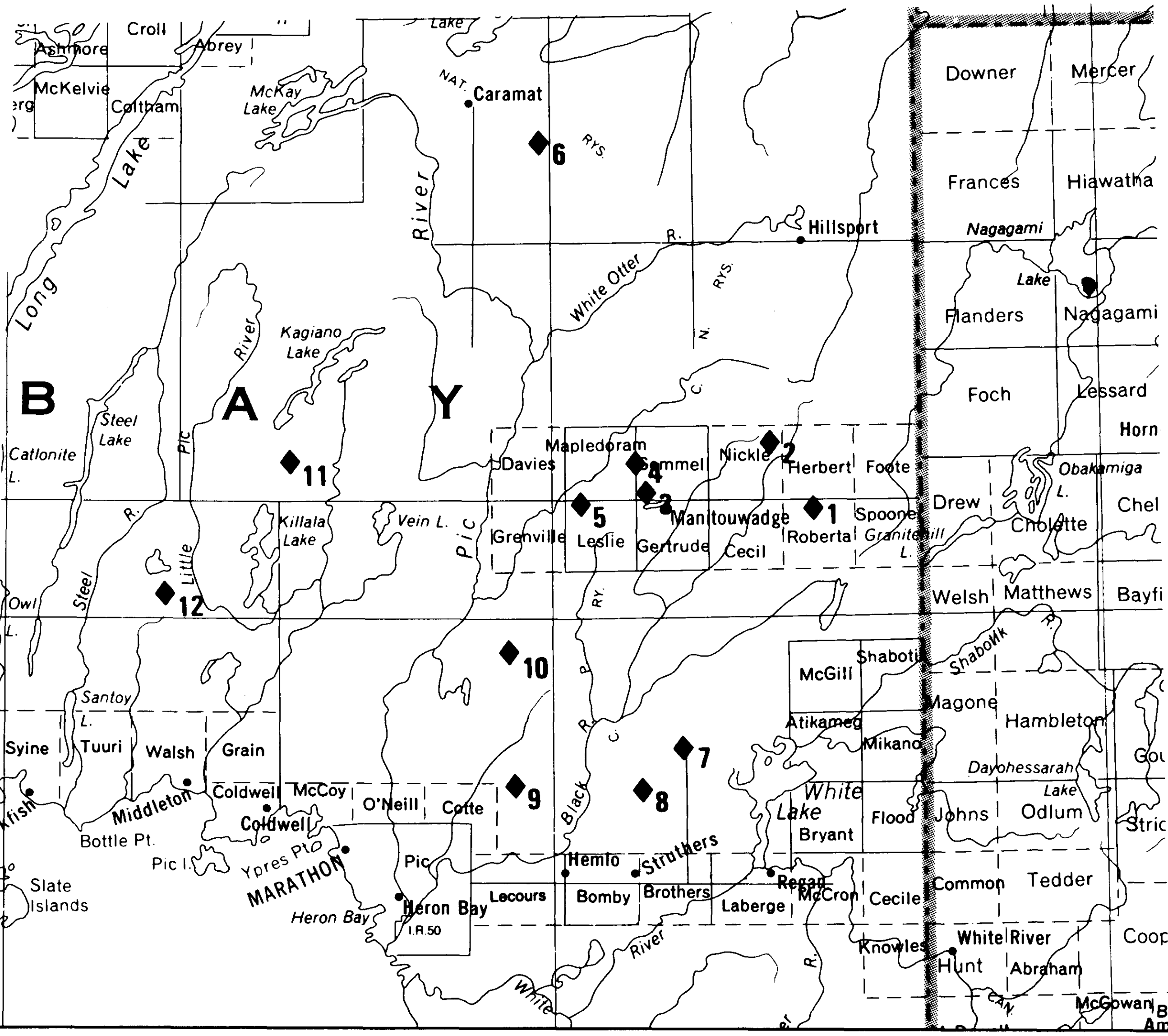


TABLE 7.6. INDUSTRIAL MINERAL PROPERTY EXAMINATIONS—1990.

1	Moshkinabi–Fairies Lake Complex
2	Loken Lake Occurrence
3	Willroy Mine
4	Big Nama Mine
5	Swill Lake Occurrence
6	Little Charon Lake Graphite Occurrence
7	Dotted Lake Batholith (Calicchia Stone Industries)
8	Highway 614 Sillimanite Occurrence
9	Gowan Lake Pluton
10	Fourbay Lake Pluton
11	Killala Lake Alkalic Complex
12	Prairie Lake Carbonatite Complex

and Minerals Symposium held in Toronto during December 1990 and will be presented in April 1991 at the Northwestern Region, Mines and Minerals Symposium to be held in Thunder Bay. Information sessions for prospectors are planned for 1991 in Marathon and Manitouwadge. These sessions will provide local prospectors with information on industrial mineral opportunities in the area, markets and commodities, production in Ontario, and business contacts.

Study activities included a detailed literature search of assessment files, industrial mineral and Resident Geologist files to compile a series of data files on the industrial mineral occurrences in the area. Field visits were undertaken (Figure 7.3; Table 7.6) to locate, sample and record occurrences of high potential. Samples have been cut and polished for display purposes. Clients have received assistance in the form of property visits, sample preparation and discussion relating to the industrial mineral industry.

In the past, mineral exploration in the Manitouwadge area has focussed upon the search for base and precious metals. With increased interest in industrial mineral commodities, their subsequent increased market value, and the fact that there are occurrences of over 10 such commodities in the study area, a new range of exploration targets has been realized.

ACKNOWLEDGMENTS

This report was reviewed by B.R. Schnieders and M.C. Smyk and edited by K.G. Fenwick. Typing was done by S. Warren. Sample preparation was provided, in part by D. McKay. Myra Gerow contributed valuable information and discussions. Staff of Geco Division mine (Noranda Inc.) assisted by providing samples from the mine and information on the geology of the area. Numerous prospectors provided invaluable information on occurrences in the area.

DIMENSION STONE

There are numerous granitic bodies (5 Early Precambrian (Archean) silicic plutons and 2 Late Precambrian (Proterozoic) alkalic complexes) within the study area, which have potential for quarrying as building or monument stone. It should be noted that the term commercial "granite" includes all intrusive igneous rocks regardless of composition, including gneissic rocks (Kennedy and Gertzbein *in* Patterson et al. 1985).

Although there are no producing quarries within the study area, to the southwest a number of properties (Table 7.7) in the Coldwell alkalic complex, near Marathon, were developed for their dimension stone between the 1880s and 1930s (Kennedy and Gertzbein *in* Patterson et al. 1985). In recent years, with the increased market for building stone, these properties have been re-evaluated and exploration work carried out.

One high potential granitic body, the Dotted Lake batholith, is currently being investigated by Calicchia Stone Industries of Cleveland, Ohio. A detailed property description is provided in this report.

Other igneous bodies that may have dimension stone potential include the Fourbay Lake pluton (27 km southwest of Manitouwadge), Gowan Lake pluton (46 km south-southwest of Manitouwadge), Musher Lake and Cedar Lake plutons (34 km and 48 km south of Manitouwadge respectively) and the Killala Lake alkalic complex (46 km west of Manitouwadge). Field visits were conducted by the author to 3 of these sites: Fourbay, Gowan and the Killala complex. The granodiorites at the Fourbay and Gowan plutons display high jointing frequencies and alteration halos along joints and fractures at the sites visited. The central syenites (Sage 1988) of the Killala Lake complex in the vicinity of Kentron Lake, however, are coarse grained and massive, with a joint spacing of 2 to 3 m and a banded texture in some outcrops. A detailed property description is provided in this report.

TABLE 7.7 GRANITE PROPERTIES BEING EVALUATED IN THE STUDY AREA

1	Calicchia Stone	Wabikoba Lake area, Dotted Lake property
2	Petrunka, David	Coldwell Township, Coldwell property
3	Petrunka, David	McCoy Township, Angler property
4	Petrunka, David	Pic Township, O'Neill Black property
5	Petrunka, David	Seeley Lake Area, Pic and McCoy townships

GARNET

As a metamorphic mineral, occurrences of garnet around the world are quite common. However, commercial production of garnet as an industrial mineral is far from commonplace.

Within the study area garnets have been documented at numerous locations. Of special interest is the Manitouwadge synform, where garnets occur in high concentrations. They are associated with the hydrothermal alteration and amphibolite- to granulite-facies metamorphism of the Archean mafic metavolcanic and metasedimentary rocks and are present in a variety of schists and gneisses.

Two garnet occurrences located in the synform were visited. The Willroy Mines Ltd. property, located 3 km north of Manitouwadge, contains extensive amounts of garnet. Garnets range in size from 0.5 to 3 cm and are generally subidioblastic to idioblastic in form. Concentrated in bands up to 1 m thick, garnets constitute up to 75 percent of the rock volume. Minerals associated with the garnets at the Willroy Mine site include anthophyllite, cordierite, quartz, magnetite and minor biotite.

The other property visited was the Swill Lake occurrence, in Leslie Township, approximately 7.5 km west of the town of Manitouwadge. The property is held by Albert Turner, a resident of Manitouwadge. A trench approximately 30 m in length and 3 to 5 m wide has been excavated. Garnet-rich bands, similar to those seen on the Willroy property, were noted. Garnets ranging in size from less than 0.5 cm to 2 cm were observed and samples taken. A detailed property description is given by Schnieders and Smyk (1990).

ALUMINOSILICATES

Commonly known by the industrial mineral industry as the sillimanite group of minerals, sillimanite, andalusite and kyanite are anhydrous aluminum silicate polymorphs. They are primarily used in the refractory industry in the form of bricks. In the form of high-temperature mullite, they display resistance to chemical and physical erosion.

Occurrences of sillimanite and kyanite are primarily restricted to the Manitouwadge synform, although a minor occurrence of sillimanite on Highway 614, 40 km south of Manitouwadge, was noted by Milne (1968).

Sillimanite occurrences are located on the Geco mine and Willroy mine properties, primarily as sillimanitic gneisses representing altered mafic metavolcanics and arenaceous metasediments (Pye 1960).

At both properties sillimanite occurs mainly in biotite-sillimanite-quartz schists and locally in biotite-sillimanite-muscovite-quartz schists as fibrous aggregates (fibrolite, "faserkiesel") up to 4 cm in length and composing up to 15 percent of the rock. A sample was provided from underground by Greg Charlton of Noranda Inc., Geco Division.

GRAPHITE

Advances in technology have brought graphite to the forefront of the industrial mineral industry. Traditionally used in heavy industry, new applications in the refractory and steel industries have increased the demand for quality graphite. Graphite for industrial use is grouped into 3 types: crystalline (flake), lump and amorphous. All 3 are products of metamorphism and can be found worldwide in a range of schists, gneisses and marbles.

One occurrence of flake graphite, 10 km southeast of Caramat near Little Charon Lake, was identified within the study area (Gerow and Bellinger 1990). Upon visiting the occurrence, 2 trenches were located containing highly metamorphosed iron formation, sugary quartz and flakes of graphite up to 4 mm in size. A more detailed property description is provided in this report.

BARITE

Barite is an industrial mineral with a multitude of uses. A primary component of drilling muds, barite is also used as a filler and extender, and by the chemical, glass and ceramic industries (Griffiths 1988).

Eight occurrences of barite are located in the southern part of the study area 3, of which are associated with the producing gold mines of the Hemlo camp. The 3 mines, David Bell Mine, Golden Giant Mine and Williams Mine, all contain baritic sections within the ore zone. A detailed description of the nature of the barite in the orebodies is available in Harris (1989). The other 5 occurrences are located 10 to 16 km east of Marathon on the Northern Eagle Mines Ltd., Padre Resources Ltd., Kadrey Energy Corp., Cal Dynamics Energy Corp. and Rideau Resources Corp. properties. Patterson (1984) provided property descriptions for 4 of the aforementioned properties. A paper discussing barite and flourspar production in Ontario is currently being prepared by Deborah Conrod of the Mineral Development Section of the Mineral Development and Land Branch (D. Ash, Ministry of Northern Development and Mines, personal communication, 1990).

WOLLASTONITE

Wollastonite is a calcium silicate ($CaSiO_3$) and is used as a mineral filler and extender, flux and as a source of silica and alkalis in ceramics. Considered as a possible replacement for silica, feldspar and talc in the ceramics industry, wollastonite is valued for its high aspect ratio, chemical inertness, high strength and firing characteristics (Harben and Bates 1984).

Within the study area, wollastonite occurs only in the Prairie Lake carbonatite complex, 45 km northwest of Marathon. The complex is Late Precambrian (Proterozoic) in age (Sage 1987) and contains carbonatitic, syenitic, ijolitic and fenitic rocks. Wollastonite occurs within the ijolitic rocks at the centre of the complex. Outcrops of wollastonite-bearing rocks, observed by P. Hinz (author), are deeply weathered and form a crumbly grus (Sage 1987). Bands of wollastonite 40 to 45 cm wide, striking north-northwest, were observed. The crystals of wollastonite were 8 to 12 cm long. A detailed description of the complex and wollastonite-bearing rocks is given in Sage (1987).

OTHER COMMODITIES

Also located within the study area are occurrences of decorative stone, nepheline, lime, rare earth elements, niobium, cordierite, anthophyllite, muscovite, titanium and vermiculite. These commodities range from minor to major occurrences. Information on all industrial mineral occurrences mentioned in this report is now available (Industrial Mineral Files for the Manitouwadge area, Resident Geologist's Office, Schreiber–Hemlo District, Thunder Bay).

PROPERTY EXAMINATIONS

"Km 23" Occurrence

A somewhat unique mineral occurrence is exposed in a gravel pit 23 km north from Highway 17 on the Dead Horse forest access road. It was first documented as a uranium occurrence by John Scott in 1979 (Resident Geologist's files, Schreiber–Hemlo District, Thunder Bay). The occurrence has garnered only sporadic prospecting activity in the past. It was visited by staff of the Resident Geologist's Office in 1990.

The area is underlain predominantly by syenitic and granitic rocks which are brecciated and cut by small, anastomosing quartz veinlets, and are hematitized along fractures in the vicinity of a hematite-rich, syenite dike. The dike is typically massive, fine grained and pink with closely spaced joints, some of which are filled with calcite. It is approximately 5 m wide, strikes at 120° and dips 20° to the north. Sections of the dike are strongly fractured, brecciated *in situ* and hematitized. Angular white quartz fragments are cemented by massive hematite. Other brecciated sections contain rounded, rebrecciated xenoliths in a coarser grained, igneous matrix. Marginal to the main dike, smaller, variably oriented, syenitic to aplitic dikes intrude crenulated biotite schists and granitic rocks to the north and south, respectively. The biotite schists, interpreted to be migmatitic metasedimentary rocks, are epidotized and hematitized along fractures.

A small pit has been sunk on a 20 cm wide quartz vein and flat-lying, parallel quartz veinlets approximately 25 m north of the main dike. The vein is heavily mineralized with fine-grained, net-textured pyrite. A grab sample of the vein returned no gold or silver and 0.034% Cu. Gossanous outcrops occur along strike with the main dike occurrence. Radiation at these showings were estimated to be 3 to 4 times the background level. Grab samples returned the following assays:

Sample Number	Uranium (ppm)	Thorium (ppm)	Zirconium (ppm)	Beryllium (ppm)	Niobium (ppm)
F-150-79	37	40	2500	10	700
F-151-79	24	30	500	5	600
F-152-79	14	130	300	4	1000

(Resident Geologist's files, Schreiber–Hemlo District, Thunder Bay)

On the west side of the road, a 20 m wide diabase dike strikes at 170° and intrudes granitoid rocks. There are no outcrop exposures of the syenite dike, but along strike, gossanous, carbonate-rich, sandy regolith has developed. Euhedral crystals of smoky to amethystine quartz have been recovered from this unconsolidated material. Crystals with pyramidal terminations and doubly terminated, penetration twins may reach 4 cm in size. It is suggested that this regolith has resulted from the deep weathering of vuggy, quartz-carbonate-hematite-rich sections of the dike and/or brecciated portions therein.

Landsat satellite images reveal several northwest-striking faults in the area. The "Km 23" syenite dike is perhaps related to these faults. It is interesting to note that this occurrence is situated between the uraniferous Dead Horse Creek diatremes and the Prairie Lake carbonatite. Other similar occurrences could likely be found along these structures. This amethyst occurrence is notably the farthest east of any amethyst occurrences in the Schreiber–Hemlo District.

Killala Lake Alkalic Complex, Central Syenites

The Killala Lake alkalic complex is located approximately 46 km west of the town of Manitouwadge and is best accessed by either float plane or helicopter. The complex is Proterozoic in age; rock types present include gabbro, nepheline syenite and syenite (Sage 1988).

Sites along the north shore of Kentron Lake, where the Inner Buff syenites outcrop, were visited. The syenites are massive, coarse grained and range in colour from pink to buff. Rhythmic mafic segregation banding (Sage 1988) was observed at a number of outcrops with bands 25 to 50 cm apart. Two major joint sets were observed striking northeast and northwest at a frequency of 2 to 3 m. Horizontal (sheet) joints were not observed.

A hand specimen was cut and polished for display. The sample took a high polish and displays an attractive red-brown to buff colour.

Calicchia Stone Industries, Dotted Lake Property

The property is located 31 km south of the town of Manitouwadge off Highway 614 and 1 km southeast of Dotted Lake. Six claims were staked over biotite leucogranodiorite (Milne 1968) of the Dotted Lake batholith. Prospecting and sampling were conducted by Calicchia Stone Industries as a preliminary assessment of the dimension stone potential of the property.

Outcrops along the Dead Otter–Twist lakes road were up to 15 by 20 m in dimension. The leucogranodiorite is coarse grained, massive and pink with widely spaced orthogonal joints. Primary mineral constituents are plagioclase feldspar, quartz, potassium feldspar and biotite with trace magnetite. Minor quartz veins, narrow shear zones and aplite dikes were observed.

Hand samples were taken, cut and polished for display. A high polish was obtained and an attractive pink to grey colour displayed.

Little Charon Lake Graphite Occurrence

This graphite occurrence is located approximately 10 km southeast of the town of Caramat on the Canadian National Railway line. Flake graphite is observed in 2 small pits approximately 15 m north of a rock cut on the tracks. Although the pits appear to be quite old, the first mention of the occurrence is by Coates (1968), who identified the location as a sulphide showing. Innes and Ayres (1969), on the Caramat–Pagwa River Compilation Sheet, marked the showing as a graphite occurrence. Gerow and Bellinger (1990) reported that a prospector brought the occurrence to their attention, and indicated that a 100 m wide zone grading 17 percent graphite was present. Although the author (P. Hinz) did locate 2 pits north of the tracks, graphite-bearing rocks were not located elsewhere.

The host rock appears to be a highly metamorphosed silicate iron formation which displays relict banding. The flake graphite is present in recrystallized sugary quartz. The flakes are generally less than 4 mm in size and compose up to 5 percent of the rock. The graphite-bearing quartz reaches a maximum of 20 cm in width in the east pit. Garnets are present in the iron formation and are generally less than 1 cm in size. Cummingtonite was also noted.

RECOMMENDATIONS FOR EXPLORATION

GRANITE DIMENSION STONE

Dimension stone continues to experience market growth. New technologies in quarrying and processing have reduced production costs. Colours that continue to fare well in consumer markets are black, red and pink. However, granites of almost any colour with an attractive or unique texture could be economic if properly marketed. Several granitic bodies within the study area should be investigated for their dimension stone potential. These include the Dotted Lake, Gowan Lake, Fourbay Lake, Cedar Lake, Musher Lake and Heron Bay plutons, as well as sites within the Coldwell and Killala Lake alkalic complexes. Of particular interest is the Dotted Lake batholith and Killala Lake alkalic complex where little exploration has been conducted. At both locations massive outcroppings of attractive stone can be found. Occurrences of granite dimension stone should be evaluated by the following criteria (Storey 1986): fracture and jointing frequency, colour and texture, marketability of colour and texture, deleterious minerals and size of the occurrence.

GARNET

Primary markets for garnet are in the sandblasting and abrasives industry and for water filtration. Major garnet producers in the U.S. work deposits grading up to 20 percent garnet, with averages of just under 10 percent (Hight 1983) and grain sizes ranging from less than 1 cm up to 9 cm. Garnet is abundant within the study area, predominantly within the Manitouwadge synform. The author (P. Hinz) visited the Swill Lake property and Willroy mine site within the synform and noted garnet-rich bands. The garnetiferous schists and gneisses of the synform should be examined for their potential.

ALUMINOSILICATES

The markets and prices for these minerals have remained strong. Aluminosilicates are used primarily in the production of refractory bricks and for advanced ceramic applications. Sillimanite and kyanite are found in significant concentrations within the Manitouwadge synform. To be of economic significance, a minimum alumina content of 56 percent with 42 percent silica (Harben and Bates 1984) must be present, and no more than 2 percent impurities. Sites surrounding the Geco Division and Willroy mines with sillimanite- and kyanite-bearing schists and gneisses should be investigated for their potential.

GRAPHITE

Demand for graphite continues to grow while markets for flake graphite remain strong. With current market trends, flake graphite will continue to command high prices. Typically, deposits of flake graphite range in grades from 2.4 to 50 percent carbon (Sutphin and Bliss 1990) with a median of 9 percent. Flake size ranges from less than 1 mm to 5 cm with the average being 5 mm (Pettifer 1980). The gneissic and migmatitic terranes in the Manitouwadge area should be investigated for occurrences of graphite. The Little Charon Lake occurrence near Caramat should be examined to determine if there are significant widths of graphite-bearing rocks and if the graphite present is of economic grade.

WOLLASTONITE

Wollastonite continues to experience market growth with its application as a filler and extender, and in the adhesive and paint industries. Wollastonite, with an aspect ratio between 1:3 to 1:5, is used primarily in the ceramics industry. However, with an aspect ratio of 1:15 to 1:20, semifibrous wollastonite is considered a possible replacement for asbestos. Wollastonite occurs in ijolitic rocks at the Prairie Lake carbonatite complex. The occurrences should be studied to determine the concentrations of wollastonite and to which application it would best be suited.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

1. T.L. Muir, in the course of completing field work for the Hemlo tectono-stratigraphic study, re-examined newly exposed outcrops on Highway 17 which had been covered and/or partially destroyed by highway widening. Time was also devoted to the preparation of a road log and stop descriptions for an upcoming field trip in the Hemlo area that will be offered in conjunction with the Geological Association of Canada–Mineralogical Association of Canada Annual Meeting in May 1991.

2. H.R. Williams and F.W. Breaks continued their reconnaissance mapping program in the Manitouwadge–Hornepayne area as part of their geologic studies. A compilation map has been prepared at a scale of 1:50 000; a preliminary version of the map accompanies the summary report of Williams and Breaks (1990). Field work in 1990 has allowed a more precise delimitation of the lithologic units and structural, metamorphic and alteration effects that were described in some detail by Williams and Breaks (1989).

GEOLOGICAL SURVEY OF CANADA ACTIVITIES

3. Under the field supervision of P. Holman, the Airborne Geophysics Section of the Geological Survey of Canada conducted a combined airborne gamma ray spectrometric, VLF and total field magnetic survey over NTS sheets 42D/09 and 42D/14 to 42D/16. These blocks cover an area along the north shore of Lake Superior from west of Schreiber to Heron Bay. The survey area was extended beyond these blocks to also include Hemlo and the Prairie Lake carbonatite. This survey composed approximately 3500 line-kilometres at a line spacing of 1 km and provides additional coverage to a similar survey flown in 1989 in the Georgia Lake area (42E/04, 42E/05, parts of 52H/01 and 52H/08). Follow-up geologic reconnaissance will likely be conducted in 1991 by K. Ford, contingent on survey results.

RESEARCH BY OTHER AGENCIES

R.H. Mitchell and R.G. Platt (Lakehead University, Thunder Bay) are continuing research into the petrology of the Coldwell alkalic complex.

P. Fralick (Lakehead University, Thunder Bay) and H. Strauss (Ruhr Universitat, West Germany) are investigating sulphur and carbon isotope values from the Winston Lake massive sulphide deposit, and sulphide-facies iron formation in the Schreiber–Terrace Bay area.

ONTARIO GEOSCIENCE RESEARCH GRANT PROGRAM

Y. Pan (MSc candidate, University of Western Ontario, London) and M.E. Fleet (Professor, University of Western Ontario, London) are continuing their metamorphic petrology study of the White River gold prospect, near Hemlo.

D. Good (PhD candidate, McMaster University, Hamilton) and J.H. Crocket (Professor, McMaster University, Hamilton) are investigating copper and platinum group element occurrences in the Coldwell alkalic complex.

UNIVERSITY THESES

S. Osterberg (PhD candidate, University of Minnesota, Duluth) is conducting a stratigraphic-alteration study of the Winston Lake stratigraphy northwest of Schreiber.

Dave Nicol (MSc candidate, Lakehead University, Thunder Bay) is studying the structure and metamorphism of rocks in the Faries Lake area near Manitouwadge.

Derek Nicol (MSc candidate, Lakehead University, Thunder Bay) completed a study on assimilation of basic xenoliths in Center 3 syenites of the Coldwell alkalic complex.

R. McLoughlin (MSc, Lakehead University, Thunder Bay) completed a study of accessory rare metal mineralization of syenites, Coldwell alkalic complex.

C. Barr (HBSc Lakehead University, Thunder Bay) is completing his study of sphalerite geobarometry at the Winston Lake Division Mine (Minnova Inc.).

M. Antonellini (PhD candidate, Michigan State University, East Lansing) is investigating tectonism associated with Logan diabase sill emplacement in Sibley Group sedimentary rocks.

J. Grant (MSc candidate, Queen's University, Kingston) is conducting a tectono-stratigraphic field study in the Hemlo area.

SELECTED PUBLICATIONS RECEIVED

Corfu, F. and Muir, T.L. 1989a. The Hemlo – Heron Bay greenstone belt and Hemlo Au-Mo deposit, Superior Province, Ontario, Canada: 1. Sequence of igneous activity determined by zircon U-Pb geochronology; Chemical Geology (Isotope Geoscience Section), v.79, p.183-200.

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8. Northeastern Region Introduction

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The mining and exploration industry continued on a downward trend for yet another year in northeastern Ontario. While exploration for base metals and platinum group metals maintained a moderate level of activity, particularly in and near the Sudbury Basin, exploration and development activity in the gold and silver sector suffered its greatest decline in recent years throughout most of the region.

The overall decline in mining exploration and development activity is attributed to a number of factors, including: changes in flow-through shares funding and the cancellation of the Canadian Exploration Incentive Program (CEIP); the sustained low price of gold and its corresponding long-range forecast; lack of investor confidence in speculative mining ventures; and the onset of recessionary pressures.

Similarly, there was a decrease in the number of mineral claims staked relative to 1989 except for specific areas within the Sault Ste. Marie, Sudbury and Cobalt Resident Geologists' districts. Increases in these areas are attributed to the release of a government-sponsored airborne geophysical survey of the Batchawana Greenstone Belt in the Sault Ste. Marie district and the opening of townships or parts of townships peripheral to the Bear Island Indian Land Claim in the Temagami area that had previously been withdrawn from staking. The opening of these lands spurred on the interest of several mining companies in a large aeromagnetic anomaly that is similar in size, shape and signature to that of the Sudbury Structural Complex.

At the beginning of 1990, 58 mines and quarries were operating in the region, producing principal commodities, such as, gold, silver, nickel, copper, zinc, cobalt, platinum group metals, uranium, iron ore, silica, serpentine, talc, barite, limestone, dolostone, building stone and decorative stone. By the close of 1990, the number of producing mines and quarries in the northeast, including seasonal operations, had been reduced to 48.

Coupled with a significant reduction in exploration and development activity, mine closures and labour disputes have had a substantially negative impact on the economy of several mining communities throughout the region. In Elliot Lake, the Quirke Mine and the Panel Mine, both operated by Rio Algom Limited, have ceased uranium production. The town of Wawa and surrounding area have been affected by the closing of Canamax Resources Inc.'s Kremzar Mine in the Goudreau area and the Magnacon Mine belonging to Muscocho Explorations Limited, Flanagan–McAdam Resources Inc. and Windarra Minerals Limited in the Mishibishu Lake area. The cessation of development work at Citadel Gold Mine Inc.'s Surluga Mine, until gold prices improve substantially, and the strike/lockout at the George W. MacLeod Mine in Wawa, owned by the Ore Division of Algoma Steel Corporation, have also impacted upon the town's economy. It is anticipated that the temporary shutdown of iron ore production in Wawa may become permanent by 1992. This event, combined with the recent closing of Dofasco Inc.'s Sherman Mine in Temagami and the Adams Mine in Kirkland Lake, will bring to a close a long history of iron ore production in the northeast. Silver production in the Cobalt district has ceased for the first time since its discovery in 1909 with the closing of the Beaver–Temiskaming Mine operated by Agnico–Eagle Mines Limited. The Timmins area has seen a substantial reduction in the work force at Placer Dome Inc.'s operating Dome Mine and Detour Lake Mine, as well as at the gold operations controlled by Royal Oak Resources Limited (formerly Giant Yellowknife Mines Limited). Sudbury witnessed the closing of 2 nickel mines during the past year, the East Mine and the Falconbridge Open Pit, No. 5 Shaft, both operated by Falconbridge Limited.

The negative impact of mine closures has been offset somewhat in some communities by the re-opening of former producers, including: the Kerr Mine in Virginiatown by Deak Resources Corporation and GSR Mining Corporation, following the purchase of the mine and mill facilities from Golden Shield Resources Limited; the Creighton No. 3 Mine in the Sudbury area by Inco Limited; and the Langmuir No. 1 Mine near Timmins by Timmins Nickel Inc. The opening of 2 new quarries, 1 in the Sault Ste. Marie district by Ontario Trap Rock Co. to excavate diabase for highway aggregate, and the other (Breault Quarry) in the Cobalt district by Dymond Clay Products to quarry limestone for a new calcined lime plant in Burke Township, have both aided in sustaining development of the local economies.

Several advanced exploration and development projects will help ease the recessionary impact on certain northeastern Ontario mining communities. A production decision is anticipated in the near future for the Eagle River Gold Project by partners Noranda Inc., Central Crude Limited and Hemlo Gold Mines Inc. in the Mishibishu Lake area. The town of Kirkland Lake and surrounding communities will benefit from the production of the Garrison Gold Project controlled by Deak Resources Corporation and Silverside Resources Inc. in Garrison Township and the New Kelore Gold Project owned by Goldpost Resources Inc. and St. Andrew Goldfields Limited in Hislop Township. Other promising projects in the Kirkland Lake district include: the gold-bearing Creek Zone in Hislop Township owned by Stroud Resources Limited; Noranda Inc. and Glimmer Resources Inc.'s gold property in Beatty and Hislop townships; and the Lightening Zone in Harker and Holloway townships controlled by Noranda Inc. and Freewest Resources Inc. where preliminary drill-indicated reserves to date are reported to be 5 million tons averaging 0.25 ounce Au per ton. In the Timmins area, feasibility studies are in progress on 2 gold properties: an open pit feasibility study on the Aquarius Mine property in Macklem Township by Asarco Exploration Company of Canada Limited; and Royal Oak Resources Limited's Porcupine Peninsular property on the shore of Nighthawk Lake. The Sudbury district will benefit from Inco Limited's Lower Coleman Mine and McCreedy East Mine, slated for development/production in 1991 and 1996, respectively, as well as from the Craig orebody currently being developed by Falconbridge Limited from the lower levels of the Strathcona Mine and from the possible production of their Thayer Lindsley deposit where shaft-sinking operations are nearing completion.

Another development which may have significant future implications was the discovery of 8 diamonds in 4-inch drill core from the C-14 kimberlite pipe in Clifford Township, Kirkland Lake district, by DiaMet Minerals Inc. The largest stone recovered weighs 0.17 carat and is believed to be the largest diamond recovered from host kimberlite in Canada to date.

The Mineral Resources Program of Northeastern Region of the Mines and Minerals Division, Ministry of Northern Development and Mines (MNDM) has undergone many changes in personnel during the past year, largely precipitated by the Ministry's relocation to Sudbury. Many individuals have been seconded to other departments and projects within the Division, including: P.E. Giblin, former Manager, Mineral Resources, to the Planning and Information Office of the Mineral Development and Lands Branch; W. Meyer, Resident Geologist, Sudbury district, as Acting Manager of the Planning Information Office of the Mineral Development and Lands Branch; L. Owsiacki, Resident Geologist, Cobalt district, as Provincial Coordinator for a new federal-provincial mineral development agreement similar to the former Canada-Ontario 1985 Mineral Development Agreement; J. Ireland, Staff Geologist, Timmins district, as Acting Resident Geologist, Cobalt district, and Acting Manager of Temiskaming Testing Laboratories; M. Cosec, Staff Geologist, Cobalt district, as Staff Geologist, Sudbury district, and as principal staff temporarily in charge of the Resident Geologist's program in Sudbury; G. Grabowski, Staff Geologist, Kirkland Lake district, as Incentives Evaluator for Ontario Prospectors Assistance Program (OPAP) and Ontario Mineral Incentives Program (OMIP); and E. Frey, Staff Geologist, Wawa district, who terminated his employment with the Ministry.

There are 6 Resident Geologists' offices in the Northeastern Region, located in Kirkland Lake, Cobalt, Sudbury, Sault Ste. Marie, Wawa and Timmins, along with the MNDM regional office also located in Timmins. Drill core libraries, supervised through the Resident Geologist's program, are located in Timmins, Kirkland Lake and Sault Ste. Marie, with a satellite storage facility in Cobalt. During the year, staff of these facilities provided technical assistance and advice to more than 7000 visitors.

The Resident Geologists and their staff visited and reported upon exploration and development projects and producing mines within their various districts. As well as maintaining a geoscientific data base of work conducted by the mineral exploration community active in their districts, and other relevant information, Resident Geologists and their staff did the following: conducted numerous geological field trips for industry, government and university participants; presented prospectors' classes in Timmins, Hearst, Sudbury, Wawa, Cobalt and Kirkland Lake; spoke to school groups, service clubs, provincial park visitors and other groups; and responded to numerous requests from client groups, including providing assistance to applicants requesting and receiving OPAP/OMIP financial assistance for exploration projects.

The Resident Geologist's offices were also involved in identifying and reporting on unattended tailings sites throughout the region which may pose an environmental threat similar to that experienced recently by the discharge of tailings material into the Montreal River system near the Town of Matachewan.

A computerized data base collection and assessment of all known mineral occurrences within the region, referred to as the Mineral Deposits Inventory (MDI) project, has been initiated in all the Resident Geologists' offices. The MDI, scheduled for completion by the end of March 1991, constitutes the first phase of the Geoscience Exploration Database (GED) project.

Information resulting from the aforementioned work conducted by the Resident Geologists and their staff was used in the following: to assist the minerals industry in exploration and development work; to guide utilities, provincial and municipal governments in landuse, regional development and hazard abatement projects; and to contribute toward geoscientific projects undertaken by other government agencies and universities.

The 10th Annual Regional Geoscience Seminar, consisting of 36 poster displays and 17 lectures presented by Ministry and industry geoscientists, was held early in the year in Timmins, with more than 300 people attending each day of the two-day event. The seminar is designed to highlight and present new geoscience developments and information relevant to northeastern Ontario to the mineral exploration community.

Resident Geologists' staff also presented poster displays at the Ontario Mines and Minerals Symposium held in Toronto in December, as well as posters and information booths in local communities during Mining Awareness Week in October sponsored by the Ontario Mining Association.

There are 6 Northern Development Fund projects nearing completion as part of the four-year Wawa Economic Development Initiative to establish a Resident Geologist's office and to assist the exploration and mining industry in that community. The 6 projects, to be completed or terminated by the end of March 1991 include: 1) Wawa Mineral Deposits Data Base, consisting of 407 records; 2) Metallogenetic Study of the Michipicoten and Mishibishu Lake Greenstone Belts; 3) Geological Data Inventory Folios (GDIFs); 4) Geology and Economic Potential of the Kabinakagami Lake Greenstone Belt; 5) Building Stone and Industrial Minerals Prospects—Wawa Resident Geologist's district; and 6)

Computer Applications and Geographic Information Management for Mineral Resource Planning in the Wawa district.

Regional Geologist Howard Lovell is nearing the completion of a four-year study of gold occurrences and petrogenesis of the Matachewa–Kirkland Lake–Larder Lake area. As well, the COMDA-funded Study of Mineral Occurrences, Deposits and Mines of the Black River–Matheson Area (BRIM) has been completed by A. Bath. The study describes over 260 mineral occurrences and is available as an Open File Report at the Resident Geologist's office, Kirkland Lake.

The drill core libraries continued to collect and catalogue drill core donated by the mineral exploration industry to be made available for examination and analytical work by industry, universities and government. The majority of the drill core libraries have reached or will soon reach on-site core storage capacity. Consequently, an Alternate Drill Core Storage Study was initiated to address the matter, the results of which are to be available in early 1991.

To stimulate and assist mineral exploration, 3 MNDM-sponsored airborne electromagnetic and magnetic geophysical surveys covering selected greenstone belts within the northeastern region were provided to the public during the year by the Ontario Geological Survey. The 3 areas surveyed include 25 townships within the North Swayze and Western Abitibi greenstone belts; 18 townships within the Shiningtree area; and the Batchawana Greenstone Belt north of Sault Ste. Marie.

LITHOPROBE, a five-year, federal-, provincial-, and industry-funded, multidisciplinary study of the earth's crust, continued in 1990 in the Sudbury Basin. The study consisted of a 100 km transect of regional-surveying and 40 km transect of high-resolution seismic reflection surveying across the Sudbury Basin designed to model the configuration and complexity of the Sudbury Structural Complex, the results of which may help mining companies in future drilling programs leading to the discovery of new ore deposits.

The regulations governing the Ontario Minerals Incentives Program (OMIP) were amended in 1990 to increase the scope of the program. The maximum grant level was increased from $150,000 to $300,000 per applicant per year. Flow-through shares programs were made eligible for funding, while other amendments included allowing for 100 percent expenditures of surface exploration diamond drilling, limited underground expenses, industrial minerals laboratory and pilot plant studies and marketing and environmental studies.

As an added incentive, the Elliot Lake area and the Kirkland Lake/Temiskaming area were selected for special OMIP assistance, whereby a grant of 50 percent of eligible expenses could be obtained for exploration work performed in these areas rather than the normal 30 percent grant elsewhere in the province.

To further assist the Elliot Lake area, which has suffered considerable economic hardship due to recent mine closures, the Ontario government has approved a $2.2 million expenditure over 4 years in support of a Special Geological Reassessment Project of the Elliot Lake area. Components of the project will include: bedrock mapping of areas known to have potential to contain base and precious metals; the mapping of unconsolidated surface deposits; the study of rock units with potential to contain platinum group metals; and the assembling of a geoscience data base of the results of these components and all previous mineral exploration activity in the area.

The Ministry of Northern Development and Mines has also announced the opening of a Mineral Development Consultant's office in Elliot Lake in early 1991. J.A. Robertson has been chosen for the position based on his familiarity with the area, having been associated with it through the Ontario Geological Survey since 1954 and later as Uranium Policy Advisor to the Mineral Resources Branch of the MNDM.

It is envisioned that the continued incentive initiatives provided by the Ontario government through the auspices of the Ministry of Northern Development and Mines will assist in the discovery of new mines and renewed prosperity for all Ontarians.

9. Wawa Resident Geologist's District—1990

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INTRODUCTION

The Wawa Resident Geologist's office continued into its fourth year of operation, providing exploration companies and the public with access to information on mineral resources, mineral development, land use and technical advice. It also acted as a sales outlet for claim maps, claim tags, prospectors' licences, geological maps and publications.

The number of visitors through the office averaged about 70 per month, a decrease of 15% from last year. This decline is due to the decrease in exploration activity in the district. The number of work permits dropped significantly from 1989 (Figures 9.1 and 9.2), and reflects a decline in exploration activity by major and junior mining companies. However, exploration by local prospectors has increased as a result of grants received from the Ontario Prospectors Assistance Program (OPAP).

Permanent office staff consists of: D. Tortosa, Resident Geologist; E. Frey, Staff Geologist (to the end of October 1990); and B. Leschishin, Resident Geologist's Secretary. Contract geological staff consists of: P. Beach, P.C. Delisle, R. Henri, C. Lowe, R. Stewart (to the end of March 1990), A. Wilson, and W. Wing (to the end of January 1990). T. Beckett was employed as a Data Folio Geologist during the summer. He also provided field assistance to both P. Morra (Claims Inspector, Sault Ste. Marie) and P.C. Delisle. Summer contract assistants were E. Wilson and M. McLean. M. McLean was employed through the Experience 1990 program, and later in the year, on contract, as a data entry clerk.

Exploration and mine development in the Wawa District occurred primarily in 5 main areas: 1) the Wawa–Michipicoten area, 2) the Goudreau–Lochalsh area, 3) the Mishibishu Lake area, 4) the Renabie–Dog Lake area, and 5) the Kabinakagami Lake and Dayohessarah Lake greenstone belts in the northern part of the district. Exploration and mining activity declined in terms of: the number of exploration companies active (Figures 9.1 and 9.2; Tables 9.1 and 9.2), the active number of mines (Figure 9.3), the number of work permits, the duration of exploration projects, and the number of clients using the Wawa Resident Geologist's office (Figure 9.4). This is due to factors such as the low price of gold, changes to federal exploration incentives, and the onset of a recession.

In the Wawa area, the Algoma Ore Division of the Algoma Steel Corporation Limited, continued underground development and mining activities at the George W. MacLeod Mine. Operations were temporarily suspended between August and November due to a strike at the Algoma steel plant in Sault Ste. Marie. Underground production, ore preparation, and sintering will continue until 1992, at which time operations will be shut down unless an alternative, limited operation proves feasible. Citadel Gold Mines Inc. initiated a surface exploration program on its properties south of the Surluga Mine, which it continued to dewater. Test mining and milling have indicated that a substantial rise in the price of gold is required before the mine will be economic. Citadel has a mill on site and is interested in using it for custom milling. Van Ollie Explorations Limited has continued exploration east of Citadel's property.

In the Goudreau area, Canamax Resources Inc. continued with the underground development of the Lochalsh deposit, and accessed the mineralized zone prior to suspending operations in the fall. The company also suspended mining activity at the Kremzar mine in August and closed the mill in October. The nearby Magino Mine (Muscocho Explorations Limited) continued to operate through 1990. Spirit Lake Exploration Limited completed a diamond- drilling program to evaluate the gold reserve on the Edwards property. Corona Corporation continued a long term exploration program on 13.5 townships leased from the Algoma Central Railway in the Goudreau and Iron Lake areas. New gold-bearing zones related to areas of high strain have been identified.

In the Mishibishu Lake area, the Magnacon Mine suspended underground operations in mid-summer and closed the mill in the fall. At the Eagle River project (Hemlo Gold Inc.–Central Crude Limited), underground development and test stoping were completed, with favourable results. A production decision is expected in 1991. Exploration on the

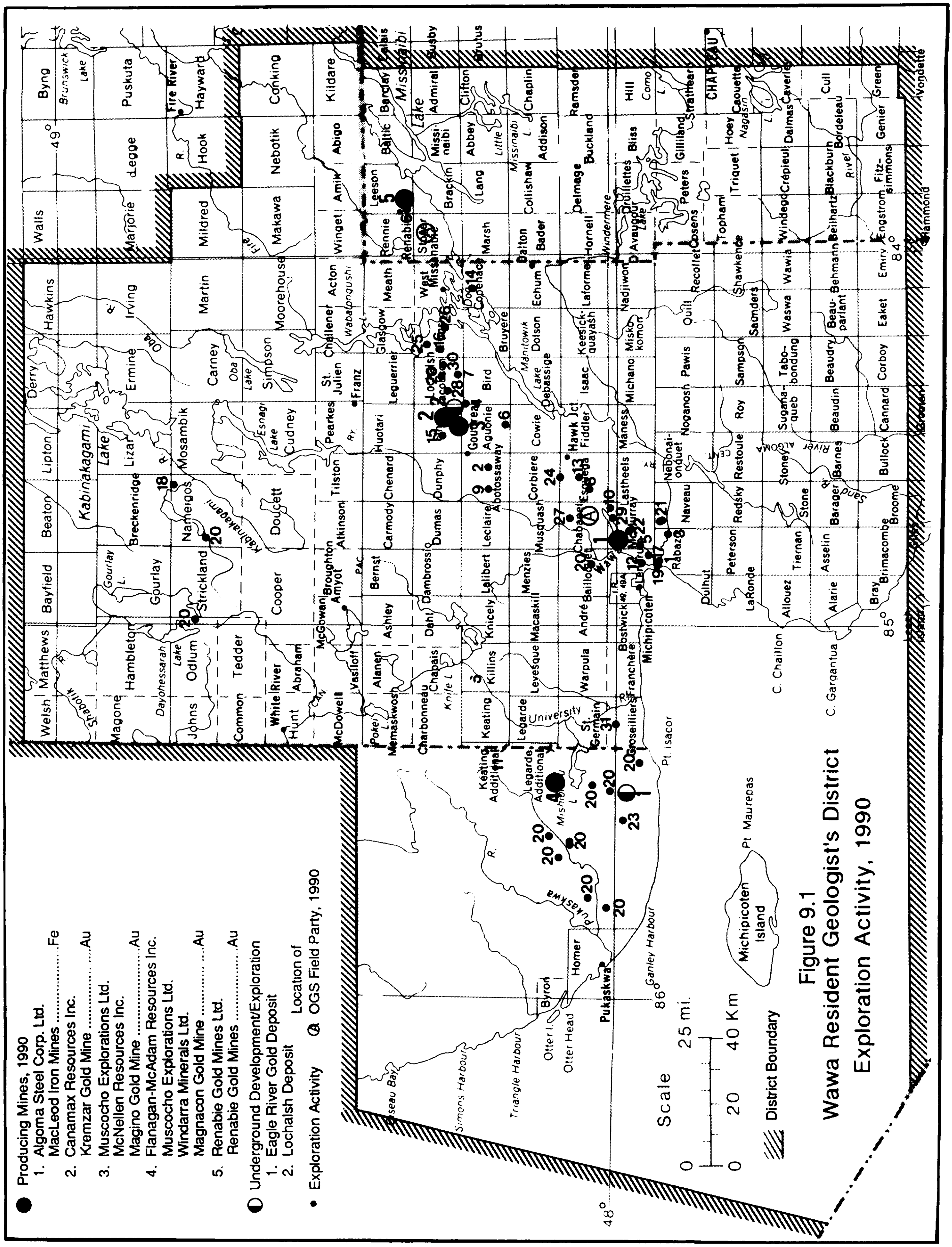


Figure 9.1
Wawa Resident Geologist's District
Exploration Activity, 1990

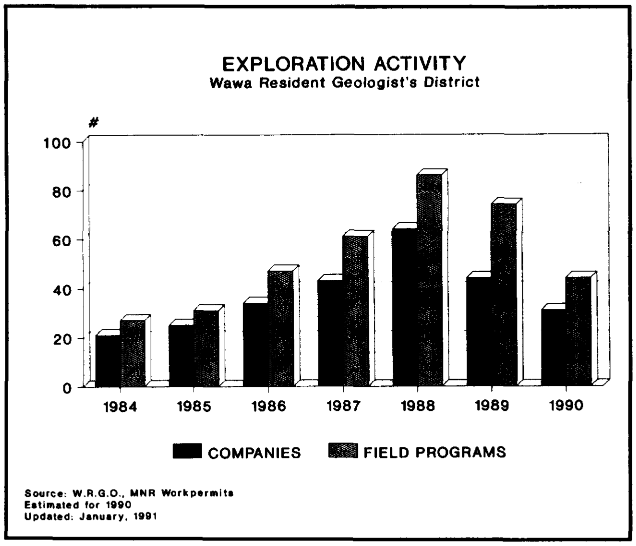


Figure 9.2. Exploration activity in the Wawa District 1984–90.

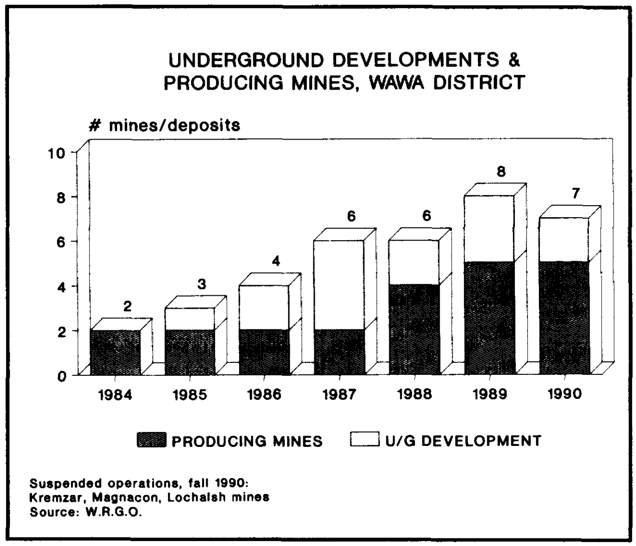


Figure 9.3. Producing mines and underground exploration, 1984–90.

Denison Lake project (Joutel Resources Limited–Queenston Mining Limited) outlined a gold-bearing quartz vein system that extends over a strike length of about 1 km.

Exploration, mine development, and mining activity in the Wawa District continued to have a significant impact on the communities in the area. In order to assist in regional development, the Provincial Government completed the construction of a road link to the Goudreau area mines by way of Highway 519 from Dubreuilville.

MINING ACTIVITY

Algoma Ore Division

The Algoma Ore Division of the Algoma Steel Corporation Limited continued to mine siderite ore at the George W. MacLeod Mine in Wawa. Production to the end of June was 699 889 tons of sinter from 700 516 tons of ore with an average grade of 34.8% Fe. Underground development, through to the end of June, amounted to 3038 feet resulting in the completion of the production level for a 5 million ton block of ore. A second block of 1 million tons is currently being developed. The mine has a total of about 8 million tons of ore fully developed.

The Algoma Steel Corporation Limited previously announced that underground production, ore preparation and sintering at its Algoma Ore Division in Wawa would continue until 1992. At this time, operations will be shut down unless an alternative, limited operation proves feasible. This alternative operation would involve the recycling of waste oxides or scale from other steel plants which would be mixed with siderite to produce a high grade iron oxide sinter. This sinter would be used in the blast furnaces in Sault Ste. Marie. "Sinter pot" tests were completed at the Algoma Ore Division in preparation for a blast furnace test in Sault Ste. Marie; however, completion of the second stage of testing was set back by the strike at the Algoma steel plant.

Renabie Mine

Production at the Renabie Mine through October 1990 was 223 594 tons with an average grade of 0.193 ounce Au per ton, at a 91.07% recovery. The mill operated at an average rate of 736 tons per day. Expected production for 1990 is estimated at about 268 000 tons at 0.2 ounce Au per ton (F. Kurz, Renabie Gold Mines Limited, personal communication, 1990). Mining activity during 1990 took place between the 3660- and 3930-foot levels which are accessed by an internal ramp and winze. The underground mining operation consists of trackless sublevel caving with the ore and waste dumped to the 4245-foot level where skips carry the ore to the 3105-foot level. Railcars transfer the ore and waste on the 3105-foot level to the main shaft for hoisting to surface. The mine and mill employ 180 people.

During the year, mine development occurred between the 3700- and 3810-foot levels. Underground exploration and delineation drilling totalled 11 500 feet. The total estimated proven and probable reserves are 705 059 tons at 0.213 ounce Au per ton (F. Kurz, Renabie Gold Mines Limited, personal communication, 1990). Mining on the main ore shoot will continue until mid-1991 by which time deeper ore shoots will have been developed.

The Renabie ore zone consists of large pods and lenses of quartz up to 100 feet wide and 500 feet in length, containing gold associated with pyrite. The quartz pods and lenses

TABLE 9.1. EXPLORATION ACTIVITY DURING 1990.

Number on Figure	Individual or Company	Activity
1.	Alluvial Gold Mines Inc.	Trenching, Stripping
2.	Argeris Perdomo	Mineral - Line Cutting
3.	Babcock Consulting Ltd.	Diamond Drilling
4.	Canamax Resources Inc.	Diamond Drilling, Stripping
5.	Citadel Gold Mines Inc.	Mineral Exploration
6.	Corona Corporation	Mineral Exploration
7.	Cymbal Exploration	Mining - Diamond Drilling
8.	Firesand Exploration Ltd.	Mineral Exploration - Diamond Drilling, Stripping
9.	Gold Fields Canadian Mining Ltd.	Line Cutting, Trenching, Stripping, Diamond Drilling
10.	Golden Point Exploration Ltd.	Mineral Exploration
11.	H.L. Mineral Holdings	Geological Mapping, Prospecting
12.	Jayson A. Gerdes	Mineral Exploration - Stripping, Sampling
13.	John P. Rapski	Mineral Exploration - Stripping
14.	Jules Anglehart	Mining - Possible Diamond Drilling
15.	Kresin Engineering and Planning Ltd.	Mineral Exploration, Sampling
16.	Loydex Resources Inc.	Mineral Exploration
17.	Mr. C. Clement	Trenching, Stripping
18.	Mr. Jack Partington	Line Cutting for Grid Plots
19.	Mr. Jim Rastel	Mineral Exploration - Prospecting
20.	Noranda Exploration Company Ltd.	Trenching, Stripping, Diamond Drilling, Mapping, Line Cutting, Geochem., Geophys.
21.	North Superior Mineral Resources Corp.	Mineral Exploration
22.	Pan Orvana Resources	Line Cutting, Trenching, Stripping, Diamond Drilling
23.	Placer Dome Inc.	Mapping, Prospecting, Rock Sampling
24.	Reed Lake Exploration	Mineral Exploration
25.	Richard Paynter	Mineral Exploration - Trenching, Stripping
26.	Robert James Dillman	Prospecting, Geophysics
27.	Soocana Exploration Ltd.	Mineral Exploration
28.	Spirit Lake Explorations Ltd.	Mineral Exploration
29.	Van Ollie Explorations Ltd.	Mineral Exploration
30.	Vega Explorations Ltd.	Mineral Exploration - Stripping, Drilling
31.	Joutel Resources Ltd. & Queenston Mining	Mineral Exploration

TABLE 9.2. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK FILED, 1990.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days.
1990[1]	2,175	4,678	12,650	45,217.7	128,300	30,794.17	204,304.87
1989	1,257	3,967	15,019	93,232	198,925.1	60,898.6	353,055.7
1988	6,131	1,665	17,138	133,386	301,089	22,630	513,862
1987	4,880	2,030	12,172	54,720	224,756	10,349	350,321

[1]As of November 30, 1990

plunge about 60° west and form shoots within a steeply south-dipping shear zone (the Renabie "break"), characterized by a hematized, quartz sericite schist.

Magnacon Mine

Underground development at the Magnacon Mine (Muscocho Explorations Limited) ceased in April 1990, and underground mining operations ended in June 1990. The mill continued to process the surface stockpile until it was shut down in early November. Underground development occurred on levels 2, 3, 4, and 5. Subsurface exploration diamond drilling totalled 4 700 feet for the year. Production for the year was 165 000 tons of ore (E. Anderson, Muscocho Explorations Limited, personal communication, 1990). Total gold output for the first half of 1990 was 15 356 ounces (*The Globe and Mail*, August 31, 1990, p.B4). Recalculated reserves stand at 1.47 million tons at 0.2 ounce Au per ton (*The Northern Miner*, April 23, 1990, p.3). No surface exploration was carried out on the property during the year.

During the year, the mine experienced a series of mechanical problems and equipment breakdowns. Attempts by the company to secure alternative financial arrangements for the operation were not successful. A letter of intent was signed by Flanagan–McAdam Resources Incorporated, Mus-

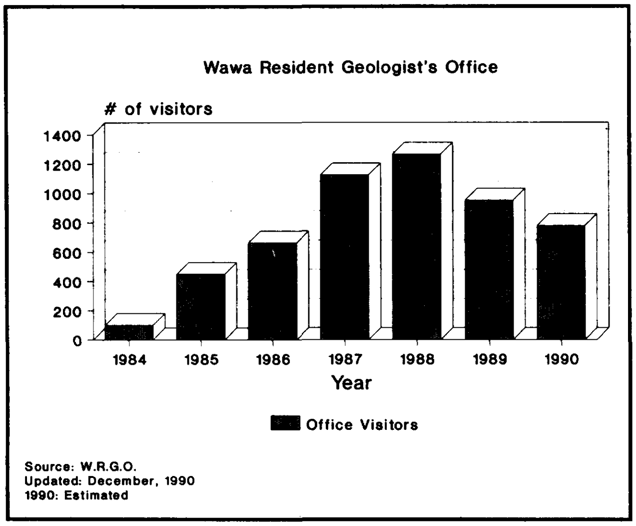


Figure 9.4. Client services — number of visitors, 1990.

cocho Explorations Limited, and Hemlo Gold Mines Incorporated for the purchase of the mill and related surface infrastructure late in the year.

The Magnacon main zone consists of a quartz vein system(s) that trends east and dips steeply north. The gold mineralization is contained within a shear zone composed of quartz-sericite schist which forms part of the broader Mishibishu Lake deformation zone (Heather 1986). Gold occurs freely in association with arsenopyrite, pyrite, galena and other minor sulphides, and is particularly concentrated along the edges of the quartz veins.

Kremzar Mine

The Kremzar Mine is owned and operated by Canamax Resources Inc. Access to the orebody is by a spiral decline to a vertical depth of 244 m. Sublevel retreat mining was used in the upper levels of the orebody and blasthole mining, using remote-controlled scoops, occurred below the 170 m level. Gold production until mill closure on October 5, 1990 was 20 010 ounces. Total gross tonnes mined was 234 927 with an average millhead grade of 4.81 g/t Au. Mining took place primarily in the B and X zones with a minor amount occurring in the R Zone of the orebody.

Underground development over the year consisted of 1705 m of drifting. A total of 8313 m of subsurface drilling was also completed during 1990. Recalculated proven and probable reserves are 678 700 tons averaging 0.21 ounce Au per ton. The mill is designed to operate at a capacity of 550 metric tonnes per day and uses a carbon-in-pulp extraction process for gold recovery. Mining operations ceased August 16, 1990. The mine is being kept dewatered.

The Kremzar gold deposit consists of a series of siliceous lenses plunging about 45° west, separated by less strongly mineralized, altered host rock. The gold-bearing lenses and altered host rock form a shear zone that strikes 140° and dips 70° southwest and transects a metagabbro.

Magino Mine

The Magino Mine is owned by Muscocho Explorations Limited (50%) and McNellen Resources Inc. (50%). Operations at the mine continued through the year with a total production of 145 480 tons mined and milled, at an average millhead grade of 0.169 ounce Au per ton. Total production to the end of October was 23 317 ounces Au. Production was predominantly from the 200-, 350-, and 400-foot levels. Estimated annual production is 28 000 ounces. The mill operates at a capacity of 500 tons per day and this is expected to increase to 600 tons per day in 1991. The mine and mill employ a total of 112 employees.

The Magino orebody is accessed by a spiral decline with levels at 100, 150, 200, 250, 300, 350, 400, and 500 feet below surface. A total of 7931.5 feet of underground development (ramping, level drifting, and raising) occurred on all levels to the end of October. Delineation and underground exploration drilling totalled 13 941 feet for the year. Longhole stopes accounted for 80% of stope muck with the remainder of production coming from shrinkage stopes.

Gold mineralization occurs in silicious zones and quartz veins within sheared portions of the Webb Lake granodiorite-trondhjemite stock. The mineralized shear zones strike east and dip steeply to the north, forming part of the Goudreau Lake shear zone.

ADVANCED EXPLORATION AND DEVELOPMENT

Hemlo Gold Mines Inc.–Central Crude Limited

Noranda Exploration Company Limited completed underground development on the 4900-, 4880- and 4860-foot levels of the Eagle River deposit. Haulage drifts provided access to two bulk sampling stopes which yielded a total tonnage of about 60 000 tons. This development ore was processed at the company's mill at Hemlo. Once in operation, the planned mining method will be by sublevel retreat. Results from the underground test mining indicated a slight upgrading from the previously reported cut grade of 0.25 ounce Au per ton (Central Crude Limited, press release, April 24, 1990).

The initial proposed milling plan is to use a 700 ton per day semi-autogenous grinding and ball mill to process the ore. Gold will be recovered as a sulphide concentrate using a simple flotation circuit. One truck load of concentrate would be trucked to the Hemlo mill daily. However, Hemlo Gold

Mines Inc. has signed a letter of intent with Flanagan–McAdam Resources Limited and Muscocho Explorations Limited for the purchase of the Magnacon mill (*Northern Ontario Business*, October 1990, p. M10).

Canamax Resources Incorporated

Canamax Resources Incorporated continued underground development of the Lochalsh gold deposit located about 2 km southeast of the Kremzar Mine. The main ore zone is accessed by a 950 m decline with development drifts on the 125 and 140 m levels. A total of 4172 tonnes of ore were mined and used as a bulk sample for processing at the Kremzar mill. Results from the custom milling indicated a head grade of 6.6 g/t Au. Underground exploratory diamond drilling totalled 4280 m for the year. Reserves for the Lochalsh deposit are estimated at 1.4 million tons averaging 0.23 ounce Au per ton. Recalculated reserves based on the results of the bulk sample test were unavailable at the time of writing. Canamax ceased underground development August 15, 1990.

EXPLORATION ACTIVITY

WAWA–MICHIPICOTEN AREA

Citadel Gold Mines Inc. completed an exploration program on their properties south of the Surluga Mine which include the Parkhill and Grace Mines (past producers). The program consisted of geological mapping, prospecting and stripping. A follow-up diamond-drilling program is planned (R. Rupert, Citadel Gold Mines Inc., personal communication, 1990). Several gold-bearing zones were uncovered southeast of the Parkhill Mine. These zones contain quartz veins with assays averaging up to 0.67 ounce Au per ton over a distance of 135 feet (*The Northern Miner*, October 15, 1990, p.B23). Samples from a second zone at the east end of the gold-bearing structure yielded assays of 0.31 ounce Au per ton over 20 feet.

Since the start of the year, all mining and milling operations at the Surluga Mine had ceased. Pan Orvana Resources Inc., a private company funded by Rio Algom Limited, initiated a review of the open pit potential of Citadel Gold Mines' Surluga gold deposit. The arrangement between Pan Orvana and Citadel Gold Mines will involve a four-year program, if completed, after which the company would initiate open pit operations (*The Northern Miner*, March 5, 1990, p.20).

Van Ollie Explorations Limited continued to evaluate a number of gold occurrences and past producers in McMurray Township. The company completed a total of 65 short diamond-drill holes on the Captain, Smith, and Mickelson veins. The Lucky Strike vein was mapped and sampled. A diamond-drilling program on the Sunrise vein is planned. The company hopes to outline sufficient reserves from their properties to provide mill feed to the Citadel mill.

Soocana Explorations Limited completed a geological mapping program in Esquega Township and surveyed the claim boundary to bring the property to lease. The Babcock group of companies (i.e., Van Ollie Explorations Limited, Soocana Explorations Limited and North Superior Resources Limited) has completed a lease arrangement with the Algoma Central Railway for the remaining open ground in Esquega and Naveau townships. North Superior Mineral Resources Limited plans to undertake an exploration program on the Centennial Mine (past producer) and the Valenti occurrence in 1991.

Babcock Consulting Limited conducted a ground electromagnetic survey to locate an airborne anomaly, in Esquega Township, near the Regnery Mine. Two test trenches were completed and the property was prospected. Mineralization in the Regnery Mine is hosted within the rocks of the Hawk Lake granitic complex and consists of chalcopyrite veins, up to 10 cm thick, with silicified alteration envelopes containing clots of molybdenite. The mine has no know past production and consists of an inclined shaft accessing 2 levels.

Firespur Exploration Limited completed stripping, channel sampling and detailed mapping at the Lakemount No.1 vein, Lakemount, BCH vein, Lakemount D vein, Lakemount E vein and Lakemount F vein. At the Lakemount F vein, the company also completed a surface pulse electromagnetic survey and 3 diamond-drill holes. Four diamond-drill holes were completed at the Lakemount E vein.

GOUDREAU–LOCHALSH AREA

Goldfields (Canadian) Mining Corporation initiated a line-cutting, prospecting, and geological mapping program on the Ego Mine property (Abotossaway Township) in the fall of 1990. The program included an evaluation of diamond-drill core, and a compilation of earlier assessment work on the property. The company expects to continue their program during the summer of 1991.

Noranda Exploration Limited completed 8 diamond-drill holes on the Cline Lake property in the area of the 'A' vein and the No. 3 shaft. East of the Cline Lake property, in the Godin Lake area, a trenching program was carried out on soil and IP anomalies outlined during the 1989 field program.

Spirit Lake Explorations Limited conducted a diamond-drilling program on the Edwards gold property (Jacobson Township) to test a mineralized zone occurring on strike with the Magino and Lochalsh deposits. All 3 deposits appear to be controlled by a regional structure known as the Goudreau Lake shear zone. Significant drill intersections of up to 1.06 ounces Au per ton over 15 feet have been returned from this 400-foot long zone (*The Northern Miner*, April 9, 1990, p.21). There are 2 main gold-bearing vein systems from which the company hopes to outline a small high-grade deposit. Future work may include a drill program to extend the outlined deposit, and a program of shaft dewatering, rehabilitation and underground drilling and/or development.

Corona Corporation has discovered a zone of high strain in the northern portion of Cowie Township. Grab samples from areas of carbonate and biotite alteration within the high strain zone, have yielded assays as high as 0.38 ounce Au per ton over 1 m. These assays resulted from a mapping and stripping program completed on the Cowie Township property during 1990.

MISHIBISHU AREA

Noranda Exploration Company Limited concentrated its surface exploration on the properties in the area of the Eagle River deposit. An exploration program consisting of stripping, sampling, and mapping continued on gold occurrences (the Falcon Creek zone and the Stockwork zone) east of the Eagle River area. These occurrences lie along the trend of the Eagle River deformation zone which contains the main Eagle River deposit. Noranda dropped its option on the Champagne Lake gold occurrence at the western end of the Mishibishu Lake deformation zone.

Noranda discovered a new zone of gold mineralization about 1000 feet east of the main Eagle River deposit. The new zone (the No. 2 shear) occurs in the metavolcanic rocks which lie outside of the diorite intrusion that hosts the main deposit. A diamond drill program (7000 feet total), indicated that the new zone is approximately 6 to 35 feet wide along an 800-foot strike length. Drilling results indicate grades of 0.17 to 0.94 ounce Au per ton over widths up to 46 feet and to depths of 400 feet (*The Northern Miner*, October 1, 1990, p.6). Preliminary estimates indicate potential tonnages of 300 000 (*The Northern Miner*, October 15, 1990, p.B8).

Placer Dome Inc. completed a mapping, prospecting, and sampling program on the Maple Lake and Floating Heart properties, that were optioned from Oneida Resources Inc., located west of the Eagle River deposit (Hemlo Gold Mines–Central Crude Ltd.). Placer Dome discontinued their option agreement with Oneida Resources Inc. at the end of the summer.

Granges Inc. revised its reserve calculations on the Mishi Project in 1990. Current reserves on the Mishi main zone are estimated at 751 000 tons averaging 0.13 ounce Au per ton (open pit), and 565 000 tons grading 0.22 ounce Au per ton (underground). Granges was making plans to ship a bulk sample to the Magnacon mill prior to Magnacon closure (*The Northern Miner*, October 15, 1990, p.B18).

Joutel Resources Limited and Queenston Mining Limited completed diamond-drilling programs on their respective properties. On the upper Denison Lake property, Queenston established the presence of a 3000-foot long deformation zone that contains anomalous gold mineralization (*The Northern Miner*, October 15, 1990, p.B18). This deformation zone continues onto the Joutel property to the south. A drill program tested gold anomalies on the 3000-foot Sprout vein which had returned assays as high as 0.78 ounce Au per ton from surface grab samples taken in 1989 (*The Northern Miner*, June 11, 1990, p.3). The Sprout vein is a quartz vein system occupying a shear zone that cuts a metagabbro. High gold assays are associated with the sericitic and biotitic sections of the quartz vein. The vein pinches and swells from 0.5 to 3 m wide along strike.

Corona Corporation continued to explore their Algoma Central Railway property holdings in the Iron Lake area. The company has completed mapping, prospecting, and soil sampling surveys which have resulted in the discovery of a new gold occurrence northeast of Iron Lake (the porphyry zone). The highest channel sample returned an assay of 4.5 g/t Au over 3 m. Grab samples returned assays as high as 17.2 g/t Au. Gold occurs in quartz-filled gash fractures, occurring in a quartz-feldspar porphyry contained within mafic metavolcanic rocks. This occurrence and enclosing host rocks lie within the Iron Lake deformation zone.

RENABIE–MISSANABIE AREA

Quote Resources Inc. is assessing the magnesium potential of an olivine gabbro in Riggs Township. Assay results from 4 gabbro samples averaged 27.7% MgO. The company reports that the rock is suitable for quarrying (*The Northern Miner*, April 2, 1990, p.12). Quote Resources and Watson Lake Mines, the claim holders, are investigating a possible 50/50 joint venture for the property (*The Northern Miner*, June 18, 1990, p.B1).

Renabie Gold Mines Limited stripped and channel sampled the surface exposure of the Renabie main ore zones (A, B, D, and E zones). Detailed mapping of the stripped areas will be completed in 1991. The company hopes to outline additional ore-grade material to augment the underground production.

During the fall of 1990, Corona Corporation completed channel sampling of the Frontenac vein. The Frontenac vein is located north of the Renabie Mine.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The Resident Geologist spent 80% of his time involved in activities related to the administration and management of the Wawa office and 5 Northern Development Fund projects which employ 6 contract staff. He also participated in committee-related work on behalf of the Mines and Minerals Division. The remainder of his time was spent on field-related activities. The Northern Development Fund projects are part of a four-year Wawa Economic Development Initiative designed to assist in establishing the office and to provide support for the local exploration and mining community. Funding for these projects ended March 31, 1991.

During the year, a presentation was made to the Superior East Economic Development Council on the history of mining and exploration in the Wawa area and the future economic implications for both northern Ontario and the Wawa area. A presentation was also made to industry and inter-ministerial representatives on computer applications in the Wawa Resident Geologist's office at a Mines and Minerals Division Seminar in Toronto. Poster displays on exploration and development activities in the Wawa area were displayed at the annual Northeastern Regional Mines and Minerals Geoscience Seminar in Timmins and at the annual Ontario Mines and Minerals Symposium in Toronto.

The Resident Geologist was a member of a number of internal and inter-ministerial committees. They included the Regional Inter-Ministry Development Committee for the Wawa District (Wawa Region Working Group) and the Mishibishu Lake Area Committee, which is involved in assisting companies, at the advanced exploration stage, with their permit requirements. The Resident Geologist chaired the Mineral Potential/Mineral Impact Task Group, which completed a report outlining guidelines and recommendations to be used in the development of mineral potential and mineral impact maps. The Resident Geologist also represented the Mines and Minerals Division and the Northeastern Region on 3 committees involved in the development of policies and plans for the implementation of information technologies within the Ministry of Northern Development and Mines (MNDM).

The number of visitors to the Wawa Resident Geologist's office decreased by about 15% during 1990 compared to 1989 (Figure 9.4). This decline reflects the decrease in exploration activity. B. Leschishin provided the Resident Geologist with capable administrative assistance and client service support throughout the year and began processing assessment files submitted to the Wawa Resident Geologist's office. She continued the French Language Training Program through Contact North and Cambrian College–Sudbury, completing the Beginners Level in December 1990. M. McLean completed the data entry for the Wawa Resident Geologist's office library of journals and publications.

The primary activities of the Staff Geologist consisted of providing information and technical advice on request to prospectors and to geologists from the exploration, academic, and government communities and to the general public. In the first 10 months of the year, the Staff Geologist responded to 283 geoservice requests, conducted 11 organized and impromptu field trips and visited 8 exploration/mining projects. Prorated to year end, service requests are 25% fewer than in 1989, and 52% less than in 1988.

A field trip was conducted, jointly with A.C. Wilson, for 14 geologists from the Karelian Geological Institute, Petrozavodsk, USSR. A revised version of the annual Wawa gold mineralization field trip for exploration geologists was held in June. In addition, a field-trip guidebook on the geology of Wawa gold mineralization was published by the Institute on Lake Superior Geology (Frey 1990). The Staff Geologist and A.C. Wilson jointly conducted a 20-hour prospecting course in Wawa for 12 students. They also designed and displayed a community poster p.73 for Mining Awareness Week. The Staff Geologist also assisted local prospectors with their Ontario Prospectors Assistance Program (OPAP) grant applications and reviewed their field work, and that of several Ontario Mineral Incentive Program (OMIP) grant recipients.

R.C. Stewart and E. Frey concluded the primary development of the Wawa Mineral Deposits Data Base (WMDD) with the completion of records for 407 deposits and an Open File Report on the project. They exhibited a poster on the WMDD at the Northeastern Regional Mines and Minerals Symposium in Timmins and at the Ontario Mines and Minerals Symposium in Toronto.

The Staff Geologist attended the Institute on Lake Superior Geology conference and field trips in Thunder Bay and the MNDM gold mineralization field trip in Kirkland Lake. Other activities included exploration/mining development land-use conflict resolution, as a member of the Ministry of Natural Resources, Wawa District Tourism Management Advisory Committee and by preparing the initial MNDM responses to tourism management proposals and to a Wawa MNR lakeshore management plan.

P.C. Delisle contributed to the metallogenetic study of the Michipicoten and Mishibishu Lake greenstone belts initiated in 1987 by K. Heather (geologist, Ontario Geological Survey). The Wawa-Hawk Junction area was chosen as the focus of the 1990 field program due to the extensive stripping of both base metal and gold occurrences and the lack of information on mineralization in the area. A poster entitled *Mineral Occurrence Investigations in Esquega Township* was displayed at the annual Ontario Mines and Minerals Symposium in Toronto. In addition, local field trips to review the mapping results were provided to property owners. P.C. Delisle attended geological and economic field trips given by R. Sage and K. Heather, respectively. He also attended a three-day ore deposit course held at the University of Toronto.

C. Lowe continued to update Geological Data Inventory Folios (GDIFs) and process exploration files from various sources. She supervised T. Beckett in the compilation, updating, and computerized data entry of GDIFs, and provided guidance and direction to B. Leschishin in the processing of assessment file submissions. C. Lowe and B. Leschishin completed the final stage of a three-year project which incorporated Algoma Central Railway files and microfiche into the assessment files of the Wawa office. A poster entitled *Geo-*

logical Data Inventory Folios was displayed by C. Lowe at the Ontario Mines and Minerals Symposium in Toronto. She also assisted the Resident Geologist's Secretary by providing client services when necessary.

A.C. Wilson concluded her field work in the Kabinakagami Lake greenstone belt during the 1990 field season. The field work involved visiting mineral occurrences and mapping new outcrop exposures in Hawkins Township. She was capably assisted by E.L. Wilson. An oral presentation and a poster entitled *Geology and Economic Potential of the Kabinakagami Lake Greenstone Belt* were presented at the Northeastern Regional Mines and Minerals Symposium in Timmins. A similar poster, reflecting changes made as a result of 1990 field observations, was presented at the annual Ontario Mines and Minerals Symposium in Toronto. In addition, A.C. Wilson attended the Institute on Lake Superior Geology conference and field trips in Thunder Bay, a Kirkland Lake economic geology field trip and the University of Toronto sponsored ore deposits course.

A.C. Wilson completed and submitted an Open File Report entitled *Building Stone and Industrial Minerals Prospects – Wawa Resident Geologist's District* (Wilson 1990). In addition, she initiated a reference system for the storage and retrieval of over 3000 donated reprints, theses and historical information. She also provided technical and editorial assistance to the Staff Geologist for an economic geology field trip guide for the Wawa area, and for an Open File Report submission entitled *Wawa Mineral Deposits Data Base*. Local field trips were conducted for prospectors interested in the building stone prospects in the district. A series of geological rock walks and evening presentations was conducted for the general public visiting Lake Superior Provincial Park during the summer. A local field trip was conducted, jointly with the Staff Geologist, for the international participants of a University of Minnesota-sponsored Archean symposium. They also jointly presented a 20-hour prospecting course in Wawa. A.C. Wilson and the Staff Geologist also prepared and locally exhibited a poster for Mining Awareness Week 1990.

P. Beach, with the assistance of R. Henri, continued to develop and implement computer applications related to geoscience data integration, mineral resource management, and land-use planning. Both provided assistance and technical support to the Resident Geologist related to his involvement on information technology and mineral development committees. P. Beach assisted the Resident Geologist in a mine tailings study and served on the Wawa District Tourism Management Advisory Committee. He also began transferring the Wawa Mineral Deposit Data Base information to the Geoscience Data Centre's Mineral Deposit Inventory format during the latter part of the year. Support was also provided to the Staff Geologist in the production of computer-generated maps for the Wawa Mineral Deposit Data Base and Open File Report. A poster entitled *Computer Applications in the Wawa Office* was exhibited at the Northeastern Regional Mines and Minerals Symposium in Timmins. Two posters entitled *An Integrated Geoscience Information System, Wawa District* and *Geographic Information Management for Mineral Resources Planning, Wawa District* were presented together by R. Henri and D. Tortosa at the annual Ontario Mines and Minerals Symposium in Toronto.

P. Beach made several presentations on computer applications and their use for geoscience data integration, mineral resources management, and land-use planning. These included: MNDM staff from Timmins and Kenora, members of the Mineral Potential/Mines Impact Task Group, the Claims Inspectors Committee, the Sault Ste. Marie Prospectors and Developers Association, and the Forest Resources Group of the Ministry of Natural Resources. He also attended several seminars and symposiums, including: a Global Positioning Satellite Receiver (GPS) field test, a GIS and Remote Sensing Seminar sponsored by Laurentian University and the Centre in Mining and Mineral Exploration Research in Sudbury, and the annual Geographic Information System Seminar in Toronto, sponsored by the Ministry of Natural Resources and Canadian Institute of Survey and Mapping.

PROPERTY EXAMINATIONS

Murray–Algoma Gold Prospect

The Murray–Algoma gold prospect is located in Esquega Township, 2.5 km west of the town of Hawk Junction and is easily accessible by bush road (Figure 9.5). Gold was discovered on the property by R.H. Reed in 1928. In 1934, Murray–Algoma Mining Company Limited carried out a program of prospecting, trenching, stripping and diamond drilling. The company built a 25 to 30 tons per day mill that reportedly processed 500 tons of ore in 1937. J–Q Resources completed electromagnetic, radiometric and geological surveys on the property in 1981. In 1988, Socana Explorations Limited conducted magnetic and geological surveys, stripping, channel sampling and drilled 8 holes (302 m total) (assessment files, Resident Geologist's office, Wawa).

The geological units are dominated by felsic and mafic intrusive rocks ("Mineral Occurrence Investigations in Esquega Township", research by staff of Resident Geologist's office, Wawa). The structural geology is complex and consists of 3 phases of folding and deformation (Figure 9.6). The first phase formed a steeply dipping east-trending schistosity. The second phase produced a shallow dipping schistosity which resulted in the development of crenulation cleavage with shallow plunges, 6° to 20°, to the west. The third folding event deflected both earlier fabrics from an easterly trend to a northerly direction.

The mineralized zone consists of a series of short quartz veins and pods which occur within both a folded quartz porphyry dike and a carbonatized (ankerite) mafic intrusive rock, and at their contact. The mineralized quartz veins have variable dips to the north and south and follow the crenulation cleavage pattern. The quartz is massive, recrystallized, and white, and contains tourmaline, muscovite, ankerite- and calcite-filled fractures. Up to 3% pyrite, traces of chalcopyrite and pyrrhotite, and a few specks of visible gold are also present. The adjacent wall rock is mineralized with 5% sulphides. Recent drilling indicated reserves on the property are 7000 tons at 0.3 ounce Au per ton (based on 13 diamond-drill holes). Preliminary gold assays of the nearby No. 4 vein are encouraging. Three grab samples yielded 12.6 g/t Au and 1200 ppb Au from the veins and 26.4 g/t Au from the wall rock.

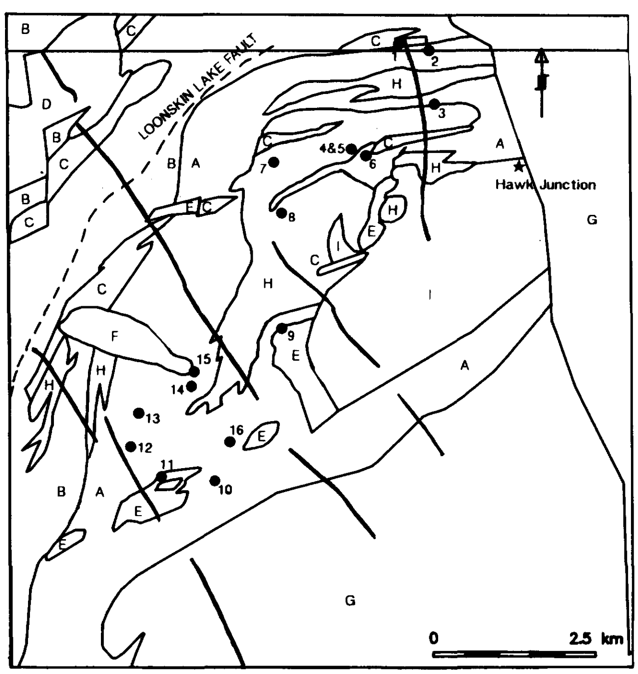
Lakemount #1 Vein—Base Metals and Gold

The Lakemount #1 vein is located in Esquega Township, 15 km east of the town of Wawa (Figure 9.5). The property is accessible by the Bremner Lake bush road. The prospect was discovered by Mr. Bond (prospector) in 1926. In 1928, Engineers Holding Co. Limited completed a trenching, blasting and channel sampling program. In 1980, Firespur Explorations Limited conducted an electromagnetic survey which was followed by the completion of 1 diamond-drill hole. In 1990, the company completed a stripping, channel sampling and detailed mapping program on the property (assessment files, Resident Geologist's office, Wawa).

The geological setting of the property consists of 2 intermediate pyroclastic units intruded by: a quartz-feldspar porphyry dike, a diorite, and a coarse-grained, blue, quartz-eyed, intermediate intrusive rock. Late feldspar porphyry intermediate dikes and diabase dikes crosscut the mineralized zones.

Two parallel, north-northeast trending, mineralized zones (Zone 1 and Zone 2), are exposed over a stripped area of the property and are nearly conformable to the trend of the enclosing lithologic units. Near the south boundary of the stripped area, the mineralized zones and surrounding rock units are south-trending. The north-northeast zones contain mineralized splays that trend north. Zone 1 has the configuration of a horsetail and is exposed over a strike length of 60 m. It dips moderately to the southeast at its southwestern end and steeply to the northwest at its northeastern end. Zone 2 has a minimum strike length of 250 m and displays consistently steep dips to the northwest.

Both mineralized zones consist of discrete anastomosing quartz-calcite breccia zones and stockworks with fracture fillings containing sulphide mineralization. The sulphide



LEGEND

- DIABASE
- I GRANODIORITE
- H FELSIC TO INTERMEDIATE PORPHYRY INTRUSIVE ROCKS
- G TONALITE TO QUARTZ DIORITE
- F PERIDOTITE
- E GABBRO
- D METASEDIMENT ROCKS
- C FELSIC TO INTERMEDIATE METAVOLCANIC ROCKS
- B MAFIC TO INTERMEDIATE METAVOLCANIC ROCKS
- A ULTRAMAFIC TO MAFIC METAVOLCANIC ROCKS

• MINERAL OCCURRENCE

MAP NUMBER	OCCURRENCE NAME	MINERALIZATION
1	SOOCANA-HOLDSWORTH	Au-Cp-Py
2	O'REILLY SCHEELITE VEIN	W
3	REED-BOOTH	Au-Py-Cp-Gn-Sph
4	MURRAY ALGOMA	Au-Cp-Py
5	#4 VEIN	Au-Cp-Py
6	BLACKSMITH	Au-Py-Cp-Po
7	ATNEL	Au-Py-Cp-Po
8	ATNEL-BLACKSMITH	Au-Py-Cp-Po
9	BUKELL COPPER	Cp-Po-Gn-Cu
10	LAKEMOUNT-#1 VEIN	Au-Cp-Po-Bn-Gn-Sph-Py-Cu
11	LAKEMOUNT A VEIN	
12	LAKEMOUNT BCH VEIN	Au-Cp-Po-Sph-Gn
13	LAKEMOUNT D VEIN	Au-Cp-Py-Bn
14	LAKEMOUNT E VEIN	Au-Sph-Cp-Bn-Py
15	LAKEMOUNT F VEIN	Po-Py-Cp-Pent-Sph-Ag-Au-Pt-Pd
16	LAKEMOUNT J VEIN	Po-Gn-Cp-Sph-Py

Figure 9.5. Geology and mineral occurrences, Esquega Township.

mineral assemblage in decreasing order of abundance is: chalcopyrite, pyrite, bornite, malachite, pyrrhotite, galena, sphalerite, and native copper. The sulphide content and composition in the individual mineralized zones is variable. The mineralized zone ranges in thickness from less than a few centimeters to 4 m. Quartz usually occupies between 10 and 15% of the fracture system, but occurs massively in places. The sulphide content on the average is 1 to 2% disseminated sulphides, but grades into pods of massive sulphide in places.

The best channel sample from Zone 1 assayed 0.20 ounce Au per ton and 0.7% Cu over a width of 2 feet. Zone 2 has returned no anomalous gold values.

Lakemount F Vein—Base Metal and Gold

The Lakemount F vein prospect is located in Esquega Township, 16 km east of the town of Wawa near the southeast shore of Elbow Lake, and east of Sunrise Lake (Figures 9.5 and 9.7). The deposit was discovered by J.H.Tease in 1926. Between 1942 and 1957, Lakemount Mines Limited and their various joint-venture partners completed a diamond drilling program (18 170 m total). In 1967, Amax Exploration Inc. completed a compilation of all previous work and estimated a reserve of 2 500 000 tons of ore containing 0.36% Cu and 0.55% Ni (assessment files, Resident Geologist's office, Wawa). In 1980, Firespur Explorations Limited completed ground electromagnetic and geological surveys, stripping, channel sampling, and 3 diamond-drill holes (346.5 m total).

The prospect is hosted by an elliptical ultramafic intrusion that has a west to northwest orientation (2000 m by 350 m). The centre of the intrusion is medium- to coarse-grained olivine pyroxenite (Durose 1988) with fine- to medium-grained serpentinized peridotite at the northwest and southeast end (Figure 9.7). The ultramafic intrusion crosscuts the north to northeast trend of the enclosing supracrustal rocks.

Drill-core interpretation by Amax Exploration Inc. suggests that the western portion of the ultramafic intrusion at Sunrise Lake is a reclined fold (Figure 9.8). The eastern portion at Elbow Lake, which is faulted up relative to the western portion, exposes only the bottom limb of the fold. The east-trending axial trace of the fold is interpreted by the author to be an F2 fold, based on field work elsewhere in the township.

A petrogenetic study by Durose (1988) concluded that a magmatic process controlled the emplacement of the copper-nickel mineralization. Disseminated sulphides are hosted by

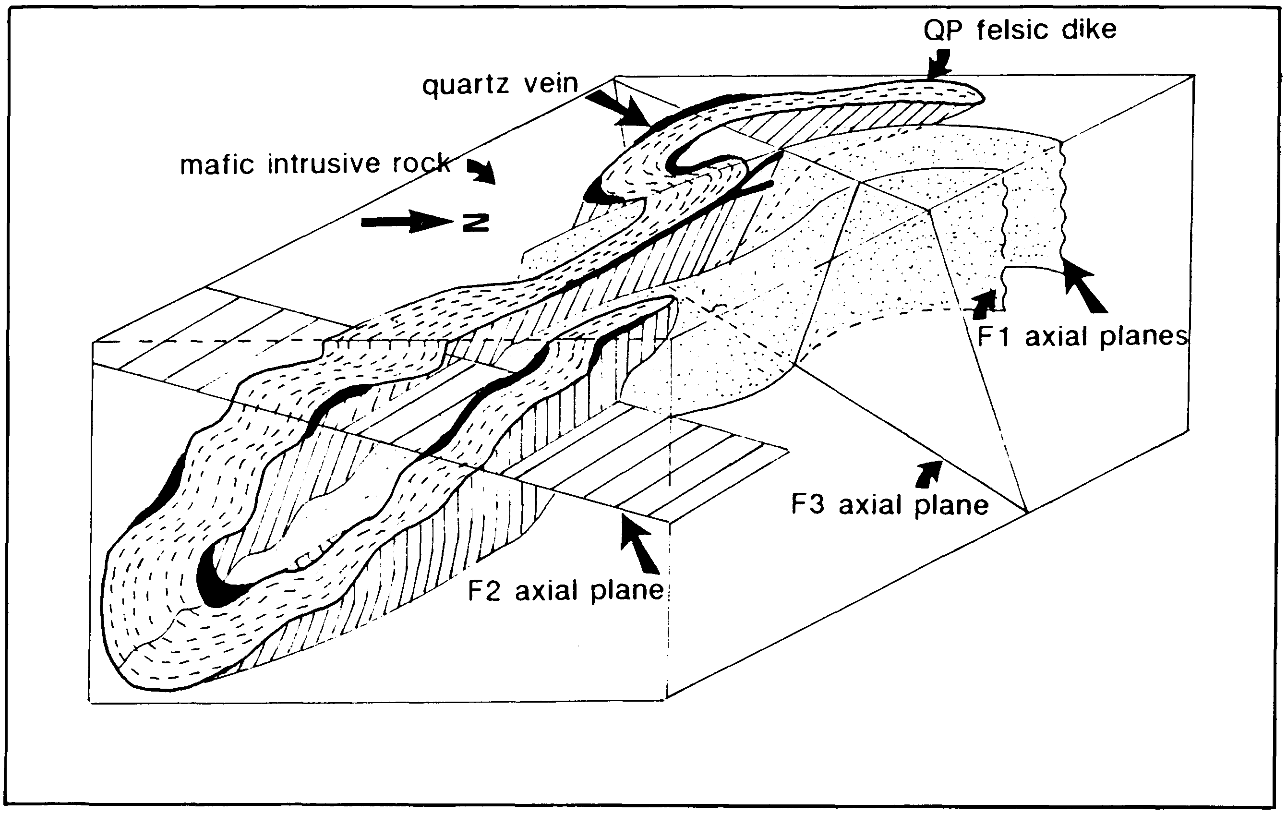


Figure 9.6. Idealized and interpreted block diagram of the refolded fold at the Murray–Algoma gold prospect, Esquega Township.

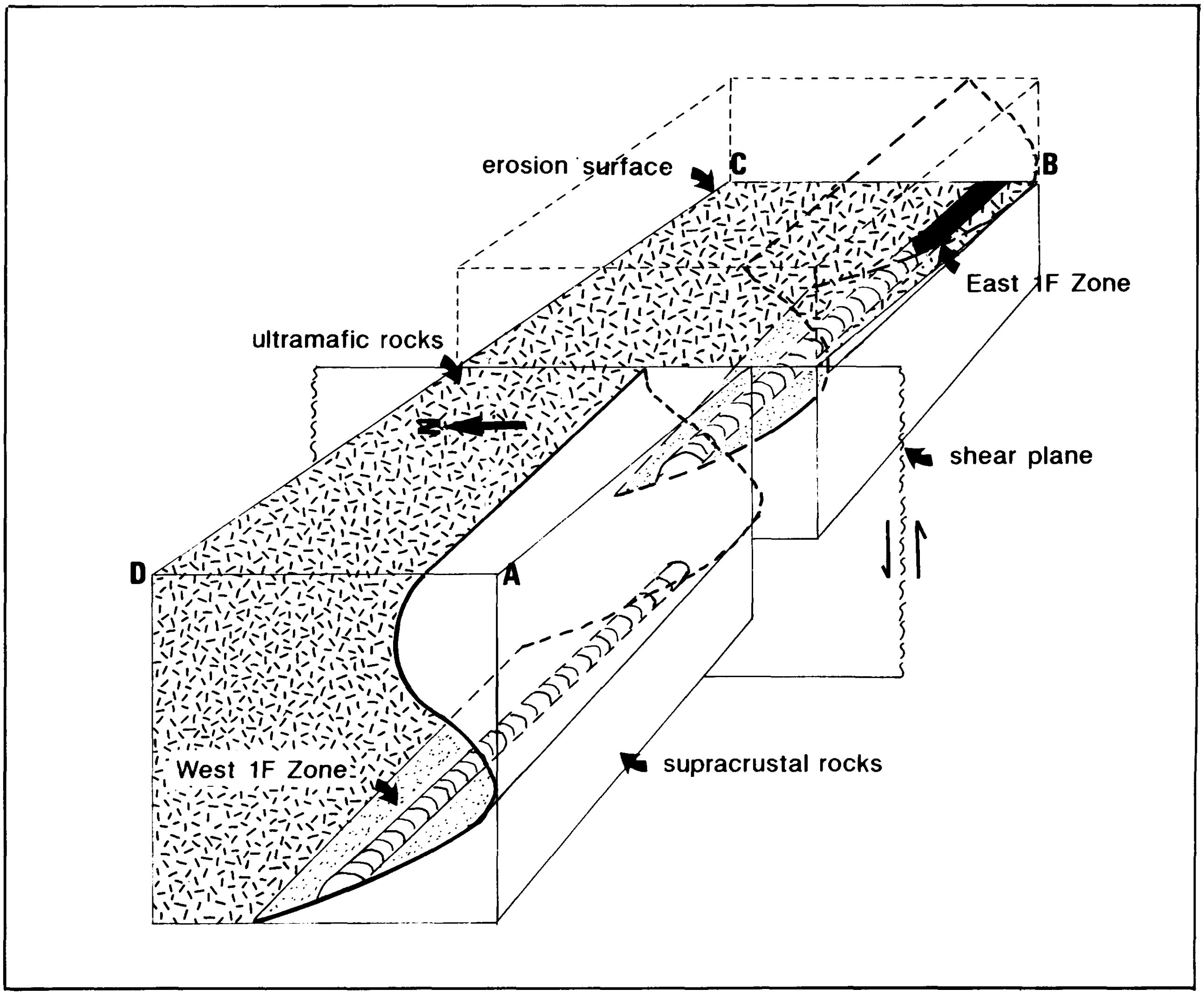


Figure 9.7. Geology and location of the Lakemount Nickel-Copper Occurrence, Esquega Township.

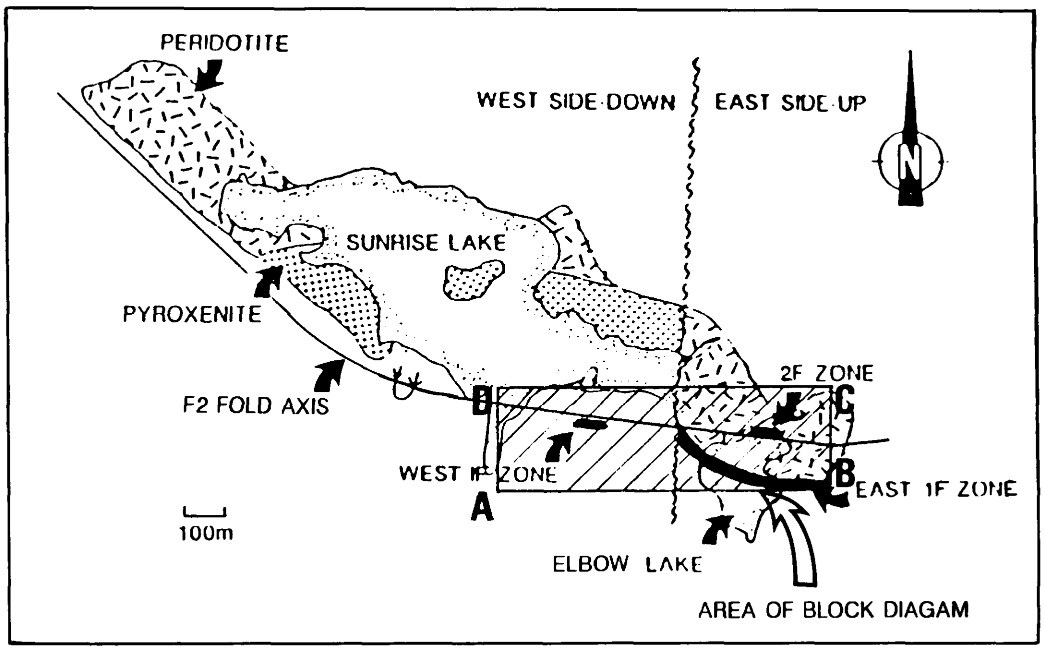


Figure 9.8. Idealized and interpreted block diagram of the Lakemount F Veins, Esquega Township.

the peridotite and the pyroxenite. The sulphide mineral assemblage in decreasing order of importance is: pyrrhotite, pyrite, chalcopyrite, pentlandite and violarite with minor sphalerite. Minor silver, gold, palladium and platinum also occur in the mineralized zones (Durose 1988).

Drilling has defined two main mineralized areas. The first area consists of the East 1F zone (the F vein discovery at Elbow Lake) and the West 1F zone (Sunrise Lake). These zones occur close to the southern, sheared contact between the ultramafic intrusion and the country rock. The mineralized, rod-shaped zone is exposed at Elbow Lake but occurs at depth below Sunrise Lake. The second mineralized area, referred to as the 2F zone by the author, occurs under Elbow Lake, 120 m north of the East 1F zone. This zone was discovered by Lakemount, while drilling to test the East 1F zone at depth. The ore shoots plunge shallowly to the west in both mineralized areas (Figure 9.8).

In 1969, Amax Exploration Inc. outlined 2 050 000 tons of ore containing 0.55% Ni and 0.36% Cu (assessment files, Resident Geologist's Office, Wawa).

RESEARCH BY RESIDENT GEOLOGIST'S STAFF

WAWA DISTRICT MINERAL DEPOSITS DATA BASE

by E.D. Frey and R.C. Stewart

The Wawa District Mineral Deposits Data Base (WMDD) project concluded its primary development with the completion of records for 407 mineral deposits in the Wawa Resident Geologist's District and an Open File Report. The project objective was to develop and maintain a data base of facts on the geology, production, and location of the numerous gold, base metal, and other mineral commodity occurrences in the area using a microcomputer retrievable format. The data base enables efficient information storage, search and retrieval on the basis of up to 3 parameters. P.D. Beach provided a new addition by linking the WMDD records to digitized base maps, using QUIKMap® software, allowing on-screen access to the data base records directly from location maps. The design and development of the WMDD has been described previously (Tortosa et al. 1988, 1989, 1990). The project was funded by the MNDM Northern Development Fund, Wawa Economic Development Initiatives.

MINERAL OCCURRENCE INVESTIGATIONS IN ESQUEGA TOWNSHIP, WAWA DISTRICT

by P.C. Delisle

Introduction

Sixteen mineral occurrences were mapped in Esquega Township during the 1990 field season (Figure 9.5). This project was a contribution to the recent metallogenetic studies of the Michipicoten and Mishibishu Lake greenstone belts by the Ontario Geological Survey (Heather 1986, 1989a, 1989b; Heather and Arias 1987; Heather and Buck 1988). An additional objective of the program was to provide detailed documentation of mineral occurrences in the Wawa–Hawk Junction area so as to upgrade the Wawa Mineral Deposits Data Base. An Open File Report is in preparation which will describe each mineral occurrence in detail. It will include lithology, mineralogy, structure, alteration, assays, development history, and geological maps.

The project was funded by the MNDM Northern Development Fund, Wawa Economic Development Initiatives.

General Geology

The Michipicoten greenstone belt in the vicinity of Wawa initially was mapped by Goodwin (1963), followed by Leahy et al. (1971) at scale 1:31 680. Sage (1982) produced the first detailed map of Esquega Township at scale 1:15 840 for the Ontario Geological Survey. A synoptic mapping program of the Michipicoten greenstone belt is currently underway (Sage 1987 and Sage et al. 1987). It has been concluded that Esquega Township is part of a 2.9 Ma volcanic cycle (cycle I), underlying a 2.75 Ma volcanic cycle (cycle II). The unconformity between volcanic cycle I and II is a sheared contact (R. Sage, personal communication, 1990) which occurs south of the Loonskin Lake Fault (Figure 9.5). The mafic portion of volcanic cycle I is basaltic to peridotitic komatiite in composition, in contrast to the tholeiitic composition of volcanic cycle II. All mineral occurrences investigated in 1990 occur within the oldest volcanic cycle which covers about 80% of the township.

Volcanic cycle I consists of a sequence of mafic to felsic metavolcanic rocks capped by a narrow sulphide iron formation and a chert horizon (Sage 1987a). This cycle includes the Hawk Lake granitic complex, an intrusion of trondhjemitic to granodioritic composition. U-Pb zircon isotopic data indicate that the intrusive complex is 2888 ± 2 Ma in age (Sage 1990).

Metavolcanic Rocks

Metavolcanic rocks mapped during the present field program are mafic plagioclase-phyric flows, massive and pillowed flows, and intermediate to felsic pyroclastic rocks, felsic tuffs and bedded flows.

Intermediate to Felsic Intrusives Rocks

Intrusive rocks of various compositions occupy a large part of the mapped areas. Crosscutting relationships suggest that intermediate to felsic porphyritic dikes are the earliest intrusive rocks; from oldest to youngest, these dikes are: coarse-grained glomeroporphyritic quartz porphyry, containing 1.2 cm clusters of 2 mm quartz eyes; quartz porphyry; quartz-feldspar porphyry; fine-grained felsic dikes; and feldspar porphyry. All of these dikes are common and are usually folded. U-Pb zircon isotopic data indicate that the quartz-feldspar porphyry dikes are 2881 ± 4 Ma, suggesting that the dikes, as a whole, are a part of volcanic cycle I (Sage 1990).

Mafic Intrusive Rocks

Intrusive rocks are gabbroic to dioritic in composition and are widespread in the township. They are contemporaneous with all felsic dikes, except the feldspar porphyry dikes which appear to be a later event. The most common mafic intrusive rock is a fine- to medium-grained spotted diorite containing subhedral feldspar crystals less than 1 mm long. The spotted diorite appears to be a multiple injection dike, trending north-northwest, and bounded by distinctive aphanitic chilled margins.

Late Intermediate to Mafic Intrusive Rocks

Intermediate to mafic dikes cut all the dikes cited above. They also intrude the mineralized zones. The earliest are very fine- grained, intermediate feldspar porphyries that trend east. The feldspar porphyry dikes are cut by diabase dikes of late Archean and early Proterozoic age. The diabase dikes trend mainly north- northwest and, to a minor extent, to the east. The youngest dikes, are lamprophyres of Proterozoic age.

Structural Geology

Within the study area, rock units and foliation in the supracrustal rocks trend generally northeast to east, parallel to the contact with the Hawk Lake granitic complex. However, within highly deformed zones, complex deformation consisting of ductile- brittle shearing and multiple folding events is exhibited. The limited exposure of crosscutting fabric relationships prevents a more comprehensive structural interpretation; however, at least 3 phases of deformation have been identified in the mapped areas. They are characterized by early reclined, recumbent and overturned folds which have been refolded. An example of this complex folding is best exposed at the Murray–Algoma gold prospect (Figure 9.6).

Four structural trends have been identified. From earliest to latest, they are : 160°, 030°, 045 to 065°, and 080 to 110°. Zones of high strain (shear zones) in Esquega Township appear to be limited to a few meters in width and have an indeterminate strike length. The shear zones are characterized by ductile deformation consisting of strong penetrative fabrics (045 to 065° and 080 to 110°), crenulation cleavages, transposition, shallow plunging folds, and strong carbonate and biotite alteration. The 030° and 160° fabrics are mostly a brittle deformation product whose relative sense of lateral movement shows both dextral and sinistral displacement. Micro-fault displacements indicate that 045 to 065° and 080 to 110° fabrics are mainly dextral and the 030° and 160° fabrics are sinistral.

Some of the structural trends show evidence of reactivation. The best evidence is represented by minor 030° shears that cut a diabase dike at the Lakemount BCH vein. This observation suggests that reactivated early shears may also affect the late diabase dikes. It may also explain why the generally north to northwest trending magnetic highs of the area (Ontario Geological Survey 1988), which correlate with diabase dikes, comprise *en échelon* arrays instead of continuous linear trends.

A structural study in progress on rocks of volcanic cycle II (Arias and Helmstaedt 1990) in the central part of the Michipicoten greenstone belt has identified a large regional nappe that has been refolded. This structural setting probably has important implications on the early structural history of the rocks in Esquega Township.

Economic Geology

Mineral occurrences in Esquega Township can be subdivided into 3 groups based on mineralogical, structural and, in some cases, lithological characteristics: 1) shear-hosted, refolded, gold-bearing quartz veins, 2) gold-bearing sulphide fracture fillings, and 3) copper-nickel mineralization associated with an ultramafic intrusion.

The first group consists of refolded gold-bearing quartz veins, hosted in east- to northeast- and east- to southeast-trending shear zones, e.g., the Murray–Algoma. Alteration products are biotite, ankerite, chlorite and an associated sulphide assemblage consisting of chalcopyrite, pyrrhotite and pyrite. There is also an apparent lithological control of the quartz veins due to their close association with felsic dikes. Crosscutting relationships between folded quartz veins and folded felsic dikes suggest that the quartz veins were emplaced between 2881 ± 4 Ma and the main deformation event.

The second group consists of gold-bearing sulphide fracture fillings of various orientations, e.g., the Lakemount #1 vein. They consist of discrete, anastomosing, quartz-carbonate breccia zones containing chalcopyrite, galena, sphalerite, pyrrhotite, bornite, pyrite and native copper. The alteration mineralogy is chlorite, sericite with minor biotite, epidote and calcite.

The third group consists of copper and nickel mineralization and minor platinum group elements (PGE), gold and silver associated with a magmatic ultramafic intrusion at Elbow Lake, e.g., the Lakemount F veins. Sulphide assemblages are pyrrhotite, pyrite, chalcopyrite, pentlandite, violarite and occasional sphalerite (Durose 1988).

Preliminary Pb-Pb isotope ages on galena from mineralized zones (Lakemount J vein: 2864 Ma; Lakemount E vein: 2859 Ma; Lakemount BCH vein: 2813 Ma; and the Reed–Booth gold prospect: 2575 Ma) indicates an older crustal component (Thorpe 1987). The date from the Reed-Booth gold prospect is doubtful and indicates either remobilization and contamination of lead from an earlier volcanic cycle that mixed with cycle I during the hydrothermal process, or the addition of lead, derived from deeper crustal activity, into the hydrothermal system. Pb-Pb dating of galena from the Lakemount #1 vein is currently in progress.

An example of each of these styles of mineralization is outlined in the Property Examinations section that precedes this report.

GEOLOGICAL DATA INVENTORY FOLIO PROGRAM AND EXPLORATION DATA MANAGEMENT

by C. Lowe and B. Leschishin

Updating of Geological Data Inventory Folios (GDIFs) continued in 1990, supported by the MNDM Northern Development Fund under the Wawa Economic Development Initiatives.

A total of 67 Geological Data Inventory Folios are available at the Wawa Resident Geologist's Office. There are 20 published GDIFs to date and, of these, Glasgow and West townships have been updated. Forty-seven GDIFs, are unpublished of which 12 have been updated. The following updated GDIFs will be submitted for publication by April 1991:

1. Pukaskwa River	7. Groseilliers Township
2. Mishibishu Lake	8. Meath Township
3. David Lake	9. Rennie Township
4. Abbie Lake	10. Stover Township
5. Pt. Isacor	11. Pilot Harbour NE
6. St. Germain Township	12. Pilot Harbour NW

GDIFs may be viewed or purchased (for the cost of photocopying) at the Resident Geologist's office. Data for 31% of all townships, and 65% of those with high gold potential have been compiled (Figure 10.8, Tortosa et al. 1990, p.199).

In 1990, 108 files were incorporated into the Wawa Resident Geologist's office library of assessment data. Those files included were 71 from the Assessment File Research Office (AFRO), 9 from the Ontario Mineral Exploration Program (OMEP), 8 from Algoma Central Railway (ACR), and 20 donated. Townships and areas with new assessment data information and accompanying GDIFs are identified in Figure 9.9. A list of assessment files is available on request.

Information gathered as a result of the Algoma Central Railway Exploration File Consolidation Project has been transferred to microfiche. The ACR files and microfiche have been incorporated into the Wawa assessment files. Duplicate copies of the microfiche and paper files have been given to the ACR, and are available for reference at their offices in Sault Ste. Marie. The Sault Ste. Marie Resident Geologist's District office also was provided with copies of the microfiche pertaining to that district. Duplicate copies of the microfiche and original maps have been given to the AFRO. The Wawa Resident Geologist's office will continue to process ACR assessment information as it is submitted.

RECONNAISSANCE MAPPING OF THE KABINAKAGAMI LAKE GREENSTONE BELT—AN UPDATE

by A.C. Wilson

The mapping program in the Kabinakagami Lake greenstone belt, initiated in 1988, concluded during the 1990 field season. Details of the geology of the greenstone belt and descriptions of the mineral occurrences can be found in Tortosa et al. (1989), p.193-198 and Tortosa et al. (1990), p. 195-198. The observations included in this report are complementary to those reports.

Both the Kabinakagami Lake and Hawkins Township map areas were revisited during the field season. Additional outcrops missed due to inclement weather conditions in 1988, were mapped on Kabinakagami Lake. Additional mapping of the Hiawatha gold mine and the Hawkins Township mineral occurrences also were completed. The details of the entire mapping program (1988-1990) will be summarized in an Open File Report which will be completed before April 1, 1990.

Funding for the program was provided by the MNDM Northern Development Fund, Wawa Economic Development Initiatives.

Structural Geology

The Langdon Lake shear zone, mapped during the 1989 field season (Tortosa et al. (1989), p.201) is a steeply dipping, eastward-trending structure. In Hawkins Township, strongly- to intensely- foliated mafic metavolcanic rocks and tonalites lie within the 0.75 to 1 km wide shear zone.

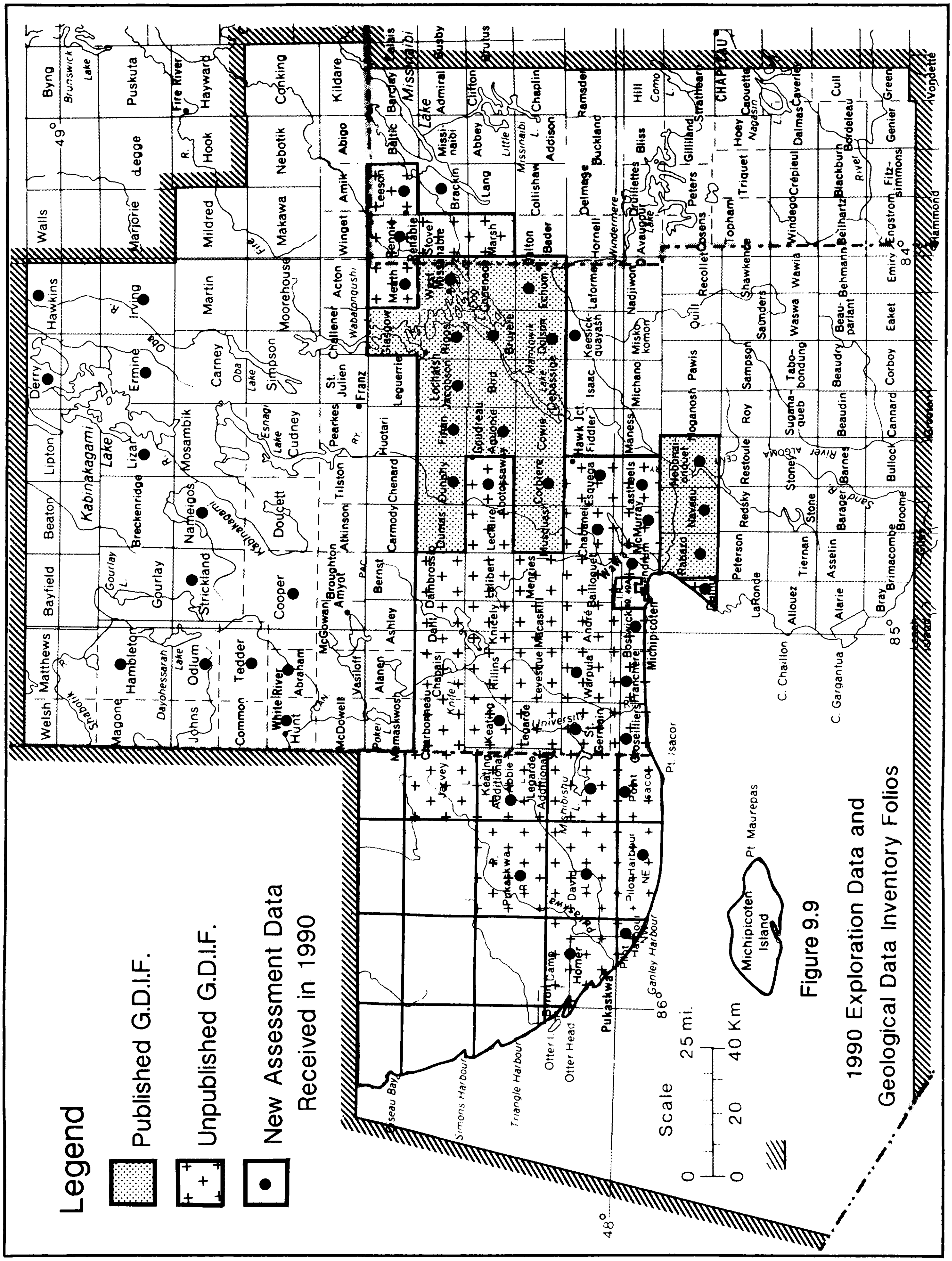


Figure 9.9
1990 Exploration Data and Geological Data Inventory Folios

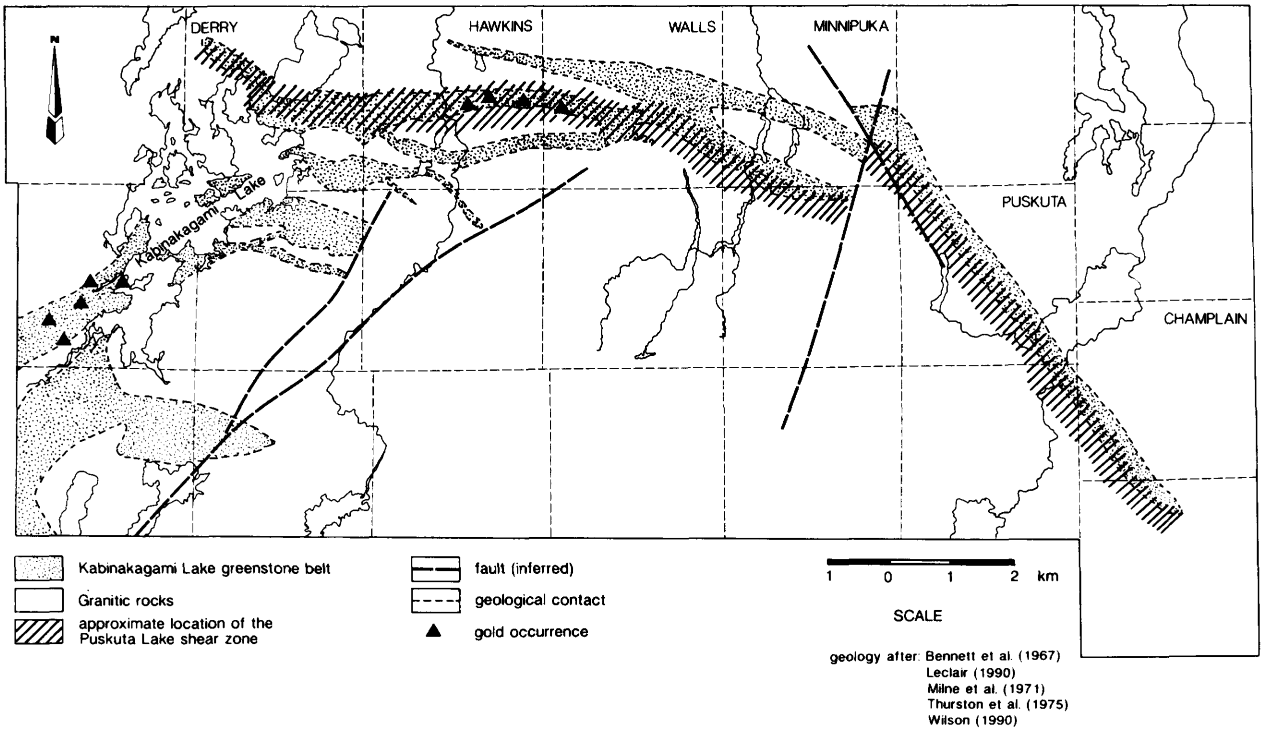


Figure 9.10. *Kabinakagami Lake greenstone belt and the inferred location of the Puskuta Lake shear zone.*

The shear zone forms the contact between a sequence of pillowed and massive mafic metavolcanic rocks, which are intruded by quartz porphyry and quartz-feldspar porphyry sills, and a tonalitic intrusion. The mafic metavolcanic rocks in the vicinity of the shear zone are strongly deformed. Pillows are stretched and are recognizable only by the presence of fine- grained garnetiferous bands that are relict pillow selvages. These units show a strongly developed tectonic layering of the garnetiferous selvages and fine-grained pillow cores. The porphyry sills also are strongly deformed, particularly at the contacts. Quartz eyes within the sills are flattened. The dominant foliation measured within the mafic metavolcanic sequence is approximately 100/90.

Folding within the mafic metavolcanic sequence is common. Both broad, open, symmetrical folds and asymmetrical, parasitic folds are recognizable in outcrop. The folds generally plunge very steeply to the west.

The southern section of the shear zone lies within a tonalitic intrusion that separates the 2 mafic branches of the greenstone belt in Hawkins Township (Tortosa et al. 1990, p. 197). Within the high strain zone, the tonalite is fine- to medium-grained and strongly gneissic to mylonitic. In its relatively undeformed state away from the shear zone, the tonalite is homogeneous, medium- to coarse-grained and only weakly foliated. Foliations within the tonalite are commonly eastward-trending and steeply dipping to the northeast.

This same shear zone has been recognized east of Kabinakagami Lake area where Leclair (1990) has traced the eastward and southeastward extension for over 60 km into the Kapuskasing Structural Zone. Systematic mapping of the area by Leclair (1990) and Leclair and Poirier (1989), has outlined an arcuate, concave to the southwest, regional-scale deformation zone that forms the south boundary of the Kabinakagami Lake greenstone belt. This shear zone has been named the Puskuta Lake shear zone (Leclair 1990). The location of the Puskuta Lake shear zone is outlined in Figure 9.10.

The Puskuta Lake shear zone has been recognized by the abrupt northward transition from coarsely crystalline granitoid rocks in the south, to extremely well foliated, tectonically layered, mafic and felsic metavolcanic rocks in the north. Leclair (1990) has observed that the fabrics developed within this zone, dip steeply north to northeast and have a subhorizontal stretching lineation. This observation is similar to that observed in the mafic metavolcanic rocks that occupy the shear zone in Hawkins Township.

In general, the Puskuta Lake shear zone is a roughly 2 km wide zone of intense ductile deformation that is coincident with the southern volcano-plutonic contact of the Kabinakagami Lake greenstone belt. The continuation of this shear zone from the Kapuskasing Structural Zone, northwestward through Hawkins Township and possibly into Derry Township, is suggested by a strong northwest-trending aeromagnetic anomaly (Geological Survey of Canada 1984). The same magnetic anomaly, corresponding to the shear zone, can be traced westward into Derry Township (Ontario Department of Mines–Geological Survey of Canada 1963a, 1963b). Due to the thickness and extent of overburden, it was not possible to trace the high strain zone on the ground.

Economic Geology

In Hawkins Township, the shear zone hosts 3 known gold occurrences, one of which, the Shenango gold mine, was a low-grade, low-tonnage producer (Tortosa et al. 1990), p.193-195). All 3 occur within similar geological settings. In all cases, the gold is associated with quartz veins at the strongly sheared contact between mafic metavolcanic rocks and felsic intrusives (tonalite). The contact and its associated shear zone is east-trending and dips very steeply to the north at all of the occurrences (266/86N). Carbonate and sericite alteration is pervasive.

A fourth gold occurrence, the Culbert–Peterson–Dubroy occurrence, lies approximately 4.5 km to the east of, and on strike with, the 3 other occurrences. This occurrence reportedly consists of 7 parallel, auriferous quartz veins which trend 352/85E. The veins range in width from 2 cm to 30 cm, and the total width of the mineralized section is 125 m (Maynard 1929). The quartz veins are hosted by strongly sheared mafic and felsic metavolcanic rocks which have been intruded by aplitic dikes. All units are crosscut by massive, north-trending pegmatite and diabase dikes (assessment files, Resident Geologist's offices, Wawa and Timmins). Property descriptions suggest that the rocks in the vicinity of the showing have been locally displaced along northeast-trending faults. Native gold reportedly has been panned from several localities within the occurrence, although no assays have been recorded.

COMPUTER APPLICATIONS AND MINERAL DEVELOPMENT PROGRAM

by P. Beach, R. Henri, and D.Tortosa

A Geoscience Information System for the Wawa District

A program of computer compilation and integration of geological, geophysical, geographical and topological data for the Wawa District has been undertaken to provide a user-friendly method of handling digital geoscience information. The main component of this system is QUIKMap® which is an archival Geographic Information System (GIS) software used on IBM-compatible computers. QUIKMap® is a raster and vector based graphics/data base system which is simple, fast, memory efficient, and able to accommodate all common map projections.

Both provincial and private sector GIS systems were reviewed in an effort to understand the technological, data interchange methods, as well as, implementation and standardization techniques. This knowledge has been applied to the acquisition, preparation, and utilization of digital data for the Wawa District. Base-map and data base preparations required the acquisition, compilation, digitization, and conversion of the data, as well as, geographical referencing and accuracy checking. Sources of information (both digital and non-digital) include: the Wawa Resident Geologist's office, the Ontario Geological Survey, Energy Mines and Resources, Canada, the Ontario Centre for Remote Sensing, the Ontario Ministry of Natural Resources and the Sault Ste. Marie Drill Core Library.

Partial or full coverage of the data-base-linked digital (point or polygon) information includes: whole rock and lake sediment geochemistry, mineral deposit, diamond-drill hole, land use, mineral potential, exploration activity, tailings, property locations and an assessment file map for Point Isacor. Digital base-map coverage includes topography, drainage, township boundaries and transportation routes as individual layers at 1:50 000 and 1:250 000 scales. Geoscience-related map information includes: regional and detailed geology, interpreted lineament data from radar and LANDSAT images, and contoured aeromagetic data and electromagnetic data (Figure 9.11).

A pilot project using the QUIKMap® GIS software was undertaken with the Ontario Centre for Remote Sensing and the Ontario Geological Survey. It involved overlaying interpreted lineament data from radar and LANDSAT images with geophysical and geological data. A study area southeast of Goudreau was chosen because the area contained a mixture of geologically mapped and unmapped sections. The overlaying of data allowed for the projection of some known geologic features into unmapped areas. A number of inconsistencies and anomalies in the mapped areas were noted which warrant checking and possible revisions to the geology map. The project also confirmed observations by Mussakowski et al. (1989), from a study in the Goudreau–Lochalsh area, that all layers of geoscience information (e.g., radar, LANDSAT, airborne geophysics) are required in order to fully delineate geological and structural features by remote sensing.

The integration of the digital information with a GIS provides a user-friendly tool, allowing rapid access to a wide variety of geoscience knowledge in the Wawa District. This allows the geologist with limited computer skills, the ability to simultaneously view a variety of geological and geophysical parameters and perform interpretive analyses.

Geographic Information Management for Mineral Resource Planning in the Wawa District

Geographic information management for mineral resources planning is becoming increasingly important in the Wawa Resident Geologist's District. To address these needs, an archival geographic information system (GIS) is used to rapidly compile, maintain, update and retrieve information, and to produce maps and reports. QUIKMap® software forms the main component of the graphics-data base system, and links the different data-base elements with map layers. Information compiled from MNDM and MNR sources include: lodges, commercial outpost camps, cottage lakes, canoe routes, traplines, environmentally sensitive areas, parks, Indian reservations, potential hydro-electric power generating sites, sand and gravel quarries, mining developments and mineral resource assessments for selected areas.

The Wawa Resident Geologist's office uses the geographic information system to provide rapid, up-to-date information on potential resource conflicts between the mining industry and other land users. The system has proved valuable in dealing with multiple land-use planning initiatives such as the Ministry of Natural Resources Wawa District Tourism Management Plan. In addition, there is a growing demand for this kind of information by our client industry.

Funding for the Mineral Development and Computer Applications Program was provided by the MNDM Northern Development Fund, Wawa Economic Development Initiatives.

DIAMOND-DRILL CORE STORAGE PROGRAM

by J. R. Walmsley

Permanent staff of the Sault Ste. Marie Drill Core Library presently consists of J.R. Walmsley as Drill Core Library Geologist. D. Messenger left his position as Drill Core Library Assistant at the end of August for a position with the Mining Lands Section of the Ministry. Temporary staff included: C. McKeachnie as Core Library Assistant from January to June while D. Messenger was on secondment to the Mining Lands section, Experience 1990 summer assistant B. Arbour, and co-op students A. Borelli and E. Dubois.

A survey of the indoor drill-core inventory was completed and discrepancies with the library data base were corrected. Drill core from 57 holes, totalling 10 498 m, was collected by library staff from both the Wawa and Sault Ste. Marie Resident Geologist's districts for a total of 10 408 m. A total of 825 m of core was collected from the Wawa Resident Geologist's District. An additional 5000 m of core has been donated

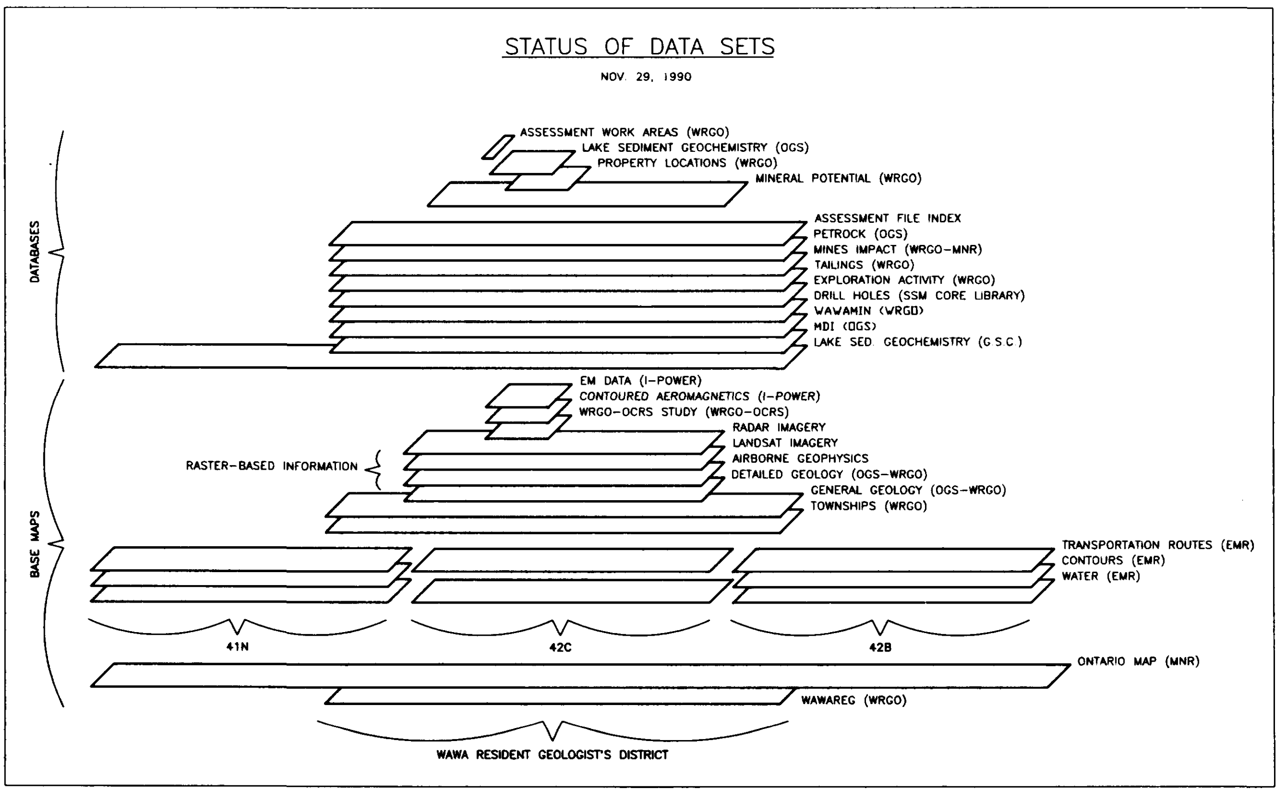


Figure 9.11. Digital geoscience datasets for the Wawa District.

from the Wawa area but has not yet been retrieved due to inaccessibility and manpower problems. Core submissions from the Wawa area include: McMurray Township (300 m); 23 assessment holes from the Kabinakagami Lake greenstone belt; approximately 2400 m from Cline Development, Jacobson Township (yet to be recovered); and approximately 1500 m from the Pukaskwa River area (yet to be recovered).

Visits to the core library totalled 116 for 1990. In addition to client visits, 5 school tours of the core library facility were conducted. Participants in the tours included local public school students, high school students from London, Ontario, and university students from Lake Superior State University. Involvement in the 1990 Mining Awareness Week included hosting an open house and contributing to a display set up by the Sault Ste. Marie Resident Geologist's office in a local mall.

Anyone wishing to view drill core should notify the Drill Core Librarian in advance to ensure that the needed core stored outside can be retrieved. Anyone wishing to donate core or requiring a copy of the core library inventory catalogue should contact the Drill Core Library or the Wawa Resident Geologist's office.

RECOMMENDATIONS FOR EXPLORATION

Kabinakagami Lake Greenstone Belt

Mapping of the eastward extension and 60 km long continuation of the mineralized shear zone in 1989 (Tortosa et al. 1990, p.201) indicates that the Puskuta Lake shear zone (Leclair 1990) is a suitable target for exploration. Four known mineral occurrences (Langdon showing, Shenango Gold Mine, Taylor occurrence and Culbert–Peterson–Dubroy occurrence) are hosted within the shear zone. Assessment file research indicates that anomalous gold assays have been returned from other sites within the deformation zone.

Leclair (1990) has observed numerous localities within the southeastern section of the shear zone that host rusty, sulphide-rich lenses and veins (up to several metres long) occurring in highly fractured, siliceous mylonitic rocks. This mineralization is often associated with quartz segregations and veins within the tectonically layered metavolcanic rocks. These sites have not been assessed for their economic potential.

Gold mineralization in Ontario is commonly associated with major shear systems that follow granite/greenstone contacts (Colvine et al. 1988). The ductile nature of the Puskuta Lake shear zone and its association with a strongly deformed mafic and felsic metavolcanic sequence suggests that this deformation zone is a favourable site for gold mineralization. The potential for base metals in the greenstone belt is unknown.

Access to the area, through a complex system of logging roads, is surprisingly good and logging in the area continues to expose new outcrop. With the exception of some shallow overburden drilling, the geologic potential of the deformation zone is virtually untested. A program of stripping, geological mapping and ground geophysics is recommended to properly assess any mineralization within the deformation zone.

Hawk Junction Area, Esquega Township

In Esquega Township both the contact between volcanic cycles I and II and the sulphide iron formation should be explored for their gold and base-metal potential. The contact is interpreted as a sheared unconformity between the 2 volcanic cycles (R. Sage, personal communication, 1990). The sulphide facies iron formation and inferred unconformity are outlined by arrays of strong INPUT EM anomalies on the airborne electromagnetic survey of the area (OGS 1988).

Detailed mapping of mineral occurrences in Esquega Township indicates that mineralized zones are folded and are structurally similar to the gold-bearing quartz veins in McMurray Township. Both areas appear to have a similar structural history and additional structural mapping of the prospects is recommended. This would provide a better understanding of the fold geometry of the mineralized zones and allow for better targeting of diamond drilling programs. In addition, the investigations in Esquega Township indicate that some occurrences are structurally connected and may provide new exploration targets or extensions for the known occurrences.

The Lakemount copper-nickel deposit is one of the few significant base metal properties in the district. Field mapping indicates that the mineralized zones are rod-shaped and faulted. Further drilling is recommended to explore the depth continuation of the mineralized zones (Figure 9.8). Other ultramafic intrusions in the area may also be suitable candidates for copper-nickel mineralization.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

The Ontario Geological Survey and staff from the Wawa Resident Geologist's office conducted joint spring and mid-summer field trips in the Wawa District. For the spring field trip, R. Sage spent 2 days reviewing the volcanic stratigraphy, iron formations, and Archean sediments and E. Frey reviewed gold occurrences in the Hawk Junction and Wawa areas. Mid-summer field trips were led by K. Heather and R. Sage in the Goudreau, Mishibishu Lake and Renabie areas. Attendance was significantly below last year's levels for both the spring and mid-summer field trips.

The Wawa Resident Geologist's office and the Ontario Geological Survey jointly conducted 2 field trips for the CIM

Mineral Deposits of Central Canada Conference held in Thunder Bay in September. Two days of field trips were held, one in the Goudreau area and a second in the Mishibishu Lake area. K. Heather conducted the field trips and D. Tortosa was the local coordinator.

The Wawa Resident Geologist's staff provided logistical support and temporary geological assistance to Ontario Geological Survey field crews and staff during the summer. The Ontario Geological Survey had 2 field projects in the Wawa area during 1990 (Figure 9.1)

PRECAMBRIAN GEOLOGY SECTION

R. Sage continued a synoptic study of the Wawa area designed to summarize and synthesize the results of 7 years of field mapping, and analytical work, including geochronology, whole rock, and trace element geochemistry.

An integrated geoscience data base was developed for the Goudreau–Lochalsh area by R.S. Mussakowski (Ontario Centre for Remote Sensing) and N.F. Trowell (Ontario Geological Survey) (*see* Research by Other Agencies in this paper).

QUATERNARY SECTION

T. Morris mapped the Quaternary geology of the 1:50 000 scale Hawk Junction map sheet. This is the first detailed regional Quaternary mapping in the Wawa area, and will also serve to identify aggregate resources for future needs.

RESEARCH BY OTHER AGENCIES

CARLETON UNIVERSITY

R. Rice initiated a sedimentological study of the Archean metasedimentary rocks in Chabanel Township. This work is part of a three-year post-Doctoral study of Archean metasedimentary rocks in the central Superior Province stretching from Wawa to Kirkland Lake.

QUEEN'S UNIVERSITY

Z. Arias completed her M.Sc. field work on the early structural evolution of the central part of the Michipicoten greenstone belt. Evidence for early nappe development followed by folding and imbricate thrusting is supported by field mapping. This work constitutes a significant advance in our understanding of the early structural evolution of the Michipicoten greenstone belt and has important implications on the general understanding of Archean tectonics.

ONTARIO CENTRE FOR REMOTE SENSING (OCRS)

R. Mussakowski (OCRS) together with R. Sage, K. Heather, and N. Trowell, (Ontario Geological Survey) completed field work to assess interpretations that resulted from the development of an integrated geoscience data set for the Goudreau–Lochalsh area. The study has demonstrated that remote sensing provides a better understanding of the connection between surface elements, geology, and geophysics, as well as serving as a reference base.

UNIVERSITY OF MASSACHUSETTS

G.E. McGill, Professor, Department of Geology, continued his structural study of the central Michipicoten greenstone belt, focusing on central and northeastern Chabanel Township.

GEOLOGICAL SURVEY OF CANADA

R.I. Thorpe continued lead isotope geochronological studies of galena-form gold deposits in the district.

UNIVERSITY OF OTTAWA

H.J. Hoffman, Professor, Department of Geology, continued to study the possible biological origin of concretionary structures occurring within pyritic siderite at the George W. MacLeod Mine, Wawa.

ACKNOWLEDGMENTS

Information for the section on Resident Geologist's Staff Activities was provided by staff. The section on Property Examinations was written by P.C. Delisle and edited by E. Frey and D. Tortosa. The section on Recommendations for Exploration was written by P.C. Delisle (Hawk Junction area) and A.C. Wilson (Kabinakagami Lake greenstone belt). Sections on Mining, Advanced Exploration and Development, and Exploration Activities were written by D. Tortosa, including the sections on Ontario Geological Survey Activities and Research by other Agencies. Information on Selected Publications Received was compiled by staff. D. Tortosa integrated the various sections into a final report; A.C. Wilson reviewed and edited the manuscript.

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10. Sault Ste. Marie Resident Geologist's District—1990

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INTRODUCTION

Low uranium prices and the termination of overseas contracts resulted in the closure of the Quirke and Panel Mines of Rio Algom Limited and the reduction in production of the Denison Mine of Denison Mines Limited in August of 1990.

Mineral exploration in the Sault Ste. Marie Resident Geologist's District probably exceeded the 1989 level. For the first time in many years, there was more interest in base metals than gold on the part of prospectors and industry geologists. There was increased interest, as well, in industrial minerals, especially decorative stone. The Ontario Prospectors Assistance Program (OPAP) has aided some local prospectors to continue work on properties acquired in 1989.

MINING ACTIVITY

The only operating mines in the Sault Ste. Marie Resident Geologist's District are the Stanleigh Mine of Rio Algom Limited and the Denison Mine of Denison Mines Limited in the Elliot Lake area.

RIO ALGOM LIMITED

The Elliot Lake operations of Rio Algom Limited were significantly reduced following the closure of the Quirke and Panel Mines in August of 1990.

The total number of employees at Rio Algom in the Elliot Lake operations as of November 26, 1990 is between 500 and 600. This compares with a total of about 2400 employees prior to the shut down of the Quirke and Panel Mines (J. Buchanan, Community Relations Officer, Rio Algom Limited, personal communication,1990).

The Stanleigh Mine

The Stanleigh Mine remains the only operating mine of Rio Algom Limited in the Elliot Lake camp. There has been a large reduction in the Stanleigh Mine work force. Mining is progressing on schedule with no unforeseen faults or ore depletions. Conventional mining is supplemented by underground spray leaching of abandoned stopes. Some flood leaching is underway but development of further flood leaching of stopes in the lower reef is planned (R. Henderson, Chief Geologist, Stanleigh Mine, personal communication, 1990).

Denison Mines Limited

Denison Mines Limited operates the Denison Mine at Elliot Lake. There was a significant downsizing at the Denison Mine in 1990. As of December 1990, there were 1075 employees at the Dension operations in Elliot Lake which was a reduction of about 585 over the past year. Total projected production of uranium oxide has been reduced from 5.1 to 2.5 million pounds per year. The tonnage milled has been reduced to 7500 tons/day on a five-day/week basis, from 8400 tons/day on a seven-day/week basis. The 1990 production is 3.6 million pounds uranium oxide.

Denison produced 40 055 kg of yttrium oxide as a by-product of uranium production in 1990. Increased yttrium production from mainland China was a major reason for temporary suspension of yttrium production at Denison in July 1990. A decision on the restarting of the yttrium circuit in the hydro-metallurgical plant is expected in the spring of 1991.

Ontario Hydro and Denison are re-negotiating contracts for delivery schedules of uranium oxide to Ontario Hydro. Negotiations are expected to be completed in late spring or early summer of 1991 (A. MacKeachern, Chief Mine Geologist, Denison Mines Limited, Elliot Lake, personal communication, 1990).

EXPLORATION ACTIVITY

Mineral exploration activity in the Sault Ste. Marie Resident Geologist's District exceeded the 1989 level (Figure 10.1). The total number of mining claims recorded was 1164 (as of November 30, 1990); this compares to 368 mining claims in 1989, a year of relatively low staking activity. Much of the staking for 1990 took place in the Batchawana greenstone belt, in the area covered by the airborne geophysical survey completed by the Ministry of Northern Development and Mines. Also, claims were staked in Joubin and Gaiashk townships in the Elliot Lake area where the geological mapping and geochemical surveys were undertaken by the Min-

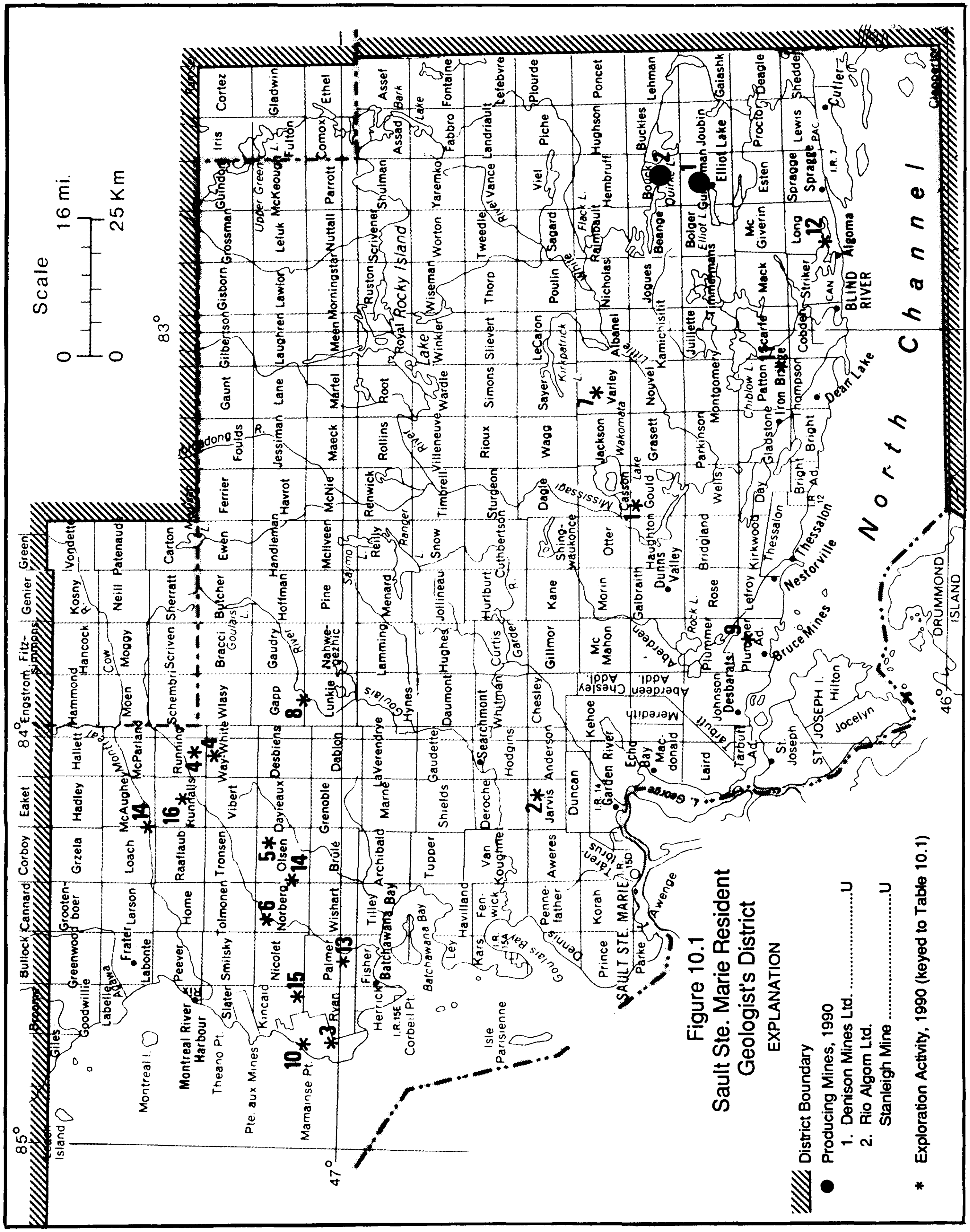

Figure 10.1
Sault Ste. Marie Resident Geologist's District

EXPLANATION

- District Boundary
- ● Producing Mines, 1990
  1. Denison Mines Ltd. ....U
  2. Rio Algom Ltd. Stanleigh Mine ....U
- * Exploration Activity, 1990 (keyed to Table 10.1)

TABLE 10.1. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure 10.1	Individual or Company	Activity
1	Blue Heaven Resources Corporation	Geophysical, geology, drilling
2	Carroll, T.	Trenching
3	Doran, F.	Stripping, sampling
4	Echo Bay Mines Ltd.	Geophysics, geology
5	Fleming–Desjardins	Prospecting, sampling, assays
6	Loydex Resources Inc.	Trenching, geology, sampling
7	Lucuik, G.	Staking
8	Noranda Exploration Company Ltd.	Geophysical, drilling
9	Ontario Trap Rock Company Ltd.	Sampling, testing
10	Paquette, J.	Trenching
11	Patrie, J.	Geophysical
12	Pelky, R.	Drilling
13	Pipoli–Shelly–Chapman	Drilling, assay
14	Placer Dome Exploration	Staking
15	Richards–Haugeneder	Trenching, sampling
16	Tri Origin Explorations Ltd.	Geophysical, geology, drilling

istry of Northern Development and Mines (MNDM) in 1990 (*see* "Ontario Geological Survey Activities").

Blue Heaven Resources Corporation

Blue Heaven Resources continued exploration work on their property which includes the Gould Copper Mine (past producer) in Gould Township. Work completed this year included very low frequency electromagnetic (VLF-EM) surveys, geological mapping, prospecting, sampling and diamond-drilling (G. & S. Babcock, personal communication 1990).

Carroll, T.

T. Carroll completed 2 trenches on his sphalerite occurrence in Jarvis Township (Mining Recorder's file, November 1990).

Doran, F.

Sault Ste. Marie prospector, F. Doran, holds 28 unsurveyed mining claims in Kincaid Township, Mamainse Point area. The claims are underlain by dark brown weathered, black to very dark grey, basaltic flows and diabase dikes of Keweenawan age. Copper mineralization occurs as disseminated blebs, stringers and coatings on fragments in shears and loose breccia-fracture zones in basalt. The minerals noted by the Resident Geologist during a visit to the property in the fall of 1990 were malachite, chalcopyrite, bornite, native copper and minor azurite. Chalcopyrite is more abundant near the north end of the deposit. Malachite and bornite is more common in the south. Quartz, calcite and laumontite (a zeolite) are gangue minerals. The mineralized zones are up to 1000 feet (300 m) long and pinch and swell in width from a few centimeters to 10 meters(according to F. Doran). They strike 000° to 020° add dip steeply (where observed). F. Doran is the recipient of an OPAP grant which allowed him to complete an impressive amount of power stripping over the mineralized area. He reports assays of channel samples of 1.79% and 4.75% Cu (F. Doran, personal communication, October 1990).

Echo Bay Mines Limited

Echo Bay Mines Limited staked 334 claims in Runnalls and Way-White townships in the Batchawana area. The company also acquired the mineral rights to 6 townships of the Algoma Central Railway. These are: Running, Desbiens, Vibert, Tronsen, Raaflaub and parts of Davieaux townships.

Echo Bay Mines Limited maintained an exploration crew of about 6 for the months of July and August. Grids were cut in Runnalls and Way–White townships. VLF-EM and total field magnetic surveys and geological mapping, scale 1:2500, were conducted over the cut lines. Geological mapping, scale 1:5000, was also completed over ungridded claims.

Fleming–Desjardins

Prospectors D. Fleming and Y. Desjardins carried out basic prospecting for gold in 1990. Work included stripping, trenching, sampling and assaying on their properties in Olsen and Palmer townships (D. Fleming, personal communication, November 1990).

Loydex Resources Inc.

Loydex Resources continued investigation of their zinc showing in Norberg Township through trenching, geological work and assaying. Assays up to 7% Zn, with some silver and gold, have been obtained. New mineralization has been detected on the east side of the Batchawana River. The property is presently under option to McChip Resources Inc. and work will continue next year (L. Nelson, personal communication, November 1990).

Lucuik, G.

G. Lucuik undertook basic prospecting for colorful ornamental stone sources and specular hematite occurrences for industrial uses. One occurrence of specular hematite was staked in Varley Township.

Noranda Exploration Company, Limited

In 1990, about 160 km of line cutting was carried out by Noranda Exploration on their projects in Gapp and Lunkie townships. Most of this line work has been surveyed by ground magnetic and electromagnetic methods. Additional work is planned. On their nearby option (with Wolverine Resources) at Hanes Lake in Gapp Township, 4 drill holes totalling 750 m were completed (R. Dahn, personal communication, November 1990).

Ontario Trap Rock Co. Ltd.

A high quarry face was developed in Plummer Additional Township in 1990 by the Ontario Trap Rock Co. The rock material (diabase) has undergone successful batch testing for specific industrial uses and plans are underway for also producing high-grade, highway-construction aggregate for both the United States and Canadian markets. Better road access to the site is presently being undertaken and hopes are high for the quarry to be operating in 1991 (H. J. Bourque, personal communication, November 1990).

Paquette, J.

J. Paquette has been trenching on his copper showing in Keweenawan-age basalts in the old McDonell Mining Location west of Ryan Township (J. Paquette, personal communication, November 1990).

Patrie, J.

J. Patrie, of Algoma Mills, holds 8 unsurveyed claims in southeast Patton Township in the Blind River area. The property is underlain by Nipissing gabbro and granophyre. Two pits on the property show pyrite and chalcopyrite mineralization in the gabbro. Mr. Patrie carried out a VLF-EM survey over the mineralized zone in 1990 (J. Patrie, personal communication, June 1990).

Pelky, R.

R. Pelky continued his investigation of a chalcopyrite showing on an island in Long Township. Two drill holes with a combined total length of 432 feet were completed. Further work is planned (J. Walmsley, personal communication, November 1990).

Pipoli–Shelly–Chapman

In 1990, the partners D. Pipoli, M. Pipoli, D. Shelly and J. Chapman conducted diamond-drilling on their 33-claim block in Palmer Township. The target was sulphide iron formation where interesting gold values had been previously obtained (N. Pipoli and D. Shelly, personal communication, November 1990).

Placer Dome Exploration

Following the release of the OGS airborne magnetic and electromagnetic maps on August 30, 1990, Placer Dome staked 45 claims in the area of Olsen and Norberg townships and another 36 claims in the area of Loach and McAughey townships. Work is being planned for these claim groups in 1991 (J. Gardiner, personal communication, November 1990).

Richards–Haugeneder

W. Richards and J. Haugeneder carried out additional trenching, sampling and assaying on their "Creek Copper" showing in Kincaid Township. They report the mineralized zone has now been delineated over a strike length of 1100 feet (350 m) and is open at both ends based on the results of trenching during 1989 and 1990 and on some previous diamond-drilling in 1964.

An old reconnaissance self-potential survey suggests that there is at least another 400 feet (130 m) of strike length to the zone. The width of the zone has been more difficult to establish due to the thickness of overburden and due to a small creek running adjacent to the zone. The old drilling, carried out only at the north end of the zone, gave "estimated true widths" of from 6 to 30 feet (2 to 10 m) over the drilled length of 250 feet (80 m).

The recent trenching to the south is indicating mineralized widths from 9 to 23 feet (3 to 7 m) but the edges are not clear. Reported assays for channel samples across parts of the trenches are: 9.54% Cu, 0.05 to 0.54 ounce Au per ton over 4.5 feet (1.4 m) and 1.77% Cu, 0.013 to 0.61 ounce Au per ton over 4.0 feet (1.2 m). A grab sample of fairly pure chalcopyrite assayed 0.09 to 1.54 ounces Ag per ton (W. Richards and J. Haugeneder, personal communication throughout 1990).

Tri Origin Exploration Limited

Tri Origin Exploration Limited staked 100 claims in Runnalls Township in the Batchawana greenstone belt in the spring of 1990. Geological mapping and induced potential surveys were completed over 2 grids. Seven diamond-drill holes totalling 1000 meters were drilled. The company plans additional work in 1991 (R. Valliant, Tri Origin Exploration Limited, personal communication, November 1990).

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The staff of the Sault Ste. Marie Resident Geologist's office consists of G. Bennett, Resident Geologist, E.J. Leahy, Staff Geologist, and B. Fremlin, Secretary. In November 1990, W. Wing was hired on contract to compile a Mineral Potential Map for the Elliot Lake area. R. Cuccullo was hired under the Experience 1990 Program and helped with general office duties during the summer.

Much of the Resident Geologist's time was divided between administrative matters and responding to public, industry and ministry enquiries. During 1990, the Resident Geologist was a member of the Mineral Resources Inventory Working Group and the Ontario Geological Map Committee. The Resident Geologist attended the Uranium Resources Assessment Group (URAG) meetings held with key mining personnel of Denison Mines Limited and Rio Algom Limited in June 1990.

Four days were spent carrying out field investigations related to the stratigraphy of the Huronian Supergroup in parts of the Elliot Lake, Thessalon, Goulais Bay and Dunns Valley areas.

The Resident Geologist made 8 visits to operating mines in the Elliot Lake area, 3 visits to active mineral occurrences and 3 visits to inactive mineral occurrences and past-producing mines. During the summer and fall of 1990, the Resident Geologist conducted 10 field trips for individuals or groups over areas of the Huronian Supergroup between Sault Ste. Marie and Elliot Lake: 3 trips were for industry consultants, 3 for geologists of the Ontario Geological Survey and 4 for university groups.

The Resident Geologist presented poster displays on aspects of Huronian stratigraphy at: the Mines and Minerals Symposium held in Timmins in February 1990 (Bennett et al. 1990); the Annual Meeting of the Institute on Lake Superior Geology held in Thunder Bay in June 1990 (Bennett et al. 1989); and the Mines and Minerals Symposium held in Toronto in December 1990. An oral presentation was also given at the Timmins Mines and Minerals Symposium.

In June 1990, the Resident Geologist submitted a tectonic map and time-space diagram for inclusion in the Geology of Ontario volume. In November, the text for sections of the Geology of Ontario volume dealing with the Lower Huronian Supergroup was submitted for editing by the Ontario Geological Survey. This completes the Resident Geologist's commitment (except for editing) to the Geology of Ontario volume.

During 1990, 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, assessment files, etc. As well, the Staff Geologist served on the Blind River–Elliot Lake Highway Steering Committee, the Bruce Mines Hazard Committee, and the Bruce Mines Simpson Shaft Tourism Committee. Time was spent to set up a display at the MNDM Open House in Timmins in February and a display for Mining Awareness Week in Sault Ste. Marie in October. Field work was very limited and confined to: monitoring mine-hazard investigating and fencing work at Bruce Mines; investigating 2 very old, previously unknown, mining pits in Plummer Additional Township; and advising the operators of a proposed industrial mineral quarrying site on culled material so as to maintain the specifications of their product.

THE SAULT STE. MARIE DRILL CORE LIBRARY

Permanent staff of the Sault Ste. Marie Drill Core Library presently includes J.R. Walmsley as Drill Core Library Geologist. D. Messenger left the position as Drill Core Library Assistant at the end of August for a position with the Mining Lands Section of the Ministry. Temporary staff included C. McKeachnie who acted as Core Library Assistant, from January to June, while D. Messenger was on a secondment to the Mining Lands section. Experience 1990 summer assistant was B. Arbour, and co-op students were A. Boreli and E. Dubois.

A survey of the indoor drill-core inventory was completed and any descrepancies with the library data base were corrected.

During 1990, core from 57 holes, making a total of 10 408 m, was collected by library staff. Core from the Sault Ste. Marie Resident Geologist's District totalled 9583 m; core from the Wawa Resident Geologist's District totalled 825 m. An additional 5000 m has been donated from the Wawa area but has not yet been retrieved due to inaccessibility and manpower problems. Similarly, in the Sault Ste. Marie District, another 730 m has yet to be recovered.

Significant contributions from the Sault Ste. Marie District include: 902 m from the Batchawana area (confidential core); 552 m by Belmoral Mines from Plummer Township;

1115 m from the Panel Mine in Elliot Lake; and 730 m by G. Konig from Gapp Township.

From the Wawa District, donations were: 300 m from McMurray Township (confidential); 23 assessment holes from the Kabinakagami Lake greenstone belt; approximately 2400 m by Cline Development from Jacobson Township (yet to be recovered); and approximately 1500 m from the Pukaskwa River area (yet to be recovered).

Visits to the core library totalled 116 for 1990. In addition to client visits, 5 school tours of the core library facility were conducted. Participants for the tours included local public schools, high school students from London, Ontario and university students from Lake Superior State University. Involvement with this years Mining Awareness Week included an open house and contribution to a display set up in a local mall by the Resident Geologist's office. Both events were well attended.

Anyone wishing to view drill core should notify the Drill Core Library in advance to ensure that core stored outside can be retrieved. Anyone wishing to donate core or requiring a copy of the core library inventory catalogue should contact the Drill Core Library or the Resident Geologist's office.

MINERAL DEPOSIT INVENTORY

The Mineral Deposit Inventory (MDI) portion of Geoscience Exploration Database (GED) is to be implemented in the Resident Geologist's office in the spring of 1991 by the Geoscience Data Center of the Ontario Geological Survey. MDI is to be a computerized map and linked data base of mineral deposits.

There have been a number of mineral deposit data bases available in the Sault Ste. Marie office although some have not been available to the public. These include: 1) STAMP (Geological Survey of Canada) mineral deposits database; 2) Mineral Deposits Inventory (MNDM), old; 3) Source Mineral Deposit Records (MNDM) containing more detailed data on many MDI records; 4) Mineral Deposit Circulars, largely out of date OGS publications; 5) Huronian Drill Hole File (Leahy, 1973) and later computerized version (MNDM and GSC); 6) Drill Core Library Drill Hole File (MNDM); and 7) Mineral Deposit (MNDM) compilation by D.G. Innes.

A project is under way to convert some of the paper-based data bases to digital format in order to plot and compare the data from these data bases using computer technology.

To date, some preliminary comparisons (on paper) have been made. The Huronian Drill Hole file has been converted to dBASE III® data file and some preliminary plots of data have been completed using DesignCad®, a low-end computer-aided design (CAD) software. Some of the STAMP data file has been converted to this format to be used in the Mineral Deposit Inventory. Work on the comparison and computerization of the Mineral Deposit data will resume in 1991.

RECENTLY ACQUIRED DATA

Two companies made donations of a substantial volume of their mining exploration data files to this office in 1990. The Staff Geologist retrieved about 53 file drawers of material pertaining to work done all across Canada from a company storage area in Michigan (company name withheld on request). With the aid of student assistants (Experience 1990 Program), R. Cucullo and B. Arbour, this material was first sorted into provincial lots. The material pertaining to Ontario was then sorted into the various Resident Geologists' districts and 59 boxes of data has been distributed amongst them to be added to their data banks. The material relating to some of the other provinces of Canada is still being processed.

The second company donating a large amount of material to us was the Algoma Central Railway (ACR). By a mutually beneficial agreement, the Staff Geologist has been given access to a storage area where the ACR keeps materials relating to mineral exploration on the Company lands, amounting to about 39 townships in area, all within the Wawa and Sault Ste. Marie Resident Geologists' districts. When this project is finished, the end result will be a more complete set of data in both offices and the ACR, along with disposing of material redundant to the Company and freeing up space for them. About 150 old, long-out-of-print, Federal and Provincial government geological reports and mineral investigations were also obtained from the ACR and have been distributed to the pertinent Resident Geologists' offices with other reports being held for the MNDM Library when it moves to Sudbury.

In addition, the smaller donations of data obtained from M. Strum of Bruce Mines and B. Johnstone of Sault Ste. Marie are acknowledged with thanks.

The worth of spending the time in obtaining and processing donated data is unquestionable. Just within the summer of 1990, 1 large exploration company was able to use a map donated in the above material showing the locations of 12 drill-hole sites for which they had drill logs but no hole locations. Another local prospector staked a mineral showing for which we had data but no location until we obtained the above donated files. In 1 of the donations, there was an old newspaper called *The Canadian Mining Reporter* that no one we contacted knew anything about. K. Fenwick, Mineral Resources Manager of Thunder Bay and N. Thurston of the Ontario Geological Survey Mines Library have followed through on this lead to discover that about 25 volumes of this newspaper still exist in certain libraries in the United States. We are hoping that copies of this material can be made available to add to the data base of the province.

HAZARD LANDS AT BRUCE MINES

At the town of Bruce Mines, the Staff Geologist has again been involved with abandoned mine hazard work, the town's official plan, and the town's tourism project. The fencing of mine hazards started last December, was finished early in the year, and then was inspected by S. Koscevic, District Mining Engineer with the Ministry of Labour, accompanied by R. Orton of the Ministry of Natural Resources and the Staff Geologist. Some places needed further work due mainly to the additional problems encountered when trying to do fencing over rough terrain when snow cover is deep.

The consulting firm of Golder Associates Ltd. carried out geophysical work and drilling at several of the still-questionable sites at Bruce Mines in the fall of 1990. The Staff Geologist visited the work sites on 3 occasions and has been supplying information to the consultant as requested. It is hoped that any further necessary remedial work will be done in 1991.

The official plan for Bruce Mines has been drafted and is now under review by the appropriate agencies. This incorporates the finalized version of the areas classified as "mine hazard" prepared by the Staff Geologist.

In January of 1990, the Staff Geologist gave a presentation on the historical development of the original Bruce Mines (1846-1876) at the annual supper meeting of the Bruce Mines Chamber of Commerce and again later in the year at a combined meeting of residents from the town of Bruce Mines and Plummer Township.

ELLIOT LAKE DATA COMPILATION

In November of 1990, W. Wing was hired to initiate a project to construct a mineral potential map of the Elliot Lake area. The areas to be included in the map are the 89 townships designated for special assistance under the Ontario Mineral Incentive Program (OMIP), approximately from the north shore of Lake Huron to lat. 46°50'N, long. 82°05' to 83°40' W. The base map will be computer generated with linked computerized data files, using the procedures developed in the Wawa Resident Geologist's office. The following map layers have been tentatively assigned: 1) topographic and cultural features; 2) mines and mineral occurrences; 3) rock types; 4) geological structures; 5) mine tailings areas; 6) underground workings; 7) access roads; 8) environmentally-sensitive sites; 9) land status; 10) geophysical and geochemical anomalies; and 11) surficial deposits.

By March 31, 1991, sufficient data will be compiled to allow construction of a mineral potential map.

ONTARIO PROSPECTORS ASSISTANCE PROGRAM

The Staff Geologist spent a considerable amount of time on tasks relating to the Ontario Prospectors Assistance Program (OPAP), including making possible candidates aware of the program, answering questions about it, reviewing applications and projects for grants and reviewing final reports before submission. For the 1990–91 program, the Staff Geologist reviewed 20 applications before submission to the Incentives Office and has reviewed 6 final submissions for projects already completed for this year. At least 23 local prospectors have worked on projects within the Sault Ste. Marie Resident Geologist's District in 1990 using OPAP grants.

In November 1990, 4 of these prospectors held a panel discussion at the meeting of the Sault Ste. Marie Prospector's Association explaining the amount of funding for which they had applied, that which they received, and how the funds were used to accomplish their exploration programs. All 4 had been able to entice mining company personnel to visit their properties, and stated that they would not have been able to do the work without the OPAP financial assistance. Two other local prospectors, in partnership, used their OPAP grant to facilitate deep bulldozer trenching to be followed by a proposed diamond-drilling program. The trenching was successful in extending a known zone of copper mineralization some 50 feet. The staff of the Resident Geologist's office advised them to forgo the planned drilling in lieu of using the remaining funds to do further trenching, and thus attempt to extend the zone farther if possible. The OPAP office concurred with this change of plan and so additional trenching was completed which extended the mineralized zone for another 500 feet. This length, along with assays obtained, has resulted in a pending option agreement. Subsequently, the Ontario Geological Survey airborne geophysical maps of the Batchawana greenstone belt were released and illustrated an interesting electromagnetic anomaly at the other end of the original showing. The partners quickly staked the anomaly and this may be the subject of a second option.

In September 1990, R. Huggins of the Incentives Office, which administers OPAP, made a presentation to the local prospectors group followed by a question and answer session. The response to the OPAP idea has been very favorable in our district. The biggest concerns are the lateness in the season before grant approval is known and also the timing of the advance portion of the grant received.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

During the summer of 1990, L.S. Jensen of the Precambrian Section, Ontario Geological Survey, carried out geological mapping of the Whiskey Lake greenstone belt at a scale of 1:20 000. The area covers parts of Joubin, Gaiashk, Cadeau, Gerow, Proctor and Daigle townships. Special attention was placed on Archean volcanic rocks and the Archean–Huronian contact.

M. Byron conducted sampling and field studies as the initial phase of a study of the lithogeochemistry of Archean rocks of the Whiskey Lake greenstone belt. The area of this study is approximately the same as that of Jensen (above). This project was funded by a grant from the Ministry of Northern Development and Mines as part of the Ontario Government's Elliot Lake Initiative.

Descriptions of these projects and preliminary results of the field investigations can be found in Jensen(1990), and Byron and Whitehead(1990).

On August 30, 1990, the Geophysics and Geochemistry Branch of the Ontario Geological Survey, Ministry of Northern Development and Mines, released the results of an airborne electromagnetic and magnetic survey of the Batchawana greenstone belt about 80 km north of Sault Ste. Marie. The area covered is that bounded by approximately lat. 46°55' to 47°20'N, long. 83°30' to 84°40'W. The data were released on Maps 81-434 to 81-459 (26 maps), scale 1:20 000. The instrumentation used was an Aerodat, multifrequency, multicoil, electomagnetic system and a Aerodat/Scintrex high sensitivity, optically pumped, caesium magnetometer. The maps are available from the Mining Recorder, Sault Ste. Marie and the Public Information Center, Ministry of Natural Resources, room 1640, Whitney Block, Queen's Park, Toronto.

SUGGESTIONS TO PROSPECTORS

Although many prospectors and industry geologists tell us that good option deals are harder to come by in the post flow-through era, there is one sector which seems to be becoming more active in recent years: that is ornamental stone. We have had recent requests, from both Canadian and U.S. producers, for coloured stone for decorative architectural use.

One of the factors which influences the value of such stone is colour. Almost any bright, strong colour, including "snow white", may have a market. Uniformity of colour, tonnage available, transportation costs, quarrying costs, environmental factors, and deleterious minerals have to be considered as well.

Prospectors should keep the above in mind as they carry on searching for gold or base metals. That vein of snow white bull quartz (without a trace of sulfides) may deserve another look.

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11. Timmins Resident Geologist's District—1990

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[6]Drill Core Library Geologist, Timmins Drill Core Library, Northeastern Region.

INTRODUCTION

In 1990 the Timmins Resident Geologist's District experienced yet another precipitous drop in exploration and development activity. The number of companies actively exploring in the area decreased by 50% from 1989 to 1990.

A study completed for Northeastern Region in 1989 showed a similar 48% drop in exploration expenditures from 1988 to 1989. The low price of gold and no indication of a rise in the price of that metal, the changes to flow-through funding, the cancellation of the Canadian Exploration Incentive Program (CEIP), and a general lack of interest in speculative mining ventures have all been cited as reasons for the continued decline of exploration and development.

Although sustained high base-metal prices led to active base-metal exploration, these programs were dominated by a few major mining companies.

In 1990, there were 13 active mining operations in the Timmins Resident Geologist's District (3 base-metal mines; 6 underground gold mines; 2 open pit gold mines and 2 open pit industrial mineral producers). There were 2 active advanced underground exploration and development projects as compared to 6 in 1989. One new mine, the Langmuir No. 1 zone, was brought into production by Timmins Nickel Inc.

The year saw mining operations plagued by layoffs and labour disputes. Significant staff reductions occurred at the Dome Mine, at the Detour Lake Mine and at the Giant Yellowknife Mines Limited operations.

On a more positive note, prospectors and developers in the District made good use of funding supplied under Ontario Prospectors Assistance Program (OPAP) and Ontario Mineral Incentive Program (OMIP) and this served to partially alleviate the decline in exploration activity. Some technical successes achieved by prospectors who obtained financial assistance from OPAP resulted in the optioning of newly found mineral showings to major companies.

CLAIM STAKING ACTIVITY

From January 1 to November 1, 1990, there were 3 199 claims recorded in the Porcupine Mining Division. During the same period last year, 3901 claims were recorded. This represents a net reduction of 17.9%, indicating the continuation of a three-year decline in staking activity. The rate of reduction, however, is somewhat less than in 1989 and 1988 (33.6% and 33.5%, respectively), and notably less than in 1987, when staking dropped by 48.9% from the previous year (Table 11.1).

Areas of highest interest evidenced by intensive staking are as follows:

1) Over 40% (1312 claims) of recorded staking occurred within a 30-mile (50 km) radius of Timmins.

2) Just under 20% (625 claims) of recorded staking took place within the Swayze Greenstone Belt, due in part to renewed interest in base metal potential in Cunningham Township, and also as a result of the publication in early October of OGS map 81387, Airborne Electromagnetic Survey and Total Intensity Magnetic Survey, North Swayze–Montcalm area.

3) Just over 13% (419 claims) of recorded staking occurred in the relatively unexplored Limestone Rapids Area, thought to be underlain by small, discrete greenstone lenses.

4) Just over 8% (259 claims) were staked in the Atkinson Lake–West of Sunday Lake Areas (Detour Lake Area).

5) Approximately 6% of recordings (188 claims) were staked in Belford, Montcalm, Nova, Strachan and Watson townships, where interest was kindled by the release in early October of OGS Map 81387, Airborne Electromagnetic Survey and Total Intensity Magnetic Survey, North Swayze–Montcalm area.

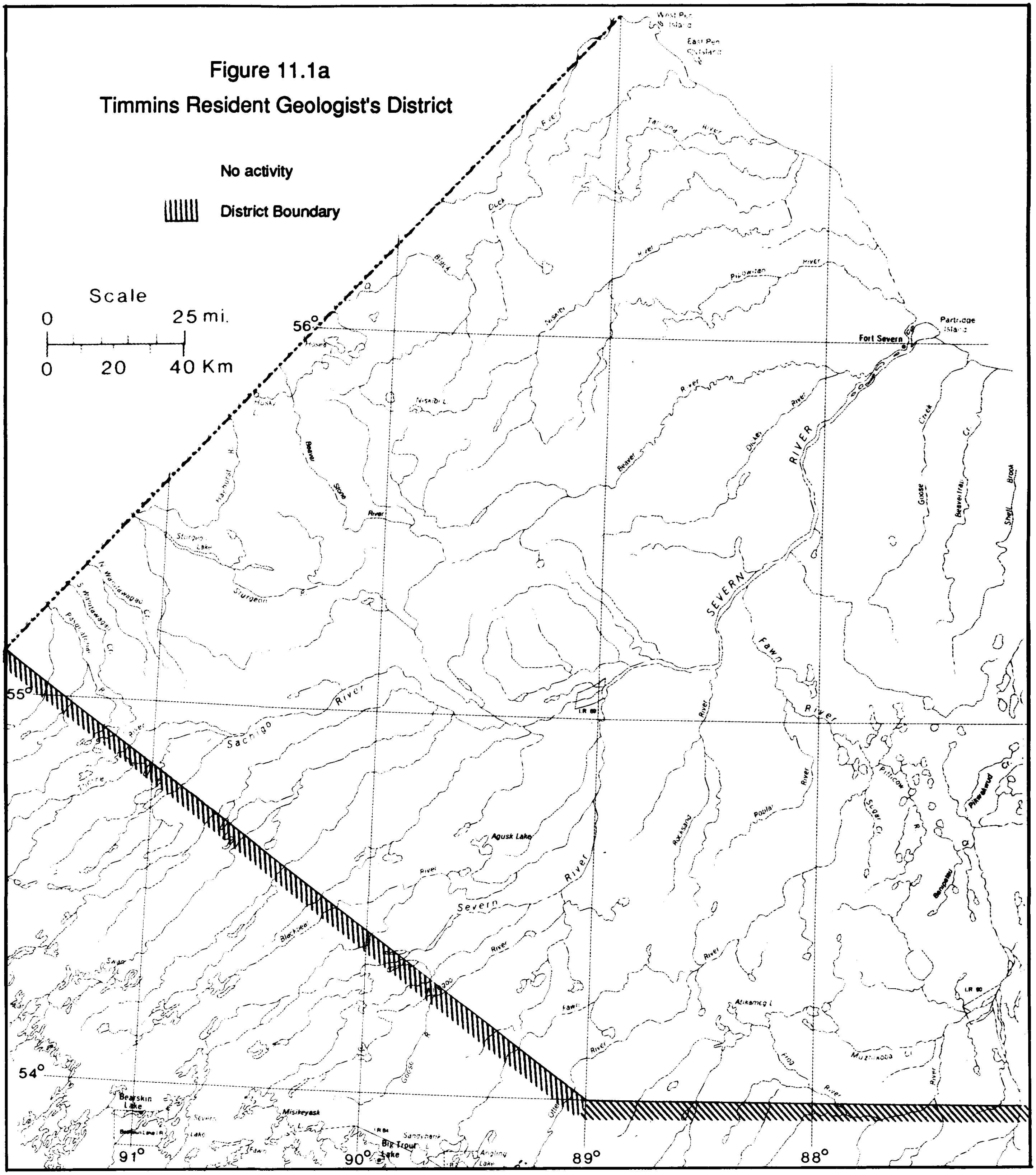
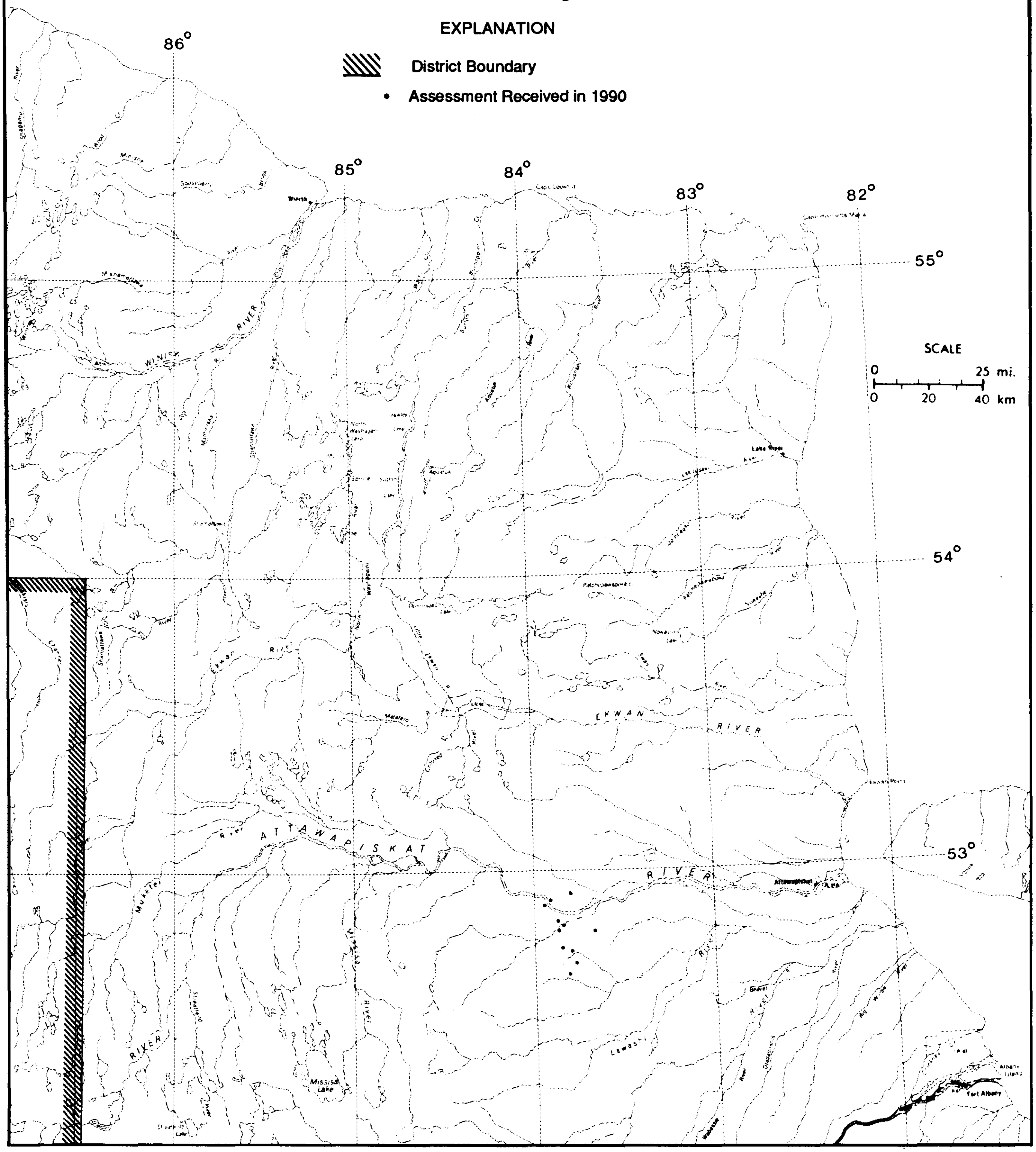


Figure 11.1a
Timmins Resident Geologist's District
No activity
District Boundary
Scale
0
25 mi.
0
20
40 Km
56°
55°
54°
91°
90°
89°
88°
Fort Severn
SEVERN RIVER
Sachigo
Severn
Agusk Lake
Bearskin Lake
Big Trout Lake
Misikeyask

Figure 11.1b
Timmins Resident Geologist's District



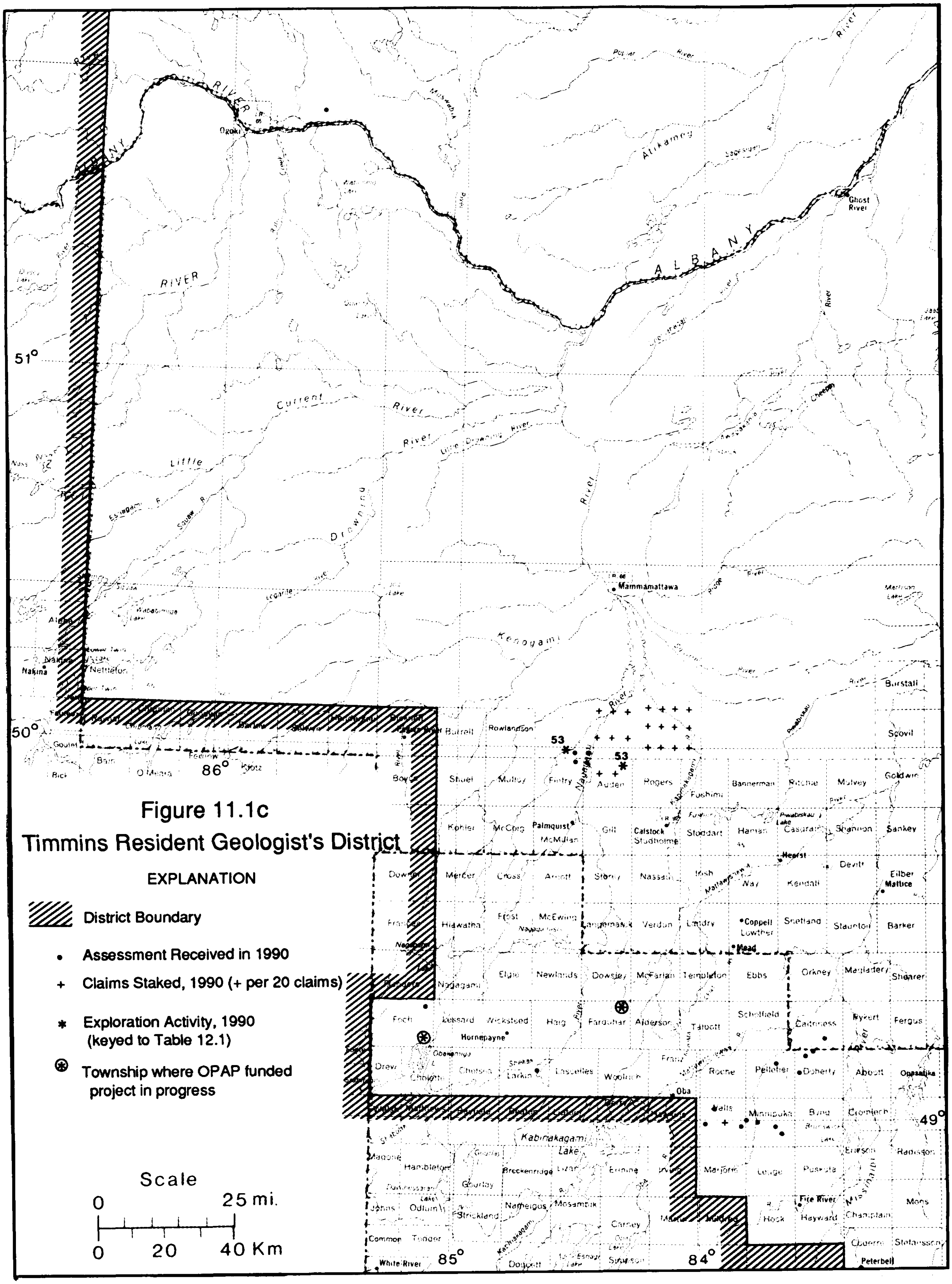


Figure 11.1c
Timmins Resident Geologist's District
EXPLANATION
District Boundary
Assessment Received in 1990
Claims Staked, 1990 (+ per 20 claims)
Exploration Activity, 1990 (keyed to Table 12.1)
Township where OPAP funded project in progress
Scale
0 25 mi.
0 20 40 Km
ALBANY RIVER
Ogoki
Ghost River
Current River
Little Current River
Drowning
Kenogami
Mammamattawa
Nakina
Nettleton
Hornepayne
Oba
Hearst
Mattice
Calstock
Palmquist
Coppell
Mead
Kabinakagami Lake
Fire River
Peterbell
White River
Burstall
Scovil
51°
50°
49°
86°
85°
84°
53

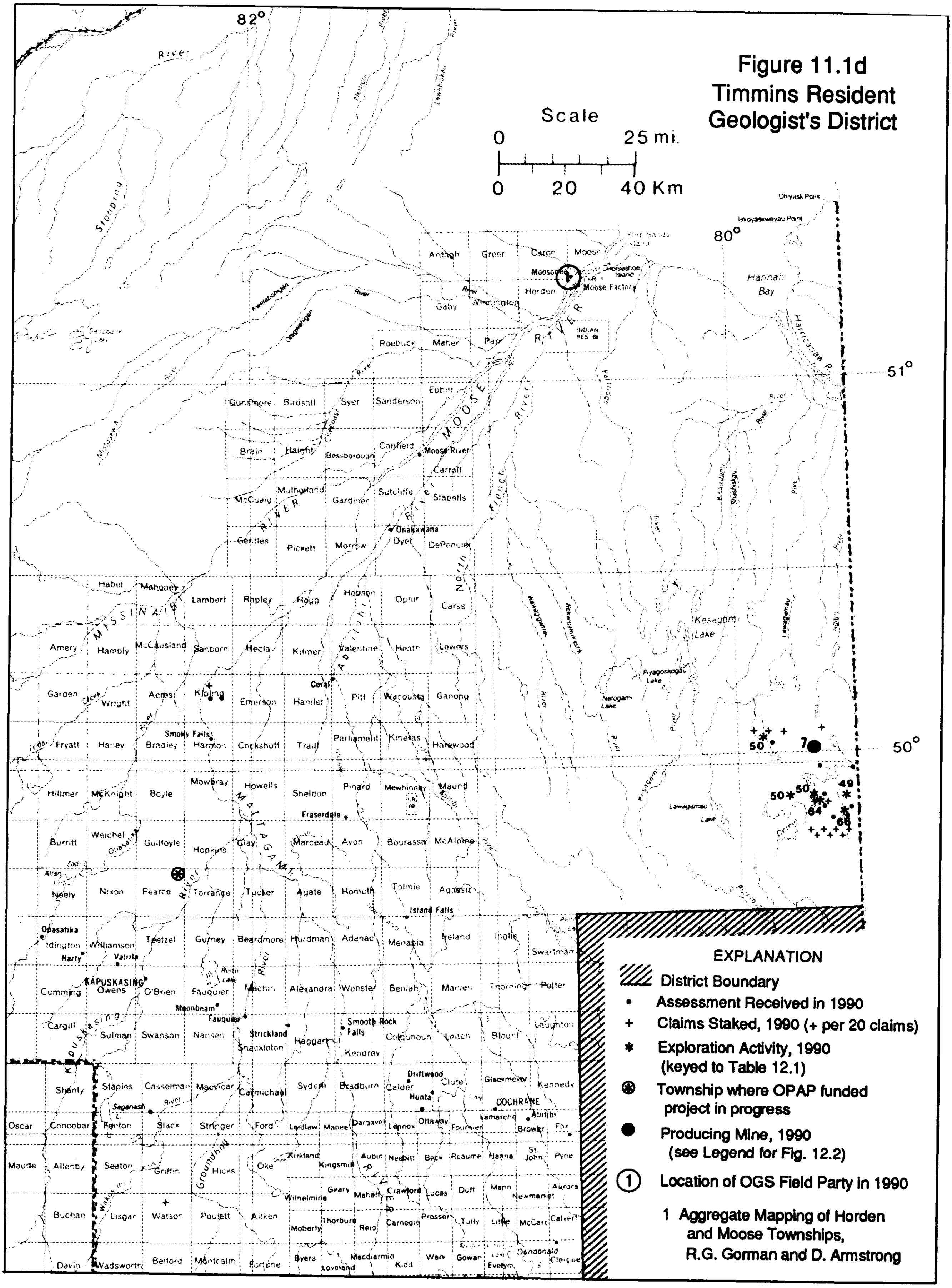
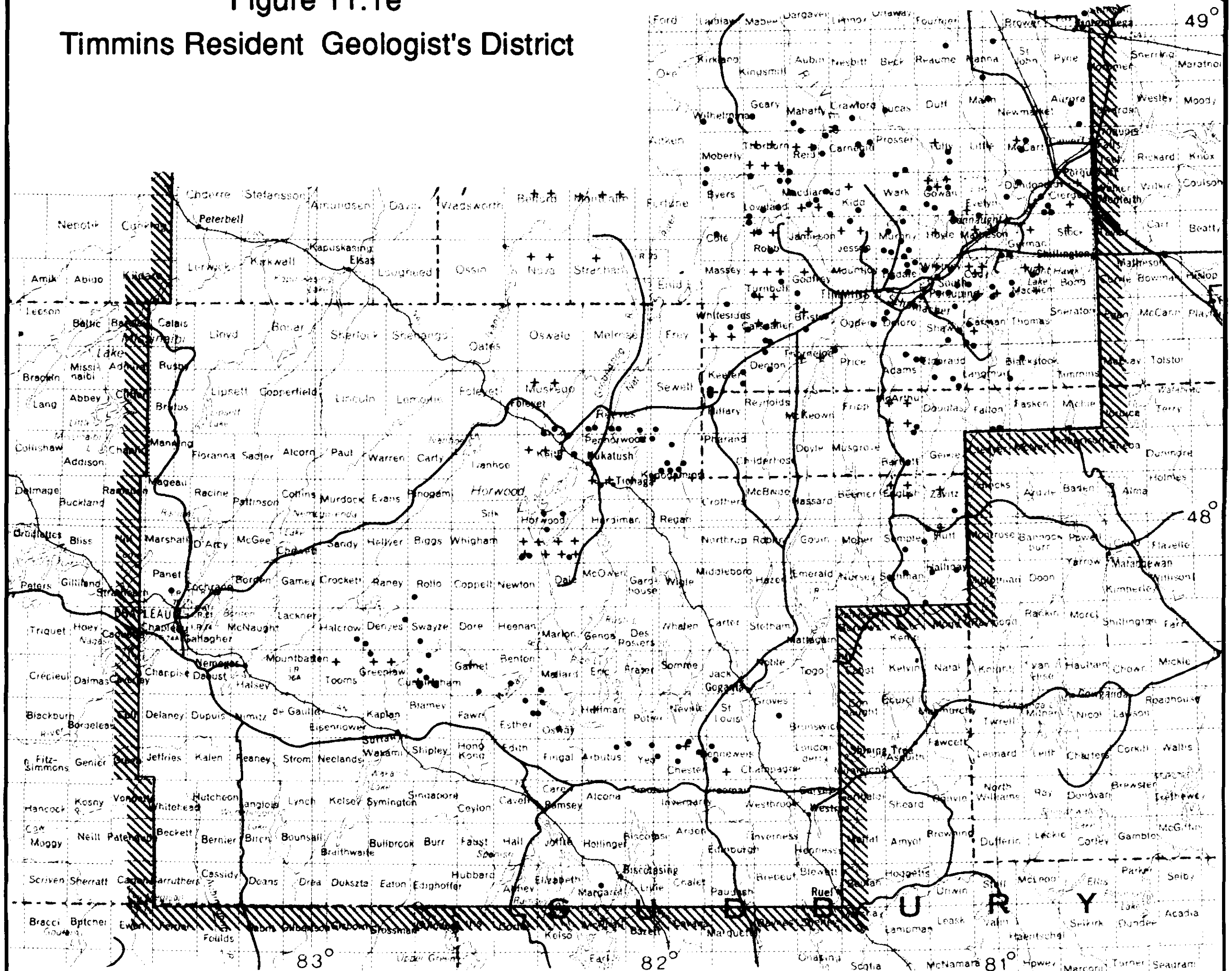


Figure 11.1d Timmins Resident Geologist's District

Figure 11.1e
Timmins Resident Geologist's District



EXPLANATION

- District Boundary
- • Assessment Received in 1990
- \+ Claims Staked, 1990 (+ per 20 claims)

Scale

0 25 mi.

0 20 40 Km

TABLE 11.1. EXPLORATION ACTIVY DURING THE YEAR.

Number on Figure	Individual or Company	Location and Activity
1	Anglo Canadian/Kenora Gold	Matheson--diamond drilling
2	Asarco Exploration Co.	Horwood--geological, geochemical and geophysical surveys Whitney, Thorneloe--magnetic and electromagnetic surveys Tisdale--diamond drilling and stripping
3	BHP Utah Mines Ltd.	Hutt--geological, magnetic and horizontal loop electromagnetic surveys Whitney, English--diamond drilling McArthur--magnetic, induced polarization, very low frequency and horizontal loop electromagnetic surveys
4	BP Canada Inc.	Keith, Muskego, Reeves--diamond drilling
5	Blue Falcon Mines/Goldbar Res.	Benneweis, Champagne, Chester, Mallard, Yeo--airborne magnetic and electromagnetic surveys
6	J. Boissoneault and G. Boissoneault	Matheson--diamond drilling, stripping, sampling
7	G.S.W. Bruce	English--sampling and geological surveys
8	M. Burton	Esther--sampling and manual work
9	M. Caron	Turnbull--magnetic and horizontal loop electromagnetic surveys
10	Y. Collin, J. Grant and K. Lapierre	Deloro--stripping, trenching, sampling and geological surveys
11	Chesbar Resources/Murgold Resources	Chester--diamond drilling
12	Chevron Canada	Ogden, Price--diamond drilling
13	D. Clermont	Dundonald--airborne magnetic and very low frequency electromagnetic surveys
14	D. Collin	Nesbitt--overburden drilling
15	Cominco Ltd.	Cunningham, Gowan, Prosser, Wark, Geary, Mahaffy--magnetic, horizontal loop electromagnetic and UTEM surveys
16	Comstate Resources	Price, Reid--diamond drilling and electromagnetic survey Hanna--geological survey
17	R. Dumont	Whitesides, Massey--magnetic and very low frequency electromagnetic survey
18	Falconbridge Gold Corp.	Hoyle, Matheson--diamond drilling
19	Falconbridge Ltd.	Kenogaming, Sothman, Godfrey, Mahaffy--linecutting, geological and geophysical surveys Clergue, Dundonald, Carman, Gowan, Halliday--magnetic and horizontal loop electromagnetic surveys Robb--diamond drilling, magnetic and horizontal loop electromagnetic surveys Semple, Hutt--stripping
20	G. Founier	Eldorado--magnetic and horizontal loop electromagnetic surveys
21	R. Garceau	Nesbitt--overburden drilling
22	W. Gasteiger	Godfrey--very low frequency electromagnetic survey
23	W. Gasteiger et al	Murphy--linecutting, geological, geochemical, magnetic, horizontal loop and very low frequency electromagnetic and induced polarization surveys
24	H. Gonzalez	Whitney--magnetic and horizontal loop electromagnetic surveys
25	Granges Inc.	Eldorado--overburden drilling, diamond drilling, assays Bond--diamond drilling
26	C. Hanninen	Tully--magnetic and horizontal loop electromagnetic surveys
27	L. Hill	Mann--sampling
28	D. Jones	Fox--magnetic and horizontal loop electromagnetic surveys
29	W. Karvinen	Denton--overburden drilling
30	T. Kioki	Shaw--magnetic and very low frequency electromagnetic surveys
31	Kirkton Resources	Cunningham--stripping, trenching, geological, geochemical and geophysical surveys
32	J. Landers	Horwood--stripping, trenching, sampling
33	L. Larche and V. Larche	Kenogaming--magnetic and horizontal loop electromagnetic surveys
34	Lucky Eagle Mines Ltd.	Reid, Mahaffy--diamond drilling
35	D. Meunier	Loveland--geological survey
36	Mingold Resources Inc.	Garnet, Keefer--diamond drilling
37	Moneta Porcupine Mines Inc.	Murphy, Tisdale--linecutting, diamond drilling, magnetic, very low frequency and horizontal loop electromagnetic and induced polarization surveys Whitney--magnetic and very low frequency electromagnetic surveys
38	E. Mord	Macklem--magnetic and very low frequency electromagnetic surveys

TABLE 11.1 CONTINUED.

Number on Figure	Individual or Company	Location and Activity
39	C. Morin	Kenogaming--mechanical work
40	C. Mortimer and V. Noseworthy	Swayze--magnetic survey Horwood--diamond drilling, sampling, magnetic and very low frequency electromagnetic survey
41	D. Morin	Kenogaming--stripping
42	D. Mullen	Hutt--geological and very low frequency electromagnetic surveys
43	L. Naveau	Moher--linecutting, trenching and geological survey
44	J. Newsome	McCart--magnetic and electromagnetic surveys
45	New Texmont Explorations	Tully--diamond drilling
46	Noranda Exploration	Aurora--magnetic and horizontal loop electromagnetic surveys German--very low frequency electromagnetic survey Ogden, Cody--diamond drilling Loveland, Carscallen, Thorburn, Enid--diamond drilling and geophysical surveys
47	Northgate Exploration Ltd.	Macdiarmid--diamond drilling and UTEM survey
48	Pamorex	Macklem, Cody, Whitney, Tisdale--stripping, sampling and diamond drilling
49	Pelangio Larder	Detour Lake Area--diamond drilling
50	Placer Dome Inc.	Hopper Lake Area--linecutting, geological survey West of Sunday Lake, Lower Detour Lake Areas--linecutting, sampling and geological survey
51	K. Pye	Eldorado--magnetic and very low frequency electromagnetic surveys
52	Rio Algom Exploration Inc.	Mabee, Dargavel, Crawford, Lucas--overburden drilling, diamond drilling, magnetic and horizontal loop electromagnetic surveys
53	C. Robert, J. Robert and R. Salo	Auden, Fintry, Feagan River, Pitopiko River--magnetic and very low frequency electromagnetic surveys
54	Roseval Silica	Penhorwood--stripping, geological and electromagnetic surveys
55	Ross/Morin/Denommee Partnership	Penhorwood, Horwood, Rollo, Kenogaming--stripping, trenching, sampling and geological survey
56	A. Salo	Hoyle, Matheson, Evelyn--geological and geophysical surveys Wark--airborne magnetic and electromagnetic surveys
57	J. Salo	Michie--assaying, magnetic and very low frequency electromagnetic surveys
58	L. Salo	Tully--magnetic and very low frequency electromagnetic surveys
59	W. Sims	Keefer, Hillary--magnetic and electromagnetic surveys
60	Silver Butte Resources	Osway--geological survey
61	Skead Holdings	Mann--geological survey
62	R. Smerritt	Moberly--manual work
63	H.H. Sutherland	Whitney--electromagnetic surveys
64	Teck Corporation	Cunningham--diamond drilling
65	Timmins Nickel Inc.	Groves--diamond drilling, geophysical surveys Kenogaming--(see #55) sampling, geological and magnetic surveys
66	Total Energold Corp.	Atkinson Lake--geophysical surveys
67	Vannin Exploration Inc.	Swayze--stripping, trenching, diamond drilling, geophysical surveys
68	Young Shannon Gold Mines	Chester--diamond drilling
69	Westmin	Lower Detour Lake Area--overburden drilling, magnetic and horizontal loop electromagnetic surveys Atkinson Lake Area--magnetic and horizontal loop electromagnetic surveys

INCENTIVES PROGRAMS

ONTARIO PROSPECTORS ASSISTANCE PROGRAM (OPAP) AND ONTARIO MINERAL INCENTIVE PROGRAM (OMIP)

In October 1989, the Ministry of Northern Development and Mines announced 2 new incentives programs. By providing part of the risk capital to individuals and to junior mining companies these programs are designed to promote prospecting and the discovery of mineral deposits.

Ontario Prospectors Assistance Program (OPAP)

In the Timmins Resident Geologist's District 65 applications were designated to receive OPAP funding in 1990. This represents a total figure of $622 909 awarded. Forty-one of the programs were for gold exploration with remaining twenty-four being base metal programs. Under the regulations for OPAP, results of work done in 1990 under the program will be released to the Assessment File Research Office after April 1, 1990.

Ontario Mineral Incentive Program (OMIP)

In 1990, the regulations governing OMIP were amended to increase the scope of the program to partially fill the gap left by the discontinuation of the federal government's Canadian Exploration Incentive Program (CEIP).

The maximum grant level was changed from $150 000 to $300 000 per applicant per year. Flow-through programs and projects by producers are now eligible for funding. Further amendments include allowing 100% of surface exploration diamond drilling, limited underground expenses, industrial minerals laboratory and pilot plant studies and marketing studies and environmental studies.

In the Timmins Resident Geologist's District, 14 programs were designated to receive assistance under OMIP. This represents a total expenditure figure of $1 980 120 and a total grant awarded of $595 836.

MINING ACTIVITY—OPERATING MINES 1990

BASE METALS

Falconbridge Limited, Kidd Creek Mine

Although complete figures were not available at the time of writing, estimated production from the Kidd Creek Mine in Kidd Township to the end of 1990 was 3.7 million tonnes from the No. 1 and No. 2 mines. This compares to 4.1 million tonnes produced in 1989. The ore body at Kidd Creek is diminishing in width with increasing depth and consequently the mine output is falling slightly. Estimated grades for the 1990 production were 3.23% Cu, 4.85% Zn and 56 g/t Ag. Approximately 75% of the production came from the No. 1 Mine. The bottom level of the mine is 2500 feet below surface and 15 to 20 long hole stopes are in production concurrently. At the No. 1 mine the bulk of the ore came from between the 1600-foot level and the 2500-foot level. The No. 2 Mine supplied 25% of the production. the bottom level here is 4600 feet below surface and most of the mining was done between the 3200-foot and 4600-foot levels with 4 stopes being in production at one time.

Projected lateral development at the No. 1 Mine totalled 3260 m and vertical development totalled 2540 m. At the No. 2 Mine projected lateral development totalled 2820 m and vertical development totalled 2340 m.

An estimated total of 23 000 m of diamond drilling was done in 1990 at Kidd Creek. Seven thousand m in 25 holes of underground exploratory drilling was done mostly from the 4600 foot level, drilling down to 7000 feet below surface to define the known orebody at depth and to explore for further zones. Underground delineation drilling totalled 5500 m. These drill holes averaged 150 m in length. Surface exploratory drilling totalled 10 438 m in 9 holes. These were deep holes done by directional drilling from 3 set-ups, that is, three holes were drilled with other holes collared 500 to 600 m down the original holes. The drilling was done along a favourable stratigraphic horizon; however, no significant mineralization was intersected.

In 1990 underground development began at the No. 3 Mine with the collaring of an internal shaft collar at the 4600-foot level and 230 m of shaft sinking completed. The shaft is to be sunk to a depth of 6922 feet below surface. Also at the No. 3 Mine, 2433 m of ramp development was completed, mostly between 4800 and 4900 feet below surface. Ore production from the No. 3 mine is scheduled to begin in 1992 with the mining of 60 000 tonnes of ore.

Published ore reserves at the Kidd Creek Mine as of December 1989, were 44.6 million t grading 3.53% Cu, 5.08% Zn, 0.16% Pb and 67 g/t Ag.

A total of 2420 people were employed at the Kidd Creek operations in 1990. (Falconbridge Limited, personal communication, 1990; Falconbridge Limited, Annual Report, 1989).

Timmins Nickel Inc.–BHP–Utah Mines Ltd., Redstone Joint Venture

Final figures were not available at the time of writing; however, it was estimated that nickel production for 1990 at the Redstone Mine in Eldorado Township would be 4 062 080 pounds from 90 000 tons milled with an average grade of 2.56% Ni. Mill recovery was 88%. Average concentrate grade was 16.25% Ni. Mine production was 97 000 tons of ore. Except for 6800 tons of ore, which was trucked directly to Falconbridge Limited's Strathcona mill, the ore was trucked to and custom milled at Giant Yellowknife's GOMILL in Schumacher and the concentrate was shipped by rail to Sherritt Gordon Limited's refinery in Fort Saskatchewan, Alberta. Development began at the mine in January 1989, and the first concentrate was shipped in May 1989.

Due to a sudden drop in nickel prices, the number of employees was reduced by 33% at the end of January 1990, and development was curtailed in order to cut costs until May when nickel prices improved. Full production resumed in May and by July 1990, mining costs were significantly reduced.

Mine production came from 14 stopes located on the 150-, 270-, 340-, 410- and 500-foot levels. Access is via a decline ramp from surface. At the end of 1990, drifting was taking place on the 500-foot level and ore was intersected by devel-

TABLE 11.2. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days.
1990	4,864	10,431	19,472	130,847	112,881	20,638	313,533
1989	4,724	12,347	24,715	172,600	218,347	46,227	522,490
1988	5,867	6,117	34,553	119,758	325,685	17,260	532,820
1987	8,934	4,402	34,474	120,384	612,631	32,001	807,277
1986	17,889	8,689	33,181	129,932	481,547	26,266	717,522
1985	6,052	10,024	23,207	131,330	278,881	34,032	503,338
1984	7,633	11,040	27,179	140,864	495,323	51,723	738,038
1983	11,859	4,967	30,586	128,126	199,892	44,755	407,161
1982	5,420	6,457	23,694	91,203	359,970	36,178	596,097
1981	8,934	2,934	24,731	114,823	261,301	23,177	471,827
1980	10,742	1,778	18,753	59,993	212,208	5,246	296,852
1979	3,975	2,504	9,597	40,850	59,605	5,480	151,003
1978	3,623	4,429	8,126	38,056	47,333	1,880	94,045
1977	2,438	4,336	8,932	77,496	135,134	3,755	228,090
1976	5,837	3,621	10,830	25,819	43,920	2,140	97,258
1975	4,162	4,142	8,614	83,388	108,420	1,300	200,034
1974	3,456	3,692	7,594	69,341	52,128	3,146	142,136
1973	2,258	3,728	6,460	58,495	50,022	2,500	114,917
1972	2,980	3,509	7,939	55,900	89,560	(1,400)	149,387
1971	3,840	3,708	(8,500)	52,401	131,385	1,050	195,457
1970	3,903	3,916	(8,600)	96,946	59,013	5,560	167,465
1969	3,482	3,687	(8,700)	86,397	53,497	1,188	143,303
1968	3,935	4,906	(9,000)	42,575	26,656	2,852	74,580
1967	2,944	8,356	(9,800)	79,634	32,220	871	117,299
1966	5,724	10,352	(15,250)	151,747	65,577	(5,000)	227,732
1965	47,900	9,922	(19,000)	242,869	224,959	(6,500)	486,246
1964	20,823	931	(25,000)	48,095	93,863	(1,000)	146,633
1963	1,971	1,326	(5,250)	34,328	2,348	(200)	40,370
1962	1,440	1,425	(4,500)	(19,000)	(10,000)	(3,200)	(35,000)
1961	1,443	1,578	(4,500)	(20,000)	(8,000)	(500)	(30,000)
1960	1,321	2,296	(4,750)	(21,000)	(9,000)	(1,400)	(39,000)
1959	2,247	1,803	(5,600)	(20,000)	(5,000)	(300)	(30,000)
1958	1,451	2,147	(5,280)	(17,000)	(4,000)	(3,000)	(30,000)
1957	2,456	2,440	(5,800)	(18,000)	(2,000)	(400)	(25,000)
1956	1,536	958	(5,800)	(25,000)	(10,000)	(4,500)	(45,000)
1955	1,793	757	(5,250)	(4,000)	(3,000)	(1,500)	(10,000)

Brackets indicate approximate figures.

opment on the 600-foot elevation, the present bottom of the ramp.

Proven and probable ore reserves (fully diluted) as of September 1, 1990 were calculated to be 394 765 tons grading 2.48% Ni down to 1050 feet below surface.

Underground diamond drilling for ore delineation purposes totalled 5296 feet in 49 holes. Surface drilling for 1990 totalled 756 feet and completed a 30 000-foot program which began in 1989.

At the end of 1990, there were 59 people employed at the Redstone Joint Venture. (Timmins Nickel Inc., personal communication, 1990; personal observation, 1990).

Timmins Nickel Inc., Langmuir No. 1 Deposit

Dewatering of the ramp on the Langmuir No. 1 nickel deposit began in August 1990. This ramp was driven to 185 feet below surface by the previous operator Noranda Mines Limited in the late 1970s. The ramp was extended by Timmins Nickel Inc. to the 250-foot level where drifting and raising took place on three zones.

At the end of 1990, subdrifting was taking place on the 200-foot level and the ramp was being driven to 315 feet below surface. Nine underground diamond-drill holes were completed before development began and 10 more were drilled for a total of 4652 feet.

At the time of writing, 1260 tons of development ore grading 1.83% Ni had been milled at the GOMILL in Schumacher. Longhole stoping began in December and the 1990 production was an estimated 15 000 tons at a similar grade.

Ore reserves at the Langmuir No. 1 deposit are estimated to be 187 000 tons at a grade of 1.86% Ni. It is expected that the deposit will be mined out by the end of 1991. A total of 10 to 15 people are employed at the deposit with additional support provided by the Redstone Joint Venture Mine (Timmins Nickel Inc., personal communication, 1990).

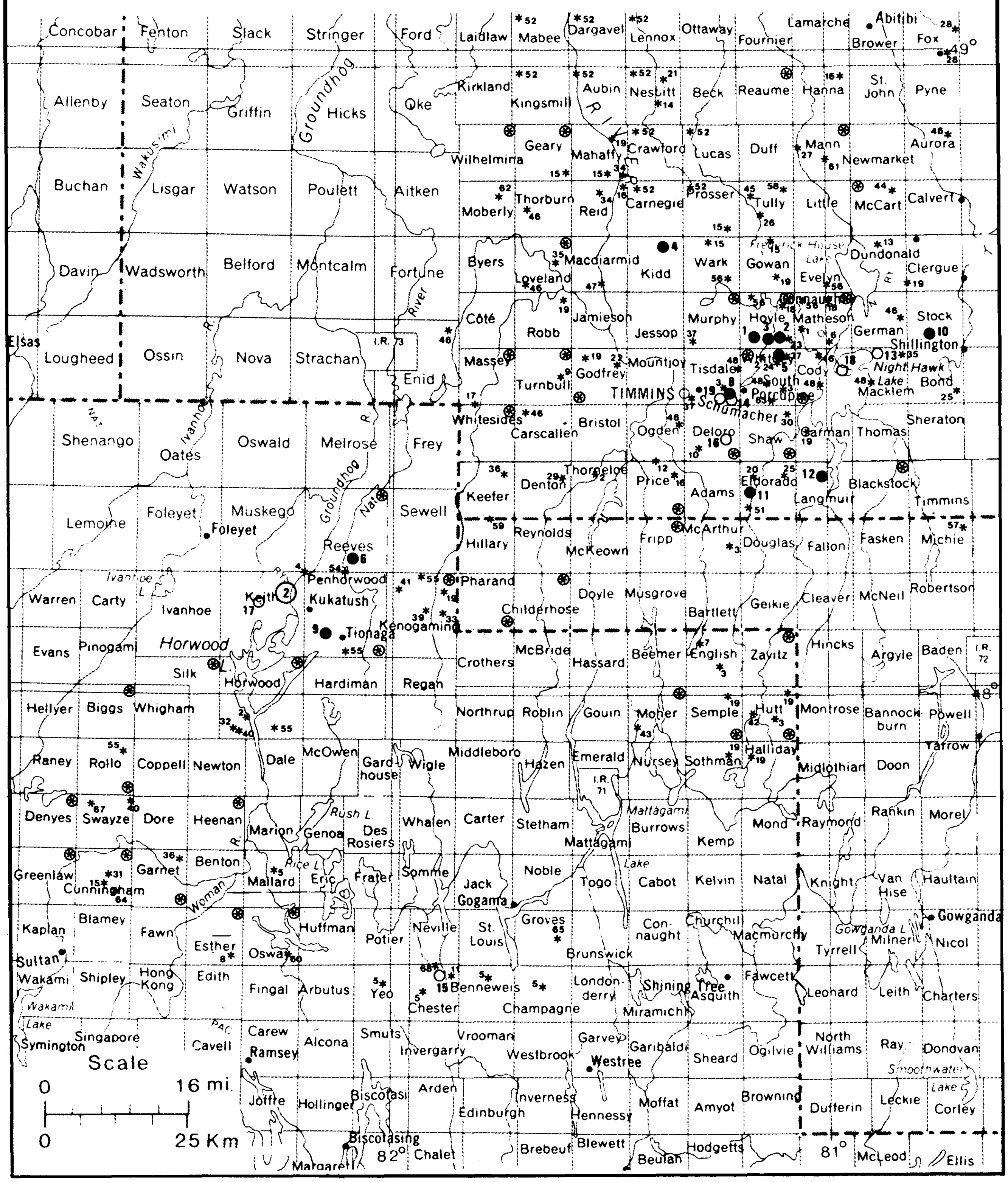
PRECIOUS METALS

Canamax Resources Inc., Bell Creek Mine

Although the 1990 figures are unavailable, estimated production from the Bell Creek Mine will total 688 905 g from 134 000 t milled with an average grade of 6.0 g/t Au and a recovery of 94%. The Marlhill zone produced 74 000 t at a grade of 5.13 g/t Au and the North 'A' zone produced 60 000 t at a grade of 7.06 g/t Au. In 1989, the Bell Creek Mine produced 787 506 oz. Au from 132 054 t at an average grade of 6.95 g/t Au and a recovery of 94.1%.

During 1990, the Marlhill zone was developed down to the 150 m level, the proposed bottom level of the mine. Access to the zone is via a decline ramp from surface north of the Bell Creek shaft. Mining has been by shrinkage meth-

Figure 11.2
Timmins Resident Geologist's District



EXPLANATION

* Exploration Activity, 1990 (Keyed to Table 11.1)

⊛ Township where OPAP funded project in progress

● PRODUCING MINES 1990

1.	Canamax Resources Inc., Bell Creek Mine	Au
2.	Falconbridge Gold Corp., Hoyle Pond Mine	Au
3.	Falconbridge Gold Corp., Owl Creek Mine	Au
4.	Falconbridge Limited, Kidd Creek Mine	Cu,Zn,Ag,Pb,Cd,Sn,In
5.	Giant Yellowknife Mines Limited, Number I Mine	Au
	Number 3 and Number 5 Pits	Au
6.	Luzenac Incorporated	talc
7.	Placer Dome Inc., Detour Lake Mine	Au
8.	Placer Dome Inc., Dome Mine	Au
9.	Roseval Silica Incorporated	Si
10.	St. Andrew Goldfields Ltd.	Au
11.	Timmins Nickel Inc./BHP-Utah Mines Ltd., Redstone Joint Venture	Ni
12.	Timmins Nickel Inc., Langmuir No. 1	Ni

○ ADVANCED EXPLORATION AND DEVELOPMENT PROJECTS 1990

13.	Asarco Exploration Company of Canada Ltd., Aquarius Mine	Au
14.	Diepdaume Mines Limited	Au
15.	Goldbar Resources Inc.	Au
16.	Magnesium Refractories Ltd.	Mg
17.	Noranda Exploration Company, Ltd. - Tarzan Gold Inc.	Au
18.	Pamorex Minerals Inc.	Au
19.	Placer Dome Inc. - American Reserve Mining Corporation, Paymaster Project	Au

② LOCATION OF OGS FIELD PARTY IN 1990

2 Geological Setting of Gold Mineralization in the Horwood Lake Area of the Swayze Belt, G.M. Siragusa

TABLE 11.3. GOLD PRODUCTION FROM THE TIMMINS RESIDENT GEOLOGIST'S DISTRICT (TO THE END OF 1989).

Mine Name	Township	Years of Production	Tons Milled	Oz. Produced	Grade
Ankerite	Deloro	1926–53, –78	4 993 929	957 292	0.19
Ankerite/March	Deloro	1926–1935	317 769	61 039	0.19
Aquarius	Macklem	1984, 1988–89	139 634	19 880	0.23
Aunor (Pamour No. 3)	Deloro	1940–1984	8 482 174	2 502 214	0.3
Banner	Whitney	1927–28, –33, –35	315	670	0.13
Bell Creek	Hoyle	1987–	145 523	61 984	0.24
Bonetal	Whitney	1941–1951	352 254	51 510	0.15
Bonwhit	Whitney	1951–1954	200 555	67 940	0.34
Broulan	Whitney	1939–1953	1 146 059	243 757	0.21
Cincinnati	Deloro	1922–1924	3 200	736	0.23
Concordia	Deloro	1935	230	16	0.07
Coniaurum/Carium	Tisdale	1913–1918	4 464 006	1 109 574	0.25
		1928–1961			
Crown	Tisdale	1913–1921	226 180	138 330	0.61
Davidson	Tisdale	1918–1920	9 341	2 438	0.26
		1988	43 850	7 301	
Delnite	Deloro	1937–1964	3 847 364	920 404	0.2
(open pit)	Deloro	1987–1988	59 067	3 602	0.77
DeSantis	Ogden	1933, 1939–42	196 928	35 842	0.18
		1961–1964			
DeSantis	Turnbull	1926		13	
Detour Lake Mine	Sunday Lake	1983–	5 159 000	540 289	0.15
Dome	Tisdale	1910–	44 606 914	11 708 096	0.27
Faymar	Deloro	1940–1942	119 181	21 851	0.18
Fuller	Tisdale	1940–1944	44 028	6 566	0.15
Gillies Lake	Tisdale	1929–31	54 502	15 278	0.28
		1935–37			
Goldhawk	Cody	1947	636	53	0.08
Goldhawk (open pit)	Cody	1980	40 000	3 967	0.1
Halcrow–Swayze	Halcrow	1935	211	40	0.19
Hallnor (Pamour No.2)	Whitney	1938–68, –81	4 226 419	1 645 892	0.39
Hollinger–Schumacher	Tisdale	1915–1918	112 124	27 182	0.24
Hollinger (Pamour Timmins)	Tisdale	1910–1968	65 778 234	19 327 691	0.29
		1976–1988	2 615 866	182 058	0.07
Hoyle	Whitney	1941–44	725 494	71 843	0.1
		1946–49			
Hoyle Pond	Hoyle	1985–	496 812	261 390	0.61
Hugh–Pam	Whitney	1926, 1948–65	636 751	119 604	0.19
Jerome	Osway	1941–43	335 060	56 893	0.17
		1956			
Joburke	Keith	1973–75, 1979–81	440 117	43 571	0.10
Kingbridge/Gomak	Chester	1935–1936	1 387	98	0.07
McIntyre (Pamour Schumacher)	Tisdale	1912–1988	37 634 691	10 751 941	0.29
McLaren	Deloro	1933–1937	876	201	0.23
Moneta	Tisdale	1938–1943	314 829	149 250	0.47
Naybob	Ogden	1932–1964	304 100	50 731	0.17

TABLE 11.3. CONTINUED.

Mine Name	Township	Years of Production	Tons Milled	Oz. Produced	Grade
Owl Creek	Hoyle	1981–1989	1 618 451	206 226	0.12
Pamour No. 1 (including Pits 3 and 4 and heap leach)	Whitney	1936–	34 876 356	3 405 259	0.11
Paymaster	Tisdale	1915–1966	5 607 402	1 192 206	0.21
Porcupine Lake/Hunter	Whitney	1937–40, 1944	10 821	1 369	0.13
Porcupine Peninsular	Cody	1924–27 1940, 1947	99 688	27 354	0.27
Preston	Tisdale	1938–1968	6 284 405	1 539 355	0.24
Preston N Y	Tisdale	1933	2 800	153	0.05
Preston/Porcupine Pet	Deloro	1914–1915		314	
Preston/Porphyry Hill	Deloro	1913–1915	46	312	6.78
Reef Mine	Whitney	1915–1965	2 144 507	498 932	0.23
St. Andrews Goldfields	Stock	1989–	52 263	6 174	0.16
Tionaga/Smith–Thorne	Horwood	1938–1939	6 653	2 299	0.35
Tisdale Ankerite	Tisdale	1952	14 655	2 236	0.15
Tommy Burns/Arcadia	Shaw	1917	21	14	0.28-0.34
Vipond	Tisdale	1911–1941	1 565 218	414 367	0.26

N.B.: ERG Resources Inc. produced 18,260 oz. Au from treatment of 2 549 189 tons of tailings from March 1988 to June 1989.

TABLE 11.4. BASE METAL PRODUCTION TIMMINS RESIDENT GEOLOGIST'S DISCTRICT (TO THE END OF 1989).

Mine	Township	Dates	Ore Milled (tonnes)	%Cu	%Zn	%Ni	Ag (g/t)	Au (g/t)
Alexo	Dundonald	1912-19 1943-44	51 529	0.07		3.93		
Canadian Jamieson	Godfrey	1966-71	800 600	2.39	4.05			
Jameland	Jamieson	1969-72	461 805	0.99	0.88		3.50	0.05
Kam Kotia	Robb	1943-44 1961-72	6 007 194	1.09	1.03		3.50	0.05
Kidd Creek Mine	**Kidd**	**1965-**	**85 100 000**	**2.06**	7.18		106.00	
Langmuir #1	Langmuir	1973-77	220 000			1.50		
Langmuir #2			320 000			1.30		
McIntyre	Tisdale	1963-81	10 162 640	0.62			0.09	0.023
Redstone	Eldorado	1989-	54 725			2.30		
United Obalski	Godfrey	1965-66	254					

ods on 3 veins. At the end of 1990, one stope at Marlhill was in production.

By the end of the year, mining of the North 'A' zone was taking place from the 240 m level, the bottom level of the mine. Both shrinkage stoping and longhole stoping were done on this vein. Development westward through a diabase dyke led to the discovery that the North 'A' zone continues westward past the dyke. Underground development and underground drilling were done to explore for and to delineate this western extension.

A ramp was started at the 240 m level downward to the 300 m level to access and develop ore on the North 'A' zone below 240 m.

In late 1989, a new gold discovery, the "Bell Creek West Zone" situated 50 m north and 100 m west of the shaft, was made by surface diamond drilling. Additional surface drilling which delineated the deposit in early 1990 was followed by underground development and underground diamond drilling. The ore is within a east-striking vertical-dipping shear zone which has been traced from surface to the 180 m level along a contact between ultramafic (to the south) and mafic (to the north) units. It contains between 1 and 7 percent pyrite and pyrrhotite and intense sericitic alteration. There is no significant quartz veining within the zone. Longhole mining above the 120 m level was started on the zone in late 1990. It is expected that the west zone will be mined out by the end of 1991.

In 1990, underground development totalled 3726 m and underground diamond drilling totalled 6300 m. As previously mentioned, most of the work was done along the west and downdip extensions of the North 'A' zone and the new West zone.

Surface diamond drilling totalled 11 900 m in 47 holes. Nine holes totalling 2400 m were drilled in early 1990 as a continuation of the 1989 program on the West Zone. The balance was drilled around the property in late 1990 in search of vein structures similar to those being mined.

Ore reserves as of December 1989, were: proven and probable, 565 422 tonnes grading 5.97 g/t Au; possible, 310 541 t grading 6.16 g/t Au.

At the end of 1990, there were 100 people employed at the Bell Creek Mine. (Canamax Resources Inc., personal communication, 1990; Canamax Resources, Annual Report, 1989).

ERG Resources Inc.

The tailings gold recovery program, owned by ERG Resources Inc. and known as the second largest project of its kind, was closed on November 9, 1989 after just over 1 year of operation. The company experienced serious financial difficulty, was delisted from the TSE in April of 1990, and is essentially bankrupt. As of June 30, 1989, the tailings inventory held by the company in the Timmins area was estimated to be 126 545 000 tonnes averaging 0.433 g/t Au. To the end of September 1989, production from the project totalled 1 092 013 g Au.

Many factors including the low price of gold combined to ensure that the project never reached commercial production. The targeted 60% recovery rate as defined by pilot testing was not reached. Severe northern Ontario weather conditions leading to shorter operating seasons than had originally been anticipated and labour disputes during the construction phase have all been cited as contributing to the failure of the project. Additional concerns have been raised by the city of Timmins relating to rehabilitation of a large pit excavated by ERG Resources Inc. at the site of the former McIntyre Park (*The Northern Miner*, various articles 1989, 1990, ERG Resources Inc., Annual Report, 1989).

Falconbridge Gold Corporation, Hoyle Pond Mine

Production at the Hoyle Pond Mine for 1990 has been estimated at 105 941 t at a grade of 18.96 g/t Au which was almost the same as that produced in 1989. Ore is being processed on a custom milling basis at Falconbridge Limited's Kidd Creek gold milling facility. A total of 8 gold-bearing quartz-carbonate veins have been identified at the mine. Five of the veins are being mined by cut-and-fill mining while exploration is being conducted on the other 3.

The mine has 4 working levels which are accessed via a ramp from surface. The lowest level is at 206 m below surface and the ramp has reached 286 m below surface. In 1990 lateral development and ramping totalled 1423 m, vertical development totalled 232.5 m. Ore delineation drilling totalled 4000 m.

An extensive exploration program was done in 1990 at the mine with 23 100 m of underground drilling completed. Targets were along strike and downdip extensions of 2 known veins within the mine area and exploration beyond the south contact of footwall carbonated ultramafic which in turn lies to the south of the known veins in the mine. Several new mineralized structures have been identified.

Ore reserves as of August 31, 1990 were 275 000 t grading 15.5 g/t Au.

At the end of 1990, 8 people were employed by Falconbridge Gold Corporation at the Hoyle Pond Mine and an additional 153 employees were under contract from the Kidd Creek Division of Falconbridge Limited (Falconbridge Gold Corporation, personal communication, 1990).

Falconbridge Gold Corporation, Owl Creek Mine

When open pit mining ceased at the Owl Creek Mine in Hoyle Township in June 1989, a large ore stockpile was left on site. During 1990, Owl Creek ore was processed either through the Kidd Creek gold mill or fed directly to the Kidd Creek smelter as flux. Estimated total stockpiled ore used as flux to the end of 1990 was 96 000 t at a grade of 3.8 g/t Au. Estimated stockpiled ore processed through the gold mill was 50 000 t at a grade of 4.9 g/t Au. Between 60 000 and 80 000 t of stockpiled ore remained at the end of 1990.

A total of 1396 m of underground exploratory drilling was done at Owl Creek in 1990 following an underground exploration development program initiated in 1988. The purpose of the program was to define the Owl Creek deposit beneath the open pit. At the time of writing (November, 1990), the evaluation of a possible mining plan was in progress (Falconbridge Gold Corporation, personal communication, 1990).

Giant Yellowknife Mines Limited, Timmins Operations

In 1990, the total production from the Timmins operations of Giant Yellowknife Mines Ltd. was projected to be 1 058 000 tons at an average grade of 0.080 ounce Au per ton. This includes production from the Pamour No. 1 underground mine at 329 000 tons grading 0.097 ounce Au per ton. Open pit production from the No. 3 and No. 5 pits at 439 000 tons grading 0.066 ounce Au per ton and production from the Hoyle underground mine, which adjoins the Pamour No. 1 Mine, at 290 000 tons grading 0.082 ounce Au per ton.

At Pamour No. 1, lateral development was projected to be 7713 feet in 1990 versus 8672 feet in 1989. Vertical development was projected to be 5559 feet in 1990 versus 6024 feet in 1989.

At the Hoyle deposit, lateral development was projected to be 5600 feet versus 2914 in 1989 and vertical development was projected to be 197 feet versus 787 feet in 1989. A ramp had been driven from surface to below the 600 level to provide access for stope development. Ore is dropped down an ore pass to the 1400 level where it is trammed to the Pamour No. 1 Mine for hoisting.

Diamond drilling at the Pamour Mine was projected to total 23 870 feet underground and 33 800 feet on surface. Two thousand feet of the underground drilling was done to test a Tn vein target and the remainder was definition drilling. Eighteen thousand feet of the surface exploration drilling tested the 85 Vein and West End Crowns targets.

Diamond drilling was expected to total 28 277 feet in 1990 at the Hoyle Mine.

Diluted ore reserves as of June 30, 1990 were:

	Tons	Grade
Pamour #1 U/G	994 033	079
Pamour #3 Pit	689 235	063
Pamour #5 Pit	82 563	079
Hoyle Mine1	531 110	081
Nighthawk Mine	869 030	170
Total	4 165 971	096

Reserves will be re-evaluated December 31, 1990.

At the end of 1990, Giant Yellowknife Mines had 314 employees at the Timmins operations (Giant Yellowknife Mines Limited, personal communication, 1990).

Placer Dome Inc.–Detour Lake Mine

Although the complete 1990 figures were unavailable at the time of writing, it was estimated that 120 000 ounces of Au would be recovered from the milling of 785 000 t of ore grading 5.1 g/t Au. As a comparison, the 1989 production was 130 080 ounces of Au from 800 000 t of ore milled. All of the 1990 production came from underground except for 30 000 t of stockpiled material grading 1.5 g/t Au which was previously mined by open pit methods.

The bulk of the underground production came from the main zone which has a strike length of 150 to 300 m and a width of between 5 to 25 m and follows the contact between tholeiitic and komatiitic rocks. Mechanized cut and fill mining constitutes 73% of the production. Longhole mining in quartz stockwork zones within the tholeiites constitutes 10%. Development on ore provides 17% of the underground production. Underground production came from the 260, 360, and 460 m levels. The 460 m level is the lowest producing level and the 560 m level is the lowest level in the mine.

Lateral development in 1990 totalled 6000 m and underground diamond drilling totalled 20 000 m. This included ore definition drilling and a drill program from the 560 m level to define the deposit at depth. 2900 m of surface diamond drilling was completed in early 1990 continuing on from a program which began in late 1989. This drilling was done to test the gold-bearing horizon along strike as well as to map the volcanic stratigraphy at the west end of the property. Nothing of economic significance was intersected.

At the end of 1990, proven and probable reserves were 6.6 million t grading 5.4 g/t Au to the 660 m level. Possible reserves were 3.7 million t grading 5.3 g/t Au down to 760 m below surface.

At the end of 1990, 307 people were employed at the Detour Lake Mine. This compares to 400 people employed at the end of 1989. (Placer Dome Inc., Detour Lake Mine, personal communication, 1990).

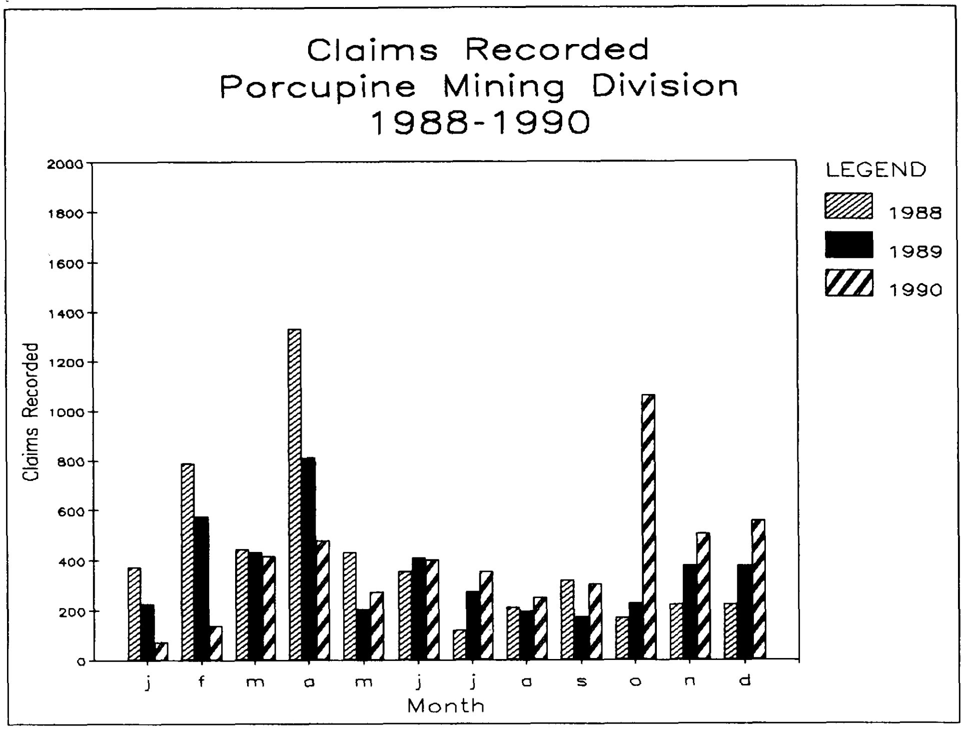


Figure 11.3. Claim staking activity.

Placer Dome Inc.–Dome Mine

Although the 1990 figures were not available at the time of writing, it was estimated that the Dome Mine in Tisdale Township would produce 75 646 ounces of Au for the year from 770 800 tons of ore. Open Pit production was 245 700 tons grading 0.079 ounce Au per ton which gave 18 673 recovered ounces of gold and underground production was 525 100 tons grading 0.113 ounce Au per ton for 56 973 ounces of gold. Production for 1989 was 144 135 ounces of Au from 1.3 million tons of ore at an average grade of 0.114 ounce Au per ton and a recovery of 96.1%.

The shortfall for the year was attributed to a six-month strike between May 7 and November 3. Limited production from underground and the milling of a 140 000 ton stockpile from the open pit was done during the strike.

Underground diamond drilling for 1990 totalled 23 111 feet compared to 61 000 feet in 1989. In 1990, 5407 feet of lateral development (drifts, crosscuts and subdrifts) and 1296 feet of raising was completed. The 1989 the totals were 15 400 feet and 2700 feet respectively.

Ore reserves at the Dome Mine as of December, 1989, were 6.8 million tons at a grade of 0.146 ounce Au per ton.

The Dome Mine employed 400 people at the end of 1990 as a result of layoffs after the strike. At the end of 1989, 703 people were employed. (Placer Dome Inc., Dome Mine, personal communication, 1990).

St. Andrew Goldfields Ltd.

Production began at the Stock Township mine in October, 1989. Actual figures are not available at the time of writing, however it was anticipated that 180 000 tons will have been mined and milled at an average grade of 0.155 ounce Au per ton in 1990. The ore was mined from a total of 15 stopes in 5 of the ore zones with the bulk of the tonnage coming from the N-2 zone, the latest zone found at the mine which is also the largest and highest grade zone. The mining method is 75% mechanized cut-and-fill stoping and the remaining, mostly in small satellite lenses, is done by shrinkage stoping. A minor amount of longhole mining also takes place.

Lateral development totalled 3000 feet in 1990 and vertical development totalled 1500 feet.

No exploration, including surface diamond drilling, was conducted at or around the minesite in 1990.

Underground diamond drilling was restricted to ore delineation and 192 holes totalling 14 171 feet were completed.

TABLE 11.5. MAPS AND REPORTS PERTAINING TO THE TIMMINS RESIDENT GEOLOGIST'S AREA, ISSUED BY THE ONTARIO GEOLOGICAL SURVEY IN 1990.

Open File Reports	
OFR 5709	OGS FIELDLOG: A Microcomputer-based Methodology to Store, Process and Display Map-related Data
OFR 5728	Geology of Gypsum Deposits in the James Bay Lowland
OFR 5735	Mineral Occurrences–Deposits, and Mines of the Black River–Matheson Area
OFR 5736	Quality Control Data from the Black River–Matheson (BRIM) Reconnaissance Till Sampling Program: 1986–1988
Reports	
Rpt 240	Geology of the Shining Tree Area
Miscellaneous Papers	
MP 143	Geoscience Research Grant Program, Summary of Research 1988–1989
MP 145	Laboratory methods for Testing Peat–Ontario Peatland Inventory Project
MP 146	Summary of Field Work and Other Activities 1989
MP 147	Report of Activities 1989, Resident Geologists
Industrial Mineral Background Papers	
IMBP 11	Inorganic Chemicals: Prospects for Ontario's Industrial minerals
IMBP 12	Gypsum in Northern Ontario: Resources and Market Potential
Preliminary Maps	
P.3136	Bedrock Samples from the Sonic Drilling Program 1988, Lake Abitibi–Matheson Area
P.3165	Quaternary Geology, Shining Tree Area
Coloured Maps	
Map 5090	N.O.E.G.T.S. Kapuskasing, Data Base Map, 42G/SE
Map 5091	N.O.E.G.T.S. Kapuskasing, Terrain Conditions for Pipeline Construction, 42G/SE
Airborne Electromagnetic and Magnetic Surveys	
Maps 81 349 to 81 387	North Swayze–Montcalm Area
Geological Survey of Canada Publications	
Open File 2178	Regional Stream Sediment and Water Geochemical Infill Data, Larder Lake Area, Northeastern Ontario

The bottom of the shaft is 880 feet below surface. Deepening of the shaft cannot be considered due to poor ground conditions at the bottom. There are 4 main active levels at the mine with the bottom level being at 575 feet below surface. There are two producing stopes and one being prepared for production which are accessed by an internal ramp from the fourth (575-foot) level. The deepest stope is at 850 feet below surface. Being the first full year of production, emphasis was placed on establishing a good operating system. In 1990, the mill capacity and production was increased from 500 to 700 tons per day.

Published ore reserves at the end of 1989 at St. Andrew Goldfields' Stock Township mine are 767 000 tons at a grade of 0.16 ounce Au per ton.

St. Andrew Goldfields is mining and milling the Hislop East gold deposit of Goldpost Resources Ltd. for 50% of the profits. In 1990 it is anticipated that 20 000 tons of ore grading 0.184 ounce gold per ton will be mined and milled from Hislop East Mine.

At the end of 1990, 97 company and contract staff were employed at the Stock Township mine. An additional 22 people were employed at the Hislop East Mine. (St. Andrew Goldfields, personal communication, 1990).

INDUSTRIAL MINERALS

Luzenac Incorporated

Production of talc from the Penhorwood Township open-pit mine began in 1978 by Steetley Talc Incorporated. Talc is obtained from the mining and beneficiation of a talc-magnesite altered komatiite. The talc is concentrated at the minesite and processed at a fine-grind plant in Timmins. In 1988, Luzenac Incorporated purchased the Steetley operations. Most of the talc is sold to the plastics industry and the pulp and paper industry.

Although the 1990 figures are not available at the time of writing, it is expected that the company will produce and market 38 000 tons of talc from 113 000 tons of ore mined and milled. This compares to 42 000 tons of talc produced in 1989. At the end of 1990, talc production was at 75% of capacity due to poor market conditions. At present capacity, proven ore reserves are good for 20 years of production. Another estimated 10 years of potential ore exists.

At the end of 1990, 50 people were employed at Luzenac Incorporated's Timmins operations. In 1989, over 60 people were employed (Luzenac Incorporated, personal communications, 1990).

Roseval Silica Incorporated

Line cutting, detailed ground geophysical surveys and 1524 m of diamond drilling were performed on Roseval Silica's Penhorwood Township property in 1990, completing their 1989-90 exploration program. Planned exploration and development for 1991 includes detailed geological mapping, 1829 m of airtrack percussion drilling and sampling, 610 m of diamond drilling and site preparation at a previously mined (#1) quarry, and one newly developed (#2a) quarry.

Production from the #2 and #3 quarries in 1990 amounted to 85 000 t. The #2 quarry was depleted during the 1990 operations, leaving the #3 quarry as the sole site of production at the end of the year. It is anticipated, however, that production will be augmented by additional mining from the #2a and #1 quarries in the new year.

Reserves for the property are estimated conservatively 308 443 t of greater than 95% (cutoff grade) Si, with 69 853 t proven reserves of 99.9% Si in quarry #3.

A total of 13 880 t of quartz material grading 99.99% Si was shipped to SKW Alloys Incorporated in Becancour, Quebec for use in the production of silicon metal. Small quantities of less than 454 t were shipped for marketing purposes to possible customers in southern Ontario and the United States.

The company employed 22 contract workers in 1990 (Roseval Silica, personal communication).

ADVANCED EXPLORATION AND DEVELOPMENT

Asarco Exploration Company of Canada Ltd., Aquarius Mine

No underground activity took place in 1990 at the Aquarius Mine in Macklem Township, although the mine is being kept from flooding. Late in the year, a hydrogeological study was done east of the mine site by drilling 3 sonic drill holes and installing piezometers as well as in 3 previously drilled diamond-drill holes as well. A 15-inch rotary drill well was also drilled. A study is being done to determine the feasibility of open-pit mining the Aquarius deposit which has a geological reserve of 19 million tonnes to a depth of 200 m below surface.

Three exploration diamond-drill holes totalling 1095 m were drilled on the mine property in 1990. Two holes drilled to the north and east of the mine intersected nothing of significance. However, the 1 hole drilled 500 m south of the mine intersected 90 feet of albitite rock with low gold values. This felsic dyke strikes 070° and is thought to be the same as that in which Pominex Limited intersected gold values on the Weststock property in the northeast corner of Macklem Township in 1984. This site was subsequently drilled by Noranda Exploration Company Limited in 1987 and 1988.

The albitite intersected by Asarco is a buff-coloured aphanitic rock containing up to 5% small feldspar (albitite) phenocrysts. In thin section, the rock was contains an average of 35% quartz, 15% sericite and 50% albite (Asarco Exploration Company of Canada Limited, personal communication, 1990).

Diepdaume Mines Limited

At Diepdaume Mines Limited's Preston East Dome minesite, a load out to handle ore for custom milling was completed at the mill in late 1990. Sixty thousand tons of stockpiled ore at the Ross Mine in Holtyre is expected to be milled sometime in 1991 at the site.

Since the water level at the Preston East Dome Mine has dropped with the pumping out of the adjacent Paymaster Mine by Placer Dome, underground access to the deeper levels of the mine has been made possible. By the end of 1990, the shaft was rehabilitated to the 1675-foot elevation (14th level). Surveying and underground sampling was done between the 10th and 14th levels to explore for potential ore horizons (Diepdaume Mines Limited, personal communication, 1990).

Goldbar Resources Inc.

The extensive surface diamond-drilling program started in 1989 continued in 1990 on Goldbar Resources' gold property in Chester Township. During 1990, Goldbar completed 56 holes totalling 4927 m on the No. 3 and No. 1 vein systems. To date, 210 surface diamond-drill holes totalling 27 905 m have been completed on the 2 vein systems.

The 1990 diamond-drilling program consisted of detailed infill drilling of the No. 3 vein at 15 m centers to a vertical depth of 107 m. Continuity between the No. 3 and No. 1 vein zones was confirmed during the detailed drilling program.

J. Wade Engineering Ltd. of Toronto has established a geological reserve of 408 231 tonnes at an average grade of 9.94 g/t Au in the 2 vein zones to a vertical depth of 180 m (Goldbar Resources Inc., personal communication, 1990).

Magnesium Refractories Ltd.

Magnesium Refractories Ltd., a private company, has received a repayable contribution under the federal government's FedNor Industrial Program to conduct the final research and development studies for a planned magnesite processing and manufacturing plant in Timmins. The company hopes to mine, mill and process magnesite and talc from the Canadian Magnesite property in Deloro Township which acquired from Giant Yellowknife Mines Limited. The deposit contains iron in the magnesite crystal lattices which is detrimental to the production of high quality magnesium oxide. However, the company has stated it has a new method for removing the iron. Several hundred pounds of material were sent to Lakefield Laboratories where a magnesite concentrate was prepared. Laboratory tests scheduled to be completed in January 1991 were conducted in South Dakota. If the tests prove positive, a pilot plant will be constructed there to test 100 tons of material. High quality magnesium oxide is used in refractory bricks in blast furnaces (Magnesium Refractories Ltd., personal communication, 1990; FedNor press release, September 11, 1990).

Noranda Exploration Company, Limited–Tarzan Gold Inc.

The joint venture partners completed a seven-hole, 1591 m surface diamond-drilling program on the former Joburke Mine property in Keith Township during 1990. Targets drilled included the North and Main zones and their on-strike extensions. One drill hole intersected several narrow gold mineralized zones within a 39.6 m wide zone of shearing and alteration. No further work was recommended (Noranda Exploration Company Limited, Tarzan Gold Inc., personal communication, 1990).

Pamorex Minerals Inc.

Pamorex Minerals, the exploration company of Pamour Inc. conducted 6 gold exploration programs in the Timmins area on Giant Yellowknife Mines Ltd. properties in 1990.

At the Hollinger–McIntyre properties in Tisdale Township, 21 surface diamond-drill holes totalling 14 020 feet were drilled on various targets. Stripping and sampling programs were also conducted. No significant results were obtained and no follow-up work has been recommended.

On the Coniaurum property, south of Coniaurum Lake and west of the Bishop Shaft in Tisdale Township, 26 holes totalling 15 244 feet were completed. A minor amount of stripping, to augment the larger 1989 stripping program was also completed. Results of the diamond drilling indicated several significant gold intersections above the 1000-foot elevation. Further surface definition drilling is required before an underground development program can be justified.

Two surface diamond-drill holes totalling 892 feet were drilled near Pamour's No. 5 open pit near the Broulan property. Significant gold intersections were obtained extending the open pit potential.

At the Pamour No. 1 Mine in Whitney Township, 61 surface and underground diamond-drill holes totalling 20 323 feet were drilled to explore for narrow high-grade gold-bearing quartz veins in the volcanic rocks to the north. Economically significant intersections were obtained, especially in the No. 42 Vein area. The mining group of Giant Yellowknife Mines Ltd. took over the project and began underground development on the vein.

At the Hoyle mine, purchased from Falconbridge Ltd., Pamorex Minerals drilled 24 underground diamond-drill holes totalling 11 528 feet. Two conglomerate ore shoots were outlined which are presently being mined by Giant Yellowknife Mines Ltd..

Five holes totalling 4330 feet were drilled property-optioned from Mintek Resources Ltd. in Cody Township. No economically significant results were obtained.

Pamorex completed a pre-feasibility study on the Porcupine Peninsular property in Cody Township. Reserve estimates are 1.6 million tons grading 0.17 ounce Au per ton. In a revised agreement with Hydra Explorations, Hydra will relinquish all title to the Peninsular Property for $45 000 and a royalty interest. When in production, the mine will produce 700 tons per day with the ore being milled at the Pamour No. 1 site.

The Broulan property, previously held by Belmoral Mines Ltd., was acquired by Pamorex Minerals. Plans are to access the 22nd level (3300 feet below surface) via the Hallnor underground workings, owned by Giant Yellowknife Mines Ltd., in order to explore for ore on the Broulan property adjacent to the Hallnor boundary (Pamorex Minerals Inc., personal communication, 1990; *The Northern Miner*, August 13, 1990).

Placer Dome Inc.–American Reserve Mining Corporation, Paymaster Project

A program to access gold ore below the 5500-foot level at the former producing Paymaster Mine was initiated in 1989 by the joint venture partners Placer Dome Inc. (60% interest) and American Reserve Mining Corporation (40% interest).

By the end of 1990, the No. 5 shaft was pumped out and rehabilitated to the bottom (4375-foot elevation). The No. 6 winze which is collared on the 4075-foot level was pumped to the bottom level at 6025 feet below surface and rehabilitation of this winze had reached the 5000-foot level.

The program is taking more time than originally estimated due to ground problems in the shafts, more than the anticipated amount of dewatering involved and the six-month Dome Mine strike which restricted the contractors to working no more than 5 days per week. Consequently, the project is over budget.

Planned underground development in 1991 includes 500 feet of crosscutting and 500 feet of drifting on the 6025-foot level as well as 10 000 feet of underground diamond drilling (Placer Dome Inc., personal communication, 1990).

ABITIBI BELT EXPLORATION ACTIVITY

Anglo Canadian Mining Corporation

Anglo Canadian Mining Corporation and Kenora Gold Occurrences acquired an option of 51% and 49%, respectively, on the MWF property in Matheson Township from C. Miller. The property consists of 2 patented claims in the west half of Lot 12, Con II, Matheson Township. It is adjacent to and east of the Kidd Creek metallurgical complex and east of both the Hoyle Pond and Bell Creek gold mines.

Diamond drilling began in June 1990 with a total of 13 holes (13 459 feet) drilled to date. Gold intersections at the south end of the property were obtained in quartz veins and stringers in a brecciated, altered (carbonatized) mafic volcanic unit immediately north of the sedimentary/volcanic contact. Graphitic argillite occurs at the contact which dips steeply to the north. Tops as indicated by graded bedding in the sediments face north. Gold assays over narrow widths were published with the best result being 0.858 ounce Au per ton over 5.7 feet. In 1 hole, a continuous section of 121.9 feet averaged 0.051 ounce Au per ton. A narrow gold intersection was also obtained in a hole drilled at the north end of the property (Anglo Canadian Mining Corporation, personal communication, personal observations, 1990; Anglo Canadian Mining Corporation News Release, October 25, 1990).

Asarco Exploration Company of Canada Ltd.

In addition to work done on the Aquarius property in Macklem Township, the company established a grid and conducted geophysical surveys over 6 claims in central Thorneloe Township. On the "Beaumont East" claim group in northern Tisdale Township, the site of the former Beaumont Mine, 4 diamond-drill holes were completed and extensive stripping of outcrop area was done (Asarco Exploration Company of Canada Ltd., Personal communications, 1990).

BHP–Utah Mines Ltd.

BHP–Utah Mines Ltd. continued to have an active exploration program in the district during 1990. In Whitney Township, 1 diamond-drill hole (157 m) was drilled on the Three Nations property. Results were not encouraging. In southeast Whitney Township, 2 diamond-drill holes (305 m) were completed on the Snowshoe property where further work is planned.

The Ferrier Creek property in English Township was also diamond drilled but results from the 126 m hole were not encouraging and no further work is planned.

The company acquired 108 claims in McArthur Township. Line cutting, magnetometer, VLF electromagnetometer (VLF–EM), IP and Max-Min surveys are under way. Geological mapping and geochemical surveys are planned for the spring of 1991 (BHP–Utah Mines Ltd., personal communication, 1990).

G.S.W. Bruce Property

During 1990, the G.S.W. Bruce Prospecting Grubstake made an entirely new gold discovery in the eastern part of English Township (claim P. 1132675). The showing occurs within a 200 m wide, northeast-striking, sheared, altered zone which is strongly ankeritized and contains geochemically anomalous gold values across most of its width. Values of 200-300 ppb Au are common.

The principal showing area, the Road Showing, occurs within the above sheared, altered zone. The showing occurs within a 6 m width of intermittent outcrop which is flanked on either side by low, swampy overburden. Systematic sampling across the 6 m width yielded individual assays ranging from 0.36 g/t to 3.5 g/t Au. The best individual assay was 3.5 g/t Au over a 1 m width of pink ankeritic alteration containing 15% disseminated pyrite. The program received support under OPAP (G.S.W. Bruce, personal communications, 1990).

G. Boissoneault and J. Boissoneault Property

With support from OPAP, G. and J. Boissoneault completed two diamond-drill holes on their property north of Nighthawk

Lake in Matheson Township. Although no economic gold values were intersected, a 60-foot section of quartz pebble anomalous gold values and consisting of over 80% Si was outlined. In addition, some outcrop areas on the property were stripped (J. Boissoneault, personal communications, 1990).

Y. Collin, J. Grant, K. Lapierre Property

The above 3 partners joined interests to explore a property in western Deloro Township. Stripping, trenching, detailed geological mapping and sampling were done on targets defined by geophysical survey methods. The project was completed with support from OPAP (Personal observations, Y. Collin, personal communication, 1990).

Comstate Resources Ltd.

The company completed geological mapping of its 55-claim property in south central Hanna Township. The mapping was hindered by lack of outcrop and thus further geophysical surveys were recommended to outline potential diamond-drill targets.

After completing geological and geophysical surveys on property held in Reid and Mahaffy townships in 1989, Comstate Resources Ltd. diamond drilled 2 holes (300 m) in Reid Township (Comstate Resources Ltd., personal communication, 1990; Assessment Files, Timmins Resident Geologist's Office, 1990).

Cominco Ltd.

Cominco Ltd. completed horizontal loop electromagnetic surveys in Gowan, Wark and Prosser townships and a UTEM survey in Geary Township. A boundary survey was done on the Allerston talc property in Whitney Township (Cominco Ltd., personal communication, 1990).

Falconbridge Gold Corporation

Falconbridge Gold Corporation drilled 66 holes totalling 8720 m in Hoyle Township. Most of the drilling was done south of the Owl Creek–Hoyle Pond stratigraphy within a large sedimentary package of rocks. The target was a possible gold-bearing lense of mafic volcanics within the sediments. Nothing of economic significance was intersected.

Twenty-eight diamond-drill holes totalling 7115 m were completed in Matheson Township. The drilling was done along favourable stratigraphy which includes the Owl Creek and Hoyle Pond deposits and just east of the drilling done by Anglo Canadian Mining (Falconbridge Gold Corporation, personal communication, 1990).

Falconbridge Limited

As in previous years, Falconbridge Limited continued to be the most active company exploring in the Timmins area. Most of Falconbridge's effort was spent exploring for volcanogenic massive sulphide (VMS) deposits especially in the Kidd Creek area where 68 diamond-drill holes were completed totalling 24 686 m by the end of October. An additional 3000 m were planned to the end of 1990. VMS exploration continued in the Kamiscotia Area where Falconbridge drilled 31 holes for a total of 12 276 m to the end of October. An additional 2000 m of drilling were planned to the end of 1990.

The company continued an active nickel exploration program drilling 29 holes totalling 12 858 m in the Timmins area by the end of October with another 2000 m planned before year end (Falconbridge Limited, personal communication, 1990).

W. Gasteiger, D. Londry, D. Mullen, D. Pyke and B. Raine (The Murphy Syndicate)

A group of 5 geoscientists formed a syndicate to explore a jointly-held group of 27 claims in southeast Murphy Township. The claims were acquired through staking during the June 1, 1989 re-opening of lands for staking. In November and December of 1989, grid lines were established over the entire property at a 100 m spacing with a 50 m spacing where better coverage was required. In total, over 60 km of lines were established. During December 1989 and January 1990, MaxMin, very low frequncy electromagnetic (VLF-EM) and magnetometer surveys were conducted followed by detailed geological mapping and sampling. In September, approximately 10 km of IP surveys were done over selected areas of the property. This program received support under OPAP (D. Mullen, Murphy Syndicate, personal communication, 1990).

Granges Inc.

Granges Inc. maintained both gold and base metal exploration programs in the Timmins Resident Geologist's District during 1990. In southeastern Eldorado Township, 450 m of reverse circulation drilling and 400 m of diamond drilling were done as part of a nickel exploration program. Results were positive and further work is planned for 1991.

Further work is also planned on the 231-claim Currie Bowman Property stretching from Bond to Hislop Township along a belt of felsic volcanic rocks. The property was originally acquired under an agreement with Cross Lake Minerals. Work in 1990 on that portion of the property within the Timmins Resident Geologist's District consisted of 131 m of diamond drilling (Granges Exploration Ltd., personal communication, 1990; *The Northern Miner*, September 24, 1990).

Lucky Eagle Mines Limited

Lucky Eagle Mines Ltd. was formed as a joint venture company for Agnico Eagle Mines Limited and Hecla Mining Company of Coeur d'Alene, Idaho. Lucky Eagle Mines Ltd. optioned the Reid properties from Comstate Resources Ltd., Stampeder Exploration Ltd. and Ekaton Industries Ltd. for a base-metal exploration program. In previous years, geological and geophysical surveys were completed. In 1990, sampling of core previously drilled in the area and stored at the Ministry of Northern Development and Mines' (MNDM) Timmins core library was done for geochemical information. Six diamond-drill holes totalling 1054 m were drilled. Two of the holes were drilled in the southeast corner of Mahaffy Township and 4 holes were drilled along the northern part of Reid Township.

Drilling of electromagnetic conductors was done as well as drilling for geological information. No economically significant results were obtained and the option was dropped (Agnico Eagle Mines Ltd., personal communication, 1990).

Mingold Resources Ltd.

In 1990, the company completed 3 diamond drill-holes in southwest Keefer Township (D. Boucher, personal communications, 1990).

Moneta Porcupine Mines Inc.

In a joint venture with Independence Mining Company Ltd., Moneta Porcupine Mines Inc. continued an exploration program begun in 1989 on properties held in Murphy and Tisdale townships. Work done in 1990 consisted of magnetometer and VLF electromagnetic surveys done over the entire property, Max Min electromagnetic and IP surveys done over selected areas, line cutting and 3700 feet of diamond drilling in 5 drill holes. Further work is planned on the property for 1991.

By the end of 1990, Moneta Porcupine Mines Inc. also plans to complete diamond drilling from the ERG tailings dam where it extends onto the former Porcupine Prime Property in Tisdale Township.

The company optioned 45 claims in southwest Tisdale Township to Cogema Canada Limited. The property includes the sites of the former Moneta, Mace and Kayorum mines. Cogema Canada Limited will be the operator during the exploration phase of the program. By the end of 1990, a grid will be established on the property with ground geophysical surveys to follow in early 1991. Additional work by Moneta Porcupine Mines Inc. during 1990 consisted of line cutting, magnetometer and VLF surveys done on the former Beaumont Mine property in north Whitney Township (Assessment Files, Timmins Resident Geologist's Office, 1990; *The Northern Miner*, June 2, 1990, October 1, 1990; Moneta Porcupine Mines Inc., personal communication, 1990).

D. Mullen Property

D. Mullen holds a 13-claim base-metal prospect in south central Hutt Township. In 1990, a grid was re-established over 8 claims. Geological mapping, sampling and a VLF-EM survey were conducted. Pending results, additional work looking for favourable alteration in tholeiitic volcanics is planned (D. Mullen , personal communication, 1990).

New Texmont Explorations Ltd.

During 1990, New Texmont Explorations Ltd. drilled 2 deep diamond-drill holes totalling 4534 feet into the downdip projection of the Intex gold deposit in Tully Township. This downdip projection lies on the Go-West Amalgamated Resources property to the north. New Texmont has earned an interest in this property by conducting diamond drilling on the zone in 1989. The 2 holes drilled in 1990 were a continuation of the 1989 program. Gold values were intersected towards the bottom of these 2 holes which corresponded to the previously intersected gold-bearing horizon (New Texmont Explorations Ltd., personal communication, 1990).

Noranda Exploration Company, Limited

During 1990, Noranda Exploration Company, Limited continued to explore for gold and base metals in the Timmins Resident Geologist's District. The search for base metals was focused on Loveland, Carscallen, Thorburn and Enid townships. Ground geophysical surveys including deep search techniques were completed on most of the properties prior to diamond drilling. Twenty holes totalling 4660 m were drilled.

Gold exploration projects consisted of the diamond drilling of 8 holes (1600 m) near Roma Lake in Cody Township and 5 holes in Ogden Township. Additional claims were staked in Aurora Township (Noranda Exploration Company, Limited, personal communication, 1990).

L. Naveau Property

Mr. Naveau completed prospecting, trenching and blasting on his Four-claim property in Moher Township. The majority of the work was done on 2 sulphide showings. The presence of copper sulphides was noted. This program received support from OPAP(L. Naveau, personal communications, 1990).

Northgate Exploration Limited

In 1990, the company completed UTEM geophysical surveys and a 5000-foot diamond-drilling program on claims held in northeast Macdiarmid Township. Results were favourable and further work is planned for 1991 (Northgate Exploration Limited, personal communications, 1990).

Placer Dome Inc.

Although somewhat inconvenienced by the May-November strike at the Dome Mine site, the company managed to continue an active exploration program in the Timmins Resident Geologist's District during 1990.

In the Hopper Lake area, 37 kilometres of mapping and sampling and the 46 kilometers of line cutting were completed. Forty-six claims were surveyed and an additional 13 claims were staked.

In the area West of Sunday Lake, 73 claims were staked and 90 km of line cutting, sampling and mapping were done.

In the Lower Detour Lake area, 28 claims were staked and 40 km of line cutting, sampling and geological mapping were completed.

Following the release of the MNDM Montcalm–Poulett Airborne Electromagnetic and Magnetic Survey, the company recorded a total of 127 claims in the area covered by the survey (Placer Dome Inc., personal communication, 1990).

Rio Algom Exploration Inc.

During 1990, Rio Algom continued exploration of ground optioned from Abitibi Price Inc. in Mabee, Dargavel, Lennox, Kingsmill, Aubin, Nesbitt, Crawford, Lucas, Carnegie and Prosser townships. Work was also done on properties in the area obtained by staking. Since much of the area is covered by relatively deep overburden, emphasis was placed on both sonic and reverse circulation overburden drilling. In all, 43 sonic drill holes (1609 m) and 127 reverse circulation holes (4421 m) were drilled. Based partially on results of overburden drilling, 11 diamond-drill holes (2591 m) were completed. In addition 205 line-km of line cutting, magnetometer and electromagnetic surveys were done. Poor access to these townships north of Timmins gave the company the added expense of constructing 100 kilometres of winter road and 21 kilometres of summer road and bridge construction (Rio Algom Exploration Inc., personal communication, 1990).

Total Energold Corporation

Total Energold Corporation carried out a ground geophysical program on its 188 staked claims in the Atkinson Lake area near the Quebec border. Drilling may follow in early 1991 (Total Energold Corporation, personal communication, 1990).

SWAYZE BELT EXPLORATION ACTIVITY

Asarco Exploration Company of Canada Limited

Geological mapping, ground geophysical surveys and lithogeochemical sampling were completed on the Asarco Exploration Hardiman Bay claim group in Horwood Township. The property is underlain by the Hardiman Bay fault, a major regional structure trending northeast which exhibits many of the geological and structural features associated with the Porcupine–Destor fault zone. Results of the 1990 program are currently being evaluated.

In October 1990, Asarco Exploration optioned and staked an additional 50 unpatented claims on the southeast side of Hardiman Bay, adjacent to their existing claim block. The optioned property is host to a recently discovered base metal occurrence ("Denommee, Ross and Morin Partnership" in this section). The recently released government Airborne Geophysical Survey of the North Swayze–Montcalm indicates the presence of a moderate to strong electromagnetic (EM) conductor extending for over 1600 m across the property. Additional contiguous claims were staked to protect 2 exceptionally strong EM conductors located northeast of the optioned claims.

Chalcopyrite and sphalerite occur with pyrrhotite and graphite as the matrix of a brecciated chert unit near the top of an arkosic greywacke sequence that has been at least partially eroded by batholitic intrusion. The mineralized horizon appears to vary in thickness from a few centimeters to up to 6 m, but there may be several mineralized cherty units of varying thickness in the sequence.

Preliminary evaluation of the base metal showing, including reconnaissance and detailed mapping, prospecting and some ground geophysical test lines, was under way at the time of writing (Asarco Exploration Company of Canada Limited, personal communication, 1990, personal observations, 1990).

B.P. Canada Inc.

B.P. Canada Inc. completed a single surface diamond-drill hole totalling 111 m on the 140-claim Ross–Morin option in Keith, Muskego and Reeves townships. The option was subsequently dropped (B.P. Canada Inc., personal communication, 1990).

Blue Falcon Mines Limited–Goldbar Resources Incorporated

Blue Falcon Mines Limited completed an extensive airborne geophysical survey over their numerous claim groups situated in Benneweis, Champagne, Chester, Mallard and Yeo townships. Part of the Benneweis Township survey was flown on behalf of Goldbar Resources Inc., who hold claims adjacent to the Blue Falcon group (Report of Work, 1990).

M. Burton Property

M. Burton completed an OPAP-funded detailed sampling program on a number of gold-bearing quartz-carbonate-arsenopyrite veins located on patented mining claims in Esther Township. Many of the veins were exposed during earlier work on the property but were never systematically sampled (M. Burton, personal communication, 1990).

Chesbar Resources Inc.–Murgold Resources Inc.

The joint venture partners completed a 15-hole, 11 189-foot surface diamond-drilling program on their Chester Township gold property in 1990. Thirteen holes totalling 10 189 ft were drilled to test the downdip and along strike extension of the Goldbar Resources Inc. No. 3 vein zone on the Chesbar–Murgold side of the property boundary. Results of the diamond-drilling program on the Goldbar No. 3 zone were mixed, with the best results coming from near the property boundary. Significant intersections reported include: 0.312 ounce Au per ton over 12.3 feet (DDH S-90-1); 0.221 ounce Au per ton over 15.5 feet (DDH S-89-1); 0.295 ounce Au per ton over 4.1 feet (DDH S-89-4). Initial drilling indicated a significant change in trend of the -70° south dipping mineralized zone from 065° to 083° as it entered onto the Chesbar–Murgold ground. Several drill holes failed to reach the zone while the wider intersections reported cut the zone obliquely.

Two diamond-drill holes totalling 1000 feet were drilled to test other exploration targets on the property. One hole was drilled to test a VLF-EM anomaly located on the east part of the property and the second hole was drilled under a trenched surface gold showing, also located on the east part of the property. No significant results were obtained from these holes (Chesbar Resources Inc., personal communication, 1990).

Cominco Limited

Detailed ground geophysical surveys were completed on the Shun claim group held by Cominco Ltd. in Cunningham Township. Several conductors of varying intensity were defined. Further evaluation of the property is planned (Cominco Limited, personal communication, 1990).

Falconbridge Limited

Line cutting, geological mapping, ground geophysical surveys and stripping were completed on the Norduna patents owned by Falconbridge Limited in Kenogaming Township in 1990. Falconbridge is re-evaluating a low-grade nickel-copper occurrence on the property (Falconbridge Limited, personal communication, 1990).

Kirkton Resources Limited

Detailed evaluation of the base metal potential of the Shunsby property in Cunningham Township was undertaken by Kirkton Resources Limited in 1990. The $300 000 program included a computerized compilation of all previous diamond drilling on the property and a detailed re-calculation of the zinc-copper ore reserves. Field work included geological mapping, ground geophysical surveys, extensive stripping and trenching and geochemical sampling. A surface diamond-drilling program is planned following evaluation of the information obtained from the 1990 work program (Kirkton Resources Limited, personal communication, 1990).

J. Landers Property

Mr. J. Landers continued trenching, stripping and sampling on his Horwood Township claims in 1990. Quartz-pyrite stockworks exposed by earlier work appear to be more extensive than originally known. Erratic but significant gold values are being obtained from the west end of the stripped area. Mr. Landers reports the presence of at least 2 generations of quartz veining. More detailed sampling is planned to determine if one particular vein set is carrying the economic gold values (J. Landers, personal communication, 1990).

V. and L. Larche Property

Ground geophysical surveys were completed on property held by V. and L. Larche in Kenogaming Township as part of the 1990 OPAP program (Work Report, 1990).

Mingold Resources Inc.

A four-hole, 2000 feet diamond drilling program was completed on Mingold Resources Inc.'s Garnet Township property in 1990. Drill targets were VLF-EM conductors located up-ice from gold geochemical anomalies returned during earlier till sampling. No significant results were reported from the diamond drilling (Mingold Resources Inc., personal communication, 1990).

C. Mortimer and V. Noseworthy Property

C. Mortimer and V. Noseworthy combined their OPAP grants to complete ground geophysical surveys and a 300 foot surface diamond drill hole on their Stangiff Lake property in Horwood Township. Sampling of mineralized sections was in progress at the time of writing (C. Mortimer, V. Noseworthy, personal communication, 1990).

Ross–Morin–Denommee Partnership

Mssrs. G. Ross, F. Ross, D. Morin and R. Denommee, all local prospectors, formed a partnership to more effectively explore and work their several properties in the Timmins and Foleyet areas. All 4 were recipients of OPAP grants in 1990–91.

In addition to regional prospecting programs in Biggs, Garnet, Keith, Heenan, Hellyer, Horwood, Rollo and Nova townships, the partners completed stripping, trenching and sampling on the following properties:

a) Penhorwood Township Zinc Showing

b) Penhorwood Township Gold Showing

c) Penhorwood Township Talc Showing

d) Rollo Township Copper/Gold Property

e) Kenogaming Township Nickel/Copper/PGE Property

f) Horwood Township Copper/Zinc Property

As a result of their OPAP-funded work during 1990, the partners have successfully optioned the Copper/Nickel property in Kenogaming Township to Timmins Nickel Incorporated and the Copper/Zinc property in Horwood Township to Asarco Exploration Company of Canada Ltd. (G. Ross, F. Ross, D. Morin, R. Denommee, personal communication, 1990).

Teck Corporation

A seven-hole, 833 m surface diamond-drilling program was completed by Teck Explorations Ltd. on 3 claim groups in Cunningham Township. Massive sulphides were reportedly intersected in 6 of the holes but base metal values were described as generally low (Teck Explorations Ltd., personal communication, 1990).

Timmins Nickel Incorporated

Following completion of ground geophysical surveys on the Groves Township nickel-copper prospect, Timmins Nickel completed a 21 hole, 1839 m surface diamond-drilling program to test the known zone at depth. The drilling program confirmed the existence of the previously delineated east-plunging deposit but was unsuccessful in tracing the mineralized zones eastward across a major diabase dyke. The mineralized zones were traced westward but only low values were intersected.

In Kenogaming Township, Timmins Nickel completed preliminary evaluation of nickel-copper-PGE occurrences located on the recently optioned Ross–Morin–Denommee claims. Pyrrhotite, pentlandite and chalcopyrite occur as part of the matrix of an olivine cumulate horizon 4 to 8 m thick within a massive, partially serpentinized ultramafic mass of undetermined origin. Late cross-fractures, possibly developed during cooling, have been in filled with pentlandite. The extent of the mineralized zone has not been determined.

Detailed grids were cut over the main showing near Crawford Creek to facilitate geological mapping, sampling and gradient magnetometer surveys. Additional work is planned (Timmins Nickel Incorporated, personal communication, 1990).

Vannin Exploration Inc.

Vannin Exploration Inc. completed stripping, trenching, ground geophysical surveys and a three-hole, 1117 feet surface diamond drilling program on their Cree Lake property in south-central Swayze Township during 1990. Much of the work was completed near the former Flint Rock Gold Mines' high-grade gold occurrence on Cree Lake.

The 3 diamond-drill holes were drilled from north to south 150 feet east of a west-trending, north-dipping surface showing. A quartz vein intersected near the collar of the third hole reportedly averaged 1.0 ounce Au per ton over 5 feet. This intersection was too far north of the projected eastward extension of the surface showing, suggesting possible sinistral faulting east of the main showing. Previous diamond drilling by Flint Rock Gold Mines failed to outline the vein east of the existing trenches. Additional gold-bearing quartz veins intersected stratigraphically above and below the key intersection were reported (Vannin Exploration Inc., personal communication, 1990).

Young Shannon Gold Mines Limited

As part of the ongoing evaluation of their Chester Township gold property, Young Shannon Gold Mines Limited completed 45 surface diamond-drill holes totalling 7020 m in 1990. Since the current exploration program began in 1987, Young Shannon has completed 24 533 m of surface diamond drilling in 182 holes to test and delineate the several known gold-bearing structures located on their property.

The 1990 diamond-drilling program was completed to test the northeast-trending extension of the "C Prime" zone beneath Three Duck Lakes and also to evaluate and define the several gold bearing structures within the "A" zone, located on the northeast shore of Three Duck Lakes. Poor ice conditions on the lakes hampered diamond drilling on the "C Prime" zone and several hundred meters of strike length remain to be tested. The easternmost hole completed on the "C Prime" zone averaged 38 g/t Au across 3.35 m, and the zone remains open at depth and to the east.

Young Shannon Gold Mines Limited is planning additional diamond drilling from the ice on Three Duck Lakes during the 1990-91 winter season, pending completion of a $600 000 underwriting which was being prepared at the time of writing (Young Shannon Gold Mines Limited, personal communication, 1990).

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

During 1990, the Timmins office was staffed by: Resident Geologist, L. Luhta; Staff Geologists, P. Sangster and J. Ireland; Drill Core Library Geologist, C. Hamblin; Data Geologist, D. Draper; Drill Core Library Geological Assistant, M. Leroux; Secretary, D. Egerland; M. Bradshaw, contract geologist, January to March 1990 and Experience '90 Students, J. Devins and S. Nadon. D. Farrow was hired as Staff Geologist on a short-term contract to replace J. Ireland who accepted a training and development position as Resident Geologist, Cobalt and Manager, Timiskaming Testing Laboratories. C. Hamblin completed a short-term training and development assignment as acting Staff Geologist, Kirkland Lake.

C. Presswood was hired on a short-term contract to compile an inventory of mine tailings in the Timmins Resident Geologist's area.

Phase One of the Ontario Geoscience Exploration Data Base (GED) compilation program began in mid-September. The firm of M.V.W. White and Associates Ltd. has been hired to update the existing Mineral Deposits Inventory for the Timmins Resident Geologist's District. The completion date for this first part of the program is March 31, 1991.

Despite a severe decline in exploration and development activity in the District during the year, client use of the Resident Geologist's facilities remained high. From December 1989 to the end of November 1990, over 2500 visits were recorded. This does not include those who participated in the any of the 18 field tours. Group presentations were given during the year to classes from Queen Elizabeth Elementary School, Roland Michener Secondary School and Northern College of Applied Arts and Technology. A total of 340 assessment files and 18 Ontario Mineral Exploration Program submissions were incorporated into the assessment file library.

Although no geological data inventory folios were published during 1990, GDIF's were compiled for Horwood and Keith townships and are currently available through the Resident Geologist's Office. Data compilations were done for the areas covered by the recent government airborne geophysical releases and are also available through this office. D. Draper also designed and implemented an inventory system for publications to aid and abet the program of the Timmins Mining Recorder.

The Resident Geologist's staff made 46 property visits to 21 sites and attended 9 tours of operating mines. Poster sessions were presented at: the Northeastern Ontario Mines and Minerals Symposium, the Kirkland Lake Core Shack Seminar, the Northern College Career Exposition 1990, Kettle Lakes Provincial Park and the Ontario Mines and Minerals Symposium.

All geologists spent considerable time in assisting OPAP and OMIP applicants with their submissions and in follow-up field inspections of projects funded by these programs. L. Luhta attended the 8th International Association on the Genesis of Ore Deposits (IAGOD) Symposium in Ottawa and a geophysical course in Kirkland Lake jointly sponsored by MNDM and Haileybury School of Mines. He also continued as a member of the Provincial Drill Core Library committee.

M. Leroux attended the Northwestern Quebec Polymetallic Belt Conference in Rouyn–Noranda.

P. Sangster acted as local liaison with the IAGOD field trip committee, providing advice and assistance in preparing the sites for field trip stops and text for guidebook entries.

The 10th Annual Northeastern Ontario Mines and Minerals Symposium was hosted by Timmins office. The two-day event was well received, with over 300 visitors each day to view the 36 poster sessions on display and to attend 17 talks given by both ministry and industry geoscientists.

The Staff Geologists' workload continued to consist mainly of office and field consultations with exploration industry clientele. In additional, input was provided by J. Ireland to Ministry of Natural Resources groups studying conflicts between timber resource and mineral exploration operations such as the Northern Roads Access Committee.

Two Basic Prospecting courses were presented in 1990, 1 in Timmins in the spring and 1 in Hearst in the fall. In total, some 50 aspiring prospectors attended the courses. Many of the graduates have already staked claims and the Resident's Office is currently advising several individuals on how to best to explore their properties.

TIMMINS DRILL CORE LIBRARY PROGRAM

As in previous years, client service continued to be the top priority of the Timmins Drill Core Library program. Despite a serious decrease in exploration activity, the library facilities were used by 460 representatives of industry, government and universities from October 31, 1989 to November 1, 1990. During the same time period, 9100 m of drill core was received from a number of sources (Table 11.6).

The library now has on file some 134 850 m of core representing 3545 individual holes or 532 230 m of diamond drilling. Individuals or companies wishing to donate core, to use the Core Library facilities or to receive a copy of the Timmins Drill Core Library Catalogue should contact:

C.D. Hamblin,
Drill Core Library Geologist,

Ministry of Northern Development and Mines,
60 Wilson Ave.,
Timmins, Ontario
P4N 2S7
Telephone: (705) 267-1401

TABLE 11.6. DRILL CORE RECEIVED DURING THE PERIOD OCTOBER 31, 1989 TO NOVEMBER 1, 1990.

Company	Township
Aurizon Mines Ltd.	Little, McCart
BHP–Utah Mines Ltd.	English, Muskego, Whitney
J. Boissoneault	Matheson
Chevron Resources Ltd.	Bristol, Price
Colt Resources Ltd.	Scholfield, Talbot
Cross Lake Minerals Ltd.	Wilhelmina
Ebony Gold Mines Ltd.	Dundonald
Ekersval Resources Ltd.	Walls, Minnipuka
Markbridge Resources Ltd.	Walls, Minnipuka
Steeler Resources Ltd.	Scholfield
Teck Explorations Ltd.	Wilhelmina
Ventex Energy Ltd.	Blackstock, Langmuir, Sheraton, Thomas

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

A detailed description of work done by the Ontario Geological Survey in the Timmins Resident Geologist's District is provided in the Summary of Field Work and Other Activities 1990 (Ontario Geological Survey 1990).

Deformation and Associated Auriferous Quartz Veining in Keith Township, Northern Swayze Belt.

G.M. Siragusa continued a study begun in 1988 of gold mineralization in the Swayze belt. During 1990, field work on the project consisted of mapping a recently stripped outcrop area east of the Joburke Mine, at a scale of 1:250. Sampling of the map area for a lithogeochemical study and reconnaissance visits to other sites in the area were also completed.

R.G. Gorman and D. Armstrong completed an aggregate mapping project of Horden and Moose townships in the Moosonee area. The short program was done in co-operation with the Ministry of Natural Resources.

In the of fall of 1990, J.S. Springer began a compilation of geological data for Murphy Township. Mapping of the township including examination of available diamond-drill core, is scheduled for the 1990 field season. After the study of Murphy Township is completed the scope of the program will be expanded eastward to include other previously unmapped areas.

Recent Airborne Electromagnetic-Magnetic Surveys in northern Ontario.

In October 1989, it was announced that work had been started on 3 new airborne magnetic and EM surveys in the Timmins Resident Geologist's District. Areas covered included: 10 townships in the Montcalm area, 15 townships in the North Swayze Area and 18 townships in the Shining Tree area. Results from the Swayze and Montcalm surveys were released on October 4, 1990. Results from the Shining Tree survey are to be released on December 18, 1990.

RESEARCH BY OTHER AGENCIES

In 1990, a report by Watts, Griffis and McOuat Limited was released as the completion of Phase II of the Timmins Hazards Program. This phase of the program consisted of researching and documenting mine workings within the limits of the city of Timmins. Site inspections were completed wherever possible. The Dome, Preston, Faymar and Kam Kotia mine sites were covered by this part of the program (Study of Former Mine Workings Within the City of Timmins, Including Active Mines, 1990, 6 volumes.).

B. Hrabi, Queen's University, completed the second year of a structural mapping program in the English and Halliday townships area as part of the work for his post-graduate thesis.

K. Baron, University of Western Ontario, logged and sampled drill core from various properties in the Timmins area as part of a research project on linear carbonatites.

R. Kerrich and R. Feng, University of Saskatchewan, continued research on the geochemistry of fine-grained clastic sediments in the Abitibi greenstone belt.

12. Kirkland Lake Resident Geologist's District—1990

G. Meyer[1], H. Lovell[2], D. Guindon[3] and C. Hamblin[4]

[1]Resident Geologist, Kirkland Lake Resident Geologist's Office, Northeastern Region.

[2]Regional Staff Geologist, Kirkland Lake Drill Core Library, Northeastern Region.

[3]Drill Core Library Geologist, Kirkland Lake Drill Core Library, and Staff Geologist (Secondment), Kirkland Lake Resident Geologist's Office, Northeastern Region.

[4]Staff Geologist (Secondment), Kirkland Lake Resident Geologist's Office, Northeastern Region.

INTRODUCTION

The Kirkland Lake Resident Geologist's District comprises the northern two thirds of the Larder Lake Mining Division. The mining division remains busy, although activity has dropped from the high levels achieved during the flow-through years. Active claims are down to 19 821 and new recordings and man-days of assessment work filed are also well down from previous years (Table 12.1).

On March 31, 1990, Dofasco Inc. closed the Adams Mine as in accordance with an announcement made a year earlier. This put over 300 people out of work and was a major blow to the Kirkland Lake area. There are still many years of ore reserves left; however, the site is currently being considered as a landfill site to accept garbage from Metro Toronto.

Deak Resources Corporation and GSR Mining Corporation purchased the assets of Golden Shield Resources. These include the Kerr mill, and mine and property in Virginiatown which have been put back into production. Plans are to expand the mill capacity and to include, in the future, a base metal concentrating circuit.

LAC Minerals Ltd., Macassa Mine, will see its most productive year ever in 1990, due to easy mining of wide stopes, negligible dilution, better than expected grades and increased mill throughput. LAC has also been very successful in recovering gold from the Lake Shore tailings.

In Holloway Township, joint venture partners Noranda Inc. and Freewest Resources Inc. have announced high-grade gold assay results from the Lightning zone. A drill-indicated deposit, of at least 4 million tons grading 0.25 ounce Au per ton, has been delineated. Also, partners Noranda, Freewest, Newmont Mining Corp. and Teddy Bear Mines Ltd. are working on the extrapolated down-plunge extension of the Lightning zone onto the Teddy Bear property. Some encouraging results were recently released.

Joint venture partners Noranda Inc. and Glimmer Resources Inc. have expanded their existing Beatty–Hislop property, on which 2 gold deposits have been outlined to date.

Pamour Inc. conducted extensive exploration on the Young Davidson property in Powell Township during the year. Good gold assays were returned from 2 mineralized zones on the property.

Pamorex Minerals Inc. completed several short drill programs on the Upper Beaver property in Gauthier Township. High-grade gold intersections were intersected, but further drilling is needed to determine the geometry of the mineralized zones.

A tailings spill from the Matachewan Consolidated Mines tailings disposal site caused drinking water problems for communities downstream on the Montreal River. The spill was caused by the overflow of an adjacent lake onto the Matachewan Consolidated Mines tailings site. The tailings were deeply eroded, creating a plume in the river containing high levels of particulate lead.

The Federal Government terminated the Canadian Exploration Incentive Program (CEIP) and did not accept applications for grants for flow-through arrangements entered into after February 19, 1990.

The Ontario Prospectors Assistance Program (OPAP) and Ontario Mineral Incentive Program (OMIP) were well received by the public. Parts of the Matachewan–Kirkland Lake–Larder Lake area were included in the enhanced OMIP program allowing a 50% exploration grant, as compared to the regular 30%. Forty-two mineral exploration projects in the Larder Lake Mining Division were granted $2 871 177 in special grants under the OMIP program representing exploration expenditures of $7 324 337. A total of $1 753 026 was paid to 21 projects in the enhanced area, while the remaining $1 118 151 was given to the other 21 projects outside this area. In the Larder Lake Mining Division there were 85 OPAP recipients this year with grants totalling $819 177.

MINING ACTIVITY

There were 9 producing mines within the Kirkland Lake Resident Geologist's District (Table 12.2 and Figure 12.1)

TABLE 12.1. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geolog.ical Surveys (Man Days)	Total (Man Days)
1990	4 170	6 838	19 821	100 787	132 394	24 048	302 037
1989	3 511	5 239	22 642	154 099	88 288	34 941	319 325
1988	3 885	4 814	26 240	209 276	333 274	34 998	654 132
1987	6 742	3 854	27 146	197 727	319 836	17 872	600 241
1986	6 973	6 787	24 160	107 108	399 511	48 263	631 038
1985	7 558	5 011	23 974	95 076	276 646	19 517	460 183
1984	7 943	4 492	21 397	93 946	245 542	44 113	473 820
1983	8 354	3 866	17 946	121 213	98 366	15 233	304 770
1982	3 253	5 218	13 458	99 526	133 511	17 926	313 690
1981	5 498	2 697	15 423	69 906	125 459	19 536	247 087
1980	6 299	1 834	12 622	64 454	115 031	10 981	209 357
1979	4 261	1 452	8 157	29 714	25 352	4 990	68 763
1978	1 710	2 065	5 248	32 602	38 100	8 887	87 144
1977	1 826	2 334	5 703	37 101	45 436	1 820	98 992
1976	2 350	2 979	6 712	47 724	42 338	6 220	102 936
1975	2 916	5 010	7 341	45 880	38 047	6 738	98 624
1974	4 757	2 296	9 435	40 678	55 716	4 441	110 165
1973	3 260	3 214	6 974	34 113	35 811	8 150	92 616
1972	3 253	4 740	6 781	39 371	52 351	3 358	106 026
1971	4 065	3 846	8 268	29 433	48 785	4 764	96 047
1970	4 315	3 704	8 049	25 683	28 683	4 133	73 157
1969	3 404	5 273	7 438	50 892	45 713	15 829	130 185
1968	4 171	7 909	9 307	74 649	82 637	5 799	180 437
1967	5 450	7 341	13 045	79 172	29 073	4 032	143 600
1966	7 606	11 101	14 936	117 544	30 971	8 050	182 352
1965	9 331	6 906	18 431	123 129	88 259	6 530	257 029
1964	12 842	3 884	22 912	77 807	32 644	11 725	149 198
1963	4 710	3 895	13 954	95 696	16 241	4 226	138 627
1962	4 675	4 028	13 139	63 003	5 494	5 099	97 219
1961	3 749	4 451	12 492	47 862	5 494	1 118	79 219
1960	5 024	6 747	13 194	75 123	7 296	4 751	104 632
1959	6 419	5 594	14 917	22 947	3 792	1 404	80 322
1958	8 582	7 108	14 902	37 381	7 481	1 941	66 783
1957	4 664	8 212	12 618	95 934	12 593	3 948	139 891
1956	9 673	3 594	16 166	77 879	20 982	6 693	130 894
1955	4 182	3 999	10 087	75 561	3 389	3 529	105 925

during 1990: 6 gold mines, 1 iron mine, 1 barite mine and 1 lizardite mineral filler mine.

American Barrick Resources Corporation

The Holt–McDermott Mine, in the northwestern corner of Holloway Township, has improved since its initial start-up problems. Some zones lacked continuity and the grade of ore from some stopes was lower than expected. Increased development work is now providing access to new stopes and cable bolting is controlling ore dilutions. Both factors have contributed to the overall improvement of performance at the mine. New stopes are located on the McDermott, Worvest and Three Star properties. A drift on the 250 m level has reached the Mattawasaga zone. This zone was acquired from Canamax Resources in the fall of 1988. Definition drilling

TABLE 12.2. PAST GOLD PRODUCTION IN THE KIRKLAND LAKE RESIDENT GEOLOGIST'S DISTRICT .

Mine	Township	Tons Milled	Production (oz. Au)	Production (oz. Ag)	Grade (oz. Au/T)	Years of Production
Aljo	Beatty	2 333	42	5	0.02	1940
American Eagle	Munro	60	40	nil	0.67	1911
Argyll	Beatty	25	30	nil	1.2	1918
Ashley	Bannockburn	57 076	50 123	7 644	0.32	1932-1936
Baldwin	Eby	81	43	81	0.53	1929,1938
Barber Larder	McGarry	30 118	3 072	nil	0.1	1988
Barry Hollinger	Pacaud	267 741	77 000	8 502	0.26	1918,25-36,44-46
Bidgood	Lebel	586 367	160 184	72 468	0.27	1934-51
Blue Quartz	Beatty	500	81	33	0.16	1923,26,28,34
Bourkes	Benoit	1 298	277	50	0.21	1918,36-38
Canadian Arrow	Hislop	279 593	17 045	nil	0.06	1980-1983
Canamax (Matheson Project)	Holloway	38 765	5 391	nil	0.14	1988
Cathroy Larder (Mirado Mine)	McElroy	89 719	10 231	993	0.11	1941-44,47,57,87
**Centre Hill	Munro	327 007	422	36 883	0.001	1967-1970
Chesterville	McGarry	3 260 439	358 880	19 371	0.11	1930-1952
Croesus	Munro	5 333	14 859	1 423	2.79	1915-18,23,31-36
*Eastmaque(tailings)	Teck	1 051 744	28 740	nil	0.027	1988-
Gateford (Swastika)	Teck	103 684	30 068	nil	0.29	1910-1947***
Golden Summit	Maisonville	737	57	nil	0.08	1936-37,45
Gold Hill	Catharine	4 616	660	nil	0.14	1927-28
Gold Pyramid	Guibord	175	36	nil	0.21	1911
*Holt-McDermott	Holloway	800 989	87 202	nil	0.11	1988-
Hudson–Rand	Teck	6 496	483	143	0.07	1922
*Kerr	McGarry	38 886 590	10 311 849	573 501	0.27	1911,1938-
Kerr Addison (Murphy)	Garrison	70 000	9 000	nil	0.12	1981
Kirkland Lake	Teck	3 140 283	1 172 955	130 579	0.37	1916-1960
Kirkland Townsite	Teck	4 230	1 921	168	0.45	1958-1959
Laguerre	McVittie	40 514	7 568	1 383	0.19	1937-1939
Lake Shore	Teck	17 117 923	8 573 246	1 955 132	0.5	1918-65, 1982-87
*Macassa	Teck	6 630 835	2 927 387	425 417	0.44	1933-
*Macassa (Lake Shore Tailings)	Teck	206 000	12 804		0.062	1989-
*Matachewan Consol	Powell	3 525 200	378 101	133 210	0.11	1934-1954
McBean	Gauthier	557 621	45 900	nil	0.08	1984-1986
Miller Independence	Pacaud	31	59	70	1.9	1918
Moffat–Hall	Lebel	16 388	4 780	1 149	0.29	1934-1935
Morris Kirkland	Lebel	127 253	16 999	29 754	0.13	1936-38,40-42
New Telluride	Skead	104	62	50	0.6	1931-1932
Omega	McVittie	1 615 081	214 098	29 290	0.13	1913,26-28,36-47
Queenston	Gauthier	1 054	177	2 380	0.17	1941
Ross	Hislop	6 714 482	995 832	1 544 795	0.15	1936-
**Ryan Lake	Powell	184 790	1 352	36 141	0.01	1948-57,62-64
Stairs	Midlothian	15 835	3 573	1 767	0.23	1965-1966

TABLE 12.2. CONTINUED.

Mine	Township	Tons Milled	Production (oz. Au)	Production (oz. Ag)	Grade (oz. Au/T)	Years of Production
Sylvanite	Teck	5049536	1674808	337956	0.33	1927–1961
Teek Hughes	Teck	9565302	3709007	501657	0.38	1917–1968
Toburn	Teck	1186316	570659	135238	0.48	1912–1953***
Upper Beaver	Gauthier	580562	140709	59167	0.24	1913–1972***
Upper Canada	Gauthier	4648984	1398291	589696	0.30	1938–1971
White–Guyatt	Munro	50	10	nil	0.20	1911
Wright Hargreaves	Teck	9934327	4821296	853643	0.49	1921–1965
Young–Davidson	Powell	6213272	585690	131939	0.10	1934–1957
Total (Gold Ore)		121789715	38381555	7621678	0.32	
Total (Tailings)		1257744	41544		0.033	

* Producer in 1989

** Bass Metal Mine

*** Intermittent Production

has begun with the possibility of mining this area in the last quarter of 1991. A drift on the 350 m level to the same zone is planned for 1991.

In the first 6 months, the mine milled 234 414 tons to produce 32 523 ounces Au with an average recovery of 93% and a production cost of US$276 per ounce.

The shaft of the Holt–McDermott Mine is being deepened to a minimum depth of 550 m below surface. The cost of this project, which will be completed in 1991, is budgeted at $2 million.

In 1989 reserves at Holt–McDermott totalled 4.6 million tons grading 0.136 ounce Au per ton. Of this figure, 2.6 million tons are in the proven and probable categories.

A 1989 surface diamond-drilling program identified a shallow gold deposit 2.5 miles southwest of the Holt–McDermott shaft. Probable and possible reserves total 420 000 tons grading 0.19 ounce Au per ton in 2 adjacent zones, to a 440-foot vertical depth. The zones remain open at depth. Another 1990 surface drilling program, 3000 feet east of the mine shaft on the Mattawasaga property, has indicated 200 000 tons of open-pitable reserves grading 0.10 ounce Au per ton. The zone is open along strike and further exploration is being done.

Also, 3 good intersections were also reported in underground drilling, including 85 feet averaging 0.23 ounce Au per ton, at depth in an area 800 feet east of the open-pitable zone. This new discovery has been reported over a strike length of 1150 feet, between 1150 to 1500 feet below surface, and is located between 2 major faults — the McKenna and the Ghostmount. Twelve holes have already been completed and an equal number is to be drilled between October and Christmas (*The Northern Miner*, October 15, 1990 and J. Boutin, Holt–McDermott Mine, personal communication, 1990).

Deak Resources Corp.–Gold Shield Resources (GSR) Mining Corp.

Early this year Deak Resources Corporation and GSR Mining Corporation purchased the assets of the bankrupt Golden Shield Resources. These included the Kerr mill, mine and property located at Virginiatown. The Kerr mining-milling operation has made a steady comeback and close to 200 people are currently employed. Present gold production is approximately 2100 ounces per month and more than 1000 tons of ore are processed per day. The Kerr mine produces 60 to 70% of the mill feed and the remainder of capacity was recently taken up by custom milling of Silidor and Francoeur ores.

Deak Resources and GSR Mining Corp. have ambitious plans for further rehabilitation of the Kerr mill. Plans include bringing the mill back to its original capacity of 4500 tons per day and expanding the mill gold-ore capacity to 2000 tons per day. An engineering study for a 1750 ton per day base metals circuit has been completed and a feasibility study was initiated to reactivate the roaster at the mill. The replacement of the roaster with an autoclave pressure-leach system, for custom treatment of refractory ores is also being considered. The operators have access to gold ores from the Kerr Mine, Armistice, Arntfield and Silverside properties, totalling 3 747 100 tons grading on the average 0.138 ounce Au per ton. Also, they have base metal ores from West MacDonald, Magusi Zinc Zone, Hebecourt and Aldermac, all located in

Quebec, totalling 8 552 065 tons grading on the average 3.38% Zn, 1.23% Cu, 0.021 ounce Au per ton and 0.75 ounce Ag per ton (*The Northern Miner*, October 15, 1990).

Deak Resources Corp.–Silverside Resources Inc.–LAC Minerals Ltd.–Perrex Resources Inc.

Deak Resources purchased an 87.5% interest of the Silverside 75% interest in the Garrison gold project, for $705 000. LAC Minerals and Perrex Resources each hold a 12.5% interest. Deak agreed to put the property into production within 30 days of closing the deal. The open pit reserve of 50 000 tons, grading 0.18 ounce Au per ton, will be exploited immediately. Underground development from the bottom of the pit and the previously mined Murphy pit will test the remainder of the deposit. The property is estimated to contain 452 000 tons grading 0.15 ounce Au per ton to a depth of 400 to 500 feet (*The Globe & Mail*, July 7, 1990; *The Northern Daily News*, September 29, 1990; *The Northern Miner*, Oct. 8 and 22, 1990).

Dofasco Inc.

Dofasco closed the Adams and Sherman iron mines as of March 31, 1990. The Adams Mine closure resulted in a loss of 339 jobs and was a major set back for the Kirkland Lake area. Open-pitable ore reserves at time of mine closure were estimated at about 14 years, and reserves below the pit bottoms is essentially unknown.

Eastmaque Gold Mines Ltd.

From June 1989 to June 1990, the Eastmaque Gold Mines' tailings operation in Kirkland Lake produced 21 837 ounces of Au. In the first 6 months of this year, 448 204 tons of tailings were milled and 10 997 ounces of Au were produced. The average gold recovery for this period was 0.0245 ounce Au per ton and the cost per ounce during the first 10 months of the year was US$332. Gold production fluctuated due to lower plant feed and metallurgical variances of the tailings. Initiation of extensive metallurgical tests has begun to rectify the shortfall in recoveries, which stood at 53.6% during the last 6 months of 1989. As dredging proceeds toward higher grade tailings on the west side of the basin, production is improving. In August 1990, a record of 2100 ounces Au was produced. A third dredge was commissioned in September 1989, and the first dredge was subsequently reconditioned. To deal with constant ice build-up during the winter months, a protective cover was installed over the feed thickener in December 1989.

The Eastmaque tailings reserves at the end of 1989, stood at 8.4 million tons grading 0.0329 ounce Au per ton of which 5.4 million tons grading 0.0383 ounce Au per ton are in the present mining area. The company is negotiating for the purchase of an additional 25 000 000 tons of 0.022 grade tailings (Eastmaque Gold Mines 1989 Annual Report, 1990 First and Second Quarter Reports to the Shareholders; *The Northern Miner*, September 17, 1990; R. Lemire, Eastmaque Gold Mines Ltd., personal communication, 1990).

Extender Minerals of Canada Ltd.

Extender Minerals produced barite from the mine and mill in Yarrow Township. Anticipated 1990 production is in the 10 000 ton range and reserves are approximately 100 000 tons. (R.A. Hill, Extender Minerals of Canada Ltd., personal communication, 1990).

Goldpost Resources Inc.–St. Andrew Goldfields Ltd.

Goldpost Resources and new partner St, Andrew Goldfields will bring the Hislop East (New Kelore) property in Hislop Township, into production. The shaft was dewatered to the 450-foot level and definition drilling has been completed. Reserves, immediately available at the property, are estimated at 258 015 tons grading 0.18 ounce Au per ton and total reserves at the property total 835 544 tons grading 0.17 ounce Au per ton to the 450-foot level (*The Northern Miner*, March 26 and August 20, 1990).

Hedman Resources Ltd.

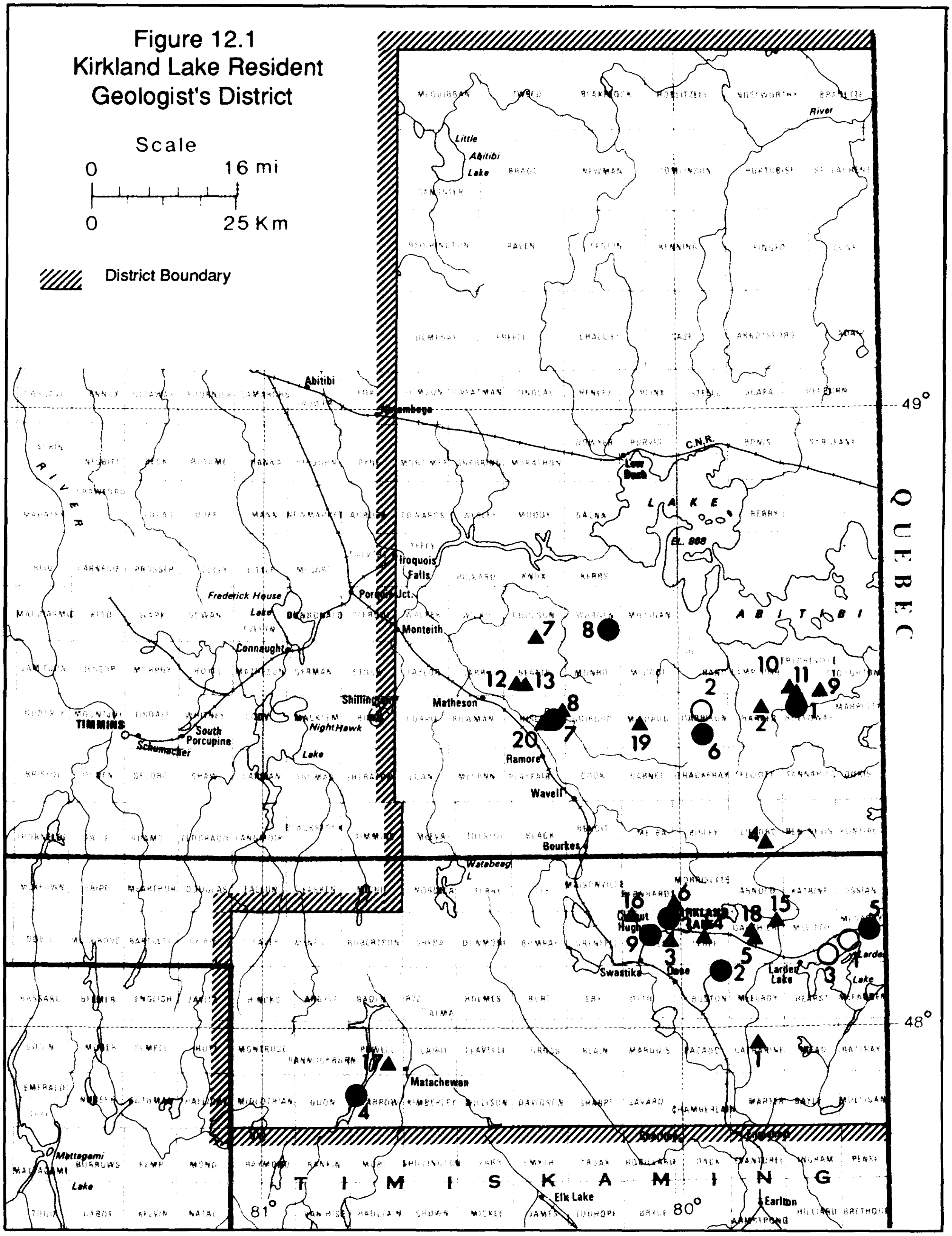
Hedman Resources Ltd. continued to produce Hedmanite, a lizardite mineral filler from an open pit mine in southern Warden Township and a milling operation in Matheson. Ore reserves to 300 feet are over 10 million tons, sufficient to produce approximately 5 million tons of filler. Mill capacity is 300 tons per day.

LAC Minerals Ltd.

The year 1990 is shaping up to be the most productive year for LAC Minerals' Macassa Mine west of Kirkland Lake. Gold production is expected to increase by 18% over 1989 to an anticipated 100 000 ounces. The increased production is ascribed to easy mining in stopes (not uncommonly 25 to 30 feet wide), precision mining techniques resulting in nearly 100% ore recovery and negligible dilution, higher than expected grades, and increased mill throughput.

The biggest surprise of the year was perhaps the record level of gold output and production tonnage in March. For the first time in the 57 year history of the mine, gold output in a single month reached 12 353 ounces, substantially exceeding the previous single month record of 9000 ounces. The mine milled a record 18 311 tons, compared to last year's monthly average of 13 790 tons. On May 23, 1990, Macassa celebrated 3 million ounces of gold production. During the first nine-month period, the mine produced 76 227 ounces Au at an average production cost of US$255. This included $223 224 paid to Queenston Mining Inc. on their Macassa Mine Royalty Properties for the production of 7739 ounces

Figure 12.1
Kirkland Lake Resident
Geologist's District



EXPLANATION

● PRODUCING MINES

1. American Barrick Resources Corp.
   Holt-McDermot Mine .... Au,Ag
2. Dofasco Inc.-Cliffs of Canada Ltd.
   Adams Mine .... Fe
3. Eastmaque Gold Mines Ltd. Kirkland Lake
   Tailings Project. .... Au
4. Extender Minerals of Canada Ltd. .... Barite
5. Deak Resources Corp.-G.S.R. Mining Corp.
   Kerr Mine. .... Au,Ag
6. Deak Resources Corp.-Silverside Resources etc.
   Buffonta. .... Au
7. Goldpost Resources Inc.-St.Andrew Goldfields
   Ltd. Hislop East. .... Au
8. Hedman Resources Ltd. .... Serpentine Filler
9. Lac Minerals Ltd. Macarsa Mine. .... Au,Ag

○ ADVANCED EXPLORATION AND DEVELOPMENT

1. Armistice Resources Ltd.-GSR Mining Corporation
   Sheldon-Larder Property. .... Au
2. Jonpol Exploration Ltd.-T&H Resources Ltd.
   Newfield Property. .... Au
3. Northfield Minerals Inc.-Rockford Minerals Inc.
   Cheminis Property. .... Au

▲ EXPLORATION ACTIVITIES

1. Akiko Loki Gold Resources Ltd.-Gold Fields Mining
   Corp. .... Au
2. American Barrick Resources Corp.-Card Lake Resources Ltd. .... Au
3. Battle Mountain (Canada) Inc.-Queenston Mining Inc. .... Au
4. Dia Met Minerals Ltd. .... Diamonds
5. Inco-Gold-Queenston Mining Inc. .... Au
6. International Platinum Corp.-Glencairn Explorations Ltd. .... Au
7. Kingwood Explorations 1985 Ltd. .... Au
8. Noranda Inc.-Alban Explorations Ltd.-Matachewan
   Consolidated Mines Ltd. .... Au
9. Noranda Inc.-Canamax Resources Inc. .... Au
10. Noranda Inc.-Freewest Resources Inc. .... Au
11. Noranda Inc.-Freewest Resources Inc.-Newmont Mining Corp.
    Teddy Bear Valley Mines Ltd. .... Au
12. Noranda Inc.-Glen Auden Resources Ltd.-Golden Dragon
    Resources Ltd. .... Au
13. Noranda Inc.-Glimmer Resources Inc. .... Au
14. Noranda Inc.-Queenston Mining Inc.-Central Crude Ltd. .... Au
15. Pamorex Minerals Inc.-Queenston Mining Inc. .... Au
16. Pamorex Minerals Inc.-Tundra Gold Mines Inc. .... Au
17. Pamour Inc.-Young Davidson Mines Ltd.-Matachewan
    Consolidated Mines Ltd. .... Au
18. Queenston Mining Inc. .... Au
19. St. Andrew Goldfields Ltd.-Phoenix Gold Mines Ltd. .... Au
20. Stroud Resources Ltd-Chevron Minerals Ltd. .... Au

Au. (Queenston Mining Inc., Third Quarter Interim Report, 1990). From the Lake Shore tailings, 9600 ounces were recovered at an average production cost of US$237 per ounce. The recovered grade averaged 0.52 ounce Au per ton with 95.6% recovery. Most of the production is from the 04 Break and hanging wall splay between the 4700 and 7050 levels. The mill treats up to 600 tons per day of ore from the mine and 750 tons per day of tailings from the LAC Lake Shore project. For the first half of the year, the tailings project gold recoveries averaged about 70%.

As of December 31, 1989, proven and probable reserves at Macassa were 1 513 000 tons grading 0.51 ounce Au per ton at a cutoff of 0.30 ounce. This is expected to increase by year's end to reflect recent exploration.

Recent underground exploration concentrated on the 05 Break, discovered in 1988. It is a structure parallel to and 1300 feet north of the 04 Break. Some drifting has been carried out on the 6100 and 6600 levels and 1 section returned 0.36 ounce Au per ton across 5.9 feet for a length of 160 feet. Another 166-foot section averaged 0.48 ounce over 6.8 feet. The 05 Break is still open downdip and to the east. So far, proven reserves are estimated at 70 000 tons grading 0.44 ounce Au per ton. The 05 Break is apparently positioned on strike with a diamond-drill hole, collared on the 3000-foot level at the extreme eastern boundary, which intersected 0.30 ounce across 6 feet. The hole actually deviated onto the Newfields Mineral Lake Shore mine property.

LAC recently reported low-grade gold mineralization for a strike length of 80 feet, as well as a value of 2.4 ounces Au per ton across 1.5 feet, from a drifting program along the 4750 level of the 04 Break extension onto the adjacent 18 claim property of Queenston Mining. Last year, LAC agreed to conduct 5000 feet of drifting and 15 000 feet of diamond drilling from its own underground workings west of the shaft. Three previous drifts on the 5875-, 6450- and 7050-foot levels (crossing the north striking Amikougami fault), have not found ore.

This year, underground exploration and development will cost about $3.5 million, of which $1.3 million will be spent on underground development and $2.2 million on exploration.

As of June 1990, the mine had 317 employees (*The Northern Miner*, February 12, April 2, September 29, and October 8 and 15, 1990; *Northern Daily News*, September 18 and 29 and October 6, 1990; LAC Third Quarterly Report, November 6, 1990; Queenston Mining Inc., Third Quarter Interim Report, 1990).

ADVANCED EXPLORATION AND DEVELOPMENT

The majority of advanced exploration and development projects reported in 1989 were put on hold, and work was reported from only a few.

Armistice Resources Ltd.–GSR Mining Corp.

As part of an agreement between Armistice Resources and GSR Acquisition, a 3000 ton bulk sample was extracted from a surface pit southeast of the Armistice shaft and milled at the Kerr mill. Also, the first 400 feet of an old drift on the 3850-foot level on the Kerr Mine property was rehabilitated (M.I. Armstrong, Exploration Project Manager, personal communication, 1990). This drift enters the Armistice property approximately 1500 feet north of the Armistice shaft. Further exploration is planned from its extension. Drill-indicated reserves for the property currently stand at 553 000 tons grading 0.16 ounce Au per ton (*The Northern Miner*, March 19, 1990; *The Northern Daily News*, March 29, 1990).

Jonpol Explorations Ltd.–T&H Resources Ltd.

Jonpol Explorations and T&H Resources, joint venture partners, are planning to deepen their exploration shaft in Garrison Township from 500 to 680 feet. Preliminary reserves of 513 800 tons at a grade of 0.28 ounce Au per ton have been outlined (cutoff grade of 0.15 ounce) above 1000 feet. Ore zones remain open in all directions. Metallurgical testing on a 2200 ton bulk sample indicates recoveries of 85 to 95% using a flotation concentrate. Jonpol wants to continue exploration on the main "JP" zone, to the west, where limited drilling intersected zones assaying 0.15 ounce Au per ton.

LAC Minerals has dropped its option to earn a 50% interest in the project. According to John Pollock, of Jonpol Explorations, the option was dropped because of the amount of refractory ore in the mineralized zones. Jonpol Explorations is now searching for another joint venture partner for the Garrison gold project. Despite the high arsenic content, Deak Resources has offered to mill the ore at the Kerr mill for $36 per ton (*The Northern Miner*, February 26, April 2, August 27 and September 10, 1990).

Northfield Minerals Inc.–Rockford Minerals Inc.

Northfield Minerals signed a $2 million agreement to purchase 68.5% interest in the Cheminis gold mine property from GSR Acquisitions. The closing date of the transaction was scheduled for April 23, 1990. This will result in Northfield and its affiliate, Rockford Minerals, owning 100% of the Cheminis project. Dynatec Mining has agreed to accept 4 189 999 common shares of Northfield, in full satisfaction of the balance of its lien, and will hold 5.3 million shares, representing 30% of the Northfield outstanding shares (*The Northern Miner*, April 9, 1990).

The Cheminis gold project is on hold awaiting higher and more stable gold prices. The shaft is completed to the 1035-foot level and accessible reserves are estimated at 300 000 tons grading 0.15 ounce Au per ton. A three-year contract has been signed with GSR Mining for the milling of Cheminis ore (*The Northern Daily News*, Oct. 3, 1990).

EXPLORATION ACTIVITIES

Akiko Lori Gold Resources Ltd.–Gold Fields Mining Corp.

Akiko Lori Gold Resources has an agreement with Gold Fields Mining to acquire a 50% interest in 2 properties in Catharine Township by spending $1 million over 3 years. Channel samples have returned values of 0.53 ounce Au per ton over 3 feet, 0.49 ounce over 2 feet and 0.21 ounce over 2 feet. A drill program was completed; however, results have yet to be released (*The Northern Miner*, May 21 and June 25, 1990).

American Barrick Resources Corp.–Card Lake Resources Ltd.

Assay results from 1 of 6 surface drill holes on the Card Lake Resources' Harker Township property held under option by American Barrick Resources, intersected 10.5 feet grading 0.26 ounce Au per ton and 7.5 feet grading 0.20 ounce Au per ton (*The Northern Miner*, February 5, 1990). The option was subsequently dropped.

Battle Mountain (Canada) Inc.–Queenston Mining Inc.

Battle Mountain (Canada) Inc. has the option to earn a 70% interest in 335 claims held by Queenston Mining in the Kirkland Lake area. The company plans to drill approximately 23 holes by the end of the year, on the Amalgamated Kirkland property in Teck Township, southwest of Kirkland Lake. The property straddles the Larder Lake Break and parallels the Kirkland Lake Main Break. Most of the holes will explore the 102 zone where channel samples have returned assays of 3 to 3.5 grams per tonne over widths of up to 6 m. Four of the first 9 holes have returned mineralization ranging from 0.16 ounce Au per ton over 3.3 feet to 0.31 ounce Au per ton over 8.8 feet. Drilling to date has tested the zone to a vertical depth of about 250 feet. Some of the remaining holes will test 2 other recently discovered zones (*The Northern Daily News*, May 31 and September 7, 1990; *The Northern Miner*, September 24 and October 29, 1990; Queenston Mining Inc., Third Quarter Interim Report, 1990).

Dia Met Minerals Ltd.

Eight macrodiamonds weighing a total of .30 carats were found in 18 tonnes of 4-inch drill core from the C-14 pipe in Clifford Township. The largest, a .17 carat gem, is believed to be the largest diamond recovered from host kimberlite in Canada. Seven of these stones were recovered from an 8 tonne sample.

The C-14 pipe was one of the LAC Minerals Ltd. kimberlite pipes (all now acquired by Dia Met) tested during a $4 million, 4 year, Ontario diamond exploration program. The rocks were analyzed at the Dia Met diamond recovery plant in Colorado, also acquired from LAC Minerals Ltd. (*Northern Daily News*, November 30, 1990; W. Fipke and M. Waldman, Dia Met Minerals, personal communication, 1990).

Inco Gold–Queenston Mining Inc.

Exploration was not performed this year at the Anoki project; however, current reserves are now reported as 1.18 million tons grading 0.12 ounce Au per ton to a depth of 1150 feet, including 650 000 tons grading 0.136 ounce. The deposit remains open at depth and plunges to the southeast. The jointly-owned McBean mill is being maintained on a stand-by basis and is capable of milling 500 tons per day. Production could be attained within 5 months given a gold price of at least US$430 (Queenston Mining Inc., Third Quarter Interim Report, 1990).

International Platinum Corp.–Glencairn Explorations Ltd.

Joint venture partners International Platinum and Glencairn Explorations have completed a 6 hole drill program on the Goodfish property 4 miles north of Kirkland Lake. The A-zone, which returned 0.26 ounce Au per ton over 90 feet in February, is now thought to consist of 3 distinct, subparallel zones. Mineralization occurs along a flow contact in zones A-1 and A-3 and in a quartz-carbonate shear zone in zone A-2. Assay results were disappointing in the follow-up holes but further drilling is planned to test depth extent. All 3 zones are open along strike and at depth (*The Northern Miner*, Oct. 8, 1990).

Kingswood Explorations 1985 Ltd.

Kingswood Explorations intersected encouraging gold values in 2 holes on the Devon property in Beatty Township. Hole 5 intersected 3 zones with values of 0.14 ounce Au per ton across 2.9 feet, 0.40 ounce over 5.0 feet, and 0.09 ounce across 10.0 feet. Hole 6, drilled 200 feet west of Hole 5, yielded a high-grade value of 0.99 ounce Au across 6 feet, at a depth of 200 feet (*The Northern Miner*, February 12 and 26, 1990).

Noranda Inc.–Alban Explorations Ltd.–Matachewan Consolidated Mines Ltd.

Noranda Exploration and Alban Explorations Ltd. can each earn a 30% interest in 12 claims optioned from Matachewan Consolidated in Hislop Township. Nine holes were drilled totalling 7641 feet. Gold mineralization extends to the 800-

foot horizon where it has a strike length of at least 700 feet and is open to the east and to depth. Four holes defined the downward extent of the gold-bearing structure. The best intersection returned values of 0.203 ounce Au per ton over a core length of 28.2 feet (News Release, Alban Explorations Ltd., January 30, 1990).

Noranda Inc.–Canamax Resources Inc.

Four hundred claims, encompassing the Matheson properties of Canamax Resources, have been optioned by Noranda. The deal calls for Noranda to spend $4.5 million over 4 years to earn a 50% interest. Two drills have been exploring the properties but results have not been released (*The Northern Miner*, October 8, 1990).

Noranda Inc.–Freewest Resources Inc.

Throughout the year, Noranda and Freewest Resources reported wide intersections at good grades from their Harker–Holloway townships joint venture project owned 60% and 40%, respectively. A 100 000-foot drill project was completed and will be expanded by a further 65 000 feet of drilling, to be completed by late January 1991. Five drill rigs have been probing the property since March when this year's $3.5 million work program began.

Surface drilling on the 5 claim Lightning zone property confirmed preliminary reserves of at least 4 million tons grading 0.25 ounce Au per ton. Some of the best intersections include 64.3 feet grading 0.43 ounce Au per ton, 75.5 feet grading 0.34 ounce, 40 feet grading 0.65 ounce, and 100 feet grading 0.25 ounce. The latest drill program of 25 to 35 holes is expected to further test the zone before an underground decision is made. Deep infill holes are being drilled at 160-foot intervals to depths between 1000 and 2000 feet below surface.

The deposit is located on the Destor–Porcupine fault. The Lightning zone is hosted by an envelope of green, sericite-altered, mafic volcanic rocks. Most of the gold mineralization is associated with fine, disseminated pyrite in distinctive grey, siliceous, altered, stratiform mafic volcanic rocks at the contact with an ultramafic unit. The zone begins 800 feet below surface, plunges approximately 30° east, and has been traced along a strike length of 2600 feet. Gold mineralization has been intersected to depths of 2600 feet and is still open down plunge to the east.

A new structure, discovered 65 to 130 feet stratigraphically above the main zone and 1200 feet below surface, contains several wide intersections, including 124 feet grading 0.24 ounce Au per ton, 72 feet grading 0.29 ounce, 36 feet grading 0.42 ounce, and 86 feet grading 0.29 ounce (*The Northern Miner*, June 4 and 18, August 27, October 8 and November 12, 1990; *The Northern Daily News*, June 5, 8 and 11, 1990).

Noranda Inc.–Freewest Resources Inc.–Newmont Mining Corp.–Teddy Bear Valley Mines Ltd.

A joint venture comprising Noranda (51%), Freewest (34%) and Newmont Mining (15%) can earn a 70% interest in the Teddy Bear Valley Mines, Harker–Holloway property. The property hosts the downdip extension of the neighbouring Noranda–Freewest Lightning zone and some of the better assay results are as follows: 9.8 feet grading 0.45 ounce of Au per ton, 41.4 feet at 0.28 ounce, 13 feet at 0.41 ounce, 26 feet at 0.24 ounce, 49 feet at 0.30 ounce, and 70 feet grading 0.26 ounce (0.33 ounce uncut) (*The Northern Miner* January 15 and November 12, 1990).

Noranda Inc.–Glen Auden Resources Ltd.–Golden Dragon Resources Ltd.

Noranda carried out a drill program on a 41 claim property owned by Glen Auden and Golden Dragon in Beatty Township. The program tested the Destor–Porcupine fault extension of a gold discovery made on the adjacent Noranda–Glimmer Resources property (*The Northern Miner*, January 1, 1990).

Noranda Inc.–Glimmer Resources Inc.

Joint venture partners Noranda Exploration and Glimmer Resources have added 8 claims to their existing 14 claim Beatty–Hislop property. Two deposits have been outlined by diamond drilling to a depth of 650 feet, and remain open along strike and at depth. Preliminary reserves of the main zone, after completion of 38 drill holes, are calculated at 467 000 tons grading 0.31 ounce Au per ton.

A 6500-foot drill program should be completed by mid-December and will check the lateral and depth continuity of the second zone, as well as test other targets. Mineralization is associated with quartz vein stockworks hosted by green, carbonate-altered volcanic rocks. An impressive 23-foot intersection was recently reported grading 0.64 ounce Au per ton or 1.59 ounces uncut (*The Northern Daily News*, Oct. 19, 1990; *The Northern Miner*, Oct. 29 and November 19, 1990).

Noranda Inc.–Queenston Mining Inc.–Central Crude Ltd.

Noranda can earn a 51% stake in the Queenston Mining 42 claim Pawnee gold property in Lebel Township by spending $1.1 million on exploration over 4 years (*The Northern Miner*, January 15, 1990). Subsequently, Central Crude signed an agreement in principle with Noranda to take over its interest in the project. Central Crude and Noranda have conducted an initial geophysical and diamond-drilling program on the property. The best assay result returned was 0.15 ounce Au per ton over 12 feet from an east-west shear zone (*George Cross News Letter*, January 18, 1990; Queenston Mining Inc., Third Quarter Interim Report, 1990).

Pamorex Minerals Inc.–Queenston Mining Inc.

Pamorex Minerals, which is earning an interest in the Upper Beaver Mine property in Gauthier Township from Queenston Mining, has completed several short drill programs. What started out as follow-up drilling of a hole drilled in 1967, which returned 0.17 ounce Au per ton across 8.8 feet, has become an increasingly successful exploration venture. Some of the best intersections reported are as follows: 21.2 feet grading 1.4 ounces Au per ton, 9.3 feet grading 1.694 ounces, 24 feet grading 0.37 ounce, 38 feet at 0.25 ounce, and 11.5 feet at 0.379 ounce. There is also potential for proving up significant copper reserves. The mineralized zones in the discovery area are quartz veins in sericitized mafic volcanics with minor pyrite. Gold mineralization has been traced into a syenite body where it is associated with quartz-carbonate veins and veinlets. To date, drilling has been inadequate to determine the configuration of the gold-bearing zones; however, the strike of the veins appears to be north-south. The structure is near-vertically dipping and has a minimum strike length of 2000 feet.

To earn a 51% project interest, Pamorex must pay $200 000 and spend $1.75 million on exploration by late 1991 (*The Northern Miner*, January 29, March 12 and 26, June 11 and August 6, 1990; *The Northern Daily News*, January 17 and 18, February 16 and April 17, 1990; P. Coad, Pamorex Minerals Inc., personal communication, 1990; Queenston Mining Inc., Third Quarter Interim Report, 1990).

Pamorex Minerals Inc.–Tundra Gold Mines Ltd.

Pamorex Minerals has earned a 60% interest in the Winnie Lake base metal property of Tundra Gold Mines Ltd., located in Teck Township, by paying Tundra $75 000 and completing 7500 feet of drilling. Ten holes were drilled and the 3 best intersections include 29.7 feet grading 2.91% Cu and 2.06% Zn, 5.0 feet at 2.25% Cu and 2.56% Zn, and 7.7 feet at 2.25% Zn. Downhole geophysics was used to help delineate the massive sulphide units (*The Northern Miner*, January 22 and March 12, 1990).

Pamour Inc.–Young Davidson Mines Ltd.–Matachewan Consolidated Mines Ltd.

Early in the year, Pamour completed a 25 000-foot drill program on its leased, 16 claim, Young Davidson Mines Ltd. gold property near Matachewan in Powell Township. A dozen widely spaced drill holes, 500 to 1500 feet apart testing depths of up to 3000 feet, intersected average grades of 0.15 ounce Au per ton over a true thickness of 25 to 50 feet. One hole returned an average grade of 0.171 ounce Au per ton, all high values cut to 0.4 ounce, for a core length of 144.5 feet (*The Northern Daily News*, April 27, 1990).

A 40 000-foot drill program, started in mid-August, is to be completed by December. This program concentrated on an area below the 2500-foot level.

Gold mineralization is mainly associated with disseminated pyrite in syenite. Two gold zones have been discovered and are referred to as the North and South zones. Both zones are irregular in shape, have east-west elongations, and dip south (*The Northern Daily News*, June 1 and August 15, 1990; *Frontier Mining News*, September 1, 1990; P. Coad, Pamorex Minerals Inc., personal communication, 1990).

Queenston Mining Inc.

The Upper Canada Mine property has total reserves of 1.3 million tons grading 0.255 ounce Au per ton in 3 zones. The zones are as follows: Upper B Zone — 600 000 tons at 0.10 ounce; Upper L Zone — 120 356 tons at 0.125 ounce; and Lower L Zone — 573 922 tons at 0.455 ounce. Queenston has plans in 1991 for an accelerated exploration project on its 100% owned property since Inco Gold has terminated its option. The McBean mill, jointly owned by Queenston and Inco Gold, is located on the Upper Canada property (Queenston Mining Inc., Third Quarter Interim Report, 1990).

St. Andrew Goldfields Ltd.–Phoenix Gold Mines Ltd.

As part of a corporate reorganization, St. Andrew is purchasing property assets of affiliate Phoenix Gold Mines. Phoenix holds a 40% interest in the Ludgate gold deposit in Michaud Township which hosts preliminary reserves of nearly 650 000 tons averaging 0.17 ounce Au per ton (*The Northern Miner*, June 25, 1990).

Stroud Resources Ltd.–Chevron Minerals Ltd.

Stroud Resources doubled its stake in the Hislop Township gold project by acquiring the 50% interest held by its former partner, Chevron Minerals (*The Northern Miner*, February 5, 1990).

Reserves on the Hislop Township property were increased to 1.1 million tons grading 0.19 ounce Au per ton on the basis of recent high-gold-value drill intersections in the Creek Zone (*The Northern Miner*, March 19, 1990).

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; G. Grabowski, Staff Geologist (now an Incentives Evaluator of the Ontario Prospectors Assistance Program (OPAP) and Ontario Minerals Incentives Program (OMIP) in Sudbury); F.M. Boucher, Administrative Secretary; D. Guindon, Drill Core Library Geologist; and M.

Gaudreau, Drill Core Library Assistant. H. Lovell, D. Guindon and M. Gaudreau are stationed at the Drill Core Library.

The vacated Staff Geologist position was filled on 2 secondments by D. Guindon and by C. Hamblin. The position will be filled permanently early in the new year.

H. Lovell, Regional Staff Geologist, is continuing with the Matachewan–Kirkland Lake–Larder Lake gold study and a final report is due in 1991.

A. Bath, Economic Geologist, completed a study of the mineral occurrences, deposits and mines of the Black River–Matheson (BRIM) area (Bath 1990). More than 260 mineral occurrences are described throughout an area covering 10 by 4 townships centred along Highway 101 from west of Matheson to the Quebec border. The project was completed at the end of March 1990.

A. Bath, as Project Geologist, completed a stream sediment and water sampling program in the Bayly Township area in 1989 and results were released this year (Friske et al. 1990).

T. Beckett, Data Geologist, has been working on contract for 6 months to process assessment data.

D. Guindon commenced a project involving the mapping and sampling of frequented roadside outcrops which is designed to provide guidance to field trips.

The Environmental Youth Corps project ended early this year. The project was sponsored by the town of Kirkland Lake and employed S. Grabowski as co-ordinator.

Data entry for the Regional Staff Geologist and Resident Geologist's office is being performed by F. Legacy for 2 consecutive contracts. Legacy is also involved in the reorganization and computerization of technical files.

B. Blaauw, R.T. Kajdas, R.P. Wilson and B.J. Wright worked on CEIC Section 25 Job Creation Programs. B. Blaauw reorganized the assessment files, which are now filed by consecutive numbers. Reorganization and computerization of technical files has been started. Some reorganization assistance was also provided by R.T. Kajdas who performed several other projects at the Drill Core Library. B.J. Wright and subsequently R.P. Wilson provided geological assistance to the Regional Staff Geologist for 6 months.

A. St.Cyr worked on the Summer Experience 1990 program at the Resident Geologist's office and L.A. Semenyna worked on the same program at the Drill Core Library.

N. Little worked on a Northern College work placement program for 2 weeks at the Resident Geologist's office.

The Kirkland Lake Resident Geologist's office maintained a high level of activity, providing assistance to more than 2500 visitors. In addition, 392 enquiries were handled by the Drill Core Library. Field trips of the local geology and mineral deposits were provided for exploration, government and university geologists from Canada, Finland, Germany, USA and Japan.

Assessment work representing 302 037 man-days was added to the assessment files and more than 150 articles were added to the Technical Library.

A number of active projects and operating mines were visited by the Resident Geologist and his staff.

A one-night prospectors' course was given by G. Meyer on exploration for volcanogenic base metals deposits. H. Lovell, as part of the prospectors course program, hosted 3 gold field trips to the public.

A Core Shack Seminar organized by the Ministry of Northern Development and Mines, town of Kirkland Lake, Canadian Institute of Mining, Metallurgy and Petroleum (CIM), and the Northern Prospectors Association was held on April 19, 1990. The seminar provided industry with the opportunity to compare gold deposit settings and review exploration models. It also gave buyers and sellers of mining claims the opportunity to meet. There were 7 speakers and 25 exhibits. CIM, Kirkland Lake Branch, organized a meeting on the evening prior to the seminar at which guest speaker Malcolm Slack discussed the Deak Resources Corp.–GSR Mining Ltd. plans to create a polymetallic, multi-mine operation utilizing the Kerr as a large area mill. Close to 200 people attended the events.

Dr. V.R. Kunduri of the Haileybury School of Mines and assisted by the Resident Geologist's staff and the Northern Prospectors Association, organized a geophysical field school at the Kirkland Lake geophysical test site in Otto Township during June 1990. Thirty-two people experienced hands-on use of traditional as well as modern instruments.

Mineral potential evaluations and mine hazard evaluations were reviewed for property rezoning at the request of the Ministry of Municipal Affairs.

A crew of 12 Junior Rangers, based at Esker Lakes Provincial Park, upgraded popular field trip stops by stripping overburden, brushing trails and bleaching outcrops.

PROPERTY EXAMINATIONS

by H. Lovell

The following reports summarize 5 property visits completed by the Kirkland Lake Resident Geologist's office in 1990.

Black Creek Gold Prospect, Black Township

The claims are in the east-central part of Black Township, and can be reached by 3 km of logging road west from Highway 11 via Butler Lake.

In 1936, Lake Shore Mines Limited collected 14 grab samples containing about $5 Au per ton from a shear zone intruded by pyritic quartz-carbonate masses (gold at $35 per ounce).

In 1946, Black Creek Gold Mines Limited diamond drilled 16 holes (total length 525 m). In 9 of the holes, drilled at intervals across a strike length of 68 m, an average of $3 Au per ton (gold at $38.50 per ounce) was obtained across an average intersection of 2.4 m.

In 1979, Card Lake Copper Mines Limited did some of its diamond drilling at this prospect and 1.5 km to the northwest roughly along strike.

Additional drilling was done in 1980 by Goliath Gold Mines Limited.

In 1989, Regal GoldFields exposed 1 of 2 or 3 parallel shear zones using a backhoe and pressure hose. A composite stratigraphic section from northeast (top) to southwest (base) that includes all strata exposed within the long cross trench as well as interflow sedimentary rocks exposed 15 m northwest of this year's "H" core diamond-drill hole comprises:

1. a pillowed basalt flow top;
2. the massive base of the flow;
3. a pillowed basalt flow;
4. a 6 m thickness of massive, coarse-grained basalt, or thick-bedded tuff, representing the base of the Blake River Group volcanics. The presence of 10% chlorite flakes that might be crushed pumice (fiamme) suggests the latter. Abundant coarse grains of white feldspar and a characteristic white subcrop surface also imply a calc-alkalic, probably crystal-rich, tuff. To the southwest (and apparently underlying) the tuff is a thinly bedded (1 to 10 cm thick beds), fine-grained, calc-alkalic basaltic tuff.
5. a variolitic pillowed basalt striking 320°, dipping steeply and with tops toward the northeast (this exposure occurs toward the northwest within the stripped area). Most variolites occupy the central parts of the pillows. Between the pillows are small zones of hyaloclastite. Adjoining to the southwest of the pillows is the massive base of the flow.
6. 7 m of interbedded slaty chloritic mudstone, rusty calcareous siltstone, and grey, fairly pure chert bands, typically 5 cm thick, and containing fine- to medium-grained pyrite. Most of the pyrite is disseminated (instead of occurring along fractures as observed at the Detour Lake gold mine main chert zone between overlying pillowed tholeiitic and underlying komatiitic basalt). Along the strike of the interflow sedimentary horizon, thin bands of rusty-white, fairly resistant, ferroan dolomite and 1 cm thick grey chert bands containing minor fine-grained pyrite have developed. Flanking the chert for a few centimetres width is 5% disseminated pyrite. Within these interflow sediments occur a few quartz-carbonate veins containing rusted, chocolate-brown calcite that is characteristically nonauriferous. The gold is stratabound within this interflow sedimentary horizon, which extends beyond the northwestern and probably beyond the southeastern ends of the 200 m long stripped zone.
7. 20 cm of breccia composed of chloritic angular fragments in a white, quartz-carbonate matrix that in some places contains considerable amounts of disseminated pyrite;
8. 3 m of pillowed chloritic "greenstone", slightly magnetic and interpreted to be tholeiitic basalt;
9. a 30 cm (maximum thickness), greenish-grey, 10 m long chert lens. Pale bleaching spreads out from fractures far enough to impart a predominantly white hue to the stripped subcrop surface. Pyrite is found mainly along fractures.
10. 4 m of slaty flagstone composed of chloritic tuff or sedimentary rock;
11. a zone of highly deformed, crenulated pillowed basalt (thickness unknown);
12. 1 m of more massive tholeiitic basalt;
13. 2.5 m of tholeiitic basalt flow-top breccia, slightly sheared;
14. 4 m of tectonically stretched, pillowed basalt;
15. undeformed pillowed tholeiitic basalt with pillow tops facing northeast.

Dyment–Kidston "Teck A" Gold Prospect, Teck Township

From Highway 112, a 1.5 km walk along the former proposed Kirkland Lake highway bypass reaches the closest of 8 or 9 areas of exposed subcrop. The overburden was removed by power stripping in October 1990. Bedrock at the south edge of the stripped area is fine-grained, pillowed, magnesium-rich basalt grading progressively to a medium- then coarse-grained equivalent. The latter is devoid of distinct contacts but it is unlikely that it represents the middle of a flow. It may represent a very large lava tube. The presence of minimal hyaloclastite and the abundance of spinifex-textured, acicular pyroxene suggests that the flow is a komatiitic basalt rather than a magnesium-rich tholeiitic basalt. Flow banding adjacent to and stratigraphically above the pillowed basalt trends roughly 125°, perpendicular to the trend of pillowed basalt. In the northeast part of the stripped area, a rusty-pitted carbonate-rich rock with concentric ring-shaped patterns is exposed. Each individual ring has an outer chloritic "selvage", inside of which is a "ring-pair" consisting of a pale outer to greenish inner less erosion-resistant material, inside of which is another similar ring-pair, at the nucleus of which is more of the above-mentioned pale resistant material. These adjacent concentric ring structures are too varied in size (1 to 30 cm) to be polysutured. The structures are not considered to be small budded pillows, pillow breccia, flow-top breccia nor conglomerate cobbles. Instead, they may be liesegang stain rings possibly related to stromatolites. The only other known occurrence of such a feature is in the carbonate footwalls of Barber Larder and Kerr Addison "flow" (carbonaceous chert and sericite schist) gold ores.

Francis T. O'Connor Gold Occurrence, Morrisette Township

East of Goodfish Lake and the Kirana gold mine and approximately 600 m east of the Kirkland Lake airport road is an old, cribbed, single compartment test pit. The pit was sunk in a white, quartz-sericite-feldspar-calcite schist. The schistosity strikes 055° and dips steeply northwest to steeply southeast. The sericite is pale green (stained by ferrous iron) or shiny grey and can easily be mistaken for graphite or molybdenite. Approximately 0.25% of this rock, which may be a sheared crystal-rich tuff, is pyrite. Interlayered with the schist are medium to dark grey silty beds, up to 10 cm in thickness, that contain small boudinaged lithic fragments and minor calcite.

The stratigraphic section from the stripped bedrock area 100 m northwest of the pit to the pit itself, from top to base is as follows:

1. a chilled margin at the base of an overlying flow;
2. pillowed basalt trending 075° and younging northward;
3. stratigraphy unknown due to soil cover for almost 100 m;
4. massive basalt, apparently calc-alkalic, therefore possible "Gauthier Group" (i.e., Skead Group);
5. 3 m width of closely-spaced fractures in interbanded grey and white rock;
6. 4 m width of quartz-feldspar-sericite-calcite schist (the shear zone at the old pit);
7. the base of the section covered by a black spruce muskeg under which there may be schist overlying the volcanic flow assumed to be farther south. The muskeg may also cover the axial zone of a fold.

The stratigraphy is further defined in drill core by the following intercalated rock types: dark grey, magnetic, iron-rich, tholeiitic basalt (probably the beginning of the Kinojevis Group); "quartz-feldspar porphyry"; crystal-rich tuff or intrusive rock; thin-bedded, fine-grained sediments; hyaloclastite (aquagene tuff or broken glass of a basalt flow); amygdaloidal basalt; and sericitic (potash-rich) tuff.

Stairs Gold Past Producer, Midlothian Township

Backhoe trenches in overburden in Midlothian Township excavated by Goldteck Mines Limited in 1987 have begun to collapse. One particularly interesting trench is located 500 m west of a concrete abutment found at the western edge of the Stairs Mine between Frank and Mule lakes north of the road to Campbell Lake. The following stratigraphy, from north to south (top to base), is present:

1. 0 to 7 m — polymictic conglomerate in which some of the matrix and pebbles are composed of rust-stained carbonate. This, or a similar rusty conglomerate unit, extends from the site to southwest of Midlothian Lake and for several kilometres east along the road to the United Asbestos Mine. Pebbles within the conglomerate include green, Cr-muscovite-bearing, carbonate rock (fuchsite or mariposite), greywacke (quartz-feldspar sandstone), black, white, and clear chert, and mudstone.
2. 7 to 9.5 m — The top of this unit contains boulders of the overlying polymictic conglomerate that have been depressed down so as to warp the underlying fine-grained detrital and chemical sediments. These latter sediments have been reworked as exhibited by cross-bedding. Thin-bedded rusty carbonate (layers averaging 1 cm thick), and more resistant dark grey siltstone (average thickness 3 mm) on the northern side of thicker rusty-brown fine sand suggests tops face north, strike 290° and dip 80° north. Some beds are siliceous (cherty) and broken apart, possibly due to shrinkage coinciding with dewatering, and have accommodated "fluidized" rusty carbonate material from above and below to now fill spaces resulting from the shrinkage.
3. 9.5 to 13 m — This interval is composed of leached-out beds of presumed carbonate leaving residual ladder vein stockworks of silica and carbonate. Carbonate and silica may have migrated upward into a rectangularly-shaped network of open fractures or shrinkage cracks. The long dimension of each rectangle is subvertical and parallel to bedding. A sample of a conical concretion resembling an Archean pseudofossil was obtained from this site. Between the "ladder vein" beds are beds of massive chert.
4. 13 to 17 m — This unit is characterized by a rusty black schist and 5 cm thick beds of black (carbonaceous) chert that is conchoidally fractured. '
5. 17 to 78 m — Within this unit, the rock is composed of brown subspherical shapes in a white matrix. Both spots

and matrix are soft, and both effervesce in dilute hydrochloric acid. Present also are schistose (micaceous) zones, and a few dark laths that may represent broken beds of shale. The attitude of the schist is of several orientations and in places the schistosity parallels the trend of the trench. If the bedding and schistosity are coincident, then the true thickness of this "Archean limestone" is exaggerated.

6. 78 to 98 m — This unit consists of black carbonaceous schist interbedded with fairly massive rusty-brown carbonate rock and grey slaty mudstone. At 90 m, the beds are black (carbonaceous) with a strike of 290° and a dip of 80° south.

7. 98 to 106 m — Here, polymictic conglomerate containing lenses of a black schist, overlies a dark chocolate-brown carbonate rock, followed by almost pure marcasite along the fractures of which are pyrite cubes and which in turn overlies pale rusty (buff-coloured) sericite schist. The marcasite layer is believed to be the source of numerous nodule-shaped (i.e., corners are rounded, and the overall shape is subspherical) pebbles of iron sulphide in polymictic conglomerates found to extend across most of Halliday and Midlothian townships.

Walsh–Taylor Gold Prospect, Catharine Township

This area was stripped of overburden in 1989 by Gold Fields Mining Corporation. The southern end of the stripped area exposes variolitic tholeiitic basalt. Pillow-shaped lava tongues or tubes within the unit indicate a strike of 140° with tops facing northeastwardly. In contact to the east is a Cr-muscovite-bearing (fuchsitic), feldspar-chlorite-carbonate rock containing numerous, stratabound, quartz-carbonate veins and stockworks. Overlying the carbonate rock with a sharp to gradational contact is iron-rich (slightly magnetic) tholeiitic basalt, the exposed surface of which is pale green while fresh surfaces are greenish black. This mafic volcanic flow strikes 130° and dips 80° northeast. Distinct, well-formed pillows, containing small variolites in the upper part of the flow indicate that tops are to the northeast. The interior of the flow consists of massive basalt. The stratigraphy from northeast (top) to southwest (base) is as follows:

1. iron-rich tholeiitic basalt flow as described above;

2. feldspar-chlorite rock containing disseminated Cr-muscovite and medium-grained pyrite. The unit is 1 m thick and appears to be a thinly bedded interflow sediment which strikes 150° and dips 75° northeast. Cross-beds are truncated to the northeast and scour-and-fill channels and grain gradation within the sediments suggest that tops young toward the northeast. Possible ripple profiles are also evident.

3. 1 m thick polymictic conglomerate of which some pebbles are dominantly white, calcic feldspathic in composition and thus erosion resistant. Other clasts include basalt and lithic fragments of greywacke.

4. 1 m thick coarse-grained sandstone displaying a grey fresh surface and composition similar to the matrix of the overlying polymictic conglomerate;

5. 1 m thick polymictic conglomerate, some pebbles of which are lithic fragments of chert, a chemical sediment indicating the carbonate component of the carbonate-rich rock nearby probably also originated by precipitation as either a chemical cement or a chemical sedimentary unit. The cherty lithic fragments are a maximum of 15 cm long and 3 cm thick, semirounded and thought to be proximal to their source. Greenstone cobbles (maximum diameter 15 cm) are present, and well rounded thus indicating a longer distance of transport.

6. 3 m thick calc-alkalic medium-grained rock that resembles gabbro. The rock contains inclusions (intrusive) or bombs (lapilli tuff), but no pillows, therefore is not likely to be a submarine volcanic flow.

At the north end of the trench underlying the carbonate-rich sediments is variolitic pillowed basalt similar to that exposed at the south end of the trench. Here the stratigraphic section consists of:

1. pillowed upper part of an iron-rich tholeiitic basalt flow that strikes 130° with tops toward the northeast;

2. the massive base of the above mentioned flow, partly carbonatized;

3. a carbonate (largely chemical, lesser detrital) sediment containing chlorite, Cr-muscovite and quartz-carbonate stockworks that characteristically "sweat out" of this rock type;

4. thin distinct beds of greywacke with cross-beds, scour-and-fill channels, and grain gradation confirming tops face northeast;

5. polymictic conglomerate containing pebbles of white feldspathic rock, possibly lapilli tuff, as well as pebbles of basalt and greywacke;

6. greywacke;

7. polymictic conglomerate containing pebbles of calc-alkalic medium-grained "gabbro" (resembling that described at the south end of the trench), pebbles of basalt, white and dark grey chert and of lithic fragments, a few of which have a high degree of sphericity but all of which are of low roundness;

8. calc-alkalic tuff containing some lapilli bombs;

9. variolitic pillowed basalt flow.

The bedrock described above is well exposed, fresh and exhibits classic primary textures. The quartz veins and stockworks characteristic of the carbonate rock typically are stratabound, and might be precipitates from fluids derived from watery silica-pyrite-iron carbonate chemical sediments.

DRILL CORE STORAGE PROGRAM

by D. Guindon

The Kirkland Lake Drill Core Library is responsible for maintaining a representative drill core collection for the Resident Geologist's district. The library increased its collection by 4658 m representing 13 244 m of drilling. The new core is tabulated on a township basis in Table 12.3 (*see also* Meyer et al. 1990, Figure 13.3).

Inside the library, 114 762 m of core from 1368 diamond-drill holes are stored, while 59 283 m from 518 holes are stored outside. These totals represent 201 524 m and 68 935 m of drilling, respectively. An additional 155 rotasonic drill holes are stored both inside the building and outside. Inside core storage is filled to 90% of capacity. To increase capacity and improve the collection, a program of culling repetitive sections was started 3 years ago. To date, 22 250 m of core has been palletized and moved to outside storage which is not accessible during the winter.

The library has started a collection of typical rock samples representative of the geology and deposits in the Kirkland Lake Resident Geologist's district. The drill core library geologist spent half the summer mapping in detail and sampling local outcrops which are the traditional field-trip stops. Trace and whole rock analyses will be performed and thin sections prepared. Samples, sections and location maps will be available at the core library. Outcrops mapped to date are colloquially referred to as the Kenogami unconformity, Don Lou Motel, Kirkland Lake discovery, Mitchell–Hearst, Larder Lake bend (Laguerre property), Cheminis, Sarcee and Chesterville. Samples were collected from Tower Gold, Lenora Southwest zone, Lebel Township porphyries and the trachytes cut by Highway 66 in Lebel Township.

TABLE 12.3. SUMMARY OF CORE COLLECTED SINCE NOVEMBER 15, 1989.

Township	Number of Holes	Total Depth (m)	Core Stored (m)
Beatty	2	808	24
Ben Nevis	1	168	163
Bernhardt	3	320	312
Bradette	2	1 131	15
Cleaver	3	489	310
Clifford	5	644	521
Coulson	6	887	27
Eby	1	154	148
Garrison	1	301	296
Hearst	4	1 242	17
Holloway	2	3 270	160
Lebel	1	140	120
Maisonville	2	284	280
McElroy	3	446	149
Melba	1	203	186
Michaud	3	768	352
Montrose	6	774	711
Morrisette	1	63	60
Mortimer	1	141	105
Skead	1	152	2
Stoughton	2	478	466
Teck	2	247	230
Warden	1	137	5
	54	13 244	4 658

MATACHEWAN–KIRKLAND LAKE–LARDER LAKE GOLD STUDY

by H. Lovell

At the end of 1990, 3.5 years of the study were completed with the final report being due in 1991. During 1990, approximately 70 days of field work were completed including diamond-drill core and bedrock examination. Eight field trips were conducted for 80 Canadian, American, Finnish, German and Japanese exploration, research and university geologists. The remaining time (70%) consisted of office work including: consulting briefly for numerous mineral exploration and geological research personnel; writing reports (with accompanying photographic slides and prints, and correlating with rock samples) on 45 mines, areas (or groups of areas) of bedrock recently stripped of overburden, and (core logs of) diamond-drill holes; labelling, listing and arranging in cabinet drawers and on display shelves 200 hand-sized samples; drafting a key map locating 25 years of reports on properties visited (totalling almost 500); and drafting simple maps of recently stripped areas exposing fault offsets and volcanic edifices.

Presentations were made at the Timmins Geoscience Research Seminar on the topic of biochemical sedimentary concentration of Archean gold protore; at the Elk Lake meeting of northeastern Ontario Museums concerning the relevance of geology to local history, museum displays and Heritage Trails; to the Kirkland Lake regional municipal councillors regarding the regional geological resource base;

and to the CIM, Kirkland Lake branch, concerning a trip made to the USSR.

STREAM SEDIMENT AND WATER GEOCHEMICAL INFILL SURVEY DATA

A stream sediment and water sampling program was undertaken in the southeastern corner of the Kirkland Lake Resident Geologist's district by A. Bath in the summer of 1989. This project was completed in collaboration with the Geological Survey of Canada, which released the results this year as GSC Open File 2178 (Friske et al. 1990). The project was a follow-up to a previous regional lake-bottom sediment survey in the area designed to confirm and better define the preliminary results (Hornbrook and Friske 1988). At least 3, distinct, multielement stream sediment anomalies were identified and are underlain by units of the Gowganda Formation. Although a number of elements have generally coincident high values in certain areas, the configuration and dimensions of the 3 multielement anomalies are different in detail and are described as follows:

Anomaly 1 — centred more or less along the joint boundary of Bayly and Ingram townships. Significantly elevated antimony, arsenic, bromine, cadmium, cobalt, copper, lead, manganese, nickel and zinc levels are present in the sediments. The results are comparable with a lake bottom sediment survey carried out in the Cobalt area (Hornbrook and Friske 1988). Silver, which was a prominent anomaly in the lake bottom survey, did not feature significantly in the stream sediment follow-up survey.

Anomaly 2 — a moderate stream sediment anomaly, centred at the boundary of Mulligan–Rattray townships, has elevated values of barium, cesium, fluorine, iron, lanthanum, rubidium, samarium, tantalum, cerium, thorium and vanadium.

Anomaly 3 — a more confined stream sediment anomaly, centred at the western extremity of Skeleton Lake in Bayly Township, has elevated values of cerium, lanthanum, samarium and terbium.

RECOMMENDATIONS FOR EXPLORATION

by G. Meyer

Past and present gold producers in the Kirkland Lake Resident Geologist's district are, with the exception of a few small deposits, confined to 2 east-striking Archean sedimentary belts. Exploration in the Matachewan–Kirkland Lake–Larder Lake gold camp has been especially successful in the immediate vicinity of gold mines such as Macassa with the discovery of the 05 Break, Pamorex Minerals Inc. at the Upper Beaver, and Pamour Inc. at the Young Davidson. These successes clearly demonstrate that re-evaluation of past gold producers may prove to be worthwhile. Many mines did not deplete their ore reserves but were forced to discontinue operations for other reasons, i.e., fixed gold price, cutback of subsidies, etc.

In the Black River–Matheson area, limited exposure and poor access prior to the construction of Highway 101 restricted exploration. For some time, this area was considered to have high gold potential. The downdip or down-plunge dimension of many gold deposits is often substantially greater than the strike length. For this reason, near surface, drill-delineated deposits have potential for substantially increased tonnage when explored to greater depth. This situation was demonstrated by Noranda on the Freewest property where it was found that the Lightning zone became more extensive at depth. Grass roots exploration in selected areas may also lead to discoveries such as that recently made on the Glimmer property.

It is interesting to note that nearly all gold discoveries were made by conventional prospecting. In the past, areas covered by overburden and/or Gowganda Formation, have been neglected due to high risk and exorbitant exploration costs. However, the question arises: at which point will it be more profitable to explore these areas compared to ground that has undergone intensive exploration and prospecting?

An additional 2, essentially east-striking Archean sedimentary belts, occur in the northern half of the Kirkland Lake Resident Geologist's district, and have excellent gold potential. Unfortunately, overburden is widespread, outcrop sparse and access poor. Some drill intersections have been reported from the Burntbush area but to date no tonnage figures have been released.

The base of Huronian-covered channelways in the "down valley" direction from the Matachewan–Kirkland Lake–Larder Lake gold camps has never been adequately tested for paleoplacer gold deposits. Water sorting is clearly evident from the variety of sedimentary layers, ranging from coarse-grained conglomerates to siltstones. There appears to be no reason why concentrations of heavy minerals, including gold, could not have formed at the base of these ancient river valleys.

Volcanogenic massive sulphide deposits discovered in the Kirkland Lake Resident Geologist's district are few in number and tend to be small. The volcanic rocks west of Abitibi Lake appear to be part of the same broad greenstone belt that hosts the Kidd Creek orebody, but outcrop is rare and thick clay covers large areas. Results of an airborne magnetic and electromagnetic survey were released in 1989. However, conductors are so numerous that even simple ground geophysical follow-up surveys and initial drill testing programs are often considered to be too costly. Sampling and major oxide analyses of available drill core may locate favourable areas subjected to hydrothermal alteration and help define areas for further exploration.

The Ben Nevis Township area has been explored extensively for base metal deposits. Hydrothermal feeder channelways, some with stringer sulphides, have been identified in several areas. Conceivably, these channelways represent conduits for fluids which may have formed massive sulphide concentrations above the present erosion surface. Further work is required to determine if a favourable base metal horizon has been preserved.

Several different types of river sediment anomalies underlain by Gowganda Formation were identified in the southeastern corner of the Kirkland Lake Resident Geologist's district (Friske et al. 1990). A prominent base metal anomaly, centred closely on the common boundary of Bayly and Ingram townships, is particularly interesting. The anomaly is virtually identical to a lake bottom anomaly identified in the Cobalt area (Hornbrook and Friske 1988). A widespread occurrence of copper may explain the copper anomaly; however, elevated lead, zinc, cobalt, nickel, arsenic, manganese, etc. values have yet to be explained.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

Detailed information on the following projects can be found in Summary of Field Work and Other Activities 1990, Ontario Geological Survey, Miscellaneous Paper 151.

PRECAMBRIAN GEOLOGY SECTION

S.L. Jackson continued a study of structure and stratigraphy in the Larder Lake area. Preliminary Compilation of the Precambrian Geology of Larder Lake Area, scale 1:50 000, OFM 134 (Jackson 1990a).

L.S. Jensen completed the West Half of Kirkland Lake Sheet, District of Timiskaming, scale 1:15 840, OFM 139 (Jensen 1990).

D.G. Troop completed the Geology of Hislop and Guibord townships, scale 1:20 000, OFM 143 (Troop 1991a); and Geology of Michaud and Garrison townships, scale 1:20 000, OFM 144 (Troop 1990b).

GEOPHYSICS/GEOCHEMISTRY SECTION

An airborne magnetic and electromagnetic survey carried out by Geoterrex Ltd. in the Shining Tree area, which includes the area southwest of Matachewan, was released on December 18, 1990.

RESEARCH BY OTHER AGENCIES

Lithoprobe–Subsidiary Lithoprobe survey lines will be completed this year in the Kirkland Lake region to complement test surveys carried out in 1988. The objectives of Lithoprobe are to use geophysical sounding techniques coupled with geological studies of surface-exposed rocks to characterize the crust to depths of up to 40 to 50 km. In certain key mining regions (Sudbury, Abitibi), in addition to studying the deep crust, special projects are designed to image the upper 3 to 5 km of crust. The latter studies are an attempt to define the regional setting of mining areas and locate structures such as shear zones, faults and stratigraphic contacts with potential for ore mineralization. Lithoprobe has completed studies of the southern Canadian Cordillera, the Great Lakes, the Kapuskasing region and Newfoundland. The leader of the Abitibi–Grenfell transect is Dr. John Ludden from the University of Montreal. For this transect, the Geological Survey of Canada is represented by Dr. B. Kilkereit and the Ontario Geological Survey by Dr. S. Jackson.

Rudgeophysika from the USSR started testing its geoelectrical method at a number of properties in the area. Also involved with the program are Scintrex, Ontario Geological Survey, Geological Survey of Canada and Queen's University (*Timmins Daily Press*, July 12, 1990). The technique is based on the principle of attracting electro-positive metallic ions to an electrode by inducing the ground with a direct current. A film covering the electrode is periodically analyzed for metals. This method reportedly has been successfully applied in Russia, and the Chinese are reported to have developed a similar technique.

UNIVERSITIES

Carleton University

A. Donaldson and R. Rice began a study of sedimentary evolution and its relationship to economic mineralization in the Kirkland Lake and Larder Lake areas.

University of Ottawa

A.E. Lalonde and G. Levesque are performing a study on trachytes in areas along the Larder Lake Break.

Queen's University

W. Powell and C.J. Hodgson are attempting to document the position of the Kirkland Lake–Larder Lake Break westward from Kenogami to the Halliday Dome area.

R.B. Hrabi and H. Helmstaedt are studying the structural geology of the Midlothian Lake–Peterlong Lake area.

Technische Universitaet Berlin (Germany)

B. Klimm has provided the following preliminary title for his research work: "The Tillex mineralization, Currie–Bowman area, province of Ontario, Canada — geochemical, carbon-isotopical, ore-petrological and lithological patterns of stratabound Cu-Zn-Au-Ag mineralization in Archean black shales of the Abitibi Subprovince and their genetic interpretation".

University of Saskatchewan

R. Kerrich and R. Feng are studying geobarometry of Abitibi batholiths.

University of Toronto

J.P. Smith and E.T.C. Spooner are studying controls on the positioning of gold-quartz vein ore systems within shear zones.

ADAMS MINE SOLID WASTE (TORONTO GARBAGE) DISPOSAL SITE

Notre Development Corp. has been negotiating for the use of 2 of the Adams Mine open pits as disposal sites for Toronto garbage. The councils of Kirkland Lake, Larder Lake, Englehart and Toronto Works Committee have signed a statement of principles endorsing the proposal. Metro will decide whether to proceed with an environmental assessment study estimated to cost $6 to $8 million. It has been suggested that an estimated 150 jobs will be created for the development. Gordon McGuinty of Notre Development Corp. has stated that the program won't happen without the guarantee of a recycling program at the site. Metro Toronto agreed to a grant, in lieu of taxes, which would provide $25 million to the 3 towns over the 25 year life of the deal.

Residents in the communities affected are divided over this issue. A group known as Responsible Environmental and Economic Prosperity Association (REEPA) is concerned about the possible inclusion of hazardous waste in the garbage and a reduction in the percentage of recyclable material compared with the original plan. REEPA conducted a poll in November that indicated 60.1% of the residents are opposed, 19.4% in favour and 20.5% undecided (*The Northern Daily News*, November 20, 1990).

As mentioned earlier, extensive ore reserves still remain. It is conceivable that in the distant future the site may once again be a viable iron mining operation and this must be considered when contemplating the establishment of major landfill sites.

MATACHEWAN CONSOLIDATED TAILINGS SPILL

In Matachewan, an unattended tailings dam belonging to Matachewan Consolidated Mines broke at approximately 8:00 p.m., October 17, spilling tailings into Davidson Creek which flows into the Montreal River. The mine closed in 1954. The spill was due to unusually high water levels in Otisse Lake caused by a combination of heavy rains and beaver dams. When the water level got too high it overflowed onto the tailings area causing erosion and dispersion. By 3:00 a.m., October 18, more than a mile of Highway 566 had been washed out. By 4:00 p.m. the beaver dam had been blasted by the Ministry of Natural Resources, lowering the level of Otisse Lake and diverting most of the flow.

Approximately 130 000 cubic metres of tailings eventually escaped into the river. Although suggestions of high arsenic, mercury, cyanide and other toxins proved to be unfounded, levels of lead were elevated.

By the night of October 21, the lead levels in the downstream plume had decreased to 0.04 mg/l from a peak of 1.25 mg/l recorded earlier near the source (compared with the drinking water standard of 0.01 mg/l). The lead proved to be in particulate form, rather than soluble form, which allowed the particles to disperse and settle over time. By the evening of October 22, the spill had progressed to within 1 kmof the community of Elk Lake and 3 of the 5 water systems belong to the town were shut down.

The plume continued down the Montreal River to Latchford and into Lake Timiskaming where it dispersed. A coffer dam, designed to protect the tailings from Otisse Lake, was completed by October 26. Plans have been made for reconstruction of the tailings dam. By November 12 the plume edge was 160.9 km from the source, 4.5 km from Lake Temiskaming, and the lead levels in the water had reached nearly acceptable drinking water levels. The Matachewan tailings mishap may prove to be a forewarning of other possible tailings problems (*The Northern Daily News*, October 19, 20, 22 to 27, 29 and 30).

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13. Cobalt Resident Geologist's District—1990

E. Basa

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INTRODUCTION

1990 will long be remembered for the cessation of silver production for the first time since its beginning in 1903 in Cobalt and surrounding areas with the closing of Agnico–Eagle Mine's Leroy and Penna shafts. Iron ore production also ceased in the area with the final closure of the Sherman Mine during the early part of the year. Further negative impact on the area resulted from a 92 percent drop in the production of metallurgical limestone in direct association with the closure of the Sherman and Adams mines and a marked 94 percent decline in building stone production, presumably due to the slowdown in the construction industry in southern Ontario and elsewhere.

Positive advancements however include continuation of the Ontario Prospectors Assistance Program and Ontario Minerals Incentive Program, the opening to staking of the equivalent of 11 townships in the Cobalt district peripheral to the Bear Island Indian land claim, and the development of the new Breault Quarry by Dymond Clay Products to provide feed to a newly-constructed and operating quicklime plant in Bucke Township. In addition, gold production was present for the first time in the immediate Cobalt area as a result of a short-term custom milling contract at Agnico–Eagle Mine's Penn Mill producing 2913 troy ounces. The Cobalt Refinery continued to recover ferric sulphate with active research and development geared to finding new markets for the material while ferrous chloride and copper production also continued at this facility. The quarrying of albite remained constant from a small operation near Mattawa. Substantial quantities of sand and gravel were also extracted throughout the district during the year.

MINING ACTIVITY

Sherman Mine (Dofasco Incorporated and Tetapaga Mining Company Limited)

The Sherman Mine was permanently shut down on March 31, 1990 after 22 years of continuous operation in the Temagami area. Low-grade ore and irreversible disadvantages were contributing factors. The 3 months of operation in 1990 resulted in 705 258 long tons of ore being mined and processed. The concentrator produced 958 584 long tons of crude feed and 314 919 long tons of fluxed concentrate. Total iron pellet production for 1990 was 276 605 long tons with the last pellet shipment being made in late May 1990. During the life of the mine 84 603 516 long tons of ore and 77 328 905 long tons of waste were extracted; 25 027 443 long tons of concentrate were produced; and 22 244 212 long tons of pellets were produced and shipped to Dofasco in Hamilton. All pellet production since June 1985 was fluxed.

The mine assets were sold to the Park Corporation of Cleveland, Ohio. After closure, a small workforce was held over for general site clean-up (S. Bartle, Cliffs of Canada Limited, personal communication, 1990).

In consultation with the local U.S.W.A., a comprehensive severance package was agreed upon which provided for an enhanced severance allowance, improved pension benefits and a housing subsidy. Funding was also provided for job retraining and relocation.

A decommissioning plan was established in consultation and conjunction with the Ministry of Northern Development and Mines, the Ministry of Environment, the Ministry of Labour and the Ministry of Natural Resources.

Pyrok North America is currently conducting a feasibility study on a cemented board plant which would utilize some of the existing facilities. Another interest group is actively pursuing the idea of building an airport on the tailings basin (S. Bartle, Cliffs of Canada Limited, personal communication, 1990).

Dofasco has provided funding for regional economic development to assist in stimulating economic activity in the area.

Bucke Quarry (Dymond Clay Products Limited)

Mining operations continued throughout the year, although production decreased significantly due to the permanent shutdown of 2 major clients in March 1990. In previous years, approximately 150 000 tonnes of flux material were shipped annually to two area iron ore mines. Although the mine closures did not take effect until March 1990, shipment of flux was discontinued in November 1989. Therefore, until recently, the quarry operated continuously throughout the year, although only crushing, loading and trucking took place during a four-month period in winter. However, this year, only quarrying at the company's newly-developed Breault Quarry to the north will proceed during the winter months (R. Garrett, Dymond Clay Products Limited, personal communication, 1990).

Dymond Clay Products Limited also produce metallurgical flux for Falconbridge Limited. Metallurgical-grade material destined for the Kidd Creek smelter in Timmins is first crushed to gravel size on the pit floor. The material is then transferred by loader to a drying furnace and from there by conveyor to a storage cone. From the cone, it is transferred by conveyor to a tertiary crusher where it is reduced to -50 mesh and conveyed to a loading hopper.

During the course of the year, the company continued its exploration and development efforts aimed at finding additional material and developing new products and clients to replace the significant tonnage losses experienced this year. Much progress was made with the development of the new Breault Quarry delineated in 1989.

The company also continued to add to its land holdings adjacent to the Bucke Quarry in Bucke Township.

Overall production decreased by 76 percent from 1989 to 34 127 tonnes this year due primarily to the closure of the Sherman and Adams mines and, in part, due to more concentrated efforts in developing the Breault Quarry. Of this total, 36 percent was metallurgical limestone sold to the Kidd Creek smelter, 37 percent was sold as aggregate and armourstone, 4 percent was used as agricultural limestone, 2 percent for research and development, 20 percent stockpiled for winter consumption and less than 1 percent as feed for the kiln in the initial start-up of the quicklime plant.

Breault Quarry (Dymond Clay Products Limited)

The Breault Quarry, located in Dymond Township, has recently been developed by Dymond Clay Products Limited through their follow-up of results from a Ministry of Northern Development and Mines drill hole put down as part of an economic evaluation of the Lake Temiskaming Paleozoic Outlier (Grant and Owsiacki 1987). In 1988, the company completed the drilling of 12 vertical holes and outlined a deposit area of approximately 60 acres. In 1989, geological mapping, minor stripping, trenching, and sampling was completed on the property. Development began in May 1990 and continued until early August. Operations are expected to resume in January 1991 and to continue throughout the year. As development progressed this year, further vertical drilling on 50 m spacings was conducted to determine the depth of economic-grade calcium-rich limestone. To date, an area approximately 120 m by 50 m has been quarried to an average depth of 2.5 m. Due to elevated magnesium content to the north and west of the property, activity is being focussed toward the east and southeast (R. Garrett, Dymond Clay Products Limited, personal communication, 1990). The operators have found that a minimum of 50% CaO content must be attained to use as feed for the lime plant to produce a consistent and competitive product. The currently-producing lime plant is a newly constructed operation in Bucke Township.

A total of 34 488 tonnes of material was quarried from this site in 1990. Fifty-two percent will be used as feed for the lime plant, 28 percent as aggregate for road construction, 1 percent as feed for the drying plant which processes material for the Kidd Creek smelter, less than 1 percent for armour stone, while approximately 19 percent is stockpiled for later use. The material designated as aggregate was used for road upgrading from the property to the highway and the company is hoping to develop a local aggregate market for this product (R. Garrett, Dymond Clay Products Limited, personal communication, 1990). Stone from the quarry has been marketed as gabian stone, riprap for local culverts and as decorative slabs.

Currently, the broken rock is crushed on site and screened only upon arrival at the lime and drying plant location. Material 1.5- to 3-inch and 2- to 4-inch size fractions are both used in the lime process while the 0.875- to 1.5-inch size fractions will potentially be sold as aggregate, once this market is developed and the less than 0.875-inch fraction will go through the drying plant. As soon as a secondary crusher is available on a permanent basis, both on-site crushing and screening will be attempted to avoid transporting oversize material.

The quarry generally employs 6 people; however, this number has been temporarily reduced to 2 until operations resume in January 1991.

McLaren's Bay Mica Stone Quarries (G.Boughner)

Quarrying of decorative building stone from this property totalled approximately 300 tons during 1990. This represents a 96 percent decrease from the 7500 tons quarried in 1989. The rapid decline in the construction market in southern Ontario and elsewhere is cited as the dominant reason for production reductions. The operator does not anticipate increased production for next year with the current widespread economic downturn in the province (G. Boughner, personal communication, 1990).

The quarry is located on the north shore of Reynolds Lake in the southwestern portion of McAuslan Township (Basa, in preparation). It consists of numerous shallow pits distributed over a long strip of land covering 23 km^2. Each individual pit, although mineralogically distinct, is underlain by micaceous quartzites and muscovitic gneisses which represent the 2 dominant rock types in this area (Owsiacki et al. 1989). Various colours of stone are quarried. These colours are due to the variety and concentration of mica within the rocks. The most popular colours are a distinctive green and red, although both black and "satin" varieties are also sold (G. Boughner, personal communication, 1989). The black stone (quartz-biotite gneiss) is present in only 1 location and has recently increased in popularity. "Satin" stone is defined as a coarse, irregular-textured quartzose gneiss (Owsiacki et al. 1989). These and other varieties of stone are crushed to sizes ranging from 5 cm to -50 mesh (G. Boughner, personal communication, 1989). This material is then used as ornamental landscaping gravel and is also being marketed for use as a metallic paint additive (G. Boughner, personal communication, 1989). The stone is distributed to markets in Montreal, Toronto and the United States.

Thorne Brilliant Stone Quarry (P. Pharand)

Located in the northern half of Poitras Township, near the town of Thorne, Ontario, the company produced approximately 220 tons of decorative building stone and flagstone in 1990. This represents a level of activity 56 percent lower than that of 1989.

The property is characterized by the presence of extensive outcrop but quarrying is restricted to 3 main areas. Underlying lithologies consist dominantly of quartz-muscovite gneisses. Minor quantities of biotite gneiss are also quarried. The stone is broken into slabs, varying in thickness from 3 to 30 cm, although the most commercial size is in the range of 5 to 15 cm. Slabs larger than this are difficult to market (P. Pharand, personal communication, 1989). Distribution of the product, advertised as a flat or wavy patio stone and flag stone, is predominantly to local markets in Ontario and Quebec. Possibly due to a recent publication, the Ontario Catalogue of Dimensional Stone published by the Ministry of Northern Development and Mines (1990), the owner has mentioned that he has received recent enquiries regarding the availability of his decorative stone products (P. Pharand, personal communication, 1990).

MILLS AND REFINERIES

Penn Mill (Agnico–Eagle Mines Limited)

Silver production from this mill ceased in early October 1989. However, a custom milling contract was signed with Mining Corporation of Canada to mill gold ore from their Goldpost property near Matheson, Ontario. The mill operated from early November 1989 until the middle of March 1990 and produced 2913 troy ounces of Au from approximately 9403 tons of ore (J. Young, Agnico–Eagle Mines Limited, personal communication, 1990).

The mill is currently inactive with no foreseeable plans for any further custom milling contracts or silver ore feed being supplied, as all operating silver mines in the area have been closed.

Remedial work was required on the existing tailings and polishing ponds to upgrade their effectiveness. The tailings pond dam has been raised and a new sluiceway has been installed on the polishing pond to extend the capacity of the pond to accommodate approximately 2 additional years of mill operational effluence (K. Saxton, Agnico–Eagle Mines Limited, personal communication, 1990). This work was completed to facilitate immediate mill start-up should it be required at a future date. The remedial construction work was performed by company employees during August and September 1990.

The company also continued work on rehabilitation of the Nipissing Mine tailings site by seeding approximately 3 acres of an abandoned tailings pond near Cobalt. Minor growth was noted before snowfall (K. Saxton, Agnico–Eagle Mines Limited, personal communication, 1990).

Environmental water sampling by Agnico–Eagle Mines in compliance with Ministry of Environment regulations is currently monitoring effluent material from both the Agnico–Eagle refinery and the Penn Mill tailings and polishing ponds.

Until recently, environmental consultants were retained by the company throughout the year to advise them on all matters relating to tailings, waste rock stockpiles and other potential environmental hazards (K. Saxton, Agnico–Eagle Mines Limited, personal communication, 1990).

Agnico–Eagle Silver Refinery (Agnico–Eagle Mines Limited)

During the year, the refinery completed processing its final silver inventory and has continued work on clean up operations of the property on which the refinery is located. One open stope has been rehabilitated due to increasing environmental concerns (K. Saxton, Agnico–Eagle Mines Limited, personal communication, 1990). Stockpiled leach residue has been transported to a nearby mill purchased from Breakwater Resources Limited in 1988 to be stored until a buyer can be found.

Cyanide solution destruction remains a concern and will be addressed in 1991. Test work conducted in 1989 by Inco resulted in a sulphur dioxide process being suggested as a possible method for destruction (Owsiacki et al. 1989). This is the preferred method that the refinery expects to use, although further test work is required before proceeding with the solution destruction (J. Young, Agnico–Eagle Mines Limited, personal communication, 1990). The process is expected to take a few months to complete.

A temporary shutdown was enforced by the Ministry of Labour recently until proper WHMIS training was provided to the employees. The shutdown was short-lived as training was delivered promptly.

Although currently seeking custom refining contracts, the Agnico–Eagle refinery remains in a neutral status except for work focussed on destruction of the existing cyanide solution on site (J. Young, Agnico–Eagle Mines Limited, personal communication, 1990).

Due a prolonged depressed price of silver and the subsequent lack of producing mines, the company was again forced to reduce its total workforce from 52 employees in November 1989 to 12 employees in November 1990. Further layoffs are expected prior to year end.

Cobalt Refinery (Cobalt Refinery Limited)

In 1989, an experimental electrowinning process was being tested to produce ferrous chloride, and extract copper from electrical circuit etchants using new technology (Owsiacki et al. 1989). Work on this process has continued although no progress has been reported as developments are proprietary, and patents have been applied for.

Approximately 40 tonnes Cu and 50 000 gallons of ferrous chloride solution are expected to be produced in 1990, using the conventional cementation process of copper removal.

Ferric sulphate is being produced from ferrous sulphate crystals obtained from several sources in Quebec, using a proprietary process, on which patent applications have been filed in both Canada and the United States.

8000 tonnes of ferric sulphate were produced this year. This product is used for water clarification and as a sedimentation agent, to remove phosphate in sewage treatment plants. It is also being used in waste water treatment to precipitate arsenic. The company is supplying large amounts of ferric sulphate for removal of arsenic and antimony from mine waste and arsenic-rich tailing effluent, using the process of chemical precipitation. The product is sold in Ontario, Quebec and many areas of the United States (as far away as Texas). The company's largest market is still in Ontario.

ADVANCED EXPLORATION AND DEVELOPMENT

Penna Mine (Agnico–Eagle Mines Limited)

The Penna shaft, completed in 1989, is collared in Nipissing diabase and extends down through a thick sequence of pebbly wackes of the Huronian-age Coleman Member into a basement of Keewatin (Archean) mafic metavolcanic rocks (Owsiacki et al. 1989). It is centrally situated within a northeasterly-trending paleotrough which may represent a Keewatin-age graben (Owsiacki et al. 1989).

Work in 1990 entailed minimal development and consisted of diamond drilling and the testing of vein continuance by raising and extracting backs. All development work and diamond drilling was confined to the fourth level and was completed by early January 1990. Several long holes were drilled to test along the margins of the paleotrough—a geologically-favourable environment for the development of silver-bearing veins. Unfortunately, no significant vein systems were intersected and all operations at the Penna Shaft were suspended in May 1990 (B. Thorniley, Agnico–Eagle Mines Limited, personal communication, 1990). Twenty-two underground diamond-drill holes totaling 13 826 feet were completed from the beginning of December 1989, to closure. The mine remained on stand-by basis until it was allowed to flood in August (K. Saxton, Agnico–Eagle Mines Limited, personal communication, 1990).

Dymond Lime Plant (Dymond Lime Products Limited)

A favourable feasibility study completed in 1989 into producing and selling quicklime convinced the company to complete construction on a new processing plant that will have a significant positive economic impact on the area. Operations began in early August with production initially attaining only 80 tonnes of its potential 216 tonne per day capacity. As adjustments were made, tonnage increased. Currently, 150 tonnes of limestone are processed daily producing approximately 80 tonnes calcined lime (S. Lescom, Dymond Lime Products Limited, personal communication, 1990). Running at optimum conditions, 75 000 tonnes of feed will be required annually. This material will be derived from the Breault Quarry.

Currently, the product is being sold to Lac Minerals' Macassa Mine and Les Mines Doyon for use in their mill circuit as a pH control (R. Garrett, Dymond Clay Products Limited, personal communication, 1990). Another possible market will be to control acid mine drainage at sites being decommissioned. Development of this market is in progress.

Factors determining the quality and grade consistency of the finished product are temperature of the kiln, retention time within the kiln and homogeneity of material size (S. Lescom, Dymond Lime Products Limited, personal communication, 1990). All these contribute to an even heating of the material. Once optimum conditions have been determined, the company expects to be operating at near capacity levels (S. Lescom, Dymond Lime Products Limited, personal communication, 1990).

The lime plant currently employs 10 people.

EXPLORATION ACTIVITY

Exploration activity continued on a decline that began in the middle of 1988, due to a combination of many factors including low gold and silver prices, lack of investor enthusiasm and confidence in the junior mining sector, and the continued restriction on land tenure as a result of the Bear Island Indian Land Claim. A great deal of expectation rose with the announcement earlier this year that lands peripheral to the Land Caution would be open to staking and exploration after being restricted for over 8 years. When the equivalent of 11 townships opened on April 3, staking activity was intense with 1106 claims being staked during April in the Cobalt district. Of these, 882 were staked in 12 townships within the Shining

TABLE 13.1. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
1	Agnico–Eagle Mines Limited	Diamond drilling, Haultain Township
2	Agnico–Eagle Mines Limited	Diamond drilling, Casey Township
3	Agnico–Eagle Mines Limited	Lithogeochemical survey, Haultain and Nicol townships
4	Annett, R.; Ferguson, R.	Diamond drilling, Churchill Township
5	Asarco Exploration Company of Canada Limited	Reverse circulation drilling, MacMurchy Township
6	Asarco Exploration Company of Canada Limited	Geological mapping, geophysical surveys, Fawcett Township
7	Asquith Resources Incorporated	Stripping, sampling, Asquith Township
8	Benner, R.	Diamond drilling, Firstbrook Township
9	Bettiole, E.	Geological mapping, Churchill Township
10	Chitaroni, G.	Trenching, stripping, geological mapping, Coleman Township
11	Chitaroni, G.	Geological mapping, sampling, Coleman Township
12	Decker, A.	Diamond drilling, stripping, Natal Township
13	Fort Knox Gold Resources	Geological mapping, sampling, stripping, compilation, MacMurchy Township
14	Gold Fields Canadian Mining Limited	Geological mapping, sampling, stripping, Bryce Township
15	Gore, J.	Stripping, trenching, South Lorrain Township
16	Gunter, C.	Stripping, Asquith Township
17	Highrock Contracting Limited	Geophysical surveys, geological mapping, stripping, Bryce Township
18	Highrock Contracting Limited	Stripping, Bryce Township
19	Hogg, J.	Geological mapping, sampling, McAuslan Township
20	JVX Limited	Reverse circulation drilling, MacMurchy Township
21	MacCallum, R.; LaCarte, A.	Stripping, trenching, sampling, Tyrrell Township
22	Manderstrom, W.	Sampling, Tudhope Township
23	McDonald, I.; Brydges, D.	Diamond drilling, Coleman Township
24	Pelangio Larder Mines Limited	Geological mapping, Tudhope Township
25	Swanson, F.; Ewanchuck, J.	Geological mapping, sampling, Tudhope Township
26	Swanson, F.	Geophysical surveys, Robillard Township
27	Winslow Gold Corporation	Airborne geophysical surveys, geological mapping, sampling, Kittson Township
28	858277 Ontario Incorporated	Diamond drilling, sampling, stripping, trenching, Bryce Township

Tree area as outlined by Ontario Geological Map 2510 (Carter 1989). This number is significantly higher than the annual total of 374 for 1989 and 338 for 1988 for the entire Cobalt district. The total number of claims staked this year to the end of October is 1399, which represents a 423 percent increase over the same time period in 1989 . However, the total number of cancellations during the year rose 640 percent from 1989 to 466. Because of the number of recordings within the same area in such a short time, there were, as expected, a number of disputes.

The Ontario Prospectors Assistance Program (OPAP) was a positive incentive this year and was well-subscribed to as a large number of local prospectors applied for and received funding. Projects were carried out in the Englehart area, the Shining Tree area, the Cobalt area and the North Bay area. Several occurrences of gold and one of potential commercial value were located and, in some cases, option agreements are being initiated. The program is expected to remain popular in 1991.

Other positive events during the year included the regulation amendments to the Ontario Mineral Incentives Program (OMIP). The move is expected to increase the scope of the program to partially fill the gap left by the announcement that the federal government's Canadian Exploration Incentive Program (CEIP) will be discontinued. Major changes to the program include: the maximum grant allowed per applicant per year being increased to $300 000 from $150 000; flow-through projects will now be eligible; producers will now be considered for assistance; allowable expenses have been expanded to include 100 percent of both surface and underground diamond drilling, limited amount of underground exploration expenses, industrial minerals laboratory, pilot plant and marketing studies; and environmental studies. Also, because both Elliot Lake and Temiskaming districts have suffered economic downturns, parts of the Cobalt Resident Geologist's district falls within the area chosen for extra OMIP incentives equal to 50 percent of eligible expenses as opposed to the standard 30 percent. These programs are intended to assist and promote exploration at all levels and may help offset further declines in the local mining and exploration industries.

Total underground and surface diamond drilling decreased in 1990 by 84 percent to 5723 m, with surface drilling alone decreasing by 92 percent to 1508 m. That is well below the level of "flow-through" days and is at the lowest level ever recorded by the Cobalt district office. Underground drilling declined by 72 percent to 4215 m, again reflecting the suspension of many flow-through funded exploration and development projects and the exhaustion of silver mine reserves in producing mines.

Although once again the majority of surface exploration programs focussed on gold, the bulk of development and underground exploration was concentrated on silver until all projects were discontinued earlier this year. Interest was also evident in exploration for copper and other base metals, and various industrial minerals including metallurgical limestone and dolomite, feldspar, building stone, kyanite, vermiculite and silica. Companies, other than those described in the following sections, expressed an interest in the Cobalt Resident Geologist's district over the year and include: A.C.A. Howe International Limited, American Barrick Resources Corporation, BHP–Utah Mines Limited, B.J. McKay Geological Consultant, Carleton University, Cold Stream Concrete Limited, Cominco Limited, Corporation of the Town of Cobalt, Corporation of the Town of Latchford, Corporation of the Township of Coleman, Compagnie Tifnout Tiranimine of Morocco, Exploration Services Limited, Gleeson and Associates Limited, Golden Myra Resources Incorporated, Golder Associates Consulting Engineers, Grant Development Corporation, Highway Book Shop, Homestake Mineral Development Company, Inco Limited, Infoterra Digital Incorporated, JVX Limited, McBride Staking and Line Cutting, Midrim Mining Company Limited, Mining Corporation of Canada Limited, Moore Mining, MPH Consulting Limited, M.V.W. White and Associates Limited, Noramco Mining Corporation, Northern Geotechnical Computer Resources Incorporated, Ojibway Ressources, Ontario Hydro, Oslo University, Placer Dome Incorporated, Parcher and Associates, Sagax Geophysics Incorporated, Science North, Settlement Surveys Limited, The Oscar Giroux Resources Limited, Tri Origin Exploration Limited, Union Mining Corporation, and W.A. Hubacheck Consultants Limited.

A more complete summary of exploration activity in the Cobalt Resident Geologist's area in 1990 is provided in the following sections (*see also* Table 13.1 and Figures 13.1a, 13.1b, 13.1c, and 13.2). Relevant Ontario Geological Survey and Geological Survey of Canada publications are listed in Table 13.2.

COBALT AREA

Mr. R. Benner completed one 161 m diamond-drill hole on a property in Firstbrook Township near the Coleman Township boundary using funding provided by a provincial OPAP grant. The hole was drilled beneath McLaren Lake to investigate a conductor located by a UTEM survey completed in 1987 and 1988. Drilling was projected to extend parallel to and approximately 60 m below a proposed south-dipping Nipissing diabase sill—an environment believed to be conducive to silver vein development. The hole passed through over 70 m of finely-laminated Firstbrook sediments and into pebbly conglomerates of the Coleman Member of the Gowganda Formation. The contact with metavolcanic basement rocks was intersected at 155 m and the hole was terminated at 160 m. No major structures were encountered. However, minor galena was found disseminated over 18 m at the unconformity.

G. Chitaroni evaluated a previously-identified very low frequency electromagnetic (VLF-EM) and magnetic anomaly in Coleman Township west of Green Lake. With the aid of an OPAP grant, the area was stripped, sampled and geologically mapped locally. The anomaly is believed to be caused by intercalated graphitic or sulphide-bearing tuffaceous sediments within a sequence of Keewatin-age mafic volcanic flows (G. Chitaroni, Prospector, personal communication, 1990). These interflow sediments commonly contain elevated values of base metals in the Cobalt area. No values have been submitted to the Resident Geologist's office. G. Chitaroni would like to continue the work in 1990 if funding is available.

J. Gore has been prospecting on claims in South Lorrain Township in the historic Silver Centre area. The claims are located on a narrow and steeply-dipping portion of the Nipissing diabase sill. Gowganda Formation sediments are found immediately to the northwest of the sill and Keewatin volcanic rocks immediately to the southeast. Three faults exist on the property; 1 trending northeast and 2 trending northwest. The northwest-trending faults displace the sediment and volcanic rocks vertically. A shaft was sunk on the property in 1929 by The Mining Corporation of Canadá Limited. A calcite vein was reported at the 375-foot level within the metavolcanic rocks, and was reported to have been traced for approximately 80 feet on the adjoining claim (McIlwaine 1970). J. Gore acquired the claims this spring and has conducted prospecting and trenching on the property. The possibility of conducting diamond drilling on the claims exists next year if funding can be arranged. J. Gore has also indicated an interest in using geophysical methods to establish the

TABLE 13.2. MAPS AND REPORTS PERTAINING TO THE RESIDENT GEOLOGIST'S AREA PUBLISHED DURING THE YEAR BY ONTARIO GEOLOGICAL SURVEY, MINISTRY OF NORTHERN DEVELOPMENT AND MINES.

Ontario Geological Survey Reports

Report 240

Report 271

Open File Maps

OFM 124

OFM 125

Preliminary Maps

P.3165

P.3166

Geological Data Inventory Folios

GDIF 480	GDIF 507
GDIF 495	GDIF 508
GDIF 496	GDIF 514
GDIF 497	GDIF 515
GDIF 498	GDIF 516
GDIF 499	GDIF 518
GDIF 500	GDIF 549
GDIF 501	GDIF 550
GDIF 502	GDIF 551
FDIF 504	GDIF 566
GDIF 505	GDIF 567
GDIF 506	

Coloured Maps

Map 2510

Map 2526

Mineral Development and Lands Branch Publications

Industrial Minerals Background Paper 11

Industrial Minerals Background Paper 13

Industrial Minerals Background Paper 14

Miscellaneous Papers

MP 139

MP 143

MP 146

MP 147

Geological Survey of Canada Publications

Open File 2178

presence or absence of interflow sedimentary rocks (J. Gore, Prospector, personal communication, 1990).

Winslow Gold Corporation completed an airborne geophysical survey in early summer over a large claim group straddling the Coleman–Kittson Township boundary, south of the Cobalt–Kittson Mine. Several electromagnetic anomalies were apparently identified (M. Calles, Winslow Gold, personal communication, 1990). Ground geophysical and geochemical surveys were to be conducted during the 1990 field season; however, no indication of further work has been obtained at this time. The company is interested in obtaining joint venture partners to help finance further exploration and development. Grab samples reportedly obtained from the property and observed in the Cobalt Resident Geologist's office suggest high mineral potential exists on the property as evidenced by black greywacke sediments containing approximately 40 percent interbedded Pb/Zn/Cu massive sulphides (Resident Geologist's files, Cobalt District, Cobalt, 1990).

ENGLEHART AREA

Exploration activity in this area, particularly in Bryce and Tudhope townships, remained at a relatively high level, reflecting a strong interest in gold potential. Three companies conducted significant exploration projects while numerous prospectors were active in the area. Once again, interest focussed on auriferous, carbonatized shear zones hosted in Archean intermediate to mafic metavolcanic rocks (Owsiacki et al. 1989).

Gold Fields Canadian Mining Limited continued work in the area on a property situated along the western boundary of Bryce Township. A program involving prospecting, geological mapping and re-evaluating old trenches along with mechanical stripping near the township boundary was completed this year. Additional channel sampling in stripped areas was performed to verify original speculations (W. Waychison, Gold Fields Canadian Mining Limited, personal communication, 1990). Results were not encouraging and no further work is planned at this time. The property was previously the site of a major trenching program completed along an auriferous and sulphide-rich, sericitized quartz-carbonate vein system in 1987 and 1988 by Kapalua Gold Mines Limited (Owsiacki et al. 1989).

Due to increasing environmental concerns, the company infilled all existing trenching on the property, dismantled an old headframe and capped a shaft on the claims which have now reverted back to Petromet Resources Limited.

Exploration work continued this year in northeastern Bryce Township on a claim group consisting of 4 patented claims and 3 staked claims held by 858277 Ontario Incorporated. The claim group includes the former B. Holmes property (Whitton Gold Prospect), on which 3 shafts were

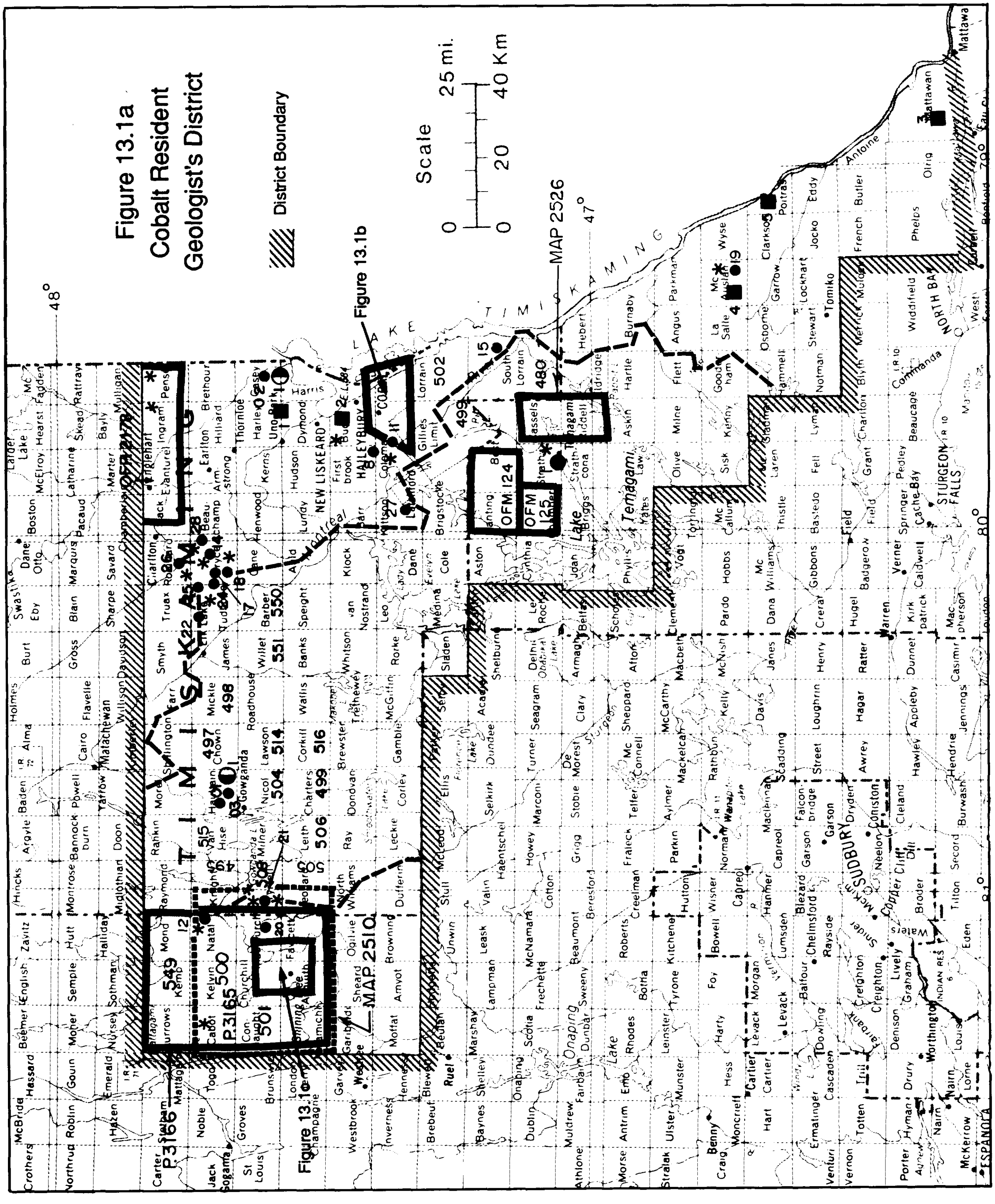

Figure 13.1a Cobalt Resident Geologist's District

EXPLANATION

● Producing Mines, 1990
1. Sherman Mine (Dofasco, Tetapaga Mining Co. Ltd.)...Fe

◑ Mines Under Development, 1990
1. Penna Mine (Agnico-Eagle Mines Ltd.).........................Ag

◐ Mines Undergoing Exploration, 1990
1. Leroy Shaft (Agnico-Eagle Mines Ltd.)..........................Ag

■ Producing Quarries, 1990
1. Bucke Quarry (Dymond Clay Products Ltd.).....limestone
2. Breault Quarry (Dymond Clay Products Ltd.)....limestone
3. Janveaux Qaurry (J-M Janveaux).........................feldspar
4. McLaren's Bay Mica Stone Quarries (G. Boughner..)..stone
5. Thorne Brilliant Stone Quarry (P. Pharand).............stone

○ Operating Mills, 1990
1. Penn Mill (Agnico-Eagle Mines Ltd.)

Ⓐ Operating Refineries, 1990
1. Agnico-Eagle Silver Refinery (Agnico-Eagle Mines Ltd.)
2. Cobalt Refinery (Cobalt Refinery Ltd.)

• Exploration Activity in 1990 (keyed to Table 13.1)

* Assessment Work Filed in 1990

2526 GDIF Published in 1990

Map, Report or Open File Issued by the Ontario Geological Survey in 1990

Areas withdrawn from staking through Bear Island Indian Land Caution

Boundary of Resident Geologist's District

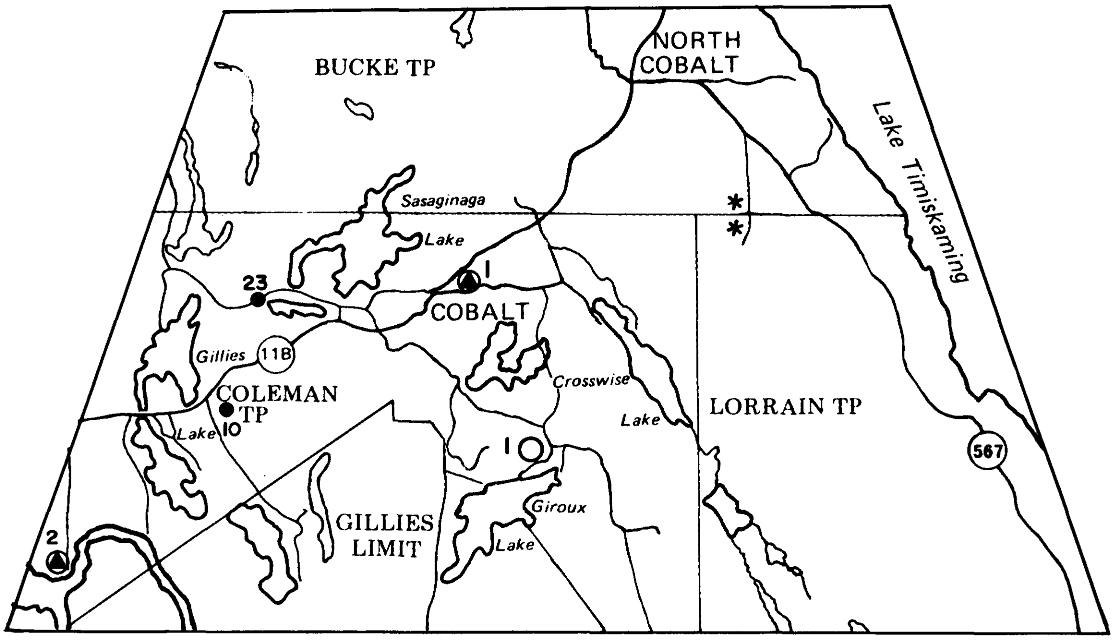

Figure 13.1b. Resident Geologist's area.

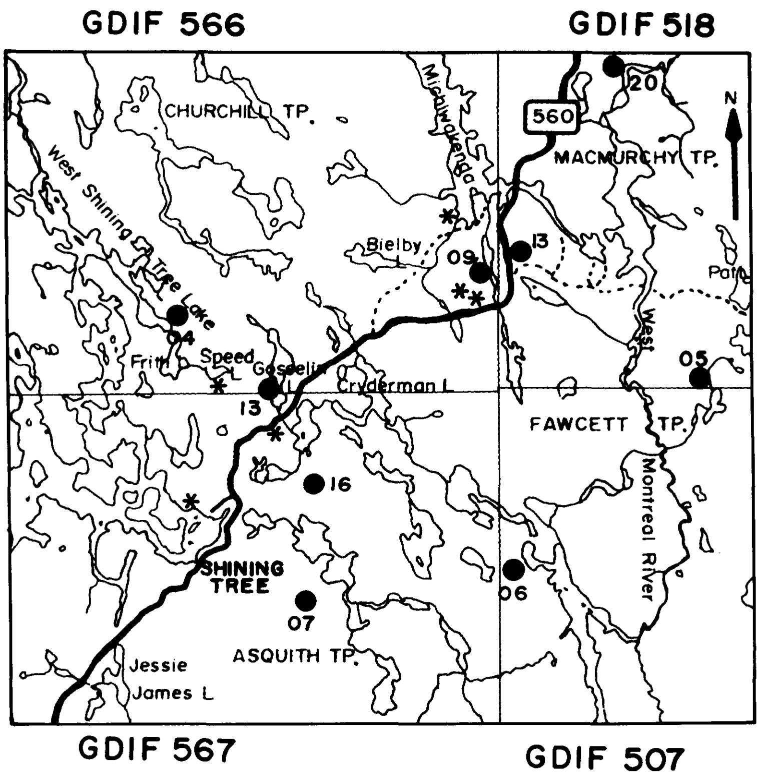

Figure 13.1c. Resident Geologist's area.

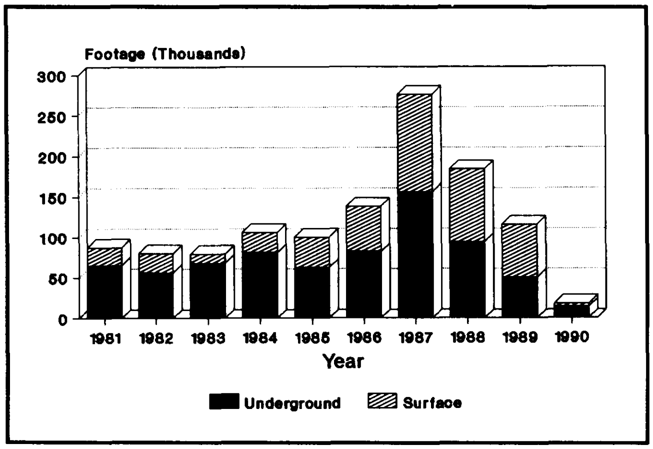

Figure 13.2. Exploration diamond drilling activity in the Cobalt Resident Geologist's area.

sunk prior to 1940 (Moorehouse 1944). The claims are underlain by massive, medium-grained mafic metavolcanic rocks which are, in part, unconformably overlain by a thin veneer of Huronian-age Coleman Member conglomerate (Owsiacki et al. 1989). The major structure appears to be a northeast-trending shear zone on which both past and present exploration has been concentrated (Owsiacki et al. 1989). Trenching last year on claim T19434 resulted in the discovery of the westerly extension of a sulphide-bearing quartz-carbonate vein near the No.1 shaft (Owsiacki et al. 1989). The vein is up to 0.3 m wide, strikes at 225° and dips 75°north. Both a gossan zone and minor shearing occur in the hanging wall but are absent on the footwall side of the vein. Two beds of cherty iron formation, up to 10 cm wide, occur adjacent and parallel to the vein (Owsiacki et al. 1989). On a separate occurrence, sheared and carbonatized mafic metavolcanic rocks were exposed during stripping operations near the No.2 shaft on claim T23279. A fine-grained quartz vein, with a maximum thickness of 0.3 m, is located on the west wall of the shaft. The vein strikes 060° and dips 65°south (Owsiacki et al. 1989). Grab samples of the vein contained minor amounts of pyrite, chalcopyrite, magnetite, arsenopyrite, and malachite. Muck from the bottom of the shaft contained similar mineralization as well as brecciated, cherty iron formation. According to A. LaCarte (Prospector, personal communication, 1989), samples of this material assayed 1.31 ounces Au per ton. The company has completed drilling in this area to test for extensions of both vein systems. Nine diamond-drill holes totalling 550 m were completed between November 1989 and January 1990. In the #1 Shaft area, holes intersected a narrow section of oxidized iron formation assaying 0.608 ounce Au per ton and 10.30 ounces Ag per ton. Most of the core within approximately 30 m of this anomalous sample hosted an extensive stockwork of calcite veinlets (M. Cosec, Staff Geologist, Sudbury, Ministry of Northern Development and Mines (MNDM), personal communication, 1990). Below the iron formation, pyritic, fine-grained metavolcanic rocks assayed from 0.008 to 0.050 ounce Au per ton over 30 cm (M. Cosec, Staff Geologist, Sudbury, MNDM, personal communication, 1990). Drilling in the #2 Shaft area intersected a quartz vein-bearing shear zone trending 065° and dipping 65° south. Assays returned values of up to 0.021 ounce Au per ton over 30 cm in a pyritiferous metasedimentary unit (M. Cosec, Staff Geologist, Sudbury, MNDM, personal communication, 1990). The company would like to continue their work next summer with additional trenching and approximately 600 m diamond drilling to delineate other potentially economical structures that might interest exploration companies in an option agreement.

Highrock Contracting Limited continued to work on claims located in the southwest part of Bryce Township funded primarily by OPAP grants and expanded their holdings to include claims in Tudhope Township as well. Substantial stripping and channel sampling, a VLF-EM geophysical survey, and mapping in the southwest corner of Bryce Township uncovered an area of sheared, carbonatized felsic volcanic rocks and additional local shear zones. Assays returned values of up to 0.33 ounce Au per ton over 1.35 m from channel samples and 0.23 to 0.24 ounce Au per ton from grab samples. The group is hoping to raise enough funds to initiate diamond drilling in 1991. This work stimulated interest in the property as several companies viewed it for a potential option agreement.

Claims around the Heather Lake area, previously held by Mingold Resources Incorporated, were staked by Highrock Contracting Limited this year. Unfortunately for them, due to claim disputes, most of their holdings were lost. They were however able to secure 14 claims in adjoining Tudhope Township but were unable to complete any exploration work on them this year. Work is planned for 1991. Interest in the property has already reportedly been expressed by nearby claim holders.

Pelangio Larder Mines Limited staked 8 claims in Tudhope Township covering a portion of the 1000-foot Taylor gold vein. The claims are situated immediately north of the contact between the Catherine and Skead groups and are underlain by massive and pillowed mafic volcanic flows intruded by narrow feldspar porphyry dikes (Johns 1986). The property is crossed by a northeast-trending shear zone known as the Palmer–Vaughan–Estival Break along which the Taylor vein occurs. The quartz vein is reported to vary in width from 7 cm to over 30 cm and contains variable amounts of pyrite mineralization. Assays have been reported from 0.11 to 3.02 ounces Au per ton by various claim holders (Johns 1986). Results from diamond drilling have been discouraging as values are generally poor and very erratic (Johns 1986). Pelangio Larder Mines has tried to duplicate previously-reported assay values and have reported values up to 2.0 ounces Au per ton and channel samples up to 0.75 ounce Au per ton over 4-foot widths (M. Hibbard, Pelangio Larder

Mines Limited, personal communication, 1990). The company is currently seeking joint venture partners to participate in further exploration programs.

F. Swanson and J. Ewanchuck have conducted line cutting, sampling, mapping, and rehabilitation and re-evaluation of old trenches on claims that they hold in eastern Tudhope Township and which are situated along part of the Taylor vein previously described. Grab samples have yielded values of up to 3.4 ounces Au per ton with an average of 1.4 ounces Au per ton over a 500 m strike length. The 2 prospectors are inspecting other northeast-trending faults and local shear zones for mineralization (J. Ewanchuck, Prospector, personal communication, 1990). Several companies have shown an interest in the property. Swanson and Ewanchuck have committed to certain exploration expenditures through an OPAP grant and are hoping to expand upon the existing data available for the property.

SHINING TREE AREA

Although staking activity was at an all time high due to recently opened lands peripheral to the Bear Island Indian Land Caution, exploration in the Shining Tree area decreased moderately from levels attained in 1989. While the most active staking took place in MacMurchy, Fawcett and Tyrrell townships, other active townships included Churchill, Natal and Asquith. One possible reason for the ensuing lack of anticipated exploration activity is that mining companies and individuals are awaiting the release of a government airborne geophysical survey of the Shining Tree area scheduled for release on December 18, 1990. As in recent years, activity was concentrated on gold exploration, predominantly in southwestern and eastern MacMurchy Township and western Tyrrell Township.

Asquith Resources Incorporated continued exploration on its 77 contiguous claim Buckingham property in Asquith Township funded by joint venture partner Asarco Exploration Company of Canada Limited. Work this year entailed completion of geological mapping and prospecting, trenching and extensive stripping with follow-up channel sampling near the Buckingham Shaft and elsewhere on the property (R. Gray, Asarco Exploration Company of Canada Limited, personal communication, 1990). Stripping has exposed 2 large areas approximately 1000 feet by 100 feet and 450 feet by 150 feet in size respectively. These exposures have revealed substantial folding of the high-grade type veins. This information was previously unknown and may therefore explain the difficulty in correlating earlier diamond-drill hole intersections (J. Tindale, Asquith Resources Incorporated, personal communication, 1990). No diamond drilling was undertaken in 1990. However, as a number of interesting gold assay values resulted from the sampling program, further work is currently being planned for 1991. Previously, the best assay values were obtained from a series of parallel, quartz-filled shear zones within carbonatized mafic metavolcanic rocks.

R. Annett and R. Ferguson, 2 local prospectors, applied for and received OPAP funding for an exploration program on a gold property located on the shores of West Shining Tree Lake in Churchill Township. Gold occurrences in this area are normally found within pyritiferous, quartz-carbonate stringer veins hosted in interbedded mafic and felsic metavolcanic flow rocks (Carter 1980). The program entailed continuing a diamond-drill program previously initiated. Although 4 holes and approximately 1200 feet have been completed since the inception of the exploration program, only 1 hole of approximately 390 feet was completed this year. This diamond-drill hole intersected a carbonate zone which is currently being assayed. No results were available at the time of writing this report.

Continued work at the Tyranite Mine site attempted to delineate sufficient tonnage of ore reserves to justify a production decision. Northfield Minerals Incorporated, the company with controlling interest in the mine, conducted extensive stripping and sampling on the property which straddles the Knight and Tyrrell Township boundary (P. Ankcorn, Northfield Minerals Incorporated, personal communication, 1990). According to the *Canadian Mines Handbook,* 1990-91, the property was optioned from Tyranex Gold Incorporated to Mill City Gold Mining Corporation and Gunnar Gold Mining Incorporated who may earn a 50 percent interest by spending \$5 million on exploration and completing a feasibility study by August 1990. Tyranex Gold Incorporated has since been taken over by Northfield Minerals Incorporated and exploration work was subsequently reduced although further work is planned for 1991. Reserve estimates currently stand at 526 000 tons averaging 0.20 ounce Au per ton (*Canadian Mines Handbook*, 1990–91).

A. Decker has completed extensive prospecting on 4 claims on the west shore of the Montreal River in the northeast corner of Natal Township. The area is underlain by a series of northwest-striking Early Precambrian metavolcanic flows ranging in composition from alkalic mafic and intermediate to subalkalic mafic and intermediate (Carter 1989a). The volcanic flows are cut by several later, Early Precambrian north-northwest-striking Matachewan type fine- and medium-grained diabase dikes (Carter 1989a). A. Decker (Prospector, personal communication, 1990) has indicated that a thick covering of gossan and altered loose rubble on the property contains abundant pyrite and pyrrhotite mineralization. The property is part of a former larger claim group previously held by Temiskaming Nickel Limited who completed 1098 m of diamond drilling on the property in the late 1960s. A. Decker completed 3 diamond-drill holes earlier this year totaling 83.3 m with assays returning between 0.39% and 0.49% Ni (A. Decker, Prospector, personal communication, 1990).

Although Tyrrell Township was subject to extensive staking in April, only 1 property has reportedly been explored in any detail to date, by 2 prospectors, MacCallum and LaCarte, who have completed extensive stripping, washing and sampling on their property. This work has uncovered a significant green carbonate zone within a succession of tholeiitic and calc-alkalic metavolcanic rocks. Samples taken within the green carbonate unit assayed between 0.024 to 0.12 ounce Au per ton (A. LaCarte, Prospector, personal communication, 1990). One sample of significant visible gold was located in a quartz stringer within the carbonate zone but was not assayed (H. Lovell, Regional Minerals Specialist, Northeast Region, MNDM, personal communication, 1990). Diamond drilling is expected to be conducted next summer or as soon as funds are available to further test the mineralized carbonate zone beneath a swamp running north-northwest to south-southeast (H. Lovell, Regional Minerals Specialist, Northeast Region, MNDM, personal communication, 1990). Presently, it appears that the unit may be approximately 183 m thick although folding of the unit is suspected. The southern portion of the property, composed of 8 claims immediately south of Reford Mines Limited's patented claims in the northwest portion of the township, contains gold and copper occurrences discovered by Amax Potash Limited. The gold discovered by MacCallum and LaCarte represents a new occurrence in the area and provides additional information to an expanding data base of information in the Shining Tree area. The prospectors have reportedly received numerous inquiries by mining companies regarding an option agreement for their property.

Fort Knox Gold Resources has been working on 2 claim groups which they have optioned in Asquith and Churchill townships. Inco has recently increased their stake in the company to approximately 40 percent and has agreed to operate and finance the first year of exploration on the properties. W. Whymark (Fort Knox Gold Resources, personal communication, 1990) has indicated that a comprehensive geoscientific compilation of the area is the next step prior to any further exploration on the properties. Exploration work in 1990 consisted primarily of reconnaissance mapping and sampling on both the Herrick property on the west shore of Michiwakenda Lake along the eastern boundary of Churchill Township and on the Gosselin property in the central portion of the Asquith–Churchill Township boundary. The Herrick property, previously explored by Unocal (Owsiacki et al. 1989), was resampled together with minor geological mapping. Channel sampling reproduced previously-obtained favourable results. Consequently, a 600 to 760 m diamond-drilling program is planned for early 1991. Stripping and channel sampling were also completed on the Gosselin prospect.

Another property of interest controlled by Fort Knox Gold Resources is the Vintage Mines Limited property on the shore of West Shining Tree Lake in north-central Asquith Township where grab samples assaying up to 1.5% Zn were collected. Part of next year's proposed exploration program will be to decipher the stratigraphy of the area and relate it to established models of gold and base metal deposits (W. Whymark, Fort Knox Gold Resources, personal communication, 1990).

Asarco Exploration Company of Canada Limited staked a considerable number of claims during early April in both Fawcett and MacMurchy townships. Mapping was conducted on the claims near Fawcett Lake in central Fawcett Township to complete areas not previously mapped. M. Carter (1989b) has recently completed regional mapping; however, much of the area around Fawcett Lake remains unmapped in detail. Local rock lithologies include mafic metavolcanics, Middle Precambrian mafic intrusive rocks and pods of komatiitic green carbonate metavolcanic rocks. Line cutting, geological mapping, and magnetometer and VLF-EM geophysical surveys were conducted west of Granite Lake in western Fawcett Township. This area has been previously mapped as a sequence of Early Precambrian mafic and intermediate metavolcanic rocks intruded by Middle Precambrian mafic intrusive rocks. At the time of writing, no results of this work had been released by Asarco Exploration. Sixteen reverse circulation drill holes totalling 281 m were completed near Cub Lake by Asarco Exploration in the south central portion of MacMurchy Township. Again, results of this drilling have not been released although drill logs will be included with the work filed for assessment credit.

GOWGANDA–ELK LAKE AREA

Agnico–Eagle Mines Limited completed 4 surface diamond-drill holes totalling 1020 feet on their Leroy Mine property in Nicol and Haultain townships. This work was designed to test for potential silver mineralization in response to that discovered during previous geological mapping, geochemical sampling and diamond-drilling programs. Diamond drilling was discontinued in late December 1989.

A lithogeochemical sampling program was initiated over 55 line-miles to delineate potential drill targets to test for significant silver mineralization. The program was part of an agreement to retain an interest in a joint venture agreement with Hecla Mining Company dealing with several properties. A total of 2336 samples were analyzed for silver, arsenic, copper, zinc and lead. No significant anomalies were identified and no further work on the property was considered to be justified. All work was completed by September 1990.

TEMAGAMI AREA

Depressed precious metal prices and the continued ban on claim staking resulting from the Bear Island Indian Land Caution, effectively stifled activity in the Temagami area again during 1990. No work was carried out in the Temagami area in 1990 as Stroud Resources Limited and Corona Corporation discontinued all work on the Leckie gold prospect (formerly the Penrose Mine) in Strathy Township. Greater Temagami Mines Limited reportedly discontinued their exploration work in the area , at least for the time being.

NORTH BAY AREA

Exploration activity in this area declined moderately in 1989, following the trend established throughout the district. In addition to building stone, gold, base metals, diamonds and feldspar, a variety of industrial minerals including vermiculite, muscovite and kyanite were prospecting targets.

J.M. Janveaux continued development work on his property in Mattawan Township, near Kearney Lake. Previous surface work exposed a series of northeast-trending albite-quartz-biotite pegmatite dikes within biotite-hornblende-garnet schist. The dikes are relatively narrow (less than 2 m) and steeply dipping (Owsiacki et al. 1989). J.M. Janveaux is interested in the feldspar for its potential applications in the high-temperature ceramics industry. Feldspar has not been produced commercially in significant quantities from this area since the late 1940s.

Production this year was the same as last year with 40 tons being produced. The material is hand-cobbed and then shipped to West Germany. The owner expects the German market to increase somewhat once the political situation has stabilized and is also hoping to expand his market possibly into the United States (J.M. Janveaux, Prospector, personal communication, 1990).

Six claims belonging to W. Hogg in eastern McAuslan Township were identified by prospecting earlier this year to contain economic-grade silica potential. Prospecting and geological mapping this summer identified the deposit. Using funding provided by an OPAP grant, a sampling program of the deposit was undertaken to determine the average grade and potential of the property for economic industrial mineralization. Silica values obtained range from 71.91% to 98.58% silica throughout the property. The main rock lithology on the claims is a quartzite composed of interlocking grains of quartz together with subordinate sericite and iron oxide. Chemical analyses averaged 95 to 99% silica content (W. Hogg, Prospector, personal communication, 1990). The silica-cemented quartz sand is an orthoquartzite, a metamorphosed member of a clastic sequence of siliceous metasediments of Middle Precambrian age. Loosely packed quartz pebbles can be recognized *in situ*. The economical portion of the orthoquartzite is up to 4000 feet long by 800 to 1000 feet wide (W. Hogg, Prospector, personal communication, 1990).

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

During the year, the Cobalt office was staffed by: Resident Geologist, L. Owsiacki and Acting Resident Geologist, J. Ireland; Staff Geologists, M. Cosec and E. Basa; Secretary, K. Larabie and J. Price; Contract Geologists, P. Anderson, E. Basa, A. Beecham and P. Born; Cartographer, L. Francis; and Experience 1990 Students, M. Audette and A. Delisle.

Extensive changes were realized over the course of the year as the five-year Canada–Ontario 1985 Mineral Development Agreement (COMDA) funding ended, resulting in all contract employees in this office being terminated. Together with the contract employees, both the Staff Geologist (M. Cosec) and long-time Secretary (K. Larabie) left for positions elsewhere. Mike Cosec is currently Staff Geologist in the Sudbury Resident Geologist's office and E. Basa was hired as the Cobalt Staff Geologist. More recently, the Resident Geologist, L. Owsiacki, has left for a secondment position in Sudbury. Timmins Staff Geologist, J. Ireland, is currently Acting Resident Geologist/Acting Manager Temiskaming Testing Laboratories.

Due, in part, to the opening of the equivalent of 11 townships within the Cobalt district, peripheral to the Bear Island Indian Land Caution, office research was greatly increased. Despite the heightened interest and research work, exploration activity decreased in the area during the year. Office use by clients increased slightly by 12 percent from the levels attained last year with the recording of 807 visitors. Staff projects, funded through nonbase sources, continued to the end of March when all COMDA funding and contract funding were discontinued. Due to the lack of funding, therefore, no projects were continued and no new projects were initiated apart from a province-wide computerized mineral occurrence index compilation. The Geoscience Exploration Database (GED) Project was created to provide to the mineral exploration industry comprehensive, readily accessible, indexed geoscience information on a province-wide basis. The first step, compiling all information in existing paper and digital data files and incorporating them into computerized data bases, has been initiated across the province. The Cobalt office has contracted A.W. Beecham Geological Services to update and create approximately 800 files on mineral occurrences in the Cobalt district. The data base is composed of records of mineral deposits, indicating deposit names, location, commodities, development status, mineralization and bibliographical references on existing information. Locally, the contractor began compilation in early November and all work will be completed by March 31, 1991.

As in previous years, the staff geologist prepared and delivered a prospector's course. This year's course was more extensive than in 1989 to allow for repeat attendance. The course was once again well-received and well-attended.

Other Staff Geologist's activities included reviewing and commenting on proposals for property severances; NORTC mine road improvement requests; Ministry of Natural Resources Timber Management Plans; Temagami area mineral potential and land use plans; and land withdrawal requests. In all cases, mineral and mine hazard potentials were identified, with this information being provided in both map and written form for input into these various plans. Assistance was also provided to the Cobalt Northern Ontario Mining Museum in its maintenance of the Heritage Silver Trail (a mining tourist attraction originally designed and built by the Resident Geologist's staff). The use of the trail remained relatively constant with respect to 1989 as close to 8000 people availed themselves of this attraction. This consistency is attributed to a concerted effort by the town and the museum to lead guided tours and expand advertising.

The Resident Geologist's office once again represented the Ministry at the Cobalt Miner's Festival, held in early August, manning a display featuring area geology. Additionally, a number of geological field trips were provided during the year for a variety of organizations and individuals from the public and private sectors, including: MNDM personnel from Sudbury and Timmins; students from the University of Michigan; Miners' Festival participants; a representative from Oslo University, Norway; and students from Ecole Sainte Croix and Cobalt Public School. Field trips promoting area geology and mineral potential were also conducted for a number of representatives of mining companies interested in the area. A short hike with oral presentation was provided to a local Provincial Park on its geology for park visitors.

Numerous presentations were also made by staff during the year. In December 1989, poster displays illustrating recent staff research including the Mines Compilation Project, the Geology and Mineral Potential of Banting Township and the Western Part of Best Township Project and the on-going GDIF Compilation Project, were exhibited at the Mines and Minerals Symposium in Toronto. In February, office staff travelled to Timmins for the Northeast Region Geoscience Seminar with the same displays and an additional display illustrating area exploration and development activities. An oral presentation on the Geology of Banting Township and the Western Part of Best Township was delivered at both of these seminars.

Staff also attended a number of seminars and training sessions during the year, among which were: Ministry Orientation seminar and WHMIS training, secretarial seminar, Performance Management/Employment Equity seminars, Prospectors and Developers Association of Canada convention, Temagami Comprehensive Planning Committee meetings, Kirkland Lake geology field trip, International Association for the Genesis of Ore Deposits in Ottawa, field school in Mining Geophysics for Prospectors, and a French evaluation session for the new Staff Geologist.

The staff geologist and contract geologists visited over 20 active properties to provide assistance and act as liaison between individual prospectors and junior and major mining companies. In excess of 7 inactive properties were also visited to obtain additional data on mineralization and/or geology. Some of these properties were visited a number of times over the course of the year.

The Resident Geologist was occupied during much of the year with the administration and management of numerous COMDA projects and base operations. However, he did manage to provide a moderate amount of technical assistance and consultative services to prospectors, industry representatives, geologists, government and the general public as a means of encouraging and facilitating effective exploration and development in the area. Over the year, an increasing amount of time was spent in managing the office and staff and responding to office visitors and inquiries. The remainder of time was spent primarily attending meetings and acting on numerous local and Ministry committees and working groups. A few property visits and underground mine visits were completed together with 3 field trips held for explorationists. A considerable amount of the administrative function was tied to the continued management of the Temiskaming Testing Laboratory. Many new clients were found for the plant which operated at 100 percent capacity for the first time in a decade. Modifications made to the sampling system and laboratory to enhance processing capabilities were well received by the clients and were responsible for long-term supply commitments (3 years) to guarantee operating at least at 75 percent of capacity.

As part of the new French Language Services Act, an extension course to upgrade French-speaking capabilities was completed by the Resident Geologist in early summer and was scheduled to resume in the fall. However, other commitments have forced the postponement of this course at the present time.

Many projects initiated in the past few years were continued, some of which are described in more detail in the following sections. These projects are designed to expand the local economic base and provide new data to assist in finding and developing new commodities as well as to expand our knowledge of the geology and ore-forming processes in the Cobalt district.

RESEARCH BY RESIDENT OFFICE STAFF

TEMAGAMI–TEMISKAMING MINE WORKINGS COMPILATION PROJECT (COMDA)

Following the closure of the Cobalt Resident Geologist's Office during the mid-1960s, little was done to obtain important deposit information from mines located on patented grounds. As a result, few reports or descriptions of the numerous underground levels, stopes, geology, grades and tonnages of properties within the Cobalt area were compiled. With so many recent mine closures in the area, permission was granted by Agnico–Eagle Mines Limited for recently laid-off employees to complete a compilation project of previously confidential information for the Ministry of Northern Development and Mines, funded by COMDA. This project began in February 1989 and employed 1 geologist until March 1990, as well as another geologist for 4 months and a draftsman for a period of 7 months in 1989 and 1990.

This length of time allowed for only 4 properties to be completed. There are approximately 30 similar properties for which a comparable project could be initiated. The project would add vital information to the existing data base of the Cobalt silver camp and is of great interest to local prospectors and geologists.

The reports completed for the 4 above-mentioned properties contain compiled information on regional and local geology, structure and alteration, economic geology and production figures. Each report is accompanied by level plans and longitudinal cross-sections of the mine workings.

The 4 properties completed include: the Beaver–Temiskaming Mine in Cobalt, the Castle Mine in Gowganda, the Langis Mine in New Liskeard, and the Temagami Copper Mine in Temagami. The reports are awaiting final editing before being published as an Open File Report (Basa and Robinson, in preparation).

GEOLOGY AND MINERAL POTENTIAL OF BANTING AND THE WESTERN PART OF BEST TOWNSHIP (COMDA)

All field work was completed during the 1989 field season. The final geological report and accompanying map were submitted this year for publication. The report should be released shortly (Owsiacki et al., in press).

A poster display was presented at both the Toronto Mines and Minerals Symposium in December 1989 and the Timmins Geoscience Seminar in February 1990. Oral presentations were delivered at both the above mentioned seminars as well as at a local Canadian Institute of Mining and Metallurgy Cobalt Branch meeting in November 1989.

GEOLOGICAL DATA INVENTORY FOLIO (GDIF) COMPILATION (COMDA)

The compilation and publication of Geological Data Inventory Folios (GDIFs) was continued during the year under the auspices of COMDA. In 1989, 3 GDIFs were published and an additional 4 were submitted for publication. In 1990, 23 GDIFs were published and an additional 15 were submitted for publication and will be published prior to April 1991. As this was the final year for COMDA funding, the GDIF compilation project has come to an end as well. Over the 7 years, GDIFs for 115 townships have been published and 15 are in press. This represents a coverage of 93 percent of the Cobalt Resident Geologist's district.

These folios are very popular with internal staff, industry and prospectors alike. The exploration work history tied to location maps with all available references listed is a valuable and time-saving publication.

NORTH BAY–THORNE BUILDING STONE INVENTORY PROJECT

Past and currently producing building stone quarries in the North Bay–Thorne area near South Temiskaming were identified and described in an internal report in 1986. Recent field visits during 1989 and 1990 have resulted in the report being updated so that it now contains maps reflecting current activity. The report (Basa, in preparation) includes descriptions, location maps and localized geology maps of each of the 8 quarries identified. In addition, 20 cm by 15 cm cut slabs of representative samples from each quarry are available at the Resident Geologist's office for viewing. The report should become available as an Open File Report during 1991.

HAZARD LANDS ABATEMENT PROGRAM

The Hazard Lands Abatement Program was initially implemented in Cobalt in 1987. It is funded by the MNDM, administered by the town of Cobalt and implemented by Golder Associates Limited. A detailed description of the history of the program and work performed is available in Owsiacki et al. (1989). This was the final year of the project, with Golder Associates completing 822.76 m drilling this year. All the core was donated to the Cobalt Drill Storage Program.

DIAMOND-DRILL CORE STORAGE PROGRAM

In 1990, 1464.2 m of core were donated to the Cobalt Drill Core Library by 3 companies. Additional core has been offered and will be added to the library next year. The cumulative length of diamond-drill core now stored in the facility is 20 971.9 m (Table 13.3). Racks were filled to capacity in 1989. Further accumulation resulted in the consideration of telescoping of core during the summer of 1990. However, staff shortages have resulted in selected core being transferred outside to accommodate new core. The overload situation should be addressed this coming year.

TABLE 13.3. SUMMARY OF DRILL HOLES STORED IN THE COBALT DRILL CORE LIBRARY.

Township	Total Holes	Total Length (metres)
Armstrong	1	16
Bucke	54	5 042
Casey	1	82
Churchill	3	327
Coleman	241	4 247
Dymond	1	300
Firstbrook	25	4 879
Harley	4	62
Harris	9	798
Lorrain	11	1 196
Mattawan	3	378
South Lorrain	2	901
Strathcona	7	1 185
Strathy	28	1 560
	390	20 972

RECOMMENDATIONS FOR EXPLORATION

Gold potential remains high in the Shining Tree area with special emphasis placed on the structurally-complex mafic to intermediate metavolcanic sequences with associated fault-related alteration zones within oxide-facies iron formation.

Shining Tree continues to be a favourable exploration target for gold prospects and with the release of an airborne geophysical survey on December 18, 1990 covering the area, the exploration data base will be greatly enhanced. A total of 19 045 line-kilometres were flown by Geoterrex Limited using a time domain EM system and a Scintrex Cesium Vapour magnetometer (Barlow 1989). Over 1921 EM anomaly intercepts were detected. These results could greatly emphasize the long-overlooked base metal potential of the area as well.

As described last year (Owsiacki et al. 1990), possible magmatically segregated zones within deep-seated mafic and ultramafic intrusive igneous bodies may have nickel, copper and platinum group element (PGE) mineralization potential.

Several gold occurrences have been documented in the Englehart area. These occurrences are located along northeast-trending fault systems and localized shear zones, as in the central portion of the boundary between Tudhope and Bryce Townships. Strongly-carbonatized gold-bearing shear zones occur in the southwest quadrant of Bryce township and near Honeymoon Lake. Both these areas bear further investigation with special attention being paid to the strong structural features and associated alteration.

Grenville age rocks in the Temagami and North Bay area hold high potential for various industrial mineral and building stone deposits. Although much of the Temagami area is withdrawn from staking by means of the Bear Island Land Caution at this time, exploration potential remains high. The North Bay area hosts deposits of mica, kyanite, feldspar and vermiculite. A new potentially high-grade silica prospect has recently been identified within an orthoquartzite gneiss in McAuslan Township. Quartz muscovite gneisses abound in the area with numerous quartz-rich layers. With the current drop in the precious and base metals prices, industrial minerals warrant due consideration as markets for these products are wide-ranging and ever-expanding.

SELECTED PUBLICATIONS RECEIVED

Alcock, P.W. 1989. Quaternary geology of the Gowganda area; *in* Summary of Field Work and Other Activities 1989, Ontario Geological Survey, Miscellaneous Paper 146, p.207-209.

Alcock, P.W. and Miller, M.J. 1990. Quaternary geology, Shining Tree area; Ontario Geological Survey, Preliminary Map P.3165, scale 1:50 000.

Alcock, P.W., Miller, M.J. and Aultman, J. 1990. Quaternary geology, Sinclair Lake area; Ontario Geological Survey, Preliminary Map P.3166, scale 1:50 000.

Atomic Energy of Canada Limited Research Company and Voss Associates Engineering Limited 1990. Microwaves and minerals: I. technology review, II. tests of Ontario's industrial minerals; Ontario Ministry of Northern Develpment and Mines, Industrial Mineral Background Paper 14, 77p.

Barlow, R.B. 1989. Recent airborne electromagnetic–magnetic surveys in northern Ontario; *in* Summary of Field Work and Other Activities 1989, Ontario Geological Survey, Miscellaneous Paper 146, p.234-236.

Born, P. 1989a. Precambrian geology, Cassels and Riddell townships; Ontario Geological Survey, Report 271, 73p.

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14. Sudbury Resident Geologist's District—1990

M. Cosec

Staff Geologist, Sudbury Resident Geologist's Office, Northeastern Region.

INTRODUCTION

Mining and exploration activities in the Sudbury District were relatively healthy in 1990 reflected, in part, by the stable price of nickel throughout the year. A total of 18 underground and open-pit mines were in operation, producing 10 commodities. Production ceased at 3 mines, only to see one reopen later in the year.

Inco Limited continued development of the McCreedy East and Lower Coleman orebodies and consolidated milling operations to the Clarabelle Mill.

Falconbridge Limited continued development at the Craig and Strathcona mines and are near to completion of shaft-sinking at the Thayer Lindsley exploration shaft. The company closed operations at the East Mine and Falconbridge Open Pit, and have sold 2 of their nonmetal subsidiaries.

Surface exploration activity was comparable to or greater than 1989. Inco and Falconbridge continued to explore their extensive patented holdings within the Sudbury Basin for nickel, copper, and precious metals. Interest in platinum group metals was high in 3 areas west of Sudbury.

Claim staking activity increased over 200 percent from 1989 due mainly to the opening of peripheral lands adjacent to the Bear Island Indian Land Caution. Falconbridge Limited and Teck Corporation obtained over 1500 claims within this area which overlies the west end of the "Temagami" magnetic anomaly.

Other major developments included the commencement of construction of a neutrino laboratory at Inco's Creighton No. 9 Mine, and the completion of field work related to the LITHOPROBE project.

On November 19, 1990, the Mining Recorder and Resident Geologist offices moved to the new Ministry of Northern Development and Mines head office building. The new address is 159 Cedar Street, 2nd Floor, Sudbury, Ontario, P3E 6A5.

The author wishes to acknowledge T. Livingstone for manuscript preparation and B. Gates for the Mines and Minerals Symposium Poster Session.

MINING ACTIVITIES

COMMODITY PRICES

Nickel prices remained strong throughout 1990 rebounding from a low of US$2.75 per pound earlier in the year to an average price of US$4.00 per pound for the first three quarters. The price was supported by several contributing factors, including a strike by nickel producers in New Caledonia, uncertainty in supply from the Soviet Union, a stainless-steel scrap shortage, and high Japanese demand.

Rhodium, a platinum group metal found in Sudbury ores, soared briefly to over US$7000 per troy ounce during the third quarter. Used largely in catalytic converters for automobiles, the rise is partly due to increasingly stringent air emission control standards.

COMPANY HIGHLIGHTS

Inco Limited reported that earnings for the first 9 months of 1990 were $368.6 million, compared with a record $601.3 million in the corresponding period of 1989. The decrease in profits is attributed, in part, to lower realized nickel prices. Net earnings include a gain of $112.2 million from the sale of a 20 percent common equity interest in the Indonesian subsidiary P.T. International Nickel Indonesia. Inco expected capital expenditures to total $540 million in 1990 and have projected a 1991 operating budget of $450 million.

Inco Limited also announced plans for an arrangement with Consolidated TVX Mining Corporation to form TVX Gold Incorporated. The new company has interests in 6 operating gold mines in Canada, the United States, Brazil, and Chile, and will focus its exploration primarily toward precious metals.

Inco Limited continues to be an industry leader in pollution abatement and revegetation research and development. The company is on schedule with its SO_2 abatement project and has commenced a $250 000 aerial seeding program over areas considered to be inaccessible to conventional reforestation or revegetation efforts.

Falconbridge Limited reported earnings of $407.6 million for the first 9 months of 1990, compared with $709.2 million for the same period last year.

In September, the company sold Indusmin, the industrial minerals division, to Unimin Canada, a subsidiary of Unimin Corporation of Connecticut. Falconbridge also sold its Fahramet Foundry Corporation to Kubota Corporation. Fahramet manufactures a broad range of custom castings and fabricated products for industry.

In June, Falconbridge surrendered its interest in mining claims in the Baie Fine area, near Killarney Provincial Park, and allowed the land to revert back to the Crown. The area has subsequently been withdrawn from staking.

NICKEL-COPPER-PRECIOUS METALS MINING

Production of nickel, copper, and precious metals by Inco Limited and Falconbridge Limited dominate mining activities in the area. Accurate production statistics for nickel and copper are not available. Production from all area mines in 1990 is projected to total 322 million pounds of nickel and 308 million pounds of copper. The Sudbury area annually produces approximately 150 000 ounces of by-product platinum. This affords Sudbury the distinction of being the world's third largest platinum producer.

During 1990, Inco Limited operated 9 underground mines, 2 open pits, 3 mills, 1 smelter, 2 refineries, and 1 strip rolling mill (Figure 14.1). Effective January 1, 1991, milling operations will be consolidated at the Clarabelle Mill. The Frood–Stobie Mill will be decommissioned by mid-1991, while concentrate dewatering will continue at the Copper Cliff Mill. The Clarabelle Mill is expected to handle 35 000 to 50 000 tons per day by 1991.

The deep levels of the Garson Mine remained closed but the mine produced from underground upper levels, accessed by ramp, and from an open pit. Production at the Creighton No. 3 Mine resumed in October after being curtailed in March.

Inco also plans to spend $179 million to bring into production the undeveloped high-grade copper-nickel McCreedy East orebody in the Levack area. Full production is scheduled for 1996 at approximately 7000 tons per day to yield 40 million pounds of Ni and 20 million pounds of Cu per year. Similar development work is also continuing at the Lower Coleman Mine.

Operations were halted for a five-week period in July and August for the annual vacation and shutdown.

Construction of the Neutrino Observatory officially commenced in April at the Creighton No. 9 Mine.

During 1990, Falconbridge Limited produced from 6 underground mines and 1 open pit mine (refer to Figure 14.1). The company continued its $280 million project to develop the Craig orebody in the Onaping–Levack area. Work is scheduled for completion in 1993 and is expected to produce 45 million pounds of nickel annually, or approximately 60 percent of Falconbridge's annual nickel production in the Sudbury area. The development work includes drifting from the Strathcona Mine to access the orebody. Work of a similar nature continued at the Strathcona Mine to access a deep, high-grade copper zone (Meyer et al. 1990).

The East Mine was closed permanently on April 27 due to limited ore reserves and high operating costs. The mine had been operating since 1953. Abandoned reserves of low-grade ore are approximately 2.5 million tons. The Falconbridge Open Pit was also closed in September.

Exploration at the Thayer Lindsley (T.L.) shaft included shaft sinking to approximately 1450 m level at the time of writing. On completion to the 1660 m level, expected by February of 1991, drill stations will be established at the 1310 m level and 1585 m level.

The company suspended operation for a two-week vacation period in June.

Orofino Resources Limited completed the milling of stockpiled gold ore at the Scadding Mine in July. The mill has since been sold to local interests.

INDUSTRIAL MINERALS PRODUCTION

The Indusmin Division of Falconbridge Limited operated the Badgeley Island silica quarry located 4 km west of Killarney prior to the purchase of Indusmin by Unimin Canada in September. Production in 1990 is estimated at 430 000 tons. The coarse silica is shipped to Midland, Ontario and Ashtabula, Ohio for further processing.

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 high face in the Silurian Amabel Formation. Production is estimated at 2.4 million tons per year.

Canadian Shield Quarries Limited extracted a small amount of coarse-grained black anorthosite from their Dana Township property. Operations ceased in the summer when excessively fractured stone was encountered. This resulted in the termination of building stone production in the Sudbury District.

EXPLORATION ACTIVITIES

The Sudbury Resident Geologist's District encompasses approximately 27 500 km^2 of land (Figure 14.2). Geologically, the district is underlain by rocks of Paleozoic, Proterozoic, and Archean age.

The Sudbury area is famous for its large nickel-copper-precious metal mines associated with the Sudbury Igneous

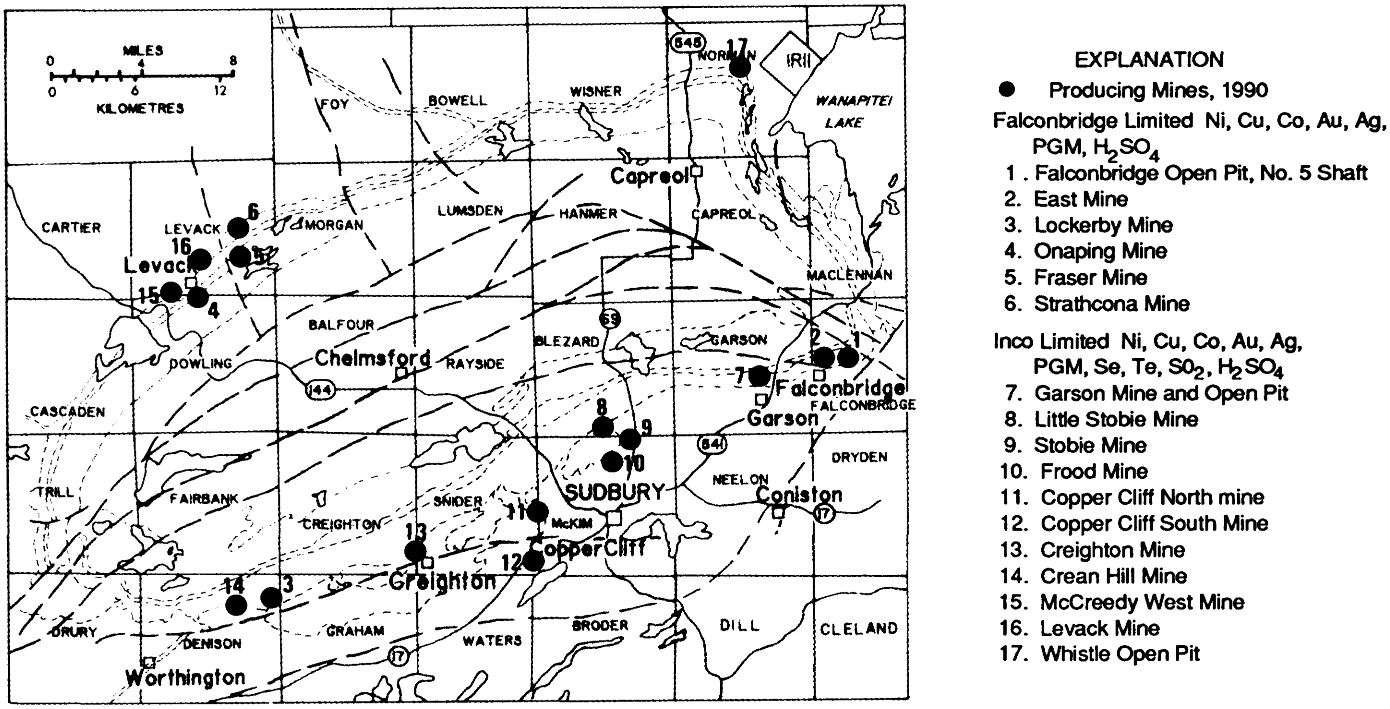

Figure 14.1. *Producing mines and commodities, Sudbury Mining Camp.*

Complex and, to a lesser extent, for its many precious and base metal occurrences which lie outside of the Sudbury Igneous Complex. The area continues to attract numerous mining exploration companies, prospectors, and visitors each year.

Several exploration projects are highlighted as follows:

Inco Exploration and Technical Services Incorporated

Inco Exploration and Technical Services Incorporated conducted mining exploration on properties situated in 8 townships within the Sudbury Basin. The majority of work was done on long-held patented ground. Exploration work was also conducted on the Foy offset dike on a property under option from Canhorn Mining Corporation/United Reef Petroleums Limited. Inco spent $5.75 million on surface exploration, the majority of which consisted of diamond drilling, as well as ground and borehole geophysical surveys. A total of 40 265 m of core was obtained from 49 boreholes completed on the various properties.

Other exploration in 1990 by Inco consisted of establishing a cut grid to facilitate geological mapping, prospecting, and magnetometer and induced polarization geophysical surveys, as well as provide control for channel sampling (K. DeBennedet, Inco Limited, personal communication, 1990).

Falconbridge Limited

Falconbridge Limited conducted mineral exploration in 29 townships in the Sudbury Basin, the Archean Benny greenstone belt, and an area lying northwest of Wanapitei Lake. The company spent approximately $8.5 million on surface exploration and completed 45 000 m of diamond drilling.

During the year, Falconbridge staked more than 1200 claims over the west end of the "Temagami" magnetic anomaly, 50 km northeast of Sudbury. The company plans a major work program over the next few years, including airborne geophysical surveying, ground seismic surveying, and deep diamond drilling (*The Northern Miner*, September 24, 1990).

T. Miron

T. Miron completed stripping and trenching on two 4 claim blocks in Rhodes Township. Explorations focused on exposing chalcopyrite- and pyrite-bearing quartz veins.

V. Boulard

V. Boulard drilled one 36 m hole on a single claim in northern Parkin Township. The hole intersected Archean mafic metavolcanic rocks absent of any significant mineralization.

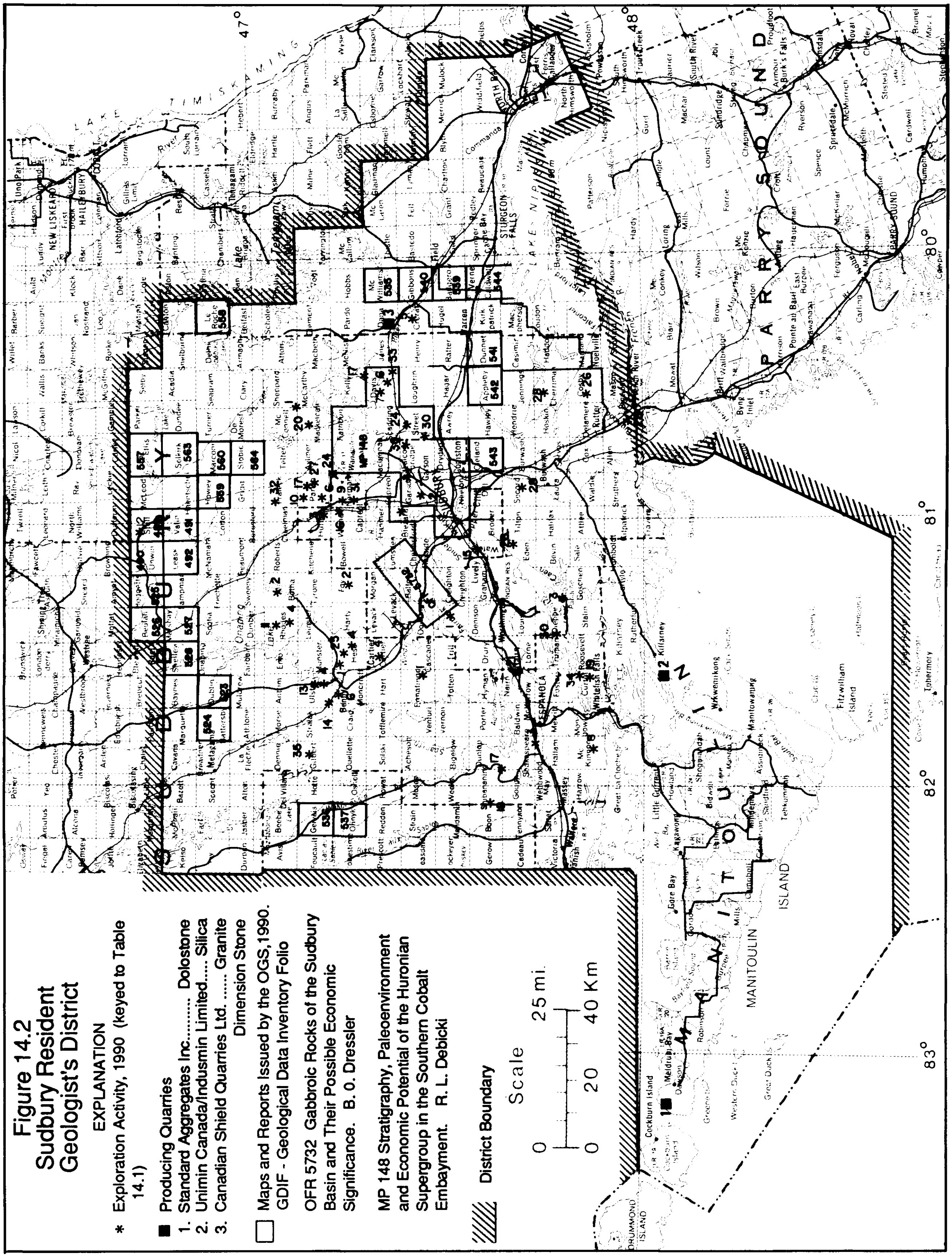

Figure 14.2
Sudbury Resident Geologist's District

TABLE 14.1. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
26	749492 Ontario Limited	Building stone evaluation
34	Art Elliot Explorations	Mineral exploration
9	Barry, D., Barry, H.	Manual
16	Barry, G., Barry, L.	Manual, stripping, trenching
4	BLM Mines Incorporated	Mineral exploration
3	Blue, P. G.	Mineral exploration
10	Boulard, V.	Diamond drilling
17	B. P. Canada Incorporated	Mineral exploration, diamond drilling
24	Bradley, J. D.	Geophysics, assaying
6	Brady, J., Brady, M.	Manual, stripping
19	Brunné, D., Stringer, R.	Mineral exploration
29	Burns, I.	Stripping
31	Dyment, G.	Manual
1	Falconbridge Limited	Mineral exploration
20	Flag Resources (1985) Limited	Diamond drilling
18	Gallo Exploration Services Incorporated	Mineral exploration
25	Geneva Lake Minerals Corporation	Geophysical, geological, diamond drilling
13	Gervais, J. C.	Manual
30	Goldteck Mines Limited	Mineral exploration
12	Hill, A.	Stripping
2	Inco Exploration and Technical Services Incorporated	Mineral exploration
27	Jarvis Resources Limited	Stripping
23	K and E Sand and Gravel Sarnia	Diamond drilling
28	Komarechka, R.	Geological
5	Leblanc, A.	Diamond drilling
11	Miron, T.	Manual
21	Owen, J.	Stripping, diamond drilling
8	Rainbow Exploration Corporation	Diamond drilling
15	Rauhala, J.	Manual, geophysical
32	Roy, B. J.	Mineral exploration
30	Salo, G.	Mineral exploration
33	Sims, W.	Mechanical
14	Stralack Resources Incorporated	Diamond drilling
7	Tomasini, A.	Diamond drilling
35	Weiss, W.	Manual

D. Brunné, R. Stringer

D. Brunné and R. Stringer completed an extensive exploration program of stripping, trenching, lithogeochemical sampling, and geological mapping on their Casson Lake property in Curtin Township. Also known as the Bridger occurrence, the claims are underlain by a differentiated gabbroic sill designated as Nipissing diabase.

During property examination, the author observed the following lithologies: a hydrothermally altered, fine-grained basal unit containing up to 5 percent disseminated sulphides; an overlying, altered, medium-grained unit lacking sulphides; another unit similar to the basal gabbro; and an upper, coarse-grained anorthosite. A grab sample of the upper gabbroic unit assayed greater than 2000 ppb combined platinum and palladium (Geoscience Laboratories, Ontario Geological Survey, Toronto).

Near the northern contact of the diabase (gabbro) with Gowganda Formation quartzite, pockets of metasomatically altered rock are prevalent. Thin section analysis of the altered

TABLE 14.2. SUMMARY OF CLIAMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total (Man Days)
1990	2 576	2 068	7 458	14 309	32 560	2 537	87 709
1989	761	1 615	6 510	25 255	49 743	8 862	104 052
1988	893	1 780	7 321	21 303	255 824	8 746	304 792
1987	5 777	720	9 358	16 266	43 721	3 467	77 041
1986	1 191	1 171	4 396	22 017	14 350	1 658	49 820

rock revealed feldspar with extensive myrmekitic and perthitic texture, indicating that the host rock had undergone some degree of albitization. The alteration zones observed in outcrop range from 2 to 5 m in length and are up to 2 m wide. Pyrite is notably absent in all but one zone. Assays of up to 1.4 g/t Au are common in samples derived from the sulphide-bearing alteration zone (Geoscience Laboratories, Ontario Geological Survey, Toronto). Similar mineralization is present in the same or similar lithologies 3 km to the east at the former Bousquet gold mine which produced 4672 ounces Au and 196 ounces Ag during the period 1936–1938 (Card 1976).

B. P. Canada Incorporated

B.P. Canada Incorporated completed 1067 m of diamond drilling in 3 holes on claims optioned from J. Brady in Parkin Township. Geological mapping and sampling were conducted on claims optioned from I. Burns also in Parkin Township. Both programs focussed on the Parkin offset, a dike-like quartz diorite breccia closely resembling offset dikes of the Sudbury Igneous Complex.

B.P. Canada Incorporated also commenced exploration of their 375 claim group in Shakespeare and Dunlop townships. Geological mapping, lithogeochemical sampling, and airborne very low frequency electromagnetic (VLF-EM) and magnetic surveys were completed over a differentiated mafic intrusive complex to assess platinum group metal potential. Twenty-eight diamond-drill holes totalling approximately 4600 m were also completed.

Gallo Exploration Services Incorporated

Gallo Exploration Services Incorporated completed stripping, trenching, geological mapping, and lithogeochemical sampling on the East Bull Lake mafic intrusion in Boon and Shibananing townships. The 115 claim property is underlain by rhythmically layered coarse-grained gabbro, anorthosite, amphibolite, and norite.

Disseminated, semimassive to massive pyrrhotite and chalcopyrite, as well as detectable quantities of platinum and palladium, are present in areas of sheared gabbro.

Rainbow Exploration Corporation

Rainbow Exploration Corporation completed 625 m of diamond drilling on the McMillan gold mine property in Mongowin and McKinnon townships. The former mine produced 2817 ounces Au and 84 ounces Ag from a 275 m shaft with 8 levels from 1934–1937. The ore consisted of pyrite- and arsenopyrite-bearing quartz veins hosted by Gowganda Formation sandstone and argillites (Card 1976).

Flag Resources (1985) Limited

Flag Resources (1985) Limited completed diamond drilling on the Wolf Lake property in Mackelcan Township. One of the more favourable holes intersected 0.32 ounce Au per ton over 43 feet within an interval of 58.5 feet which assayed 0.25 ounce Au per ton (*The Northern Miner*, April 30, 1990). Mineralization consists of semimassive to disseminated pyrite, bornite, chalcopyrite, and hematite. Host lithologies consist of green and pink Lorrain Formation quartzites which are often heavily leached within the gold-bearing zone.

The company's property is situated within a magnetic peak of the western sector of the "Temagami" magnetic anomaly.

J. Owen

J. Owen stripped 2 outcrop areas on claims in Baldwin and Nairn townships to assess the building stone potential of a Nipissing diabase sill. On the south zone, two 30 m diamond-drill holes revealed that the unit is characterized by an extensive jointing network which is common in this rock type. On the north zone however, fractures are not as closely spaced, and Mr. Owen extracted several blocks 1 m^3 in size. Material was sent for ASTM testing or to be cut and polished into tiles.

BLM Mines Incorporated

BLM Mines Incorporated conducted exploration programs on several claim groups in the Archean Benny greenstone belt under option from H. Tracanelli. Line cutting, soil and lithogeochemical sampling, stripping, and trenching were undertaken on the Hess Township lead-zinc deposit, the Last Chance gold property in Ulster Township, and other gold and base metal showings in Cartier and Rhodes townships.

K and E Sand and Gravel Sarnia

K and E Sand and Gravel Sarnia completed 153 m of short-hole diamond drilling on the French River nepheline syenite property in Bigwood Township.

The intrusive complex hosts relatively small quantities of graphite, garnet, blue and black corundum, nepheline, and feldspar which the company intends to exploit for a variety of industrial purposes such as abrasives and fillers. The structure is 11 km long and has a maximum width of 2 km, with the long axis trending north.

A. Leblanc

A. Leblanc completed a single 40 m diamond-drill hole on his Crerar Township property to investigate a copper-nickel occurrence hosted in anorthositic gabbro.

A. Hill

A. Hill completed 400 m of stripping on a claim in Stull Township. Exploration targets were veins of barytes hosted in Lorrain Formation quartzite intruded by Nipissing diabase. Little detail is reported on the geology of the area.

D. Bradley

D. Bradley completed 15.5 km of VLF-EM surveys on a 6 claim property in Street Township. In Fraleck Township, minor trenching and lithogeochemical sampling were completed to investigate chalcopyrite and hematite occurrences in the Beaver Lake area.

J. Brady, M. Brady

J. Brady and M. Brady conducted a small-scale exploration program on their claims in the Archean Benny greenstone belt and northwest of Wanapitei Lake.

Geneva Lake Minerals Corporation

Geneva Lake Minerals Corporation commenced extensive surface exploration on a 26 claim group that includes the past producing Geneva Lake Mine in Hess Township. The mine produced lead and zinc concentrates from 1941–1944 which were sold to the Metals Reserve Company, a United States government agency. The mine yielded 10.4 million pounds Zn, 3.6 million pounds Pb, and Ag valued at $28 416. Exploration work in 1949 indicated drill reserves of 114 000 tons of ore grading 10% Zn and 3% Pb. The ore consists of stratibound, massive sphalerite, galena, and pyrite occurring at a mafic metavolcanic–felsic metavolcanic contact (Card and Innes 1981).

Geneva Lake conducted line cutting, magnetometer and VLF-EM geophysical surveys, and geological mapping over the property. Diamond drilling commenced in October 1990 and is expected to continue into 1991.

749492 Ontario Limited (Norgranite Company Limited)

749492 Ontario Limited completed the third and final year of a feasibility study on the Pure Lake "blue" granite (monzonite) building stone prospect in Cosby Township. The project included quarrying a 15 to 20 ton test sample.

Jarvis Resources Limited

Jarvis Resources Limited commenced stripping and trenching on their 5 claim property in Parkin Township which lies immediately north of the Jonsmith Mines Limited nickel-copper mine and is underlain by Quirke Lake Group metasediments intruded by the noritic Parkin Offset Dike.

R. Komarechka

R. Komarechka investigated Lorrain Formation orthoquartzites in Eden Township and reportably obtained interesting silica values for flux-grade material.

In Cherryman Township, monzonitic syenites were studied for building stone potential. Little fracturing was encountered and a small quantity of material was removed for test purposes.

I. Burns

I. Burns removed overburden from a building stone prospect in Secord Township. The stripping exposed coarse-grained red syenites intruded by gneissic metagabbros. The exposed area has sparked interest from several building stone processors in central and southern Ontario.

Stralak Resources Incorporated

Stralak Resources Incorporated completed a single 94 m diamond-drill hole on the Ulster Township property. The hole intersected medium- to fine-grained, intermediate metavolcanic rocks and a sulphide-bearing sericite schist. The latter unit reportedly hosts anomalous silver and base metal values.

RECOMMENDATIONS FOR EXPLORATION

Interest in platinum group metals has been increasing over the last few years particularly west of (PGM) Sudbury in the Agnew Lake and East Bull Lake areas. Host rocks are layered and differentiated intrusive mafic complexes composed of gabbros, anorthositic gabbros, anorthosites, and their metamorphic equivalents. Prospectors exploring these lithologies should pay particular attention to subtle changes in rock texture and sulphide content. PGM-bearing facies may be relatively thin, and thus require thorough and accurate sampling procedures.

Nickel-copper deposits hosted in Nipissing diabase may contain associated PGM mineralization and thus merit attention; for example, diabase near Espanola and Wanapitei Lake.

Huronian rocks north and east of Wanapitei Lake host several previously exploited gold deposits related to soda-metasomatism. Similar alteration was observed in Huronian stratigraphy within the LaCloche area during the 1990 field season and may hold potential for hosting small gold deposits.

RESIDENT GEOLOGIST'S STAFF AND ACTIVITIES

STAFF

The following staff was assigned to the Sudbury Resident Geologist's office in 1990.

1. P.E. Giblin, Manager, Mineral Resources. P. E. Giblin was seconded at the beginning of May to the Planning and Information Office in the Mineral Development and Lands Branch.

2. W. Meyer, Resident Geologist. W. Meyer was seconded in October to the Planning and Information Office in the Mineral Development and Lands Branch.

3. M. Cosec, Staff Geologist. M. Cosec joined the Sudbury office after leaving the Cobalt Resident Geologist's office in April.

4. T. Livingstone, secretary to the Resident Geologist.

5. L. Jerome worked as a contract geological technician funded by COMDA on Geological Data Inventory Folios (GDIFs) until the end of March. L. Jerome was rehired from May to September as a GA III to compile information on the Temagami area.

6. B.I. Gates worked as a contract geologist funded by COMDA on the Sudbury Mineral Occurrence Study. The study was completed March 31, 1990 and is awaiting approval prior to printing. He was rehired November 19 in a Staff Geologist position to help relieve the low staffing situation due to W. Meyer's secondment.

7. J.K. Lacey continued to work on the COMDA-funded Sudbury Building Stone Inventory. The report was completed at the end of March and is scheduled for public release in March 1991.

8. R.J. Henri, whose contract was also funded by COMDA, assisted B.I. Gates with field and office work.

9. M. Nurmikivi joined the staff through the Experience 1990 program for the summer months as an assistant to M. Cosec.

ACTIVITIES

Staff of the Resident Geologist's office responded to over 800 inquiries regarding assessment work, the geology of the area, mineral occurrences, mineral potential, conceptual ideas, government programs, and rock and mineral identification. Staff visited properties and offered advice and assistance to property owners both in the office and in the field. The staff also assisted in land-use planning by offering advice and recommendations on geoscientific issues.

In addition, the staff guided geological field tours, gave oral presentations on a variety of topics to diverse audiences, and prepared and presented displays at several public functions, a few of which are presented below.

In February, staff participated in the poster/sample/photo display at the Northeastern Region Mines and Minerals Symposium in Timmins.

W. Meyer contributed approximately 100 black and white negatives entitled "Sudbury 1990" to a time capsule that was placed in the new Mines and Minerals Research Centre at Laurentian University.

M. Cosec guided several tours of the Sudbury Basin for a number of groups and individuals including industry geologists from throughout Ontario; H.J. Bernhardt from the University of Bochum, Germany; geologists from LaSarre Resources Ltd., Noranda, Quebec; and a road tour for the E.B. Eddy Forest Products Ltd. management meeting. M. Cosec also began a study of precious and base metal occurrences hosted in Espanola Formation limestones.

W. Meyer and M. Cosec participated in a surface geology tour of the Sudbury Basin for the USSR Academy of the Sciences, Karelia Branch, and geologists from the Minnesota Geological Survey and the University of Minnesota, Duluth, under the direction of K. Card.

In April and May, the Resident Geologist's office arranged and supervised 18 hours of prospecting classes for 57 registrants stretching over 6 evenings. Ministry staff who assisted with the classes included V. Miller, J. Springer, W.

Meyer, and M. Cosec. Facilities were provided free-of-charge by Cambrian College. Three Cambrian College staff members, A. Insinna, R. Johnson, and T. Jones, volunteered their time to instruct the class in their particular fields of expertise. Dr. R. S. James, Laurentian University, W. Peredery, Inco Limited, and M. Sweeny, Falconbridge Limited also volunteered their time to instruct the class. The Staff Geologist wishes to acknowledge the assistance of those who contributed to the success of the course.

On September 26, W. Meyer and M. Cosec guided a group of geography teachers on a ministry-sponsored, one-hour aerial tour of the Sudbury mining area, an annual event for the past several years that is part of a week-long tour organized by B. Campbell of the Ontario Mining Association. Each year, the tour offers 35 to 40 geography teachers, primarily from southern Ontario, the opportunity to visit northern Ontario mining communities. The Ministry's contribution is the aerial tour which provides an overview of all the mining activity in the area. It has been shown that the teachers leave with a better understanding of northern Ontario, particularly the role that mining plays, and are able to pass on their positive experiences and appreciations to their students. More than 500 teachers have participated in the trip since its inception.

In December, M. Cosec and B. Gates presented a poster display at the Mines and Minerals Symposium in Toronto entitled Mining and Exploration in the Sudbury Area.

The Geoscience Exploration Database–Mineral Deposits Inventory (GED–MDI) Compilation contract for the Sudbury District was awarded to Bedrock Consulting of Sudbury. The project, designed to provide an up-to-date computerized data base in all known or recorded mineral occurrences within the Sudbury Resident Geologist's District, commenced in the latter half of November and will be completed by the end of March 1991. R. Komarechka, F. Racicot, and D. Stephenson are members of the contract team.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

There were no Ontario Geological Survey activities in the Sudbury District during 1990.

RESEARCH BY OTHER AGENCIES

The Geological Survey of Canada undertook 3 projects in the Sudbury District during 1990.

K. Buchan of the Continental Science Division studied paleomagnetism of Nipissing diabase sills, dikes, and Huronian sedimentary rocks.

O. R. Eckstrand of the Mineral Resources Division studied the metallogeny of ultramafic and mafic rocks of the Sudbury area.

I. R. Jonasson, also of the Mineral Resources Division, investigated the geochemistry of ore-forming environments.

D. Peck of Laurentian University initiated a post-doctoral study on the East Bull Lake mafic intrusion. The first year of work included lithogeochemical sampling throughout the intrusion for platinum group elements, gold, and selected trace elements.

LITHOPROBE

LITHOPROBE, the five-year multidisciplinary study of the earth's crust, collected data in the Sudbury area over a four-week period during October 1990.

The project involved a 100 km regional seismic survey across the Sudbury structure, with 40 additional kilometres of a high-resolution survey. J.R.S. Exploration Company of Calgary was contracted for the work utilizing 4 seismic trucks and 20 km of geophones and cables. The traverse incorporated 3 sections: Cartier–Windy Lake, Nelson Lake–Vermillion River, and Vermillion River–Lake Panache.

Several local committee meetings were held in Sudbury prior to the survey to discuss timing and the traverse routes, chaired by A. Naldrett of the University of Toronto. Other committee members included B. Milkreit, Geological Survey of Canada; P. Snajdr and T. Watts, Falconbridge Limited; G. Morrison, W. Peredery, B. Krause and R. Martindale, Inco Limited; D. Rousell, Laurentian University; W. Moon, University of Manitoba; and M. Cosec and W. Meyer, Ministry of Northern Development and Mines.

The data should be fully interpreted by the summer of 1991. The project will be useful in developing long-term strategies for resource exploration by mapping subsurface structures which, in turn, could lead to the discovery of new ore deposits.

Funding for the project originated from the federal government, Ontario Ministry of Northern Development and Mines, Inco Limited, and Falconbridge Limited.

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, CIM Bulletin, Mining Journal, Mining Magazine, Canadian Mining Journal*, and *Dimensional Stone Magazine*.

Listed below are books received by the office in 1990. Books and periodicals are available to the interested reader for viewing at the office.

1990. Environmental guidelines for access roads and water crossings; Ontario Ministry of Natural Resources, 64p.

Boyle, R.W., Brown, A.C., Jefferson, C.W., Jowett, E.C. and Kirkham, R.V. eds. 1989. Sediment-hosted stratiform copper deposits; Geological Association of Canada, Special Paper 36, 710p.

DiLabio, R. N. W. and Coker, W. B. eds. 1989. Drift prospecting; Geological Survey of Canada, Paper 89-20, 169p.

Fulton, R. J. ed. 1989. Quaternary Geology of Canada and Greenland; Geological Survey of Canada, 839p., 5 maps.

Gallagher & Associates 1988. The foundry industry in Ontario and outlook for industrial minerals; Ontario Ministry of Northern Development and Mines, Industrial Mineral Background Paper 7, 44p.

Hains Technology Associates and Bezys, R. K., Ontario Geological Survey 1990. Gypsum in northern Ontario: resources and market potential; Ontario Ministry of Northern Development and Mines, Industrial Mineral Background Paper 12, 56p.

Hains Technology Associates and MKM Consultants International 1988. Impact of advanced ceramics on Ontario industry; Ontario Ministry of Northern Development and Mines, Industrial Mineral Background Paper 9, 96p.

Institute for Research in Construction (National Research Council Canada) and Matex Consultants Inc. 1990. Developments in building products: opportunities for industrial minerals; Ontario Ministry of Northern Development and Mines, Industrial Mineral Background Paper 13, 163p.

REFERENCES

Card, K.D. 1976. Geology of the Espanola–Whitefish Falls area, District of Sudbury, Ontario; Ontario Geological Survey, Report 131, 70p.

Card, K.D. and Innes, D. G. 1981. Geology of the Benny area, District of Sudbury, Ontario; Ontario Geological Survey, Report 206, 117p.

Meyer, W., Jerome, L.B., Gates, B.I. and Lacey, J.K. 1990. Sudbury Resident Geologist's District—1989; *in* Report of Activities 1989, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 147, p.299-311.

15. Southern Region Introduction

A.E. Pitts

Regional Manager, Southern Ontario Region.

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 for 1990 in southern Ontario are expected to be 5–10 percent lower than last year. The main reason for this is a decline in demand from the construction industry. Commodities such as cement, gypsum, and talc are particularly affected by this slowdown. Exploration activity was also at a reduced level this year, with 430 new claims being staked compared with 598 last year. Most exploration was at the grass-roots level with individual prospectors. There was a continuing interest in graphite, building stone, mica, gold, platinum, base metals, and high purity limestone.

Cal Graphite Corporation commenced its mining operation in Butt Township and has completed commissioning its mill after a few minor problems. Stewart Lake Resources Incorporated is in the process of applying for a municipal zoning amendment and meeting other regulatory requirements that would allow it to commence mining its graphite deposit in Bedford Township. Domtar Incorporated (Gypsum Division), in Haldimand Township, has almost completed construction of its new No. 3 mine. This mine will utilize continuous mining techniques, thereby eliminating the need for drilling and blasting. Initial production levels of 500 000 tonnes per year are planned. The Canadian Gypsum Company in Haldimand Township also has plans for a 6 year, $7 000 000 upgrading of its operations at the Hagersville plant.

The Southern Ontario Region has 3 Resident Geologist's offices, 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 1990, H. Meyn continued his detailed mapping and mineral deposit studies of the Queensborough syncline located in Madoc Township. A preliminary map of this work was produced in 1990. The Bancroft office also provides advice on local geology, mineral collecting, and mining activities.

Staff in the field offices handled a total of 1050 office consultations, 3660 telephone inquiries, 684 counter inquiries, and 348 written requests.

The Southern Ontario Region has two drill core libraries which are located in Tweed and Bancroft. Relevant drill core reference material is obtained from mineral exploration programs in the area and is logged and indexed for ready access by clients. There were approximately 90 visitors to these facilities this year.

Field staff were involved in a number of projects during 1990. M.I. Garland continued examining the mineral potential of the mafic to ultramafic rocks in the Central Gneiss Belt, concentrating on the McClintock Township area. H. Meyn and S. van Haaften conducted a study on the economic geology and geochemistry of Grenville carbonate rocks. They assessed and processed existing lithogeochemical data as an exploration tool. P. Kingston continued to work with Dr. W.F. Caley of the Technical University of Nova Scotia to assess the feasibility of substituting certain Ontario industrial minerals as components of steelmaking.

B.H. Feenstra and R.I. Kelly conducted a number of studies in southwestern Ontario, including buried aggregate deposit assessment in McGillvary Township; rotasonic drilling in Beaver Valley; compilation of data to evaluate mineral resource potential in the Lake Simcoe area; geochemical analysis of southwestern Paleozoic carbonates; and sampling and analysis of southwestern Ontario clays and shales.

16. Algonquin Resident Geologist's District—1990

M.L. Garland[1] and D.J. Villard[2]

[1]Staff Geologist, Algonquin Resident Geologist's Office, Southern Ontario Region.

[2]Resident Geologist, Algonquin Resident Geologist's Office, Southern Ontario Region.

INTRODUCTION

Exploration in the Algonquin District continued in 1990 at levels similar to the past several years, with special interest in base and precious metals, marble, graphite, and building stone. Claim staking increased by 25%, with 156 claims staked as of December 4, 1990.

Cal Graphite Corporation commenced their mining operation in Butt Township and were able to process a significant amount of flake, while commissioning their mill.

The industrial minerals project, funded under the 5-year Canada–Ontario 1985 Mineral Development Agreement (COMDA), ended this year. The results of that work will be published as a Mineral Deposits Circular.

Public education continues to be an important function of this office: the Ministry of Northern Development and Mines provided personnel to the Leslie M. Frost Natural Resources Centre for teaching technical sessions; specialized mineral programs were given to school groups in the districts of Nipissing, Parry Sound, and Muskoka and the county of Haliburton; prospectors classes were run for both the Algonquin District and the Southeastern District; and "Prospector Pete," a crusty old character from the old days, entertained crowds in provincial parks across southern Ontario.

MINING ACTIVITY

The exciting news for the district was the coming on stream of the Cal Graphite Mine in Butt Township. The open-pit operations began in April 1990 and the commissioning of the mill began in May. The mill is currently capable of producing 3000 tons per day (Cal Graphite Corporation 1990). Ore from the pit is crushed and stockpiled at the mill site by a contractor, then fed into the mill system as required. In the mill, the crushed ore is reduced to -20 mesh by an autogenous crusher designed to minimize destruction of the graphite flakes by the crushing process. Separation of the flake from the crushed ore is done by means of column flotation. The column flotation method is a very effective way of separating flake from the waste rock, and is capable of producing a high purity carbon concentrate. The concentrate is dried and screened into various product sizes. The computer-controlled bagging system allows the company to mix the various product sizes to the exact specifications required by the client.

Other producing mines in the district include several stone quarries. The Mill Lake Quarry on Highway 69 at Parry Sound operates on a year-round basis, producing flagstone in thicknesses from 0.5 to 4 inches (1.27 to 10.16 cm). Central Ontario Natural Stone Limited, near Washago, is also open all year, and acts as a distributing agent for a variety of flagstone and crushed stone, as well as selling their own. Rama Stone Quarries Limited in Rama Township produces dimension stone. Scattered throughout the district are several small stone quarries that are worked on an "on-demand" basis. A couple of quartz quarries are worked intermittently with the quartz used mainly for landscaping.

EXPLORATION ACTIVITY

As of December 4, 1990, a total of 156 claims had been staked in the Algonquin Resident Geologist's district (Table 16.1). Exploration activity concentrated on interests in precious and platinum group metals, base metals, building stone, and graphite.

PRECIOUS AND PLATINUM GROUP METALS

Most of the work for precious and platinum group metals was done in McClintock Township. There were 77 new claims staked in 1990, bringing the total active claims in the township to just over 300. Exploration work consisted of basic prospecting, line cutting, geological, and geophysical surveys.

Five claims have been staked in Ryerson Township. Work to date consists of basic prospecting and some stripping and sampling.

Twenty claims were staked in McConkey Township over the old Caribou Lake nickel showings. Exploration work has consisted of prospecting and sampling.

BASE METALS

A well-documented copper showing in Hindon Township has been staked by a local prospector. The property has undergone extensive exploration in the past, including diamond drilling and detailed geophysical surveys. Current work consists of reassessing previous work, prospecting, mapping, and sampling.

TABLE 16.1. EXPLORATION ACTIVITY, ALGONQUIN RESIDENT GEOLOGIST'S DISTRICT.

Number on Figure	Individual or Company	Activity
1	William Ellerington	Prospecting, line cutting, ground geophysics, mapping
2	Rene Tougas, Earl McNaughton	Prospecting
3	Fred Swain	Prospecting, ground geophysics
4	Sherry Swain	Prospecting, sampling
5	David Morin	Prospecting
6	R. Lashbrook	Staking
7	William Ellerington Jr.	Staking
8	Fred Atkinson	Prospecting
9	James Lee	Ground geophysics, mapping
10	Bert and Alwine Wickern	Prospecting, stripping, trenching
11	Bruno Manella	Ground geophysics, mapping
12	David Jennings	Prospecting
13	R. Blais	Staking
14	J. Irving	Looking for option
15	E. Jones	Prospecting, trenching

Two lead occurrences, one in Fraser Township and the other in McLean Ward, are believed by the locals to have been mined by the Indians for use in making bullets. Neither occurrence has been located, but basic prospecting is being done in an attempt to find them.

BUILDING STONE

There has been significant interest in developing flagstone quarries in the Muskoka–Parry Sound District despite the slowdown in the construction industry. Several prospectors have prospective sites on their own property, whereas others are actively looking throughout the district for rock that splits easily.

The decorative chip and coloured stone market has spawned some interest in marble, anorthosite, and peridotite occurrences.

GRAPHITE

There is still limited interest in graphite, most notably in Laurier Township and Proudfoot Township. The Laurier graphite occurrence has undergone extensive drilling, trenching, and sampling in the past 7 years for graphite as well as gold. The prospector who currently holds the claims has been doing geology and rock sampling.

Work on the graphite in Proudfoot Township is in the preliminary stages, with just some prospecting and sampling accomplished.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The office is currently staffed by D. Villard, Resident Geologist; M.I. Garland, Staff Geologist; and J. Reed, Secretary. In December, Chris Marmont was hired to carry out a project dealing with gold and base metals in high-grade terrains and Rick Keevil was hired to work on educational matters at the Leslie M. Frost Natural Resources Centre. Both of these people will be on staff until the end of March 1991.

The Resident Geologist has been busy with the Cal Graphite development, as well as providing assistance to numerous entrepreneurs who would like to get into the stone business. In addition to his regular resident functions, his time has been taken up with field work related to several small projects.

The Staff Geologist continued work on 2 projects: examining the geology and mineral potential of the mafic and ultramafic rocks in the Parry Sound and Muskoka districts, and updating the geology of the Cal Graphite deposit as the open pit progresses. The results of these projects have been presented in papers given at the Ontario Geoscience Research Symposium and the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Annual General Meeting, both in 1990.

Public education has kept the Staff Geologist busy, with presentations on identification and uses of minerals to school groups in all municipal districts within the Algonquin District. The Staff Geologist also contributed to the teaching of geology sessions and maintaining the lapidary at the Leslie M. Frost Natural Resources Centre. She also took the Junior

Rangers to Bancroft for their education day. The Rock and Mineral Travelling Road Show, along with Prospector Pete, visited 12 provincial parks in southern Ontario, presenting mineral shows and a slide show starring "Gerry the Geologist," and conducting geology hikes. The Staff Geologist serves as a judge at most of the region's science fairs.

Prospectors' courses in Huntsville and Tweed were conducted by the Staff Geologist. Each course consisted of 4 sessions plus a field day. Response to these courses was excellent.

PROPERTY EXAMINATIONS

McClintock Township

The 2 original showings, concessions IX to XI, lots 17 and 18, consist of massive to disseminated pyrrhotite, pyrite, and chalcopyrite in lenses of a metamorphosed basic rock. These showings have been mapped, trenched, sampled, and drilled in the late 1950s by companies interested in nickel. The showings and the surrounding area have been restaked for their platinum and precious metal potential by several different prospectors.

One group of prospectors conducted airborne magnetic and very low frequency electromagnetic surveys over their claims last year, and spent this summer doing ground geophysical and geological follow-up on the airborne results.

Most of the rocks visible are varieties of quartz-feldspar gneiss. There is very little outcropping of the mafic sulphide-bearing unit.

Ryerson Gold

Six claims have been staked in Concession VII, lots 32, 33, and 34, Ryerson Township, on a showing known to that prospector from working in the area 20 years ago. The occurrence consists of a shallow pit and some stripping exposing quartz and quartz-feldspar pegmatite. There are more boulders of quartz lying around than actual outcrop. The country rock is a poorly banded quartz-feldspar-hornblende gneiss and a hornblende-feldspar-garnet gneiss, with mafic bands consisting of hornblende and garnet. The quartz occurs as glassy white lenses paralleling the gneissosity of the rock. Stringers of this quartz penetrate the host rock, and the lenses thicken into pods of coarse-grained quartz-potassium feldspar-plagioclase pegmatite. The pegmatites are sheared, leaving augens of feldspar floating within the gneiss.

Maria Township Graphite

The property appears to be the same as it was in 1989. The area near the large trench was being logged, but apart from some staking, no further geological or exploration work was in evidence.

Laurier Township Graphite

The trenching and stripping done by Astwood Park Resources still provides easy access to the outcrop. Mapping of the stripped area near the original shaft showed that the massive graphite thought to be a "vein" is actually pods and lenses of complexly folded graphite schist within a fracture system. This fracture system parallels the lineament that shows up well on the airphoto, and may be the structure responsible for the silicification evident near the shaft. This possibly spawned the original interest in gold.

Cal Graphite Mine, Butt Township

Preliminary mapping in the open pit indicates that the podlike nature of the nongraphitic units is continued downdip, and the graphitic units exhibit as much deformation in the third dimension as in two dimensions.

Chapman Township Amazonite

The Bluestar Mine in Chapman Township continues to offer mineral collecting trips to tourists, but little work has been done to clean out new collecting sites in the pegmatite.

Flagstone, Burk's Falls to Trout Creek

Township roads in 12 townships between Burk's Falls and Trout Creek, straddling Highway 11, were surveyed for outcrops of what looked to be good splitting and aesthetically pleasing rock. Several outcrops of an attractive straight gneiss that should split well were found along the edge of the Parry Sound Domain in the area between Magnetawan and Sprucedale. A major problem with this particular area is the amount of privately owned land.

Flagstone, Perry Township

An individual in the first concession of Perry Township owns several hundred hectares of land with good outcrops of quartzofeldspathic gneiss. He is interested in the flagstone potential of the gneiss and plans to produce some flagstone to test the viability of starting a quarry operation.

Flagstone, Town of Parry Sound

Situated across Highway 69 from the Mill Lake Quarry, this prospect consists of a ribbon-foliated gneiss. Good flagstone was produced at this site 20 years ago. The owner plans to open up the original quarry and produce flagstone to meet local demand.

RESEARCH BY RESIDENT GEOLOGIST'S OFFICE STAFF

MINERAL POTENTIAL OF THE MAFIC TO ULTRAMAFIC ROCKS IN THE MUSKOKA–PARRY SOUND AREAS OF THE CENTRAL GNEISS BELT OF THE GRENVILLE PROVINCE, ONTARIO

by M.I. Garland

Introduction

The work reported here is a continuation of a program to assess the mineral potential of the mafic and ultramafic rocks found in the Muskoka and Parry Sound areas (Figure 16.1). Several occurrences, found to be within mafic and ultramafic rocks, produced copper, nickel, and gold earlier in the century. The mafic and ultramafic rocks occur either as lenses within the gneiss or as less-deformed areas within large tracts of well-developed mafic gneiss. Mineralization can be massive in restricted occurrences, but tends to be spotty overall.

Mineral Exploration

Exploration activity was highest from the pre-1900s to about 1930 for most of the occurrences in the area, and descriptions of this work are best described by Satterley (1942) and Hewitt (1967). Several of the occurrences actually produced ore: the Nickel Cliff Mine in Armour Township had a 10 m shaft, producing a small amount of copper-nickel ore between 1900 and 1902. The McGown copper-gold occurrence in Foley Township was originally mined in 1894, and mining by the Parry Sound Copper Mining Company continued up to 1908. In the 1950s, the deposit was drilled by Kalbrook Mining Company Limited, and in 1964–1965, the shafts were dewatered and a bulk sample was taken by the R.M. Clarke Mining Company Limited. The Consolidated Copper Company of Parry Sound sank a 50 m shaft into a sulphide occurrence on Spider (Cowper) Lake in 1902–1903. The Wilcox Mine on Spider Bay was discovered and developed by H. Harris and T. Wilcox, and by the Parry Sound Copper Mining Company Limited from 1893 to 1904. The deposit was drilled by Waterways Copper Mines Limited in 1939, and again by Kalbrook Mining Company Limited in 1951. Bayshore Zinc and Copper Mines Limited drilled 30 holes into a sulphide zone east of the Wilcox Mine in 1942–1943, and Kalbrook Mining Company Limited drilled this prospect again in 1951. The nickel occurrences in McClintock Township were drilled and trenched between 1957 and 1959 by Slocan Van Roi Mines Limited. Pamike Mines Limited did extensive geophysics, geological mapping, and diamond drilling over the showings in 1971 and 1972. A prospectors' group has been working the entire centre part of the township since 1987, including airborne geophysics, geology, and diamond drilling.

General Geology

The study area is encompassed entirely by the Central Gneiss Belt of the Grenville Province. The geology of this area has been described by workers at the Geological Survey of Canada (Davidson and Morgan 1981; Davidson et al. 1982; Davidson et al. 1985; Davidson and Grant 1986; Culshaw 1988a,b) and the Ontario Geological Survey (McRoberts and Tremblay 1987; Bright 1989). This part of the Central Gneiss Belt consists of different structural levels or layers separated by ductile shear zones. Each structural level has been subdivided into domains and subdomains on the basis of lithological, structural, and metamorphic patterns. Mafic and ultramafic rocks occur either as parts of a large tract of mafic gneiss in the western Parry Sound Domain or as shear-bounded lenses within the gneiss of the lowermost structural layer.

The western Parry Sound Domain is characterized by gabbro and amphibolite and their gneissic equivalents, gabbroic anorthosite, and anorthosite. The occurrences in the Parry Sound Domain consist of copper-gold mineralization within gabbroic rocks in mafic gneiss; and copper-nickel, copper-zinc mineralization located in a contact zone between a felsic and mafic suite of gneiss.

Current Work

Field work continued with mapping these occurrences in an effort to relate mineralization to the surrounding geology. Work this summer was concentrated in McClintock Township.

INDUSTRIAL MINERALS AND BUILDING STONE

During 1990, the final report under the Canada–Ontario 1985 Mineral Development Agreement was completed. The program was carried out to evaluate the industrial mineral and building stone potential of the Muskoka–Parry Sound–Nipissing area. It is anticipated that a Mineral Deposit Circular will be released sometime in 1991.

As a result of the excellent work carried out by Chris Marmont, several companies and individuals have conducted evaluations of several sites, and there is optimism for some development occurring in the near future.

GOLD IN HIGH-GRADE TERRAINS

In December, Chris Marmont was hired to carry out a research project to evaluate the gold potential in the high-grade rocks within the Central Gneiss Belt of Ontario. The work will mainly be limited to library research, but his familiarity with the geology of the area will enable him to provide a practical aspect.

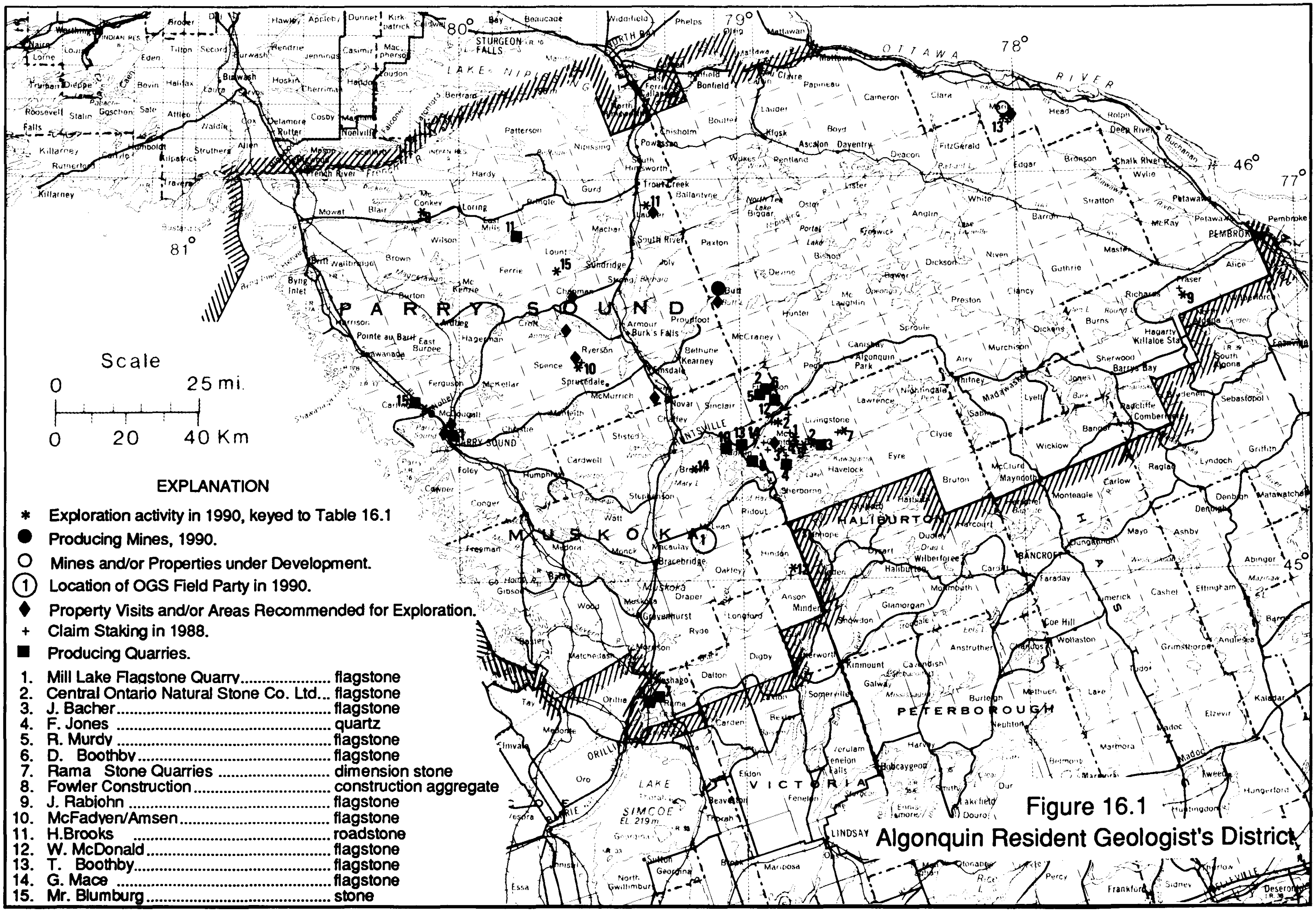

Figure 16.1
Algonquin Resident Geologist's District

RECOMMENDATIONS FOR EXPLORATION

The large amount of unmapped territory, coupled with the smells of gold picked up in quartz veining in the gabbroic gneiss in the western Parry Sound Domain, make this area definitely interesting for prospectors.

Pods of ultramafic rock found within the gneiss of the Muskoka area are usually sulphide bearing and should be sampled for base and precious metals. Interest in these bodies to date has been for road gravel as they weather to a black, pea-sized gravel.

There is great potential for flagstone in the district. Prospectors should familiarize themselves with splitting techniques and determine for themselves the ease with which the rock splits. There is also good potential for dimension stone, and the COMDA pamphlet on building stone outlines several localities, two of which are now staked as a direct result of this work.

RESEARCH BY OTHER AGENCIES

UNIVERSITIES

P. Rasmussen, a Ph.D. student at the University of Waterloo, is attempting to determine if the source of mercury contamination in the fish in a chain of lakes near Huntsville is geological and to evaluate the importance of this source compared with atmospheric sources.

R. Macfie (Queen's University) is completing his doctoral thesis on the structural relationships among the Parry Sound, Sequin, and Rosseau domains.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

A.F. Bajc of the Engineering and Terrain Geology Section completed the first year of a 2-year program to map the glacial deposits and features of the district municipality of Muskoka. The program's purpose is to identify landscapes with significant heritage areas and to protect these values through the municipal planning process. In addition to their geological component, areas considered for protection will be evaluated for their biological and cultural features.

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17. Southeastern Resident Geologist's District—1990

S. van Haaften[1], P.W. Kingston[2], and V.C. Papertzian[3]

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[2]Resident Geologist, Southeastern Resident Geologist's Office, Southern Ontario Region.

[3]Drill Core Library Geologist, Southeastern Resident Geologist's Office, Southern Ontario Region.

INTRODUCTION

During 1990, 24 mines operated in the Southeastern District, producing building stone, gemstones, industrial minerals, and magnesium. Many pits and quarries produced construction aggregate.

MINING ACTIVITY

A total of 24 mines operated in the district during 1990. Mining activity is summarized in Figure 17.1 and Table 17.1.

Two Island Marble Corporation held an official opening of their marble dimension stone operation in May, which the Minister of Mines attended. The company has a small finishing plant at Dacre where it makes cut and polished stone products from white dolomitic marble, which it mines from a quarry in Griffith Township.

The Staff Geologist visited several industrial mineral producers during the fall. The visited producers all said that product shipments were lower in 1990 than in 1989. One producer reported that demand for its product began to decline as early as February 1990.

Steeprock Resources Incorporated was completing the upgrading of its flotation mill in the fall, and was expecting to start production from this mill soon. This company was acquired by Pluess-Stauffer A.G. in 1989.

Strathcona Mineral Services Limited, jointly with Canada Talc Limited, put down a number of deep diamond-drill holes from the surface at the producing talc mine. This drilling intersected the Henderson and East Orebody talc bodies at depth. Some staff had to be laid off at the mine, which was operating at a reduced rate to satisfy customer demand.

ADVANCED EXPLORATION AND DEVELOPMENT

Stewart Lake Resources Incorporated announced in 1989 that it had received the feasibility study prepared by Kilborn Limited. This study called for initial development by quarry in the first 3 years, with ensuing underground development during years 3 through 12. Mineable diluted mining reserves were reported to total 1 020 000 tons grading 8.61% graphitic carbon, sufficient for approximately 12 years of operation. The study did not include certain known graphite zones that could possibly allow ongoing expansion of mineable reserves.

During 1990, the company was in the process of applying for a municipal zoning amendment and meeting other regulatory requirements that would allow it to commence mining. It was reported that Stewart Lake Resources Incorporated expected to go into production in 1991, and was negotiating financing (*The Northern Miner*, November 26, 1990) . Exploration activity is shown in Figure 17.2 and listed in Table 17.2.

EXPLORATION ACTIVITY

Exploration activity indicators in Table 17.3 show lower activity for 1990 than for other recent years. There were few large diamond drilling projects in the district. Most of the exploration activity that took place was grass-roots prospecting, some of which was supported by the Ontario Prospectors Assistance Program.

The following two industrial minerals exploration programs are of particular interest.

Strathcona Mineral Services Limited has been exploring the district since 1989. This year, the company examined a mica prospect in Hungerford Township and did a great deal of work at the Canada Talc Limited operating mine. The talc exploration included deep diamond drilling to test downward extensions of known orebodies.

Bedford Resources did a compilation of industrial mineral potential in the Grenville Province, as the first phase of exploration. The company's staff spent a considerable amount of time in the Tweed office of the Ministry of Northern Development and Mines (MNDM) using the office files and computer systems.

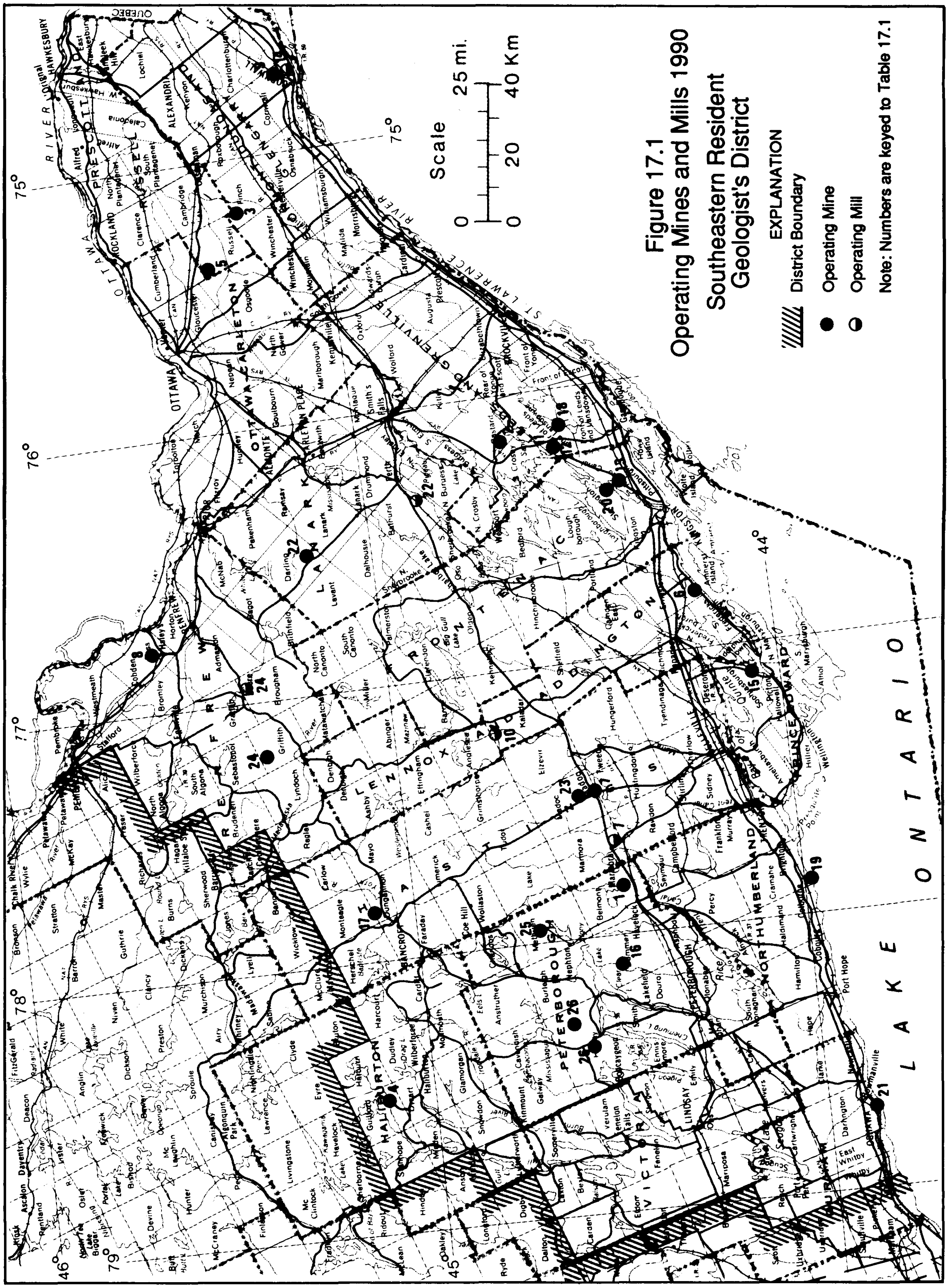

Figure 17.1
Operating Mines and Mills 1990
Southeastern Resident Geologist's District

EXPLANATION
District Boundary
Operating Mine
Operating Mill
Note: Numbers are keyed to Table 17.1

TABLE 17.1. MINING ACTIVITY 1990.

Map No.	Company	Mine	Location (Township)	Commodities	Notes
1	3 M Canada Inc.		Belmont	Traprock	Roofing granules are produced from traprock at this mine.
2	Arriscraft		Bastard	Sandstone	Sandstone for manufacture of reconstituted sandstone. Raw material is shipped to Cambridge, Ontario, for processing.
3	Blair, A.L., Construction Ltd.		Finch	Lime	Agricultural lime is produced from this crushed aggregate quarry.
4	Bolenders Ltd.		Guilford	Dolomite	Dolomite (marble): poultry grit, golf sand, decorative aggregate, white powder sold for use in bricks and mortar.
5	Canada Brick Division, Jannock Ltd.		Gloucester	Russell,, Clay products	Brick, from red shale. Quarry in Russell Tp, Plant in Gloucester Tp.
6	Canada Cement LaFarge Ltd. (Bath)		Ernestown	Cement	Cement is produced on site.
7	Canada Talc Ltd.	Henderson & Corley Mines	Huntingdon	Talc,, Dolomite	Talc products, and ground and crusheddolomite products including terrazzo chips, are produced from this mine. This company operates mills at the mine site and at Marmora.
8	Chromasco Ltd. (Div. of Timminco)		Ross	Magnesium	Magnesium is produced from dolomite mined at this location. Strontium, calcium are produced from purchased material.
9	Cornwall Sand and Gravel		Cornwall	Limestone	Limestone blocks for dimension stone are produced from thick upper beds of this crushed stone quarry.
10	Easton Minerals Ltd.	Northbrook Mill	Kaladar	Industrial minerals	This mill (no mine) processes talc and dolomite from Madoc, granite from Rear of Leeds and Lansdowne Township, and silica.
11	Easton Minerals Ltd.		Rear of Leeds and Lansdowne	Granite	Decorative red granite aggregate is produced from this quarry.
12	Granimar Quarries Ltd.	Straw Hill Quarry	Rear of Leeds and Lansdowne	Granite	Red granite blocks are mined, and shipped to dimension stone plants.
13	Hughes, W.		Pittsburgh	Silica	Sandstone is mined for silica, and sold for use in the manufacture of portland cement.
14	Karnuk Marble Industries Inc.		Cornwall	Dimension stone	This high-technology dimension stone finishing plant produces tiles and panels from marble and granite purchased off site.
15	Lake Ontario Cement Ltd.		Sophiasburg	Cement	Cement is produced on site.
16	Payne, Eldred W.		Dummer	Limestone	Flagstone.
17	Rasmussen, P.	Princess Sodalite Mine	Dungannon	Gemstones	Sodalite is mined, and sold for mineral specimens.

TABLE 17.1. CONTINUED.

Map No.	Company	Mine	Location (Township)	Commodities	Notes
18	Rideauview Contractors Ltd.		Rear of Leeds and Lansdowne	Sandstone	Sandstone building blocks (ashlar), and flagstone.
19	Saint Lawrence Cement Co. Ltd.		Cramahe	Cement	Mine only. Rock is barged to Clarkson plant near Oakville for processing.
20	Sloan, N.	Sloan Quarry	Storrington	Sandstone	Sandstone building blocks (ashlar).
21	St. Mary's Cement Ltd. (Bowmanville)		Darlington	Cement	Cementy is produced on site.
22	Steep Rock Resources Inc.	Tatlock Quarry	Darling	Calcite	High-purity, fine-grind calcite for fillers, plus other grades of calcite, and marble chips. Mill is west of Perth.
23	Stoklosar Marble Quarries Ltd.		Madoc	Marble	Marble chips (terrazzo).
24	Two Island Marble Corp.		Griffith	Marble	White marble dimension stone, finishing plant is at Dacre.
25	UNIMIN	Blue Mountain Quarry	Methuen	Nepheline syenite	Nepheline syenite, produced from a mine in this township, is processed in two mills. Magnetite is also produced.
26	Windover, N.		Harvey	Limestone	Flagstone.

RESIDENT GEOLOGIST STAFF ACTIVITIES

Services

The Resident Geologist and his staff provided a consultative technical service to people engaged in mineral exploration and mining development in southeastern Ontario. This service involved consultations in the office and in the field, and use of the Resident Geologist's library, files, and computer systems. The Resident Geologist's clientele also used the Tweed and Bancroft Core Libraries.

A variety of services are offered by the Southeastern District Resident Geologist and his staff:

1. technical consultations in the field, in the office, and by telephone

2. use of the Assessment Files, Mineral Deposit Files, library of maps, government reports, other printed material, and the associated computer data bases located at Tweed

3. use of Diamond-Drill Core Libraries at Tweed and Bancroft, for examining archived drill core, and for logging newly drilled core

4. geological maps and reports, claim maps, and prospectors' licences are sold by the Resident Geologist's secretary.

Staffing

In December 1990, P.W. Kingston was Resident Geologist, S. van Haaften was Staff Geologist, V.C. Papertzian was Core Library Geologist for Tweed and Bancroft, and C.M. Neal was Secretary. M.C. Toner was employed as summer core library assistant under Experience '90.

D.A. Williams and P. LeBaron were COMDA Project Geologists until the end of January 1990 and the end of March 1990 respectively. COMDA is the acronym for the Canada–Ontario Mineral Development Agreement, a subsidiary agreement to the Economic and Regional Development Agreement, signed by the governments of Canada and Ontario.

The Regional Specialist, H.D. Meyn, has an office at Bancroft and was assisted by K. Fell, Secretary, and two summer students. The program of the Regional Specialist is separate from the Resident Geologist's program and in 1990, the Regional Specialist carried out geological mapping in the Madoc area. Claim tags, prospectors' licences, and publications are sold at his office and the library is available for public use.

TABLE 17.2. EXPLORATION ACTIVITY 1990.

Map No.	Company	Property Name	Location (Township)	Commodities Sought	Notes
	Bedford Resources			Industrial minerals	This consulting firm carried out a compilation study of industrial mineral potential of the Grenville Province in Ontario and Quebec in 1990.
1	Canhorn Mining Corp.	Stoughton Lake Property	Lyndoch	Emeralds (beryl)	Reconnaissance prospecting, petrographic studies, humus geochemical sampling done during 1989.
2	Cathedral Gold Corp.	Addington or Golden Fleece Mine	Kaladar	Gold, silver	Diamond drilling, 1987–1988, by Michele Gold Mines Limited outlined reserves in the "D" zone. Over 24 000 feet of diamond drilling carried out from 1981 to 1984. Geochemical survey conduced in 1990. Total geological reserve indicated by past work: 785 000 tons at 0.13 oz. Au/ton.
3	Dillman, R.J.		Tudor	Gold	Trenching, stripping, induced polarization (IP), geology, diamond drilling in 1990.
4	Helm, N.	St. Charles Iron Mine	Tudor	Gold,, silver, iron	Three diamond-drill holes (438 ft) in 1990.
5	Homestake Mineral Development Co.		Lavant Grimsthorpe, Kaladar, Tudor	Gold, silver	This company is exploring a number of properties in eastern Ontario. Work in 1990 included geological and geochemical surveys, and diamond drilling.
6	Keyhoe, C.		Bedford		Power stripping, 1990.
7	Laidlaw, C.J.		Tudor	Gold	Electomagnetic (EM) survey,1990.
8	Noranda Exploration Co. Ltd.	Malone Gold Prospect (Marmora Twp.) + exploration Tudor Twp.	Marmora, Tudor	Gold	Marmora Twp.: trenching, channel sampling, 1986. Diamond drilling more channeling, 1987. More diamong drilling was done in 1988, and further exploration was done in 1990. Tudor Twp. claims were surveyed using airborne magnetometer (mag) and EM in 1990.
9	O'Shaughnessy, J.R.		Anglesea		Airborne Mag and EM surveys, 1990.
10	O'Shaughnessy, J.M.		Olden		Airborne Mag and EM surveys, 1990.
11	O'Shaughnessy, M.G.		Limerick, Tudor		Airborne Mag and EM surveys, 1990.
12	O'Shaughnessy, W.M.		Tudor		Airborne Mag and EM surveys, 1990.
13	Osiel, M.		Marmora	Gold	Manual work was done in 1990, assays and manual work were done 1989.
14	Paterson, J.H.		Olden		Airborne Mag and EM surveys, 1990
15	RAM Petroleums Ltd.	Hawley Zinc	Olden	Wollastonite, calcite, zinc	8 diamond-drill holes (576 m), mechanical work, beneficiation studies, 1990.
16	Sherlock, E.		Clarendon		Mag, VLF-EM, geology

TABLE 17.2. CONTINUED.

Map No.	Company	Property Name	Location (Township)	Commodities Sought	Notes
17	Stewart Lake Resources Inc.	Kirkham, Bawden Graphite properties	Bedford	Graphite	Kirkham property acquired by option, much other ground staked. Mineable, diluted mining reserves total 1 020 000 tons grading 8.61% graphitic carbon. In 1990, applications were made for township and other necessary approvals.
18	Strathcona Mineral Services Limited	Hungerford Mica and Canada Talc property	Hungerford, Huntingdon	Muscovite mica, talc	The mica property was examined and deep diamond drilling was carried out at the talc mine.

TABLE 17.3. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDITED, SOUTHERN ONTARIO MINING DIVISION.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Other Work (Man Days)	Total (Man Days)
1980	548	721	1 699	17 648	6 665	2 822	3 584	30 719
1981	485	758	1 531	11 855	4 041	4 022	4 699	24 617
1982	354	617	1 115	9 546	8 372	481	8 927	27 326
1983	391	377	1 157	8 317	2 840	3 135	5 032	19 324
1984	555	498	1 254	9 928	23 500	322	3 786	37 536
1985	457	360	1 312	15 619	3 192	650	5 937	25 398
1986	744	426	1 579	15 829	3 623	3 843	9 304	32 599
1987	619	526	1 641	6 672	24 592	5 721	5 352	42 337
1988	982	404	2 255	17 643	24 345	2 284	10 087	54 359
1989	598	729	2 423	22 470	14 140	4 017	8 081	48 708
1990 to November 30, 1990	400	571	2 302	7 584	9 980	1 712	11 528	30 804

Activities

In addition to providing regular services, the Resident Geologist and his staff undertook other activities.

P. Kingston was Session Chairman, industrial minerals, at the Canadian Institute of Mining and Metallurgy annual general meeting held in Ottawa in May 1990. S. van Haaften presented a talk and poster display entitled "Economic Geology and Geochemistry of Grenville Carbonate Rocks" at the Ontario Mines and Minerals Symposium held in Toronto in December 1990.

P. Kingston served on the Mines and Minerals Information Technology Committee, the Land Use Planning for Mineral Resources Committee, the Provincial Core Library Committee, and the Geoscience Exploration Database (GED) Working Group. C. Papertzian also served on the Core Library Committee, and S. van Haaften participated in the GED Working Group.

The Resident Geologist and Staff Geologist visited selected mineral prospects and active mines. Field trips and mine visits were arranged for explorationists who were new to the district. Detailed planning input was provided for the Cardiff Township and Bedford Township Official Plans, and mineral occurrence data were provided on diskette for the Haliburton County Waste Management Master Plan. P. Kingston provided information about mine tailings areas to

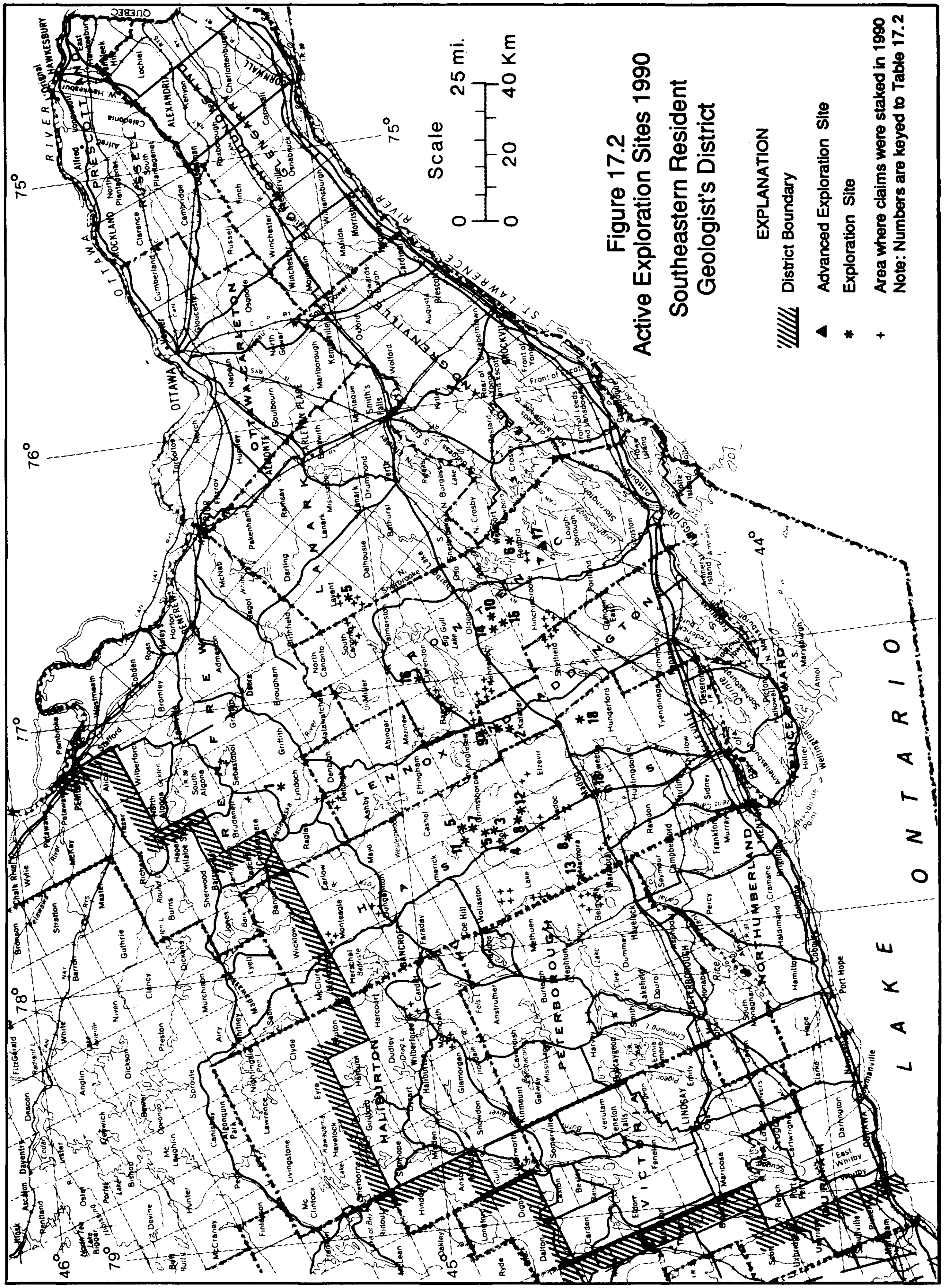

Figure 17.2
Active Exploration Sites 1990
Southeastern Resident Geologist's District

MNDM management, and conducted field inspections of selected tailings areas.

The GED project began in Tweed in August 1990. J.M. Ridgway, Contractor, is carrying out the Mineral Deposit Inventory portion of the project. Information concerning approximately 3300 mineral occurrences in the district is being coded and entered on-line into a computer data base located at the Ontario Geological Survey (OGS) in Toronto. The Southeastern District's Mineral Deposit Inventory portion of GED was expected to be completed by March 31, 1991.

Jiang Xiangdong, geologist, Shandong Bureau of Geology and Mineral Resources, China, spent 6 weeks during October and November working in the Tweed Office. Mr. Jiang was a trainee sponsored by OGS and spent all of 1990 in Ontario working in Toronto and the three MNDM Regions.

H. Meyn, Regional Specialist, and his staff set up a booth at the Bancroft Gemboree selling geoscientific publications issued by the MNDM. The ministry sponsored D.H. Gorman, formerly Professor of Mineralogy, University of Toronto, at this event to identify rocks and minerals for the rock hounds.

A prospectors' course was held in Tweed from February to April 1990. About 45 people regularly attended the course, which comprised four, 3-hour classroom sessions followed by a field day. M.I. Garland, Staff Geologist from MNDM's Dorset office, was the main instructor. S. van Haaften taught the first session, which dealt with the general geology and mineral deposits of southeastern Ontario, and R.M. Charnesky, Mining Recorder for Southern Ontario Mining Division, taught a session dealing with claim staking, assessment work, and the Mining Act.

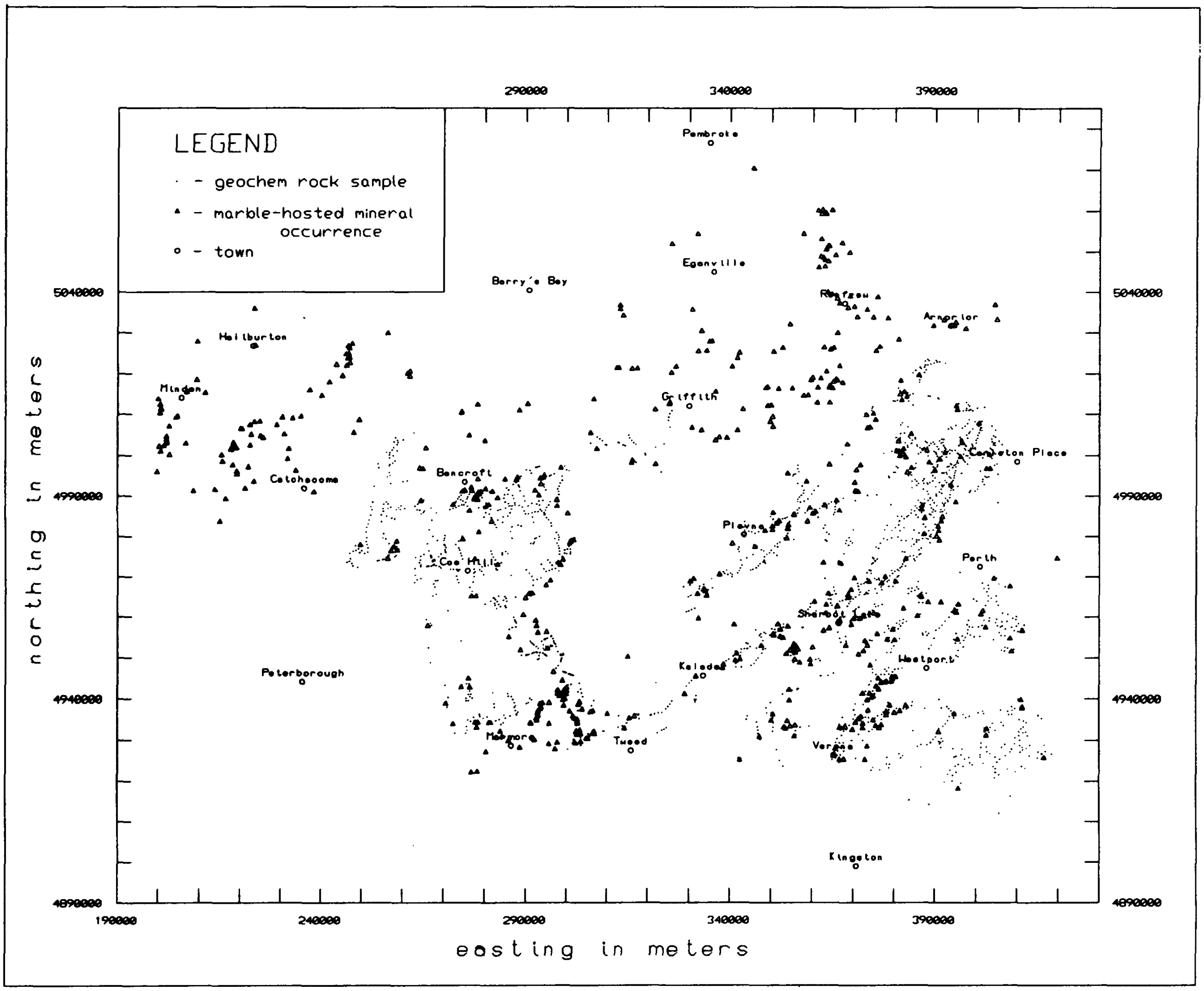

Figure 17.3. Mineral occurrences and geochemical sample locations.

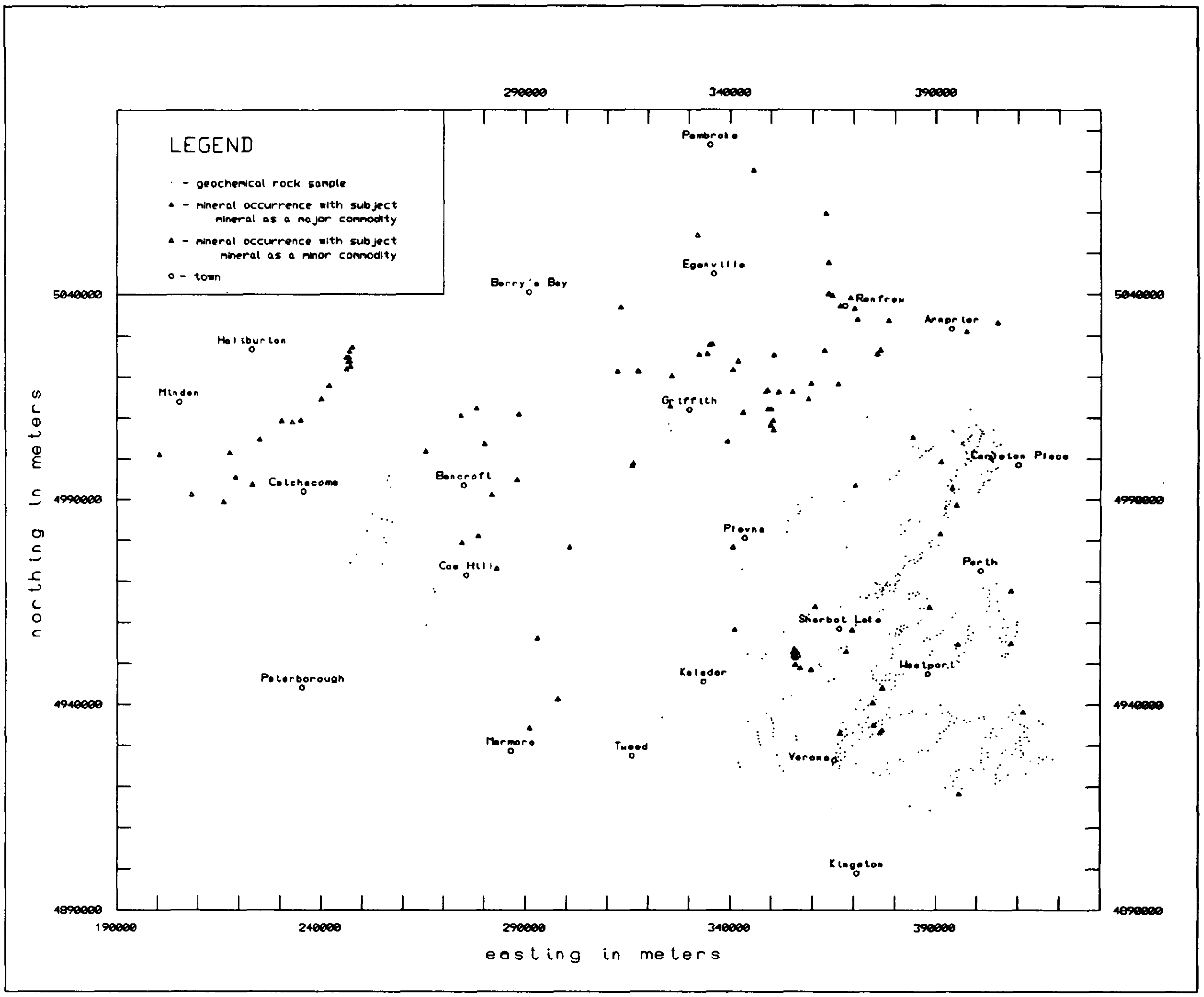

Figure 17.4. Graphite in marble: mineral occurrences and rock samples.

D. Leaper, claims inspector, and S. van Haaften jointly led the field day, which was held at the Ore Chimney Mine in Barrie Township. Mr. Albert Banner, who owns the property, attended the field day and provided very interesting commentary to the course participants about his efforts to develop the property, and about prospecting in general.

RESEARCH BY RESIDENT OFFICE STAFF

ECONOMIC GEOLOGY AND GEOCHEMISTRY OF GRENVILLE CARBONATE ROCKS

This project seeks to assess existing marble lithogeochemical data as an exploration tool by processing existing data and acquiring new data. S. van Haaften worked on this project in 1990 in cooperation with H.D. Meyn.

During this first phase of the project, it was planned to release existing carbonate rock data on floppy disks, and do preliminary data plotting. The data were published on floppy disks as OGS Open File Report 5960 (van Haaften and Meyn 1990), and map plots from the data were presented at a display and talk at the Ontario Mines and Minerals Symposium.

Open File Report 5960 contains four marble-related data files intended for analysis on personal computers. Two data files contain whole-rock and trace-element geochemical analyses and sample locations for 1912 samples, which were collected across the marble belts. Another file contains sample descriptions, including mineralogy ("impurities"). These geochemical and sample description data were previously published by Grant et al. (1989). The fourth data file, prepared by H.D. Meyn and K. Fell, contains detailed information about 636 marble-hosted mineral occurrences. Locations of all of the geochemical rock samples and mineral occurrences are shown in Figure 17.3.

The data were published as delimited ASCII files suitable for use with a variety of software. Empty dBase III Plus™ data base files were provided on the disks for convenient importing of the data by dBase™ users.

The data can be used with a personal computer to plot the spatial relationships between, for example, known occurrences of graphite, and graphite-bearing samples in the rock sample data set (Figure 17.4). Known zinc occurrences can be plotted together with the locations of rock samples, which are anomalous in zinc. Data subsets, such as data from individual marble belts, can be examined. Within some areas, the sample distribution is uniform enough to allow a reasonable attempt at contouring. An example would be contouring of silica values to identify areas of low-silica marble which might be valuable for producing mineral fillers.

Computer analysis of the marble-related data is an ongoing project in MNDM's Southeastern District, and potentially economic marble areas that are suggested by this work will be examined in the field during 1991.

INDUSTRIAL MINERALS IN STEEL MAKING SLAG

Experiments were continued this year by P. Kingston on the use of certain Ontario industrial minerals as components of steel making slags in ladle metallurgy. This experimental test work was conducted with the generous cooperation of SYSCO at the Sydney Steel plant in Sydney, Nova Scotia, in conjunction with Dr. W.F. Caley from the Mines and Metallurgy Department of the Technical University of Nova Scotia.

The purpose of these experimental trials was to test, on a full production scale, the feasibility of replacing certain high-cost man-made components and other materials currently used in these slags with relatively low-cost naturally occurring industrial minerals. Materials such as calcium aluminate and fluorspar have been replaced successfully, in whole or in part, while maintaining slag chemistry and slag fluidity, and maintaining or improving the quality of the finished steel product.

Problems with excess fluidity were encountered, but were resolved, and compatibility of the new slag composition with the ladle linings appears to be excellent.

Further trials were to be carried out in late 1990 or early in 1991, to focus on complete fluorspar replacement, as use of this mineral inherently poses environmental problems due to the free fluorine and fluorides released to the atmosphere during the refining process.

COMDA PROJECTS

From 1986 through 1989, several COMDA projects were carried out in the district focusing on building stone, buried aggregates, industrial minerals, and refractory minerals. Tweed's COMDA projects concluded March 31, 1990.

Several project reports were completed from January to March. Reports were released on the following topics: carbonate building stone resources (LeBaron and Williams 1990); building stone potential (LeBaron et al. 1990); major graphite occurrences (MacKinnon and LeBaron 1990); Precambrian dolomite resources (LeBaron and MacKinnon 1990); vermiculite (MacKinnon et al. 1990); and wollastonite (MacKinnon 1990).

DIAMOND-DRILL CORE LIBRARIES

by V.C. Papertzian

TWEED DRILL CORE LIBRARY

The Core Library was managed by V.C. Papertzian in 1990. M. Toner was the assistant from June through August as part of the Experience '90 program.

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 3, 1990, there were 94 387 m of core in the Core Library catalogue, and approximately 1000 m of recently acquired core yet to be catalogued. Table 17.4 summarizes the library's holdings. During 1990, 11 333 m of core were catalogued.

Major contributors of core this year were Lasir Gold Incorporated, who contributed 59 holes from the Cordova Mine property in Belmont Township, and Cathedral Gold Corporation, who contributed 6 holes from the Addington Mine property located in Kaladar Township.

There were 65 visitors to the facility between January 1 and December 1, 1990.

TABLE 17.4. SUMMARY OF TWEED CORE LIBRARY HOLDINGS, DECEMBER 1, 1990.

Township	Company	Depth Drilled (m)	Core Stored (m)	Commodity
ADOLPHUSTOWN	ONTARIO HYDRO	63.4	42	Engineering
ALICE	SITE INVESTIGATION LTD.	20.8	18.6	Engineering
AMELIASBURGH	INTERA KENTING	34.1	29.7	Engineering
ANGLESEA	ULTIMATE ENERGY RES.	398.6	256.7	Au
ATHOL	OGS HOLE	63.5	62.9	Engineering
BARRIE	GRANDAD RESOURCES	913.8	894.8	Au
	HENRY COOK PROPERTY	76.2	76.2	Pb,Zn,Ag,Au
	ORE CHIMNEY MINE	1 369.5	1 337.2	Au
BEDFORD	HENRY DOUGLAS PROPERTY	67.6	59.7	Au
	RICHARDSON FELDSPAR	339	327.6	Quartz
	STEWART LAKE RESOURCES	101.5	100.6	Graphite
BELMONT	BLAIRTON IRON MINE	1 460.4	1 202.4	Fe
	CORDOVA	2 875.3	2 489.6	Au
	LASIR GOLD INC.	9 169.3	8 891.1	Au
	PERSHING IRON MINE	6 712.3	5 718.4	Fe
	PREUSSAG	1 211.9	1 133.7	$CaCO_3$
CAMDEN EAST	ROBLINDALE QUARRY	17	16.8	Scientific
CARDEN	K.J. BEAMISH CONSTRUCTION	39.5	0.8	Engineering
CHARLOTTENVILLE	OLIVER IRON MINING	5 290.4	1 891.5	Fe
CLARENDON	SELCO INC.	245.4	232	Zn
	ST. JOE'S EXPL. LTD.	905	905	Zn
DARLING	HOMESTAKE MINERAL DEVELOPMENT CO.	1 236.0	25.5	Au,Cu,Zn,Ag
DARLINGTON	ONTARIO HYDRO	18.8	7.3	Engineering
DURHAM	ONTARIO HYDRO	128.9	91.7	Engineering
EDWARDSBURGH	ONTARIO HYDRO	52	27.1	Engineering
ELIZABETHTOWN	GEOCOR ENGINEERING INC.	49.3	13.5	Engineering
	MIN. OF TRANSPORTATION ONT.	28	17.8	Engineering
ELMSLEY N.	GLOBE GRAPHITE MINE	698.2	634	Graphite
ELZEVIR	CORONA CORP	702.6	652	Au
	STEEPROCK	516.2	492	Talc
ERNESTOWN	BETHLEHEM STEEL CORP	185.9	185.9	Fe
	GEOCOR ENGINEERING	19.4	16.7	Engineering
GLOUCESTER	MIN. OF TRANSPORTATION ONT.	31.7	31.2	Engineering
GRATTAN	SITE INVESTIGATION LTD.	111.2	108.1	Engineering
HARVEY	GORMLEY AGGREGATES LTD.	28.3	13.4	Engineering
HOPE	ONTARIO HYDRO	4 453.6	1 822.6	Engineering
HUNGERFORD	RAM PETROLEUMS LTD.	157.9	157.9	Mica
KALADAR	C.R. YOUNG	78.3	75.9	Mica
	CATHEDRAL GOLD CORP.	1 131.9	1 039.6	Au
	E&B EXPLORATIONS INC.	7 817.7	7 817.7	Au
	J. BYERS	123.1	121.2	Feldspar
	LACANA MINING CORP.	85.3	71.9	Mica
KINGSTON	GEOCOR ENGINEERING INC.	85.7	13.7	Engineering
LANARK	SELCO CLYDE RIVER	1 448.3	1 267.4	Zn
LAVANT	HOMESTAKE MINERAL DEVELOPMENT CO.	264.8	4.8	Au
MADOC	BANNOCKBURN MINE	260.6	177.8	Au
MADOC	DERRY, MICHENER, BOOTH	600.9	591.1	Talc
MADOC	FREEPORT EXPLORATION	3 192.6	2 244.3	Base metals
	HARWIN EXPL. & DEVEL.	792.5	792.5	Au

TABLE 17.4. CONTINUED.

Township	Company	Depth Drilled (m)	Core Stored (m)	Commodity
	MONO GOLD MINES INC.	17 964.2	17 852.6	Au
	SAGER	1 562.3	1 330.1	Base metals
	SSFC/OGS	107.3	107.3	Scientific
	SYNGENORE	3 438.4	2 388.8	Base metals
	TWIN BUTTES	150.3	150.3	Talc
MARMORA	ACKERMAN	37.1	37	Au
	BELMAR RESOURCES INC.	374.1	361	Au
	BETHLEHEM STEEL CORP.	8 706.5	478.8	Fe
	CHAMPION GOLD RESOURCES INC.	484	465.8	Au
	GOLD BROOKE EXPL.	795	810.9	Au
	MARMORATON IRON MINE	4 080.5	3 602.5	Fe
METHUEN	PREUSSAG	190.6	175.7	$CaCO_3$
MEDONTE	MINISTRY OF TRANSPORTATION	30.8	29.9	Engineering
NORTH BURGESS	INDUSMIN LTD.	115.9	98.1	Silica
	LODI METALS INC.	250.9	242	Graphite
	O.M.N.R.	52.4	51.6	Vermiculite
NORTH CROSBY	INDUSMIN LTD.	129.3	102.8	Silica
	MTC WESTPORT DDH	32.0	32.0	Engineering
NORTH FREDICKSBURGH	ONTARIO HYDRO	164.6	152.7	Engineering
OSNABRUCK	GEOCOR ENGINEERING INC.	9.8	1.8	Engineering
OLDEN	LYNX CANADA EXPL.	15 825.8	14 711.5	Zn
OPS	OGS/SSFC	155.3	149.3	Scientific
ORILLIA	SPARROW	18.0	16.9	Limestone
OTONABEE	MURRAY LITTLE PROPERTY	96.3	90.8	Engineering
PALMERSTON	FAIRFIELD PROJECTS	152.4	146.8	U
PICKERING	ONTARIO HYDRO	326.4	216.7	Engineering
PRESCOTT	ONTARIO HYDRO	6.7	2.1	Engineering
RAMA	MIN. OF TRANSPORTATION ONT.	33.5	6.5	Engineering
	LONGFORD DRILLHOLE	33.8	7	Engineering
RAMSAY	J.M. BELL	665.4	665.4	Base metals
	MIN. OF TRANSPORTATION ONT.	5.8	5.8	Engineering
SEYMOUR	ALLAN'S MILLS	3 530.8	3 170.1	Fe
SOMMERVILLE	DUDMAN QUARRY CO.	56.5	19.6	Engineering
	MASON PROPERTY	31.7	5.2	Limestone
	OGS/SSFC	28	28	Scientific
SOPHIASBURGH	ONTARIO HYDRO	83.5	52.1	Engineering
SOUTH CROSBY	INDUSMIN LTD.	391.5	342.3	Silica
SOUTH FREDRICKSBURG	LENNOX GENERAT. STN.	107.5	107.5	Engineering
STORRINGTON	INDUSMIN LTD.	75.5	62.4	Silica
THURLOW	SITE INVESTIGATION LTD.	53.1	38	Engineering
TUDOR	WOLFEX EXPL. LTD.	75.8	75.8	Au,Ag
TYENDINAGA	ONTARIO HYDRO	207.4	159.7	Engineering
WENTWORTH PQ	BLACK GREGOR EXPL.	84.4	83.1	Graphite
WOODHOUSE	OLIVER IRON MINING	1 540.5	509.1	Fe
TOTAL		**117 935.6**	**94 387.0**	

TABLE 17.5. SUMMARY OF BANCROFT CORE LIBRARY HOLDINGS.

Township	Company	Depth Drilled (m)	Core Stored (m)	Commodity Sought
Anstruther	Biron Bay Resources Ltd.	2 600.8	2 600.8	Fe, Ti
	Esso Minerals Canada	1 008.0	972.2	U, Th
	Glen Explorations	181.4	2.7	U, Th
	Northgate Exploration Ltd.	384.3	339	U, Mo
Blithfield	Ontario Hydro	174.2	127.5	Structure
Brougham	Coronation Resources	529.1	307.7	Graphite
	Ontario Hydro	204.9	98.8	Structure
Burleigh	L.V. Lomas Chem. Co. Ltd.	243.8	3.6	Marble
Butt	Vesuvius Crucibles	1 248.3	1 163.0	Graphite
Cardiff	Esso Minerals Canada	3 558.1	3 019.1	U, Th
	Griffis, A.T.	294.4	3.8	Graphite
	Kenmac Chibougamau Mines	691.3	396.2	U, Th
	Kerr Addison Mines Ltd.	10 478.6	9 691.3	U, Th
Cashel	David McMurray	290.1	285.6	Talc
Cavendish	Quebec Uranium Mines Ltd.	459.3	6	U
Dungannon	Jayfran Enterprises	681.2	639.6	Nepheline syenite
Faraday	Madawaska Mines	3 234.3	632.6	U, Th
	Mercier Exploration	735.3	10.7	U, Th
Finlayson	Canadian Gold Resources Inc.	274.6	267	Au
Galway	Halas, Frank	504.4	6	U
Glamorgan	Esso Minerals Canada	943.1	732	U, Th
	Sulpetro Minerals Ltd.	373.7	373.7	Zn
Laurier	Trout Creek	161.8	131	Graphite
Limerick	Lac Minerals Ltd.	13 281.6	9 295.9	Cu,Ni,Co
Mayo	Falconbridge Ltd.	421.9	421.9	Fe
Methuen	Indusmin Ltd.	92.2	92	Nepheline syenite
Monmouth	Esso Minerals Canada	5 256.1	4 321.5	U
Monteagle	Esso Minerals Canada	192.8	177.7	U
	Forefront Uranium Mines Ltd.	609.8	205.2	U
	Hobbs, L.G.	220.8	1.6	U
Murchison	Comet Quartz	336	283	Quartz
Ryerson	Graphite Corp. of Canada	1 338.0	1 299.5	Graphite
	Ryerson Graphite	1 113.0	1 044.8	Graphite
Snowdon	Sulpetro Minerals Ltd.	11 320.3	10 600.2	Zn
Total		**63 437.5**	**49 553.2**	

BANCROFT DRILL CORE LIBRARY

The drill core library in Bancroft was staffed by V.C. Papertzian 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 3, 1990, 34 917 m of core were stored inside, whereas 19 724 m were stored outside on a nearby pad. Table 17.5 summarizes 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 Southeastern District's mining activity. The district's proximity to markets and its

TABLE 17.6. MINES AND MINERALS DIVISION PUBLICATIONS RELATING TO SOUTHEASTERN DISTRICT RELEASED IN 1990.

PUBL	NUMBER	CITATION
** PUBLICATION TYPE: MAP		
MAP	2512	Dalhousie Lake Area, Frontenac and Lanark Counties. Geology by Liba Pauk, scale 1:31 680. Precambrian Geology Series.
MAP	2530	Precambrian Geology, Digby-Lutterworth Area. Geology by R.M. Easton, scale 1:20 000. Precambrian Geology Series.
MAP	5511	Southern Ontario Engineering Geology Terrain Study, Renfrew. Data Base Map, 31F/SE, by M.A. Roed, S.M. Ringrose and J. Sauriol, scale 1:100 000, geology 1981.
MAP	5512	Southern Ontario Engineering Geology Terrain Study, Renfrew. Engineering Capability Map, 31F/SE, by M.A. Roed, S.M. Ringrose and J. Sauriol, scale 1:100 000, geology 1981.
MAP	5513	Southern Ontario Engineering Geology Terrain Study, Ottawa. Data Base Map, 31G/SW and part of 31G/NW, by M.A. Roed, S.M. Ringrose and J. Sauriol, scale 1:100 000, geology 1981.
MAP	5514	Southern Ontario Engineering Geology Terrain Study, Vankleek Hill, Data Base Map, 31G/SE and part of 31G/NE, by M.A. Roed, S.M. Ringrose and J. Sauriol, scale 1:100 000, geology 1981.
MAP	5510	Southern Ontario Engineering Geology Terrain Study, Cobden. Data Base Map, 31F/NE, by M.A. Roed, S.M. Ringrose and J. Sauriol, scale 1:100 000, geology 1981.
OFM	132	Geology of the Mazinaw Lake Area (31 C/14), by R.M. Easton, scale 1:50,000, on file at the Resident Geologist's offices in Tweed and Dorset.
OFM	135	East-Central Madoc Township, by H.D. Meyn, scale 1:5000, on file at the Resident Geologist's office in Tweed and the Regional Specialist's office in Bancroft.
P	3092	Precambrian Geology, Haliburton Area. Compiled by R.M. Easton, scale 1:50 000. Precambrian Geology Series.
P	3093	Precambrian Geology, Clyde Forks Area. Compiled by R.M. Easton, scale 1:50 000. Precambrian Geology Series.
** PUBLICATION TYPE: PAMPHLET		
		COMDA Review, Fall 1990.
		Canada-Ontario Mineral Development Agreement, Annual Report 1987–1989.
		Directory of Ontario Dimensional Stone Producers 1990, produced by the Mineral Development Section, Ontario Ministry of Northern Development and Mines, 16p.
** PUBLICATION TYPE: REPORT		
		DIRECTORY OF MINING AND EXPLORATION COMPANIES IN ONTARIO, 1989 – a Mineral Development and Lands Branch publication.
		MID-YEAR MINING STATISTICS, 1989 – a Mineral Development and Lands Branch publication.
		Ontario Dimensional Stone Catalogue – a Mineral Development and Lands Branch Publication.
		THE EXPLORE REPORT for Mineral Exploration and Development Work Performed in Ontario in 1988 – a Mineral Development and Lands Branch publication.
IMBP	13	Developments in Building Products: Opportunities for Industrial Minerals, by the Institute for Research in Construction at the National Research Council of Canada and MATEX Consultants Inc., 164p.
IMBP	14	Microwaves and Minerals: I. Technology Review II. Tests of Ontario's Industrial Minerals, Atomic Energy of Canada Limited Research Company and Voss Associates Engineering Ltd., 77p.
MDC	30	Building Stone Potential in Eastern Ontario, by P.S. LeBaron, C.P. Verschuren, V.C. Papertzian and P.W. Kingston, 368p.
MDC	31	Vermiculite in the Stanleyville Area, Eastern Ontario, by A. MacKinnon, P.W. Kingston and J.S. Springer, 43 p.

TABLE 17.6. CONTINUED.

OFR	5712	Precambrian Dolomite Resources in Southeastern Ontario, by P.S. LeBaron and A. MacKinnon, 134p.
PUBL	**NUMBER**	**CITATION**
**** PUBLICATION TYPE: REPORT (Continued)**		
OFR	5715	Wollastonite in Southern Ontario, by A. MacKinnon, 289p.
OFR	5729	Major Graphite Occurrences within the Frontenac Axis, Southern Ontario, by A. MacKinnon and P.S. LeBaron, 77p.
OFR	5730	Paleozoic Building Stone Resources of the Lake Simcoe-Kingston Area, Southern Ontario, by P.S. LeBaron and D.A. Williams, 65p.
OFR	5960	Computer Data Relating to the Economic Geology and Geochemistry of Grenville Carbonate Rocks in Southeastern Ontario, by S. van Haaften and H.D. Meyn, 13p. plus two 5.25 inch double density diskettes for MSDOS® containing delimited ASCII files.
RPT	245	Geology of the Dalhousie Lake Area, Frontenac and Lanark Counties, by Liba Pauk, 57p. Accompanied by Map 2512, scale 1:31,680.
RPT	269	Precambrian Geology, Digby-Lutterworth Area, by R.M. Easton, 86p., Accompanied by Map 2530, scale 1:20,000.

diverse range of industrial mineral commodities make exploration for industrial minerals potentially worthwhile. White mineral fillers and dimension stone of uncommon colours, such as black and red granite, make attractive exploration targets.

COMDA reports released in 1990 provide valuable information for industrial minerals exploration. The computer data relating to marbles published by van Haaften and Meyn (1990) can be very useful in exploration for industrial minerals and zinc.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

R.M. Easton, geologist, Precambrian Geology Section, carried out detailed geological mapping in the Grimsthorpe area. D.K. Armstrong and G.H. McFall, geologists, Engineering and Terrain Geology Section, worked on Paleozoic bedrock mapping in the Lake Simcoe area and neotectonic studies in Prince Edward County respectively. G.R. Jones, geologist, Engineering and Terrain Geology Section, began aggregate mapping in the Coboconk area. Publications released in 1990 that are applicable to the Southeastern District are listed in Table 17.6.

REFERENCES

Grant, W.T., Papertzian, V.C. and Kingston, P.W. 1989. Geochemistry of Grenville marble in southeastern Ontario; Ontario Geological Survey, Mineral Deposits Circular 28, 266p.

LeBaron, P.S. and MacKinnon, A. 1990. Precambrian dolomite resources in southeastern Ontario; Ontario Geological Survey, Open File Report 5712, 134p.

LeBaron, P.S. and Williams, D.A. 1990. Carbonate building stone resources of the Lake Simcoe–Kingston area, southeastern Ontario; Ontario Geological Survey, Open File Report 5730, 65p.

LeBaron, P.S., Verschuren, C.P., Papertzian, V.C. and Kingston, P.W. 1990. Building stone potential in eastern Ontario; Ontario Geological Survey, Mineral Deposits Circular 30, 368p.

MacKinnon, A. 1990. Wollastonite in southeastern Ontario; Ontario Geological Survey, Open File Report 5715, 289p.

MacKinnon, A. and LeBaron, P.S. 1990. Major graphite occurrences within the Frontenac Axis, southeastern Ontario; Ontario Geological Survey, Open File Report 5729, 77p.

MacKinnon, A., Kingston, P.W. and Springer, J.S. 1990. Vermiculite in the Stanleyville area, eastern Ontario; Ontario Geological Survey, Mineral Deposits Circular 31, 43p.

van Haaften, S. and Meyn, H.D. 1990. Computer data relating to the economic geology and geochemistry of Grenville carbonate rocks in southeastern Ontario; Ontario Geological Survey, Open File Report 5960, 13p. and two 5 1/4 inch double-density MSDOS® diskettes containing comma-delimited ASCII files.

18. Southwestern Resident Geologist's District—1990

R.I. Kelly[1] and B.H. Feenstra[2]

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[2] Resident Geologist, Southwestern Resident Geologist's Office, Southern Ontario Region.

INTRODUCTION

The industrial mineral resources of the Southwestern District provide a large portion of Ontario's structural material and nonmetallic mineral wealth. All of the province's salt and gypsum production is derived from the district as is nearly all of the clay and shale, crushed stone, calcined lime, cement, sand and gravel, and building stone from "limestone" production.

The largest industrial mineral project in the district continues to be the development of Domtar Incorporated's new No. 3 Mine at Caledonia. Production at this mine is slated to begin in early 1991.

Mineral exploration in the district focuses primarily on oil and gas and construction aggregate resources. Interest in locating sources of high purity limestone for cement and environmental purposes has recently been brought to the attention of our office by a number of companies.

The Geoscience Exploration Database (GED) project for the Southwestern District is being completed by R. Goad, a mineral exploration consultant from London.

MINING ACTIVITIES

During 1990, a total of 42 mineral properties remained active in the Southwestern District. These operations produce building stone, clay and shale, gypsum, salt, and limestone and dolostone derived products. The locations of all operations are shown on Figure 18.1.

SALT

Rock salt is extracted from the Salina Formation by underground mining methods at Windsor and Goderich.

At the Ojibway Mine in Windsor, The Canadian Salt Company Limited employs a conventional room-and-pillar method in the 7.5 m thick Middle F Unit at a depth of 297 m. A prolonged strike at this mine severely curtailed production levels for the year.

At the Goderich Mine, Sifto Canada Incorporated, uses a modified room-and pillar (stress relief) mining design in the 23 m thick A-2 Unit bed at a depth of 537 m. The production level for the year is anticipated to reach some 3.5 million tonnes.

Rock salt is used primarily in de-icing, in the manufacture of chloralkalis, and in minor markets, such as water conditioners.

GYPSUM

Gypsum is extracted from the Salina Formation by underground room-and pillar methods at Caledonia, Hagersville, and Drumbo. Gypsum is used primarily to produce wallboard for the construction industry. Lesser amounts are used for plaster products, as retarders to control the setting of portland cement, as soil conditioners, as food additives, as fillers for paint and paper products, and in specialized cements.

Domtar Incorporated (Construction Materials Group, Gypsum Division) mines a 2.5 m thick gypsum bed at a depth of 25 m at the No. 2 Mine at Caledonia. The new No. 3 Mine, located immediately east of the No. 2 Mine, is slated to begin production in early 1991. This mine will utilize continuous mining techniques, thereby eliminating the need for drilling and blasting. Initial production levels of 500 000 tonnes per year are planned. Reserves are estimated to be in excess of 75 years.

The Canadian Gypsum Company operates a mine and wallboard operation north of Hagersville. Gypsum is extracted from a 1 m thick gypsum bed at a depth of 30 m. The company has plans for a 6 year, $7 million upgrading of operations at the Hagersville plant.

Near Drumbo, Westroc Industries Limited mines a 1.7 m thick gypsum bed at a depth of 116 m. Crude gypsum is shipped to company operations in Mississauga for the manufacture of wallboard.

BUILDING STONE

Adair Marble Quarries Division of Arriscraft Corporation quarries 10 t dimension stone blocks from bluish-grey mottled, thick-bedded, dolostone of the Wiarton–Colpoy Bay Member of the Amabel Formation near Hope Bay in the Bruce Peninsula. The company began quarrying buff-coloured Amabel Formation beds ("sepia stone") in 1989 and has found a favourable market for this stone.

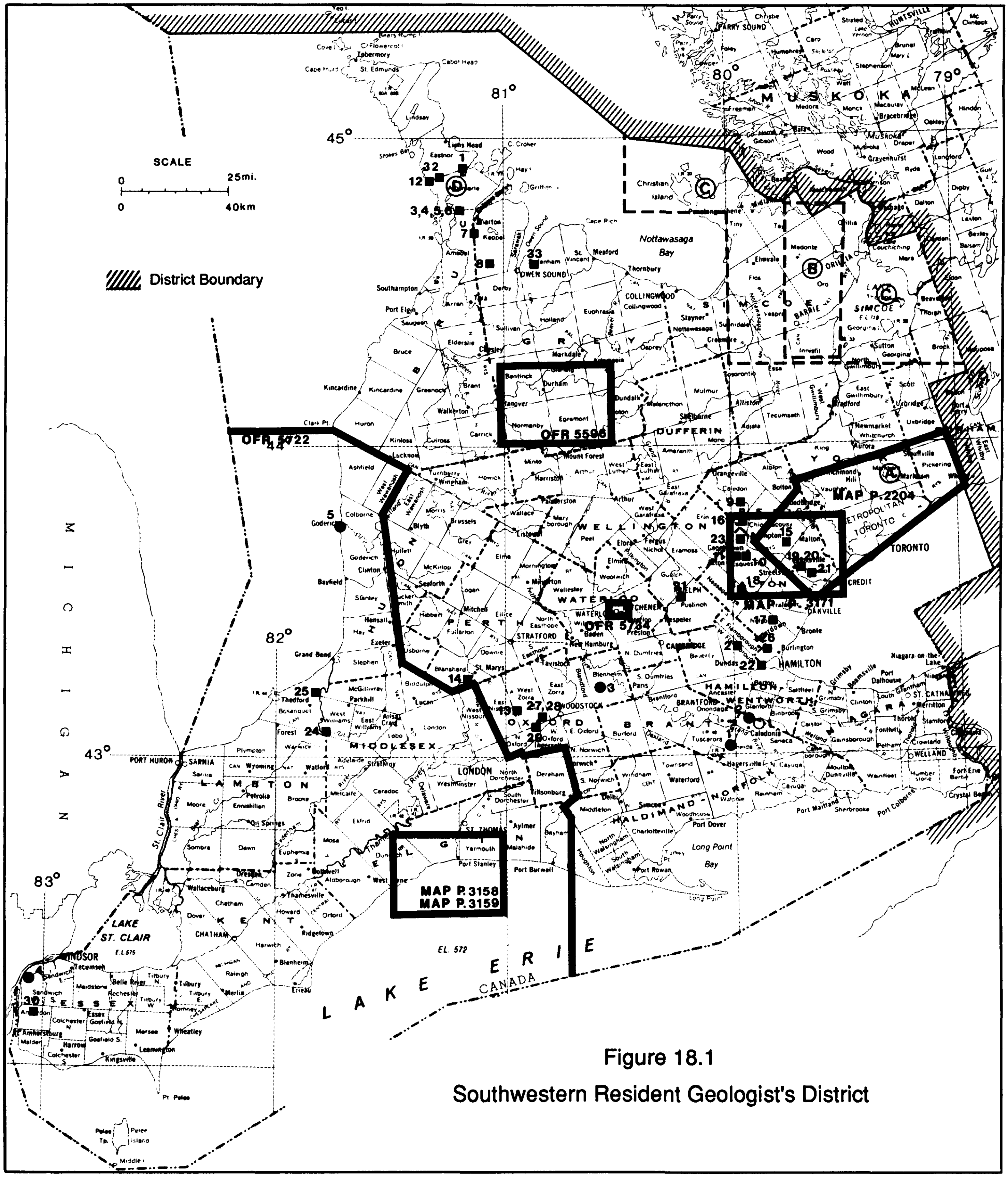

Figure 18.1
Southwestern Resident Geologist's District

EXPLANATION

(A) Location of Ontario Geological Survey Field Projects, 1990

A. Overburden Sounding Research, Markham Township
B. Quaternary Geology-Barrie-Elmvale Area
C. Paleozoic Geology-Lake Simcoe Area
D. Paleozoic Stratigraphy Drilling Program-Bruce Peninsula

Maps/Reports Issued by Ontario Geological Survey, 1990

Mines under Development, 1990

Gypsum

1. Caledonia No.3-Domtar Inc.

Producing Mines, 1990

Gypsum

1. Haldimand-Canadian Gypsum
2. Haldimand-Domtar Gypsum
3. Blandford/Blenheim Twp.-Westroc Industries

Rock Salt

4. Windsor-Canadian Salt Company
5. Goderich-Sifto Canada Inc.

Producing Quarries, 1990

Building Stone (Dolostone, Sandstone)

1. Albemarle Twp.-Adair Marble Quarries Division Arriscraft Corporation
2. Albemarle Twp.-Emerson McLay
3. Amabel Twp.-Amsen Quarry Limited
4. Amabel Twp.-Ebel
5. Amabel Twp.-Owen Sound Ledgerock Limited
6. Amabel Twp.-Ross
7. Keppel Twp.-McCartney
8. Keppel Twp.-Owen Sound Ledgerock Limited
9. Caledon-Deforest Bros. Quarry Limited
10. Halton Hills -Hilltop Stone
11. Halton Hills-Rice & McHarg Quarries Ltd.
12. Albemarle Twp.-Amsen Quarry Limited

Cement Limestone (Clay, Shale)

13. Zorra-Lafarge Canada Inc.
14. St. Marys-St. Marys Cement Company

Clay Products (Shale)

15. Brampton-Brampton Brick
16. Caledon-Brampton Brick
17. Burlington-Canada Brick
18. Milton-Canada Brick
19. Mississauga/Streetsville-Canada Brick
20. Mississauga/Streetsville-Canada Brick
21. Mississauga/Cooksville-Canada Brick
22. Burlington-Halton Ceramics
23. Halton Hills-Martin Clay Products
24. West Williams Twp.-Martin Clay Products
25. Bosanquet Twp.-Coultis
26. Burlington-Canada Brick

Chemical-Metallurgical-Pulverized Stone (Limestone, Dolostone)

27. Oxford Twp.-BeachviLime Ltd.
28. Oxford Twp.-BeachviLime Ltd.
29. Oxford Twp.-Stelco
30. Anderdon Twp.-General Chemical
31. Guelph-Guelph DoLime Ltd.
32. Flamborough-Steetley Lime & Aggregates
33. Sydenham Twp.-Owen Sound Dolomite

Recently favourable construction markets saw previously inactive building stone quarries in the Bruce Peninsula reopen. The D.R. Ross Quarry (Smithson Quarry), Amabel Township, inactive since 1980, reopened to produce cut flagstone from the Eramosa Member of the Amabel Formation. The former Moor Developments Inc. Quarry was acquired by Amsen Quarries Limited and reopened after a short period of inactivity. The quarry is now known as the Amsen–Mar Quarry. A variety of products are produced from the Eramosa Member of the Amabel Formation and overlying Guelph Formation. The main products include slabs for hearths, mantels, counters, and flooring; cut flagstone; coping; sills; and drywall.

Capital improvements, including a new office and showroom complex, are under way at the Owen Sound Quarry of Owen Sound Ledgerock Limited. Ebel Quarries Limited has plans to construct a new building stone finishing plant at their Wiarton Quarry.

CLAY AND SHALE

A number of clay and shale operations remained active during the year. The largest companies in the district continue to be Canada Brick, a division of Jannock Limited, and Brampton Brick Limited. In both operations, major production involves clay brick manufacturing from Queenston Formation shale.

In midyear, Canada Brick acquired operating facilities and properties from National Sewer Pipe (NSP) Inc., including the Queenston shale pits at Burlington, the Wallenstein soft-mud brick plant, and the St. Thomas operations of NSP. The St. Thomas plant produces flue liners, sewer pipe, and structural wall tile.

Brampton Brick received a licence under the MNR Aggregates Act to extract a maximum of 300 000 tonnes per year of Queenston shale from their Cheltanham property. Extraction from this facility has just been initiated. Production is slated for 720 tonnes per day.

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 drill core and cuttings storage facility at the Petroleum Resources Laboratory of the Ministry of Natural Resources and the Soils and Aggregates Testing facility of the Ministry of Transportation.

The office of the Resident Geologist provides advisory technical services to industry, government agencies, and the general public in support of exploration and development, land-use planning, academic studies, and general interest inquiries.

A publicly accessible geoscience and mineral resource information library is maintained at the office. The Southwestern District component of the Geoscience Exploration Database (GED) program is currently being completed by R. Goad of London. This computerized data base will allow the public easy access to geoscience information for any location in the province.

The office is also responsible for selling maps and reports published by the Mines and Minerals Division, prospector's licences, and claim tags. Staking and working claim forms are also available.

The office provided consultative services to a number of companies, including inquiries regarding sources of high purity Ca-limestone, the geology of potential crushed stone quarry sites, mineral commodities for specialized cement production, blasting sands, and the evaluation of samples for dolomitic lime production.

The Southwestern District office in London is staffed by B. H. Feenstra, Resident Geologist; R. I. Kelly, Staff Geologist and P. Smith, Program Secretary. The office employed four geological assistants: F. Butterfield, under the Experience '90 program; E. Sherlock; M. Fraser; and J. Baker.

A number of projects were also initiated by the office, including overburden drilling to evaluate aggregate potential in McGillivray Township and subsurface stratigraphy in the Beaver Valley, evaluating southwestern Ontario Paleozoic carbonate resources for various industrial applications, assessing the mineral resource potential of the Lake Simcoe area, and a Quaternary geological investigation of the Woodbridge area. Bern is currently completing a report on abandoned gypsum mines of the Paris-Caledonia area following some final data organization by summer assistant E. Sherlock.

The office is currently involved in the operation of a Section 25 Employment Canada Program in conjunction with Federal White Cement (FWC) of Woodstock. This program is focussing on the evaluation of various provincial mineral commodities for use in FWC's production of white cement.

Staff reviewed various land-use plans related to power transmission facilities, waste disposal, subdivisions, and a proposed education centre at the abandoned Don Valley Brickworks in Toronto.

Office staff participated in a number of geological field trips throughout the district, including trips to the Bruce Peninsula, Niagara Escarpment, Niagara Peninsula, and Goderich Salt Mine. The latter trip was organized by the Staff Geologist for staff of oil and gas companies, the Ontario Geological Survey (OGS), and Brock University. The Resident Geologist arranged a field trip to Arriscraft Corporation, Cambridge, and St. Marys Cement Limited, St. Marys, for the Minister of Mines in March. The operations of all OGS field parties operating in the district were also visited during the 1990 field season.

The Resident Geologist coauthored a poster paper on the St. Davids Gorge with Dr. P. Barnett (OGS), B. Semec (Ontario Hydro), and Dr. J. McAndrews (Royal Ontario Museum), which was presented at the Canadian Quaternary Association–American Quaternary Association meeting in Waterloo in June. The Staff Geologist attended the 1990 American Association of Petroleum Geologists (AAPG) Eastern Section Meeting held in London, Ontario, September 9–12, and participated in a Paleozoic and Precambrian core workshop course and a trip that examined gypsum deposits of southwestern Ontario.

RESEARCH BY RESIDENT OFFICE STAFF

BURIED AGGREGATE DEPOSIT ASSESSMENT, McGILLIVRAY TOWNSHIP

A limited program of overburden rotasonic drilling in McGillivray Township was completed as an adjunct to the electromagnetic (EM) conductivity survey recently carried out by the Ontario Geological Survey (Vanderveer 1989).

The EM survey covered an area of some 45 km^2 for the purpose of delineating the distribution and depth of burial of sand and gravel deposits. Results of the survey indicated a number of zones with potential for buried aggregates. To verify both the depth of burial and the quality and quantity of aggregates, a limited program of overburden rotasonic drilling was completed. Within the study area, six sites were selected and drilled to various depths. Of the six holes, one was advanced to bedrock to provide a stratigraphic reference.

Results of the drilling program indicated the presence of a pervasive, generally thin (<15 feet (4.6 m)) surface unit of clayey silt glacial till. This till had previously been recognized within the study area by Sado and Vagners (1975) and classified as Late Wisconsinan in age. Underlying the upper till, a pervasive sand and gravel unit was encountered. The thickness of this unit varied from <2 feet (0.6 m) to slightly greater than 24 feet (7.3 m). Samples from this unit have been submitted for aggregate quality testing. In all drill holes a light grey, massive, dense, sandy silt till was intersected immediately below the sand and gravel unit. In the stratigraphic reference drill hole, this till extended to bedrock, a thickness of some 87 feet (26.5 m). In one of the drill holes, this till unit was rather thin (25 feet (7.6 m)) and found to be underlain by a thick (50 feet (15.2 m)), poorly sorted unit of gravelly sand and silty sand. This hole was discontinued before encountering bedrock.

Results indicate that aggregate resources are present within two stratigraphic horizons. An upper pervasive body of variable thickness is buried by a generally thin cover of clay-rich till. A second discontinuous aggregate unit is buried under a thick cover of glacial sediments. Further investigations, such as shallow seismic studies, are needed to clarify the extent of the lowermost aggregate unit.

This study has helped clarify the observations of the initial EM survey and has also helped to identify areas that may have potential for aggregate extraction.

ROTASONIC DRILLING, BEAVER VALLEY

A single rotasonic drill hole was completed in Beaver Valley, Euphrasia Township, Grey County (Figure 18.2) to establish overburden stratigraphy, to verify the presence of organic-rich sediments, and to identify possible aquifer zones.

Previous boreholes, completed for water wells in the valley, indicated sediment thicknesses in excess of 300 feet (91.4 m). The completed borehole penetrated to a depth of 407 feet (124.1 m), but did not intersect bedrock.

A number of stratigraphic units were identified in the core. The uppermost unit was found to be a thin (<7 feet (2.1 m)), stratified, weathered, silty clay–clayey silt till. This till was underlain by a thin (1 foot (0.3 m)) layer of dark grey, massive, glaciolacustrine clayey silt. Underlying the thin glaciolacustrine layer, a well-sorted, medium sand unit, approximately 9 feet (2.7 m) thick, was encountered. A very thick, clay-rich, clast-poor till unit was identified beneath the sand-rich unit. This till unit extended from 17–215 feet (5.2–65.5 m) depth. Although the borehole was continued to a depth of 407 feet (124.1 m), the core sample from 352–407 feet (107.3–124.1 m) was unable to be retrieved. However, the sediments were thought to be similar to those present from 215–352 feet (65.5–107.3 m), i.e., moderately well-sorted, fine-medium sand. These sands were very clean in terms of organic matter content.

Results from this borehole provide a number of interesting insights, namely the source of organics found elsewhere in the immediate vicinity of the borehole was not intersected, and the depth to bedrock was much greater than expected, leading to questions of at what time could this bedrock valley have been cut and of what age are the sediments infilling the valley? Lastly, no favourable aquifer horizons were identified at this location.

WOODBRIDGE–ANSI SITE STUDY, TORONTO

Recent plans to expand Highway 407 and associated access roads through the Woodbridge area, immediately north of Toronto (Figure 18.2), were found to directly impact upon the Woodbridge–ANSI site by the Ministry of Natural Resources, Central Region. The Woodbridge site provides one of the most important and complete Quaternary reference sections in southwestern Ontario.

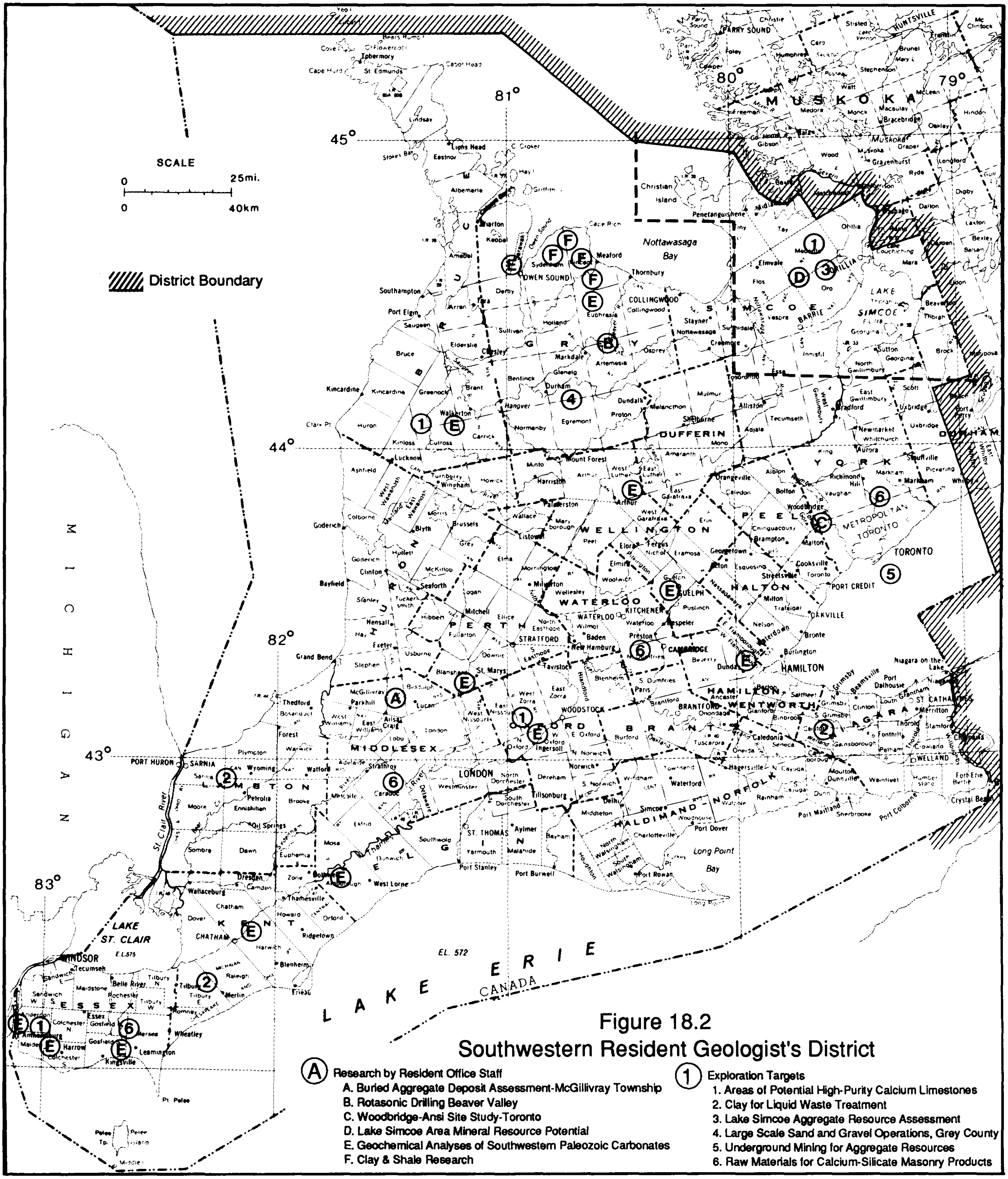

Figure 18.2
Southwestern Resident Geologist's District

(A) Research by Resident Office Staff

- A. Buried Aggregate Deposit Assessment-McGillivray Township
- B. Rotasonic Drilling Beaver Valley
- C. Woodbridge-Ansi Site Study-Toronto
- D. Lake Simcoe Area Mineral Resource Potential
- E. Geochemical Analyses of Southwestern Paleozoic Carbonates
- F. Clay & Shale Research

(1) Exploration Targets

1. Areas of Potential High-Purity Calcium Limestones
2. Clay for Liquid Waste Treatment
3. Lake Simcoe Aggregate Resource Assessment
4. Large Scale Sand and Gravel Operations, Grey County
5. Underground Mining for Aggregate Resources
6. Raw Materials for Calcium-Silicate Masonry Products

In conjunction with staff of the Ministry of Transportation of Ontario (MTO), Central Region, a limited overburden drilling program was completed in the immediate vicinity of the existing exposure. The objectives of this study were to identify and establish the lateral continuity of the various Quaternary units so as to identify potential locations for development of a suitable replacement exposure.

A total of three boreholes were completed and logged. Additional samples and logs obtained from MTO were also examined. Results of this study indicated rapid lateral changes in stratigraphy. The most complete sequence of stratigraphic units was found to occur in the immediate vicinity of the existing exposure. The Illinoian aged York Till was observed in all boreholes at depths ranging from 38 to 57.5 feet (11.6 to 17.5 m) below ground surface. A complex of sand–gravel–till overlying the York Till was encountered in all holes. Overlying the York Till, and/or sand-gravel-till complex, the Early Wisconsinan Scarborough Formation was identified. This unit appears to be restricted to the immediate vicinity of the Woodbridge cut. Shell and organic matter fragments were obtained from this unit's primarily silt-rich sediments. In two boreholes, a peculiar greenish diamicton was encountered beneath the Scarborough Formation. This unit was previously identified at the Woodbridge cut and was informally termed the Green Till (White 1975). The origin of this unit has never been fully clarified. From this drilling program, the material appears to be a glacial till. The age of this unit is undetermined, but it may represent a local readvance of the glacial ice that deposited the York Till. This hypothesis needs further work.

Overlying the Scarborough Formation, a thin (<5 cm thick) layer of Early Wisconsinan Sunnybrook Till was encountered. This unit was found to be not laterally extensive.

No Middle Wisconsinan units nor a Late Wisconsinan, pre-Halton Till, unit were encountered in any of the drill holes. A Late Wisconsinan till, the Halton Till, was found to cap the stratigraphic sequence in all boreholes. In one borehole, a complex of gravelly sands and sands was identified beneath the Halton Till. This unit had previously been identified in the area as a Late Wisconsinan glaciofluvial unit (White 1975).

The findings of this study have been presented to MTO. Revisions to highway and drainage design plans will be implemented to minimize the impact on the existing exposure.

LAKE SIMCOE AREA MINERAL RESOURCE POTENTIAL

The Ontario Geological Survey recently initiated a multiyear project to map the Paleozoic geology of the Lake Simcoe area (Figure 18.2).

Map areas to be covered include Christian Island (41A/16), Penetanguishene (31D/13), Orr Lake (31D/12), Orillia (31D/11), Fenelon Falls (31D/10), Lindsay (31D/7), Beaverton (31D/6), and Barrie (31D/5), all at a scale of 1:50 000. In addition, this project will assess aggregate suitability, with a strong emphasis on identifying areas subject to alkali–carbonate reactivity problems.

In conjunction with this study, our office has initiated a project to compile data to evaluate the mineral resource potential for the Lake Simcoe area. Commodities under study include high specification construction aggregates; chemical stone for cement, lime, and pulverized stone products; building stone; and sands for special industrial applications. The study will also outline resource areas of the most value to facilitate their protection from incompatible land uses in planning studies.

The initial phase of this project included reconnaissance of the area to describe and sample geological sections and quarry operations. In conjunction with this stage, data on overburden thickness were compiled. Drift thickness data were compiled in two ways: first, by reconnaissance of the project area to identify areas of bedrock/thin drift cover, and, second, by compiling data on thicker drift areas from information supplied by appropriate offices of the Ministry of Natural Resources, the Ministry of the Environment, the Ministry of Transportation, and the Ministry of Northern Development and Mines. Maps outlining drift thickness are currently being completed. The second stage of this project will focus on a comprehensive evaluation of the bedrock resources in those areas of thin drift cover. Samples will be submitted for geochemical analysis and aggregate testing as necessary.

A series of preliminary maps outlining mineral resource potential will be generated for the above noted National Topographic System (NTS) map sheets as well as an Open File Report summarizing prioritized mineral resource areas.

GEOCHEMICAL ANALYSES OF SOUTHWESTERN PALEOZOIC CARBONATES

Limestone and dolostone resources play an important role in the province's industrial economy. Uses include cement, lime, chemical and metallurigical stone, building stone, pulverized stone, fillers and extenders, and crushed stone aggregates.

Although southwestern Ontario has adequate carbonate rock resources to supply most of the requirements of industry, specialty stone resources are becoming increasingly limited.

To assist in the identification of potential limestone and dolostone resource areas and to update existing geochemical data within southwestern Ontario, a geochemical assessment of various Paleozoic carbonate strata was initiated.

The study focussed on the Middle Silurian Guelph and Lockport/Amabel Formation dolostones and the Middle Devonian limestones of the Detroit River Group and Dundee Formation. To allow for the evaluation of geochemical characteristics for similar geologic units over the widest area possible, rock samples were obtained from a number of sources. These included quarry sections, natural outcrops, and drill core (Figure 18.2).

Sampled quarries within the Guelph Formation included those at Dundas and Guelph. Lockport samples were obtained at Dundas. Samples of the Detroit River Group were obtained from quarries at St. Marys, Woodstock, Windsor, Amherstburg, and Teeswater. Dundee Formation limestone samples were obtained at St. Marys and Amherstburg.

Core from West Luther Township provided samples of the Guelph Formation. Samples of the Lockport/Amabel were obtained from cores drilled in Keppel and Euphrasia townships. Detroit River Group samples were collected from cores drilled at Ingersoll, Chatham, and in Essex County and Aldborough Township.

Rock outcrops at Formosa and Walkerton were sampled to obtain examples of the Formosa Reef Limestone, an isolated reefal unit of the Detroit River Group.

All samples were submitted for determination of major elements. Selected samples were chosen for analyses of Pb, Zn, Ni, Cu, and Cr.

The results of this study will help 1) identify potential resource areas having geochemical characteristics suitable for the various requirements of industry, 2) provide a better understanding of the lateral and vertical geochemical changes within similar rock formations, and 3) provide new and updated information on the geochemical characteristics of various rock formations within southwestern Ontario.

CLAY AND SHALE RESEARCH

Southwestern Ontario clays and shales have been utilized for many years to produce a variety of heavy clay products. Local interest exists in finding suitable materials to be used in the production of pottery.

To assist in locating usable materials, a series of shale samples were collected in the Meaford–Owen Sound area (Figure 18.2). Samples were obtained from the Queenston, Georgian Bay, and Blue Mountain formations. Analyses were conducted for clay mineralogy, major element geochemistry, and texture.

Results indicated that the Georgian Bay Formation may provide a suitable raw material for some pottery applications from a geochemical standpoint. Samples from other formations were either high in calcium or sulphur content, both deleterious elements in terms of firing and colouring characteristics.

RECOMMENDATIONS FOR EXPLORATION

The increasing awareness of environmental problems has required the development of innovative solutions to correct pollution problems. One area which the mineral resources of southwestern Ontario could play a major role is in the use of high purity Ca-limestones to neutralize flue gases generated from coal-fired generating stations. High purity Ca-limestones are also in demand for the steel, cement, and chemical industries. The district has potential sources of high purity limestone from the Detroit River Group and perhaps from the Ordovician Simcoe Group. Detailed mapping and geochemical assessment of these resources is needed to identify the most valuable resource areas (Figure 18.2).

A second area of investigation related to environmental problems concerns the treatment of liquid waste. Research in the United States and Europe has demonstrated that liquid waste treated with certain clays may be kiln-fired to produce a usable building material. This process clarifies the waste for recycling. The common Quaternary clays of southwestern Ontario may have potential as effective liquid waste clarifiers.

Demand for crushed stone aggregate, especially to supply the Toronto-centered market, will continue in the foreseeable future. Studies to evaluate aggregate resources of the Lake Simcoe area have been initiated, although more detailed, site specific assessments will be required by industry (Figure 18.2). Detailed assessment for potential raw material sources for large-scale sand and gravel operations in Grey County should also be carried out (Figure 18.2).

Extraction of surface resources often encounters many land-use problems. A possible solution may be to consider establishing underground mines. A properly sited mine would be able to supply various raw materials from a number of stratigraphic levels and would provide much needed storage space for future use. Such operations are currently taking place in the United States. Consideration should be given to establishing underground operations in southwestern Ontario.

Finally, recent high levels of construction activity and the projected population growth within the district will require the availability of various building products for residential and commercial construction. Recent studies (Institute for Research in Construction and Matex Consultants Inc. 1990) indicate that calcium silicate masonry products should be considered as an area of potential building materials. Southwestern Ontario has large, suitable, raw material sources of sand and limestone (Figure 18.2).

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

The locations of 1990 field investigations conducted by the Ontario Geological Survey in the Southwestern Resident Geologist's District are shown in Figure 18.1. The following provides a brief outline of each project:

1. D.K. Armstrong, Paleozoic subsection, initiated a Paleozoic bedrock mapping project (1:50 000 scale) in the Lake Simcoe area. The project will emphasize identifying alkali-reactive strata.

2. P.J. Barnett, Quarternary subsection, continued his mapping project (1:50 000 scale) of the Barrie–Elmvale area, Simcoe County, albeit at a reduced level of activity due to other constraints on his time. He also conducted a limited overburden drilling and sampling program in the area during the early part of the year.

3. R.B. Barlow, Geochemistry/Geophysics Section, continued his overburden sounding research and groundwater studies in the York Region. A limited overburden drilling program was also carried out in conjunction with this project.

4. D.K. Armstrong, Paleozoic subsection, completed a stratigraphy and facies analysis drilling program in the Bruce Peninsula, and with the co-operation of Ontario Hydro completed a 2 week long "overcoring" program at the Adair Marble quarry near Hope Bay.

RESEARCH BY OTHER AGENCIES

ONTARIO GEOSCIENCE RESEARCH GRANT PROGRAM

The following list outlines Ontario Geoscience Research Grants provided for academic studies, covering the period 1990–1991, relevant to the Southwestern District:

1. H. Halls and A.A. Mohajer, University of Toronto, received Grant 363 for the study "Seismotectonics of the Western Lake Ontario Region."

2. F. Longstaffe, University of Western Ontario, received Grant 357 for the study "Mineralogical and isotopic investigations of clastic diagenesis in Cambro-Ordovician strata of southwestern Ontario."

3. M. Sklash, University of Windsor, received Grant 389 for the study "Hydrogeologic implications of buried eskers in Essex County."

4. L. Smith, Queen's University, received Grant 372 for the study "The Salina Group: relation to Guelph reef reservoir location and quality and the availability of industrial minerals, southwestern Ontario."

5. J.P. Greenhouse, University of Waterloo, received Grant 386 for the study "Modification of the shallow reflection seismic method for urban geophysical studies in southern Ontario."

6. M. Risk, McMaster University, received Grant 340 for the study "Facies and paleoecology of the Devonian Dundee Formation."

SELECTED PUBLICATIONS RECEIVED

The following reports and maps pertaining to the Southwestern District were published during 1990 by the Ontario Geological Survey, the Mineral Development and Lands Branch, and the Ministry of Natural Resources.

Atomic Energy of Canada Limited Research Company and Voss Associates Engineering Ltd. 1990. Microwaves and minerals. I. Technology review. II. Tests of Ontario's industrial minerals; Ontario Ministry of Northern Development and Mines, Industrial Mineral Background Paper 14, 77p.

Bailey Geological Services Ltd. and Cochrane, R.O. 1990. Geology of selected oil and gas pools in the Silurian carbonates of southern Ontario; Ontario Geological Survey, Open File Report 5722, 50p.

Carter, T.R. ed. 1990. Subsurface geology of southwestern Ontario: a core workshop; American Association of Petroleum Geologists 1990 Eastern Section Meeting, London, Ontario, Ontario Petroleum Institute, 146p.

Dreimanis, A., Kelly, R.I. and O'Keefe, K. 1990. Bedrock topography, Port Stanley area; Ontario Geological Survey, Preliminary Map P.3158, scale 1:50 000.

Institute for Research in Construction (National Research Council of Canada) and Matex Consultants Inc. 1990. Developments in building products: opportunities for industrial minerals; Ontario Ministry of Northern Development and Mines, Industrial Mineral Background Paper 13, 163p.

Karrow, P.F. and Easton, J. 1990. Quaternary geology, Brampton area; Ontario Geological Survey, Preliminary Map P.3171, scale 1:50 000.

Karrow, P.F., Greenhouse, J.P. and Dusseault, M.B. 1990. Subsurface Quaternary stratigraphy using borehole geophysics; Ontario Geological Survey, Open File Report 5734, 249p.

Kelly, R.I. and O'Keefe, K. 1990. Drift thickness, Port Stanley area; Ontario Geological Survey, Preliminary Map P.3159, scale 1:50 000.

Sharpe, D.R. 1990. Quaternary geology of the Durham area;Ontario Geological Survey, Open File Report 5596, 110p.

— 1990. Quaternary geology, Toronto and surrounding area; Ontario Geological Survey, Preliminary Map P.2204, scale 1:100 000.

REFERENCES

Institute for Research in Construction (National Research Council of Canada) and Matex Consultants Inc. 1990. Developments in building products: opportunities for industrial minerals; Ontario Ministry of Northern Development and Mines, Industrial Mineral Background Paper 13, 163p.

Sado, E.V. and Vagners, V.J. 1975. Quaternary geology of the Lucan area, southern Ontario; Ontario Geological Survey, Preliminary Map P.219 (revised), scale 1:50 000.

Vanderveer, D.G. 1989. Delineation of a buried aggregate deposit in McGillivray Township, Middlesex County, southwestern

Ontario; *in* Summary of Field Work and Other Activities 1989, Ontario Geological Survey, Miscellaneous Paper 146, p.213–217.

White, O.L. 1975. Quaternary geology of the Bolton area, southern Ontario; Ontario Division of Mines, Geological Report 117.

19. Petroleum Resources Section, Ministry of Natural Resources—1990

T.R. Carter

Senior Petroleum Geologist, Petroleum Resources Section, Ministry of Natural Resources.

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. 1980. The Petroleum Resources Section of the Ontario Ministry of Natural Resources in London administers and enforces the regulations made under the act. In addition, it 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 1990. Results of drilling in 1990 are up-to-date as of December 5, 1990. Preliminary production totals are also presented. Final totals for drilling and production will not be available until April 1991. A summary of final 1989 results is presented for comparison purposes.

OIL AND GAS PRODUCTION

Oil production in Ontario in 1990, up to and including October 31, 1990, totalled 202 654.7 m^3, compared with 203 355 m^3 by the same time last year. The projected total production to the end of the year is estimated to be about the same as the record total of 243 710.7 m^3 of oil produced in 1989.

Annual oil production has tripled since 1983, due entirely to production from newly discovered Ordovician pools in Essex and Kent counties. Ordovician pools accounted for 72.7% of the total oil production in Ontario in 1989, compared with only 3.6% in 1982. Kent County produced the largest proportion of Ontario's oil in 1989. On a pool basis, the Romney 6-13-III pool in Kent County was the largest producer, with recorded production of 41 800.7 m^3 of oil (263 000 barrels (bbl)) from 6 active wells in 1989.

Preliminary totals for the production of natural gas in Ontario are not available. Total production in 1989 amounted to 488 million m^3 (17.2 billion cubic feet (bcf)), a marginal decline from the previous year. Approximately 75% of the gas came from wells on Lake Erie.

According to data supplied by Esso Resources Canada Limited, the average price received by Ontario producers for crude oil in 1989 was \$141.42/m^3 (\$22.48/bbl), compared with only \$116.68/m^3(\$18.55/bbl) in 1988. Prices received by Ontario producers for crude oil production in 1990 were at levels comparable with the previous year until August 2, 1990, when Kuwait was invaded by Iraq. Ontario oil prices increased rapidly after that date, peaking at \$295.68/m^3 on October 9, 1990. Prices have declined somewhat, but have fluctuated considerably since that time.

The weighted average price paid to Ontario producers of natural gas by Union Gas Limited in 1989 was \$100.98 per thousand m^3 (\$2.86/thousand cubic feet (mcf)), compared with \$92.96 per thousand m^3 (\$2.63/mcf) in 1988. Comparable figures for 1990 are not yet available.

EXPLORATION AND DEVELOPMENT ACTIVITY

There was a marginal increase in exploration for and development of oil and gas in Ontario in 1990. Drilling results had been reported for a total of 95 wells at the time of writing. These consisted of 26 exploratory wells, 35 development wells, and 34 service wells. The exploratory drilling resulted in 7 wells completed as gas producers and four wells completed as oil producers (Figure 19.1, Table 19.1). Development drilling resulted in 11 wells reported to be oil producers and 12 as gas producers. Projected figures indicate that a total of approximately 115 wells will have been drilled in Ontario by the end of the year, compared with 100 in all of 1989.

As during the previous 6 years, exploration for and development of Ordovician oil reservoirs highlighted drilling activity in Ontario, with drilling reported to be complete at 11 exploratory wells and 13 development wells. In other exploratory drilling, there were 3 tests of Cambrian targets,9 Guelph–Salina, and 3 Clinton–Cataract. In development drilling, Clinton–Cataract reservoirs were the principal target for 14 wells, 5 in Guelph–Salina reservoirs, and 3 in Devonian reservoirs.

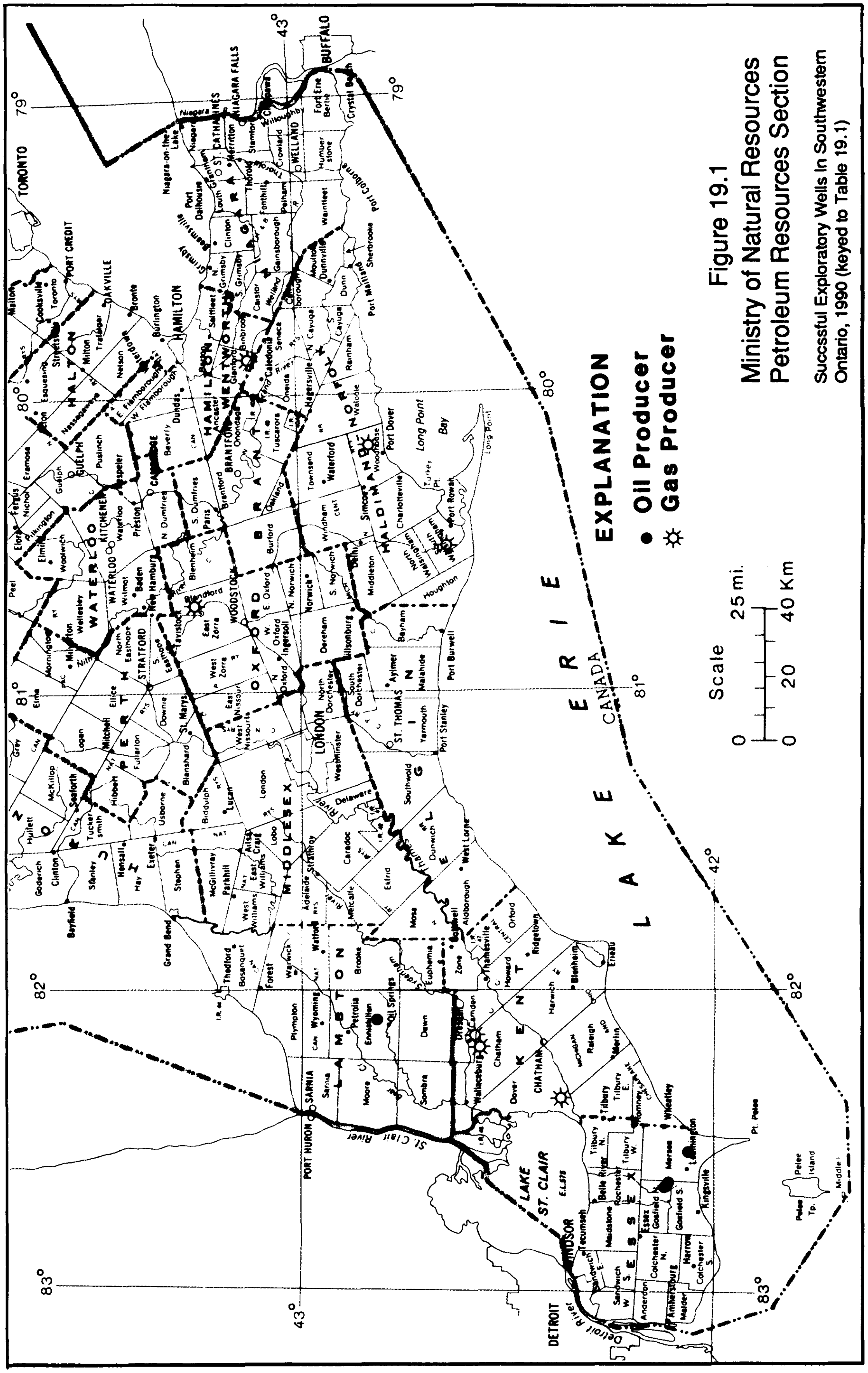

Figure 19.1
Ministry of Natural Resources
Petroleum Resources Section

Succssful Exploratory Wells In Southwestern Ontario, 1990 (keyed to Table 19.1)

TABLE 19.1. SUCCESSFUL EXPLORATORY WELLS IN SOUTHWESTERN ONTARIO, 1990.

Map No.	Latitude Longitude	Well Name	Target	Metres Drilled	Class Status	Completion Date
ESSEX COUNTY						
1	42°06′47″	Telesis 34541	Ordovician	885	NPW	90.03.01
	82°40′40″	Gosfield N. 8-20-VII			OP	
2	42°06′31.5″	Telesis 34539	Ordovician	942	NPW	90.01.05
	82°40′01″	Gosfield N. 2-21-VI			OP	
3	42°02′27″	Telesis et al. 34587	Ordovician	888	NPW	90.07.02
	82°32′31″	Mersea 4-14-I			OP	
KENT COUNTY						
4	42°34′59.5″	Chatham CG1	Salina–Guelph	496.8	NPW	90.01.31
	82°09′21″	Camden Gore 6-2-VI			GP	
5	42°34′16″	748160 Ontario No.2	Salina–Guelph	428.9	NPW	90.05.25
	82°13′27.5″	Chatham 7-17-XII			GP	
6	42°21′55″	PPC/Ram 23	Ordovician	1067	NPW	90.07.02
	82°22′14″	Dover 7-2-V E			GP	
LAMBTON COUNTY						
7	42°49′18″	Ram 100	Salina–Guelph	676	NPW	90.01.12
	82°07′28.5″	Enniskillen 7-16-VI			OP	
NORFOLK COUNTY						
8	42°38′10″	Chatham 35	Clinton–Cataract	459.2	NPW	90.01.09
	80°31′03″	S. Walsingham 10-II			GP	
9	42°50′24″	Chatham 32	Clinton–Cataract	317	NPW	90.02.20
	80°11′05″	Woodhouse 8-16-V			GP	
OXFORD COUNTY						
10	43°14′58″	Brett	Cambrian	883.3	NPW	90.08.22
	80°42′26″	Blandford 1-8-IX			GP	
WENTWORTH COUNTY						
11	43°07′21.5″	J. Weylie	Clinton–Cataract	152.5	NPW	90.06.13
	79°52′17″	Glanford 5-13-VI			GP	

OP= oil producer, GP= gas producer, NPW= exploratory well

Ordovician exploratory drilling is reported to have resulted in three new oil producers and 1 gas producer, whereas development drilling resulted in 8 new oil producers and 1 well capable of producing both oil and natural gas. As in the previous year, Essex County was the focus of most of the Ordovician exploratory drilling, accounting for 3 of the successful exploratory wells. Two of these wells were new pool discoveries: Telesis et al. 34587 Mersea 4-14-I, and Telesis 34539 Gosfield North 2-21-VI. The third well was an exploratory extension to the Gosfield North 2-21-VI discovery. In Kent County, an extension to the Dover 7-5-V E oil and gas pool was discovered by PPC/Ram 23 Dover 7-2-V E, which was completed as a gas producer.

Ordovician development drilling was evenly divided between Essex and Kent counties. In Essex County, 3 wells were completed as oil producers in the Mersea 6-23-VII pool and 3 wells were completed as oil producers in the Mersea 8-16-VIII pool. In Kent County, 1 development well was completed as an oil producer in the Romney 3-8-II pool, and

Three Cambrian exploratory tests were drilled in 1990. One well, Brett Blandford 1-8-IX, was successfully completed as a gas producer in an extension of the Blandford 3-7-VIII pool. There were no Cambrian development wells.

Exploratory drilling of Silurian Guelph reef targets and associated dolomitized zones in the Salina A-1 and A-2 Units resulted in 2 new gas wells and 1 oil well. Development drilling resulted in 2 gas producers and 1 oil producer. Exploratory drilling of Silurian Clinton–Cataract sandstone targets resulted in 3 new gas wells, whereas development drilling resulted in 9 gas producers. Two Devonian development wells were completed as oil producers, both in the Rodney oil pool.

The Oil Springs East 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 by the Ontario Energy Board dated December 6, 1989, after a 3 day hearing held in Sarnia from November 14 to 16. ICG Utilities (Ontario) Ltd. was the applicant. Ownership, use, and development of the pool will be shared 82.4 and 17.6 percent, respectively, by ICG and Union Gas Limited, and Union Gas Limited will be responsible for the operation of the pool. ICG estimated that the pool would have a working capacity of 134.6 million m^3 (4.75 bcf) when delta pressured to 7998 kPa (1160 psi). ICG drilled 6 storage wells to develop the pool in 1990, and at the time of writing had completed all surface installations and was injecting natural gas into the pool to be stored for the 1990–1991 winter heating season.

In 1989, Union Gas Limited drilled 5 storage wells and 2 observation wells to develop the former Enniskillen 28 gas pool for natural gas storage. In 1990, Union Gas drilled 4 wells to develop the former Sombra natural gas pool for storage operations. Both pools had previously been designated as storage pools following Ontario Energy Board hearings, but had not been developed for storage. The Ontario Energy Board approved applications made by Union Gas to drill storage wells in these pools in reports dated February 27, 1989 (EBRM 95, Enniskillen 28), and June 1, 1989 (EBRM 94, Sombra). At the time of writing, both pools were in operation, although the Sombra pool is not yet fully developed.

There are now 20 former gas pools in the subsurface of southwestern Ontario that have been designated as natural gas storage pools by the Ontario Energy Board. Nineteen 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. The total working capacity of the active storage pools in Ontario is approximately 5.3 billion m^3 (187 bcf).

STAFF ACTIVITIES

Geological program staff employed at the Petroleum Resources Laboratory during the year consisted of Terry Carter, Senior Petroleum Geologist; Malcolm Campbell, Petroleum Resources Laboratory Technician; and Margaret Bernardo, Clerk Typist. Angeline Lundquist was employed during the summer as a geological assistant and Chris Maciejowski was employed for part of the summer to assist in processing cuttings samples and core.

Engineering and administrative staff include Pentti Palonen, Provincial Petroleum Supervisor; Rudy Rybansky, Chief Engineer; Ernie Habib, Onshore Engineer; Jug Manocha, Brine Resources Engineer; Karen McLeod, Petroleum Engineering Technologist; Cathy Owen, Systems Analyst; Frances McKeon, Data Processing Technician; Ian Cameron, Draftsperson; Sherry Shanks, Program Secretary; and Greg Stephenson, Data Processing Technician. Karen McLeod left the section during the year to accept a position with Telesis Oil and Gas. Some of her duties are currently being performed by Laurie Pretulac.

Petroleum Resources inspectors are responsible for enforcing Petroleum Resources Act and associated regulations. Mike Hunter, Deputy Chief Inspector; Lee Chambers; and Bob Lewis are located in the Simcoe District office. Bob Sealey, Kathy McConnell, and Rod Corea operate out of the Chatham District office. Jack 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, and Colorado.

T.R. Carter acted as chairperson of the Core Workshop and Field Trips Committee for the Eastern Section Meeting of the American Association of Petroleum Geologists, which was held in London from September 9 to 12. He authored one paper and was coauthor of another paper presented during the technical sessions of the meeting (Carter and Trevail 1990; Easton and Carter 1990). Jug Manocha presented a paper on underground storage of hydrocarbons in Ontario at the same meeting (Manocha and Carter 1990). Carter was also coleader on one of the field trips (Easton et al.), contributed two papers to the core workshop guidebook (Carter 1990b; Carter and Easton 1990), and was the editor of the core workshop guidebook. In addition, Carter acted as the chairperson of the technical committee for the 29th Annual Conference of the Ontario Petroleum Institute, which was held in London November 14–16, 1990.

Open File Report 5722 - "Geology of selected oil and gas pools in the Silurian carbonates of southern Ontario", was released by the Ministry of Natural Resources on January 11, 1990 (Bailey Geological Services and Cochrane 1990). The report includes structure maps and cross sections for 40 Silurian carbonate pools in Ontario, as well as summaries of production and reservoir characteristics. Oil and Gas Paper 10 is being prepared for publication early in 1991. Summaries of oil and gas exploration, development, and production in Ontario in 1989 were prepared for and published by the American Association of Petroleum Geologists (Carter and Campbell, in press) and Northeast Oilworld.

Work is nearing completion on documentation of the stratigraphic and geographic extent of dolomitization in the Salina A-1 and A-2 Units in Sombra Township in Lambton County. Results of this work are expected to be released in 1991.

DRILL SAMPLE STORAGE

Routine collection, processing, and cataloguing of core and drill-cuttings samples from all wells permitted under the Petroleum Resources Act continued in 1990. Important new additions to the core collection in 1990 are listed below.

Core No.	Location	Formations Cored
991	Moore 7-6-V A-2	Salt to A-1 Carb.
992	Moore 2-21-XII	Guelph
993	Moore 8-17-VIII A-2	Carb. to Guelph
996	Moore 6-21-XII A-2	Salt to Rochester
998	Lake Erie 58-R	Dundee to E Unit
999	Lake Erie 56-E	Dundee to Queenston
1001	Lake Erie 96-D	Dundee to Queenston
1002	Lake Erie 95-H	Dundee to Queenston
1003	Enniskillen 1-VIII A-2	Carb. to Guelph
1004	Enniskillen 1-VIII A-2	Salt to Rochester
1005	Enniskillen 1-VIII A-2	Carb. to Guelph
1006	Sombra 1-VIII A-2	Carb. to Guelph
1007	Enniskillen 4-22-II A-2	Carb. to Guelph

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 1990, a major new Ordovician oil pool was discovered in Gosfield North Township in Essex County, broadening the area of Ordovician production. All of Essex County and the southern portion of Kent County are prospective for additional Ordovician oil production. Natural gas also occurs in solution in many of the oil reservoirs and is currently being flared at several pools in Romney Township. In response to public concern regarding this flaring, several of the major oil and gas operators have joined together in a project to develop a common gas processing and compression facility to deal with the solution gas. The Dover Township pools all produce both oil and natural gas. There are also several past-producing natural gas reservoirs to the northeast, in Bruce, Grey, and Wellington counties. The entire area between these past-producing gas pools and the pools in Dover Township is virtually unexplored for Ordovician potential and is considered to be very prospective for natural gas.

There is an increasing amount of exploration for Silurian reef reservoirs and for traps formed by dolomitized zones in the Salina A-1 and A-2 Carbonate Units, particularly in Lambton County. This increase is due, in part, to some recent successes and to the increasing value of the reef reservoirs for use as natural gas storage pools after depletion. The storage rights for the Oil Springs East pool were purchased for approximately $4.5 million, or $1.00/mcf of original reservoir volume.

There is still only a limited amount of exploration for Cambrian targets. Cambrian strata have very great undiscovered potential in southern Ontario and are expected to become the next major oil and gas play in Ontario when current interest in Ordovician pools declines.

RESEARCH BY OTHER AGENCIES

The 1990 Eastern Section Meeting of the American Association of Petroleum Geologists was hosted by the Ontario Petroleum Institute and was held in London, Ontario, from September 9 to 12. The meeting was attended by 200 delegates from several northeastern states, Ontario, and Calgary. Numerous papers relevant to the subsurface and surface geology of southern Ontario and surrounding areas were presented during the technical sessions of the conference. Abstracts of all papers and posters are published in American Association of Petroleum Geologists Bulletin, v.74, no.8, p.1303–1312. Several papers on the subsurface geology of southwestern Ontario were published by the Ontario Petroleum Institute from the proceedings of a core workshop held at the Petroleum Resources Laboratory (Carter 1990a). Several field trips were also held in conjunction with the meeting, with four field trip guidebooks being published by the Ontario Petroleum Institute (Armstrong and Goodman 1990; Coniglio et al. 1990; Easton et al. 1990; Haynes and Hughes-Pearl 1990).

One BSc and two MSc theses were completed on topics relevant to oil and gas exploration in southwestern Ontario in 1990 (Birchard 1990; Charbonneau 1990; Harper 1990). Work continued on the following five projects funded by the Ontario Geoscience Research Grant Program:

1. The Salina Group: relation to salt caverns, reef reservoirs, and industrial minerals, southwestern Ontario; Leigh Smith, Queen's University, Kingston.

2. Mineralogical and isotopic studies of diagenesis in Cambro-Ordovician sedimentary rocks, southwestern Ontario; M.A.Wadleigh and F.J. Longstaffe,University of Western Ontario, London; R.H. McNutt, McMaster University, Hamilton; and S.K. Frape, University of Waterloo, Waterloo.

3. Stratigraphy and facies of the Dundee Formation, southwestern Ontario; M.J. Risk and M.C. Birchard, McMaster University, Hamilton.

4. Styles of reservoir development in Middle Devonian carbonates, southwestern Ontario; M. Coniglio and D. Hamilton, University of Waterloo,Waterloo.

5. Diagenesis of Middle Ordovician carbonate reservoirs, southwestern Ontario; M. Coniglio and K. Middleton, University of Waterloo, Waterloo.

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Birchard, M.C. 1990. Stratigraphy and facies of the Middle Devonian Dundee Formation, southwestern Ontario; unpublished MSc thesis, McMaster University, Hamilton, 136p.

Carter, T.R. ed. 1990a. Subsurface geology of southwestern Ontario: a core workshop; American Association of Petroleum Geologists 1990 Eastern Section Meeting, London, Ontario, Ontario Petroleum Institute, 146p.

—— 1990b. Some notes on the geological setting and petroleum resources of southwestern Ontario; *in* Subsurface Geology of Southwestern Ontario: A Core Workshop, American Association of Petroleum Geologists 1990, Eastern Section Meeting, London, Ontario, Ontario Petroleum Institute, p.2–8.

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Coniglio, M., Melchin, M.J. and Brookfield, M.E. 1990. Stratigraphy, sedimentology, and biostratigraphy of Ordovician rocks of the Peterborough–Lake Simcoe area of southern Ontario; American Association of Petroleum Geologists 1990, Eastern Section Meeting, London, Ontario, Field Trip Guidebook #3, 82p.

Easton, R.M. and Carter, T.R. 1990. Geology of the Grenville basement of southwestern Ontario and documentation of widespread post-Grenville alteration (abstract); American Association of Petroleum Geologists Bulletin, v.74, no.8, p.1304.

Easton, R.M., Carter, T.R. and DiPrisco, G. 1990. Bedrock geology and the Precambrian–Paleozoic unconformity in southeastern Ontario; American Association of Petroleum Geologists 1990, Eastern Section Meeting, London, Ontario, Field Trip Guidebook #1.

Harper, D.A. 1990. Paleoenvironmental and paleogeographical interpretations of the Queenston Formation; unpublished BSc thesis, University of Western Ontario, London, 104p.

Haynes, S. and Hughes-Pearl, J. 1990. Gypsum deposits and stratigraphy of the Salina A and B units, Algonquin Arch–Niagara Peninsula, southwestern Ontario; American Association of Petroleum Geologists 1990 Eastern Section Meeting, Ontario, Field Trip Guidebook #1.

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CONVERSION FACTORS FOR MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS

Conversion from SI to Imperial			Conversion from Imperial to SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
			LENGTH		
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
			AREA		
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
			VOLUME		
1 cm^3	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.308 0	cubic yards	1 cubic yard	0.764 555	m^3
			CAPACITY		
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	**4.546 090**	L
			MASS		
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)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
			CONCENTRATION		
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

OTHER USEFUL CONVERSION FACTORS

	Multiplied by	
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 which 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.