ISSN 1916-6168 [online]
ISBN 978-1-4435-6304-8 [PDF]

ISSN 1484-9402 [print]
ISBN 978-1-4435-6303-1 [print]

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Ontario Geological Survey
Open File Report 6267

Report of Activities, 2010 Resident Geologist Program

Southern Ontario Regional Resident Geologist Report: Southeastern and Southwestern Ontario Districts and Petroleum Resources Centre

2011

Ontario

ONTARIO GEOLOGICAL SURVEY

Open File Report 6267

Report of Activities, 2010
Resident Geologist Program

Southern Ontario Regional Resident Geologist Report:
Southeastern and Southwestern Ontario Districts and Petroleum Resources Centre

by

P.J. Sangster, P.S. LeBaron, D.A. Laidlaw, A.C. Wilson, T.R. Carter and L. Fortner

2011

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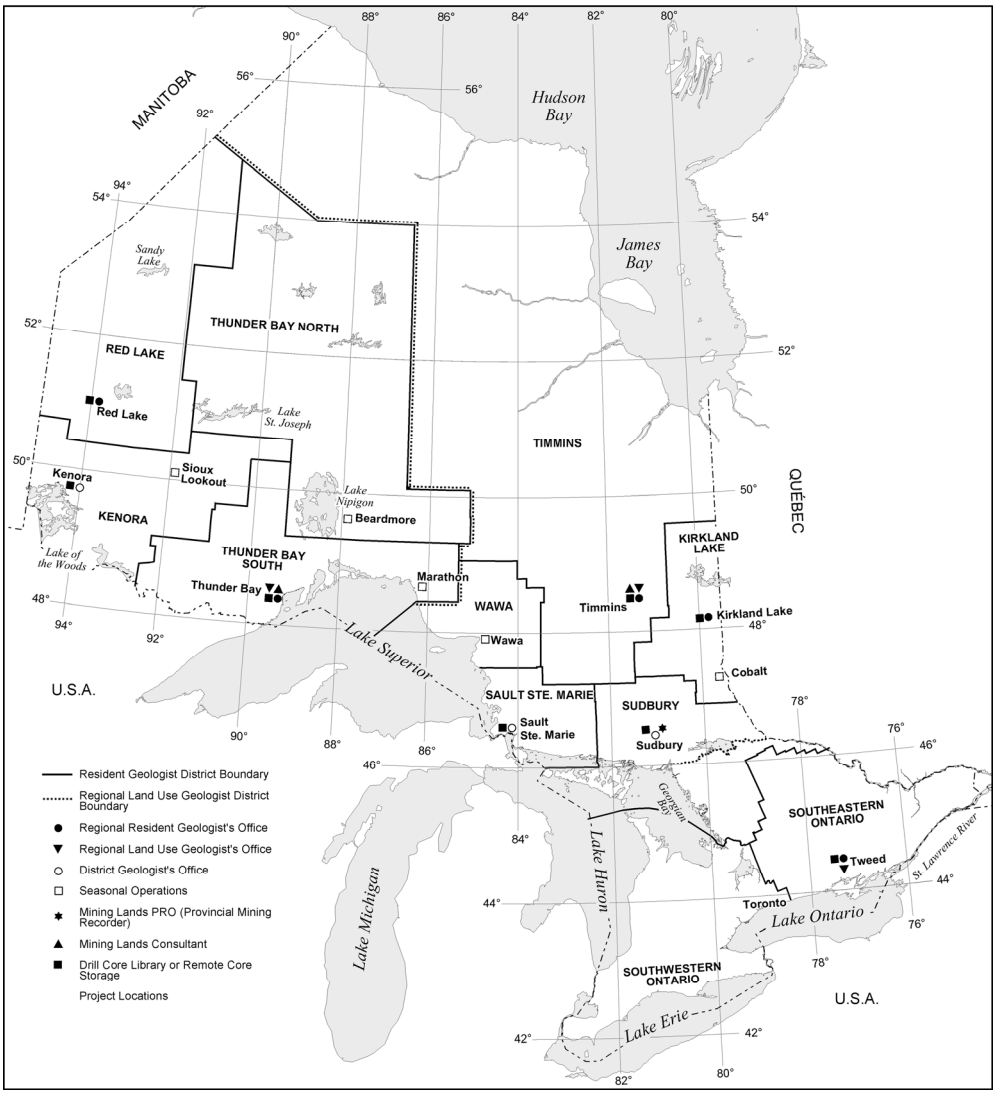
Sangster, P.J., LeBaron, P.S., Laidlaw, D.A., Wilson, A.C., Carter, T.R. and Fortner, L. 2011. Report of Activities 2010, Resident Geologist Program, Southern Ontario Regional Resident Geologist Report: Southeastern and Southwestern Ontario Districts and Petroleum Resources Centre; Ontario Geological Survey, Open File Report 6267, 65p.



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Ontario Geological Survey

Resident Geologist Program

Report of Activities—2010

SOUTHERN ONTARIO
REGIONAL RESIDENT GEOLOGIST REPORT

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INTRODUCTION

The Southern Ontario Region encompasses the most populous part of the province and includes both the provincial and national capitals. The Region stretches over 700 km from the Canada–United States border in the west, through the southern Great Lakes (lakes Huron, Erie and Ontario) and along the St. Lawrence River to the Ontario–Quebec border in the east. The northern boundary of the Region cuts across Georgian Bay striking westward north of Lake Simcoe across the Precambrian Shield, including Algonquin Park and neighbouring townships, ending at the Ottawa River and the Province of Quebec. From Paleozoic sedimentary rocks to the metamorphic terranes of the Central Metasedimentary Belt and Central Gneiss Belt, the Region hosts some of the most diverse and productive geology in the province.

In 2010, production from mines and quarries continued throughout southern Ontario within both the Paleozoic rocks in the southwest and southeast and the Grenville Province.

A total of 235 16 hectare claim units were recorded across the southeastern portion of the region on gold, nickel, copper, industrial minerals and rare element prospects. The continued exploration for, and development of, deposits of dimension/landscape stone, high-purity limestone and dolostone, calcium carbonate, aggregate, shale/brick and other commodities should result in new quarries and/or mines coming into production in the future. Junior mining companies and prospectors showed a renewed interest in exploring for copper-nickel and platinum group elements and gold.

In August, Sherritt International announced the closure of the company's Canada Talc operations in Madoc after over 114 years of continuous production. Canada Talc was the oldest continually operating underground mine in North America and its closure represents the end of an era in mining history. With the loss of this deposit, the Rio Tinto Group Penhorwood Mine in northeastern Ontario remains the only producing talc mine in Canada.

Tables 11 through 18 provide details on currently inactive mineral deposits with identified resources and past-producing mineral occurrences.

The authors note that, for ease of reading, all Web addresses were accessed on March 14, 2011, unless otherwise noted. All Universal Transverse Mercator (UTM) co-ordinates are reported in North American Datum 1983 (NAD83).

MINING ACTIVITY

During 2010, there were over 100 mineral extraction operations in southern Ontario, including 14 industrial mineral operations, 2 trap rock producers, 6 cement producer's quarries, 7 brick producer's quarries, 3 gemstone and mineral specimen sites and 64 dimension stone quarries. Statistics provided by the Ministry of Natural Resources indicate that, in 2010, there were over 500 quarries licenced under the *Aggregate Resources Act* in Southern Ontario.

All Ontario production of salt, gypsum/wallboard, natural gas and petroleum, shale/brick, lime/dolime, cement, nepheline and the majority of dimension stone, sand and gravel comes from the Southern Ontario Region.

For a complete listing of mining activity and locations of operating mines and mills in southern Ontario, please refer to Tables 1 and 2, and Figures 1 and 2, respectively.

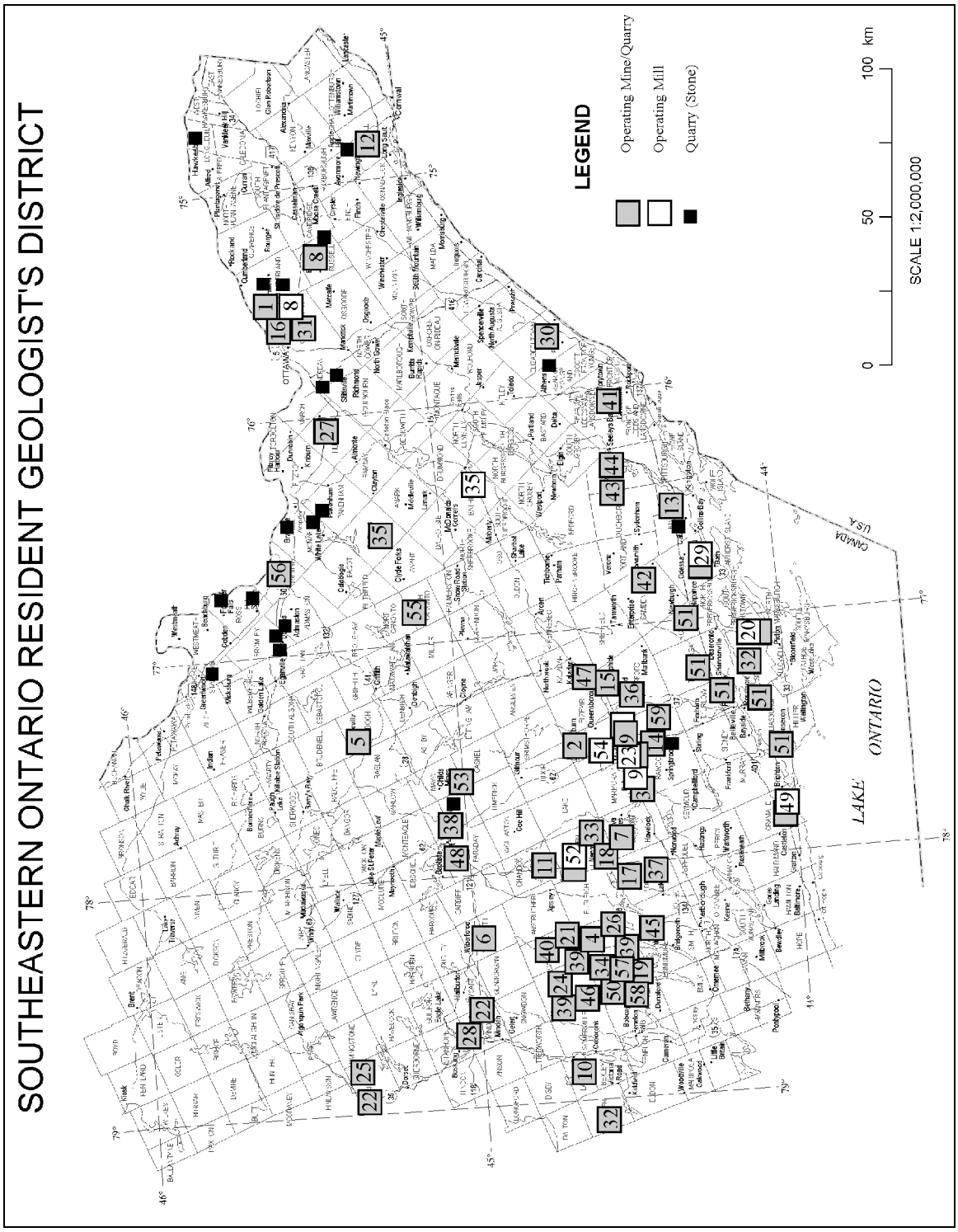

Figure 1. Mining and/or quarrying activity in the Southeastern Ontario District in 2010 (keyed to Table 1).

Table 1. Mining activity in the Southeastern Ontario District in 2010 (keyed to Figure 1).

No.	Company/Individual (Mine Name)	Township(s) (Commodity)	Mining Activity
1	Aecon Construction and Materials Ltd.	Gloucester (Dolomitic sandstone)	Dolomitic sandstone from the Ottawa Quarry is produced from the lower member of the March Formation (11 m thick) for use in pavement aggregate.
2	Allan Franks Construction Ltd.	Madoc (Limestone)	Limestone has been quarried and crushed on a seasonal basis since 1991 for road aggregate.
3	AME Materials Engineering (Aecon)	Marmora (Limestone)	Limestone is quarried from former Marmoraton mine site for aggregate.
4	Amsen Quarries Ltd.	Harvey (Limestone)	Limestone landscaping stone products.
5	Aqua Rose Quarries	Lyndoch (Gemstones, Mineral specimens)	Quarrying operations for rose quartz, beryl, feldspar, lyndochite, amazonite, cleavelandite, peristerite, columbite, fluorite and bertrandite. Two quarries are in operation: the Beryl Pit, which charges a fee for mineral collecting, and the Rose Quartz Quarry, which produces landscape stone.
6	Bancroft Chamber of Commerce (Bear Lake Diggings)	Monmouth (Mineral specimens)	Fee-for-collecting site near Wilberforce. Field trips to this site organized by the Bancroft Chamber of Commerce attract on average 40 to 50 participants. In 2008, a total of 606 people attended the field trips, with an estimated 10 000 attending the Bancroft Gemboree.
7	Belmont Rose Granite Quarry	Belmont (Dimension stone)	Granite is quarried for dimension stone, curb stone, landscaping stone, crushed decorative stone and exposed aggregate. The quarry was inactive in 2010.
8	Canada Brick (now Taggart Construction Ltd.) (Russell Quarry)	Russell, Gloucester (Clay products)	Until 2007, red shale was quarried for Hanson Brick plant in nearby Gloucester. The brick plant was closed in 2007. Quarry was inactive in 2010.
9	Canada Talc Division (Henderson Mine)	Huntingdon (Talc, dolomite)	In August, Sherritt International announced the closure of the Canada Talc mine in Madoc and mill in Marmora.
10	Central Ontario Natural Stone (Batty Quarry)	Laxton (Limestone)	Grey, buff and black limestone is produced as flagstone.
11	Colonial Brick & Stone (Elite Blue)	Chandos (Marble)	Stone is split / guillotined for flagging and landscape stone.
12	Cornwall Gravel Company Ltd. (Cornwall Quarry)	Cornwall (Limestone)	Limestone for aggregate is quarried from this quarry north of Cornwall.
13	Cruickshank Construction Limited	Kingston (Limestone)	The Elginburg Quarry near Kingston produces 500 000 t of limestone annually. This company has 12 operating quarries throughout eastern Ontario including Green Valley, Kemptville, Brockville, Iroquois, Napanee and Verona. They produce a range of products from fine aggregate to armour stone. This stone has been used in shoreline protection projects along the St. Lawrence Seaway, including a $3.5 million breakwater and a marina project in Prescott.
14	Danford Construction (Springbrook Road Quarry)	Huntingdon (Limestone)	Limestone is quarried and crushed for road aggregate and specialty concrete (seasonal operation). Annually, they produce 150 000 t of limestone and employ a staff of 24.
15	Danford Construction Ltd.	Elzevir, Hungerford (Granite-gneiss)	Granite-gneiss from the Tweed quarry is used and approved for use in "Superpave" aggregates.
16	Dibblee Paving & Materials Ltd.	Gloucester (Dolomitic sandstone)	Dolomitic sandstone from the Boyce Quarry is removed from the lower member of the March Formation.
17	Drain Bros. Excavating Inc.	Dummer (Limestone)	Limestone for use as road aggregate.
18	Drain Bros. Excavating Inc.	Methuen (Granite)	Crushed stone for aggregate.
19	Dufferin Aggregates	Harvey (Limestone)	Grey limestone is extracted for use as armour stone, landscaping stone and crushed stone.
20	Essroc Canada Inc. (Picton Quarry)	Sophiasburg (Cement)	A cement plant and on-site limestone quarry with an annual production of slightly less than 1 000 000 tons. This is one of the largest cement plants in North America and employs 160 people.
21	FPL Aggregates (Mountain Lake Quarry)	Cavendish (Granite)	Burgundy coloured granite is quarried for use as crushed stone aggregate and decorative stone. The quarry has an aggregate extraction licence, with no annual extraction limit. Product is shipped to the company's Mount Albert site serving the Richmond Hill, Newmarket and Aurora markets.

No.	Company/Individual (Mine Name)	Township(s) (Commodity)	Mining Activity
22	Haliburton Stone Works	McClintock, Minden (Granite, dolomite and limestone)	A variety of granite and limestone dimensional and landscape stone are produced from 2 quarries.
23	I.K.O. Industries Ltd. (I.K.O. Quarry)	Madoc (Trap rock)	Since 1991, I.K.O. Industries Ltd. has operated a trap rock quarry east of Madoc on the south side of Hwy 7. The quarry is located within a ridge of grey to black, fine-grained, agglomeratic metavolcanic rock. The rock is durable and exhibits no undesirable weathering effects. An on-site mill and colouring plant produce roofing granules, which are trucked to the company's asphalt shingle manufacturing plant in Brampton. In addition to roofing granules, stone from the quarry is crushed to produce HL-1 aggregate (asphalt road surfacing mix). The quarry is licenced under the *Aggregate Resources Act* to produce up to 1 Mt per year.
24	Jeff Parnell Contracting Limited	Galway (Limestone, Granite)	Natural and dimension-cut armour stone, rockery stone, garden stone, natural surface steps and natural and dimensional flagstone. Burgundy coloured granite from the site is being tested for decorative stone, landscaping and dimension stone applications.
25	John Bacher Construction Limited	McClintock (Granite gneiss)	Building stone, flagging stone, and landscaping stone.
26	Johnston Quarry	Galway (Limestone)	Gull River Formation limestone is removed for use as landscaping stone, flagstone and building stone.
27	Karson Kartage & Konstruction Ltd. (Clarke Quarry)	Huntley (Limestone)	The quarry produces limestone for use as road aggregate.
28	Keystone Granite	Minden (Granite)	Granite is quarried for use as armour, flags, steps and dimension stone.
29	LaFarge Canada Inc. (Bath Quarry)	Ernestown (Cement)	A cement plant and on-site limestone quarry with a capacity to produce 1 Mt of cement. Silica used in the production of cement is extracted from the company's Potsdam sandstone quarry in Pittsburgh Tp. as well as from recycled foundry sands.
30	Lafarge Canada Inc. (Brockville Quarry)	Elizabethtown (Dolomitic sandstone)	Dolomitic sandstone from the lower member of the March Formation (at least 19 m thick) is used for road aggregate. Markets are served in the Brockville, Prescott and Cardinal areas.
31	Lafarge Construction (Hawthorne Quarry)	Gloucester (Dolomitic sandstone)	Material from the lower member of the March Formation (11 m thick) is crushed for use as road aggregate.
32	Miller Paving Ltd.	Carden, Sophiasburg (Limestone)	This quarry east of Brechin produces grey limestone for use as aggregate, architectural stone, landscaping/armour stone, asphalt limestone, crushed limestone and manufactured sand. Product from the quarry supplies a growing market in Markham, 90 km to the south.
33	MRT Aggregate Inc.	Methuen (Aggregate)	Metagabbro is quarried and crushed on site for use as premium aggregate for HL-1 purposes. Portable crusher is moved on site as required. Production began in December 2002 and, in 2003, production totalled 100 000 t. The product is used by Miller Paving and also sold outside the company.
34	Nelson Windover Quarries (Windover, Buckhorn Quarry)	Harvey (Limestone)	Grey limestone is quarried as a seasonal operation for the production of flagstone.
35	OMYA (Canada) Inc. (Tatlock Quarry)	Darling (Calcite)	Calcitic marble is mined to produce high-purity, fine-grind calcite for fillers with terrazzo chips and landscaping stone as secondary products. Annual production is 250 000 tons and quarry reserves currently stand at over 5 000 000 tons. In 2000, a five-year expansion program was completed at their quarry and plant located in Perth.
36	Ontario Marble (Tweed Marble Quarry)	Hungerford (Marble)	White and pale blue marble for dimension stone blocks. In 2009, the quarry was for sale. An inventory of cut blocks remains on site.
37	Payne, E.W. (Payne Quarry)	Dummer (Limestone)	Flagstone is produced seasonally from this quarry.
38	Princess Sodalite Mine	Dungannon (Sodalite)	Decorative stone, landscaping stone, mineral specimens including fee for collecting.
39	Redstone Quarries	Galway, Harvey, Cavendish (Limestone, sandstone)	Beige limestone and red sandstone are quarried for weathered landscaping stone and armour stone blocks.

No.	Company/Individual (Mine Name)	Township(s) (Commodity)	Mining Activity
40	Regis Resources, Inc.	Cavendish (Vermiculite)	Production began in June 2004. Proven and probable reserves were 890 000 t at 21.4% vermiculite as well as measured and indicated resources of 380 000 t at 21.4% vermiculite. The mine produced fine, super fine, and micron grades of vermiculite, destined for markets in North America. Following 5 years of production, the known resource was depleted. Exploration failed to identify additional resources and, in November 2009, the decision was made to cease operations at the Cavendish site.
41	Rideauview Contracts Ltd. (Ellisville Quarry)	Rear Leeds & Lansdowne (Sandstone)	Sandstone produced for flagstone, granite blocks and masonry stone.
42	Rideauview Contracts Ltd. (Pettworth & Renaud Quarries)	Camden East (Limestone)	Limestone was quarried for building restoration work in Kingston.
43	Rideauview Contracts Ltd. (Rideauview Quarry)	Storrington (Sandstone)	Red sandstone is produced for ashlar and flagstone.
44	Rideauview Contracts Ltd. (Sloan Quarry, Battersea Quarry)	Storrington (Sandstone, granite)	Cream and red sandstone are quarried for the production of ashlar, flagstone and landscaping stone at the Sloan Quarry. Red granite is quarried at the Battersea Quarry.
45	Rigbe's Quarry	Harvey (Limestone)	Buff limestone is removed for use as weathered armoury and rockery, crushed aggregates and landscape stone.
46	Royel Paving	Galway (Granite)	Granite is quarried and crushed on site for road aggregate.
47	Senator Stone	Elzevir (Marble)	The quarry began production in 2001. White calcitic marble is quarried seasonally and crushed on site. Crushed material has been used as dolomitic mineral filler with lower grade used as decorative aggregate.
48	Senator Stone	Faraday (Marble)	The quarry site was brought to mining lease in 2002 (Temagami Pink marble breccia). The site is licenced under the *Aggregate Resources Act* and, in 2009, was offered for sale by the owner.
49	St. Lawrence Cement Inc. (Ogden Point Quarry)	Cramahe (Limestone, cement)	The quarry has been in production since 1959. It produces between 1.9 and 2.1 Mt of limestone per year. Crushed stone from the quarry is shipped by lake to the company's cement plant in Mississauga. The quarry employs 20 people.
50	Stone Cottage Inn Ltd. (Attia Quarries)	Harvey (Limestone)	Grey limestone is quarried for dimension stone.
51	TRT Aggregates Ltd.	Ameliasburgh, Hillier, Tyendinaga, Thurlow & Richmond (Limestone)	Rough dimension stone blocks, armour stone, flagstone and crushed limestone are produced. Most of the quarries are operated on an as-needed basis.
52	Unimin Canada Ltd. (Blue Mountain Quarry)	Methuen (Nepheline syenite)	Nepheline syenite is mined from a quarry and processed in 2 mills. Magnetite is produced as a by-product. Production rate is 2500 tons per day. The mine opened in 1955 and employs 152 people.
53	Upper Canada Stone Co. Ltd. (Mephisto Lake quarry)	Cashel, Mayo (Calcitic marble)	White marble is quarried and sold as crushed marble, landscaping stone, decorative stone and in pre-cast architectural concrete and panels.
54	Upper Canada Stone Co. Ltd. Upper Canada Minerals Inc.	Madoc and Huntingdon (Marble)	Red, pink, white, green, buff, black, blue, chocolate, light buff and light green marble are mined from 8 quarries in the Madoc area. Marble chips (terrazzo), exposed aggregate and landscape stone are produced at the mill. In 2001, Upper Canada Stone acquired operations of Specialty Aggregate - Madoc plant and quarries.
55	Ferromin Inc. (Tomclid Iron Mine)	South Canonto (Magnetite)	Magnetite is mined and crushed as high-density aggregate for use in heavy concrete applications including radiation shielding.
56	Nesbitt Aggregates	Horton (Granite)	Granite riverstone is quarried, sorted and split for use as flagstone, fieldstone, landscaping and masonry stone. The majority of production is exported to the United States.
57	Stonescape Quarry	Harvey	Limestone flagstone and ledgerock are quarried north of Buckhorn.
58	Kawartha Rock Quarry Inc.	Harvey	Limestone is quarried to produce armour stone and flagstone.
59	JC Rock, Crookston Quarry	Huntingdon Tp. (Limestone)	Historic producer; in 2010, saw dimension stone removed for restoration project, Belleville.

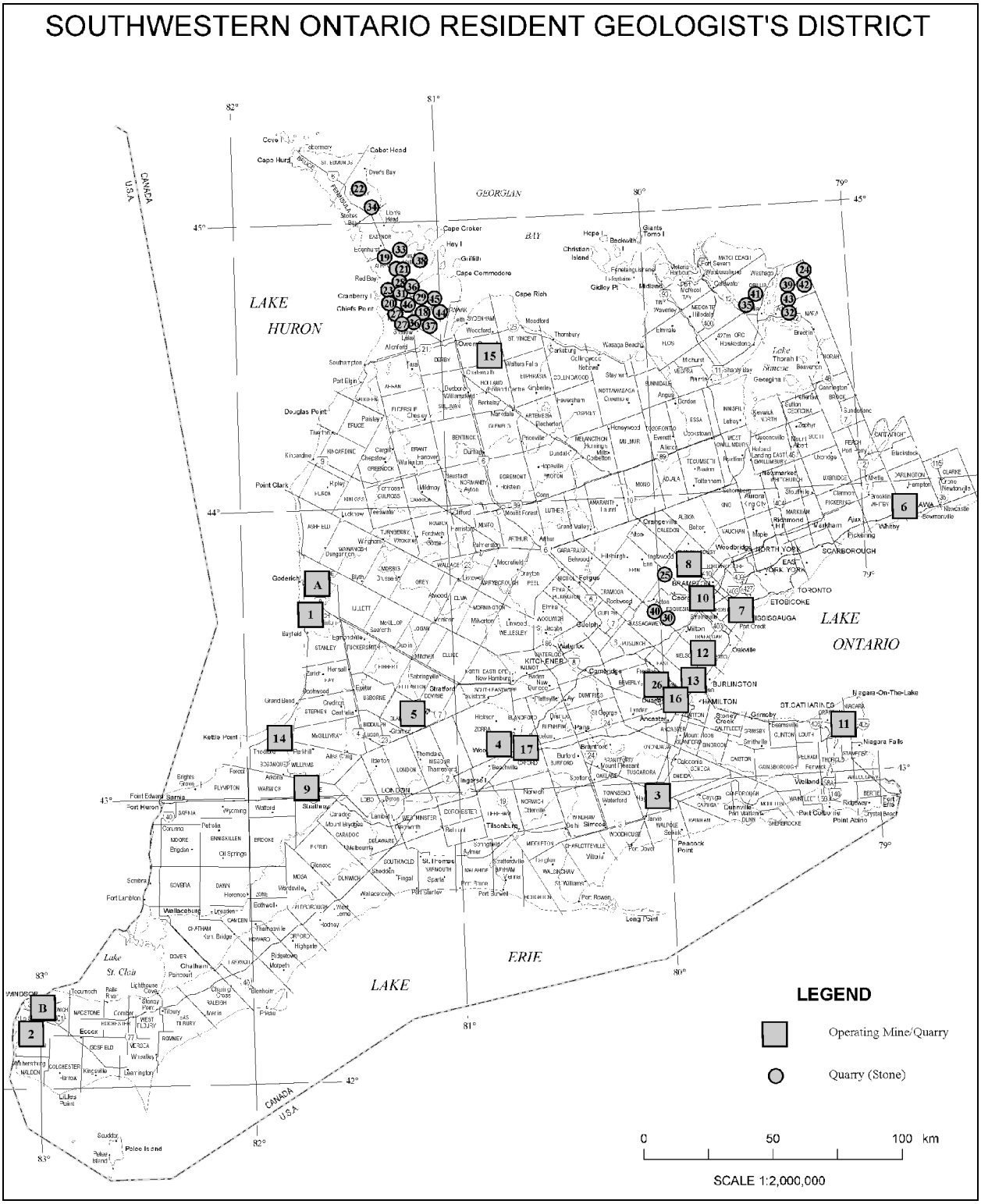

Figure 2. Producing mines and quarries in the Southwestern Ontario District in 2010 (keyed to Table 2).

Table 2. Producing mines and quarries in the Southwestern Ontario District in 2010 (keyed to Figure 2).

No.	Company/Individual (Mine or Quarry Name)	Town/Township (Commodity)	Mining Activity
1 A	Sifto Canada Inc. (Goderich Mine)	Goderich (Salt, salt in brine)	This is the largest underground salt mine in the world. The company also produces salt from an adjacent brine field (A) operation. Most production is distributed via Great Lakes shipping. In 2010, the mine continued a 5-year, $70M expansion program commenced in 2008.
2 B	The Canadian Salt Company Ltd. (Ojibway Mine)	Windsor (Salt, salt in brine)	Underground workings are adjacent to international border.
3	CGC Inc. (Hagersville Mine)	Hagersville (Gypsum)	An on-site wallboard plant utilizes gypsum from the mine.
4	Lafarge Canada Inc. (Woodstock Quarry)	Zorra Tp. (Limestone)	A subsidiary of Lafarge North America operates limestone quarry and cement plant near Woodstock. In September 2008, the company announced that the plant will cease production of clinker and remain as a grinding and packaging operation (*Woodstock Sentinel Review*, September 11, 2008).
5	St. Marys Cement Inc. (St. Marys Quarry)	Blanshard Tp. (Limestone)	Limestone quarry and cement plant complex at St. Marys.
6	St. Marys Cement Inc. (Bowmanville Quarry)	Darlington Tp. (Limestone)	Limestone quarry and cement plant at Bowmanville.
7	St. Lawrence Cement Inc. (Mississauga Quarry)	Mississauga (Shale)	St. Lawrence Cement Inc. operates a cement plant and adjacent shale quarry. Limestone is shipped to the plant from Ogden Point quarry on Lake Ontario at Colborne.
8	Brampton Brick Ltd. (Cheltenham Quarry)	Chinguacousy Tp. (Shale)	Queenston Formation shale is extracted for use in the company's brick plant.
9	Brampton Brick Ltd. (Hungry Hollow North Quarry)	Williams Tp. (Shale)	Shale is extracted for use in the company's brick plant.
10	Century Brick (Georgetown Quarry)	Esquesing Tp. (Shale)	Queenston Formation shale is extracted for use in the company's brick plant.
11	Hanson Brick Ltd. (Niagara-on-the-Lake Quarry)	Niagara Tp. (Shale)	Queenston Formation shale is extracted for use in the company's brick plant.
12	Hanson Brick Ltd. (Burlington Quarry)	Burlington (Shale)	Queenston Formation shale is extracted for use in the company's brick plant.
13	Hanson Brick Ltd. (Aldershot Quarry)	Burlington (Shale)	Queenston Formation shale is extracted for use in the company's brick plant.
14	JADE Hardwoods Inc. (Thedford Quarry)	Bosanquet Tp. (Shale)	Shale is extracted.
15	E.C. King Contracting Ltd. (Sydenham Quarry)	Sydenham Tp. (Dolostone)	High-purity dolostone is crushed for aggregate.
16	Lafarge Canada Inc. (Dundas Quarry)	West Flamborough Tp. (Dolostone)	Dolostone is crushed for use as high-quality aggregate
17	Carmeuse Lime Canada (Beachville Quarry)	Zorra Tp. (Limestone)	Limestone is extracted, crushed and processed in on-site lime plant.
18	A & A Natural Stone Ltd. (A & A Quarry)	Keppel Tp. (Dolostone)	Grey dolostone is produced for use as flagstone, landscape stone and specialty aggregate.
19	Amsen Quarries Ltd. (Mar Quarry)	Albemarle Tp. (Dolostone)	Light and dark brown dolostone is produced for use as flagstone and building stone.
20	Amsen Quarries Ltd. (Wiarton Quarry)	Amabel Tp. (Dolostone)	Light and dark brown dolostone is produced for use as flagstone and building stone).
21	Arriscraft International Inc. (Adair Marble Quarries)	Albemarle Tp. (Dolostone)	Dolostone is produced for use as architectural stone.
22	Bruce Peninsula Stone Ltd. (Lindsey Quarry)	Lindsey Tp. (Dolostone)	Dolostone is produced for landscaping and building stone products.
23	Bruce Peninsula Stone Ltd. (Wiarton Quarry)	Amabel Tp. (Dolostone)	Dolostone is produced for landscaping and building stone products.
24	Cut Above Natural Stone (Cut Above Natural Stone Quarry)	Rama Tp. (Limestone)	Buff brown, white, light to dark grey limestone is quarried for use as armour stone, cubical weathered wallstone, flagstone and random slabs.

No.	Company/Individual (Mine or Quarry Name)	Town/Township (Commodity)	Mining Activity
25	Deforest Brothers Quarry Ltd. (Deforest Brothers Quarry)	Caledon Tp. (Sandstone)	Red, grey, buff, piebald-textured sandstone is produced for use as steps, coping, wallstone, ledgerock and landscaping stone.
26	Dufferin Aggregates (Flamborough Quarry)	West Flamborough Tp. (Dolostone)	Dolostone is produced for use as armour, landscaping and crushed stone.
27	Ebel Quarries Inc. (Ebel and Arnold Property quarries)	Amabel Tp. (Dolostone)	Light and dark brown and black dolostone is produced for use as flagstone, landscaping stone, slabs, steps and wallstone.
28	The Wiarton Buckskin Quarry Co. Ltd.	Amabel Tp. (Dolostone)	Brown–beige dolostone is produced for use as flagstone, steps, slabs and curbing stone.
29	Georgian Bay Marble and Stone (Cook Quarry)	Amabel Tp. (Dolostone)	Dolostone is produced for use as landscaping stone, steps and building stone.
30	Hilltop Stone and Supply Inc. (Hilltop Quarry)	Esquesing Tp. (Sandstone)	Grey and buff sandstone is quarried for use as flagstone, masonry stone and dimension stone.
31	1590361 Ontario Ltd. (operated by Amsen Quarries Ltd.)	Amabel Tp. (Dolostone)	Crushed stone aggregate is produced.
32	James Lamb	Rama Tp. (Dolostone)	Crushed stone aggregate is produced.
33	Limberlost Stone Inc. (Limberlost Quarry)	Albemarle Tp. (Dolostone)	Light and dark brown and grey dolostone is quarried for use as flagstone, landscaping stone, steps, slabs, coping and coursing.
34	Lions Head Stone Quarry	Lindsey Tp. (Limestone)	Limestone is produced for use as splitface, landscape and armour stone and flagstone.
35	MAQ Aggregates (Hewitt Property Quarry)	Orillia Tp. (Limestone)	Operated by Gott Natural Stone ’99 Inc.
36	Owen Sound Ledgerock Ltd. (Senesun and Wiarton quarries)	Amabel Tp. (Dolostone)	Dolostone is produced for use as custom cut and architectural cut stone, masonry, ledgerock wallstone, marble tiles and slabs and landscape stone.
37	Owen Sound Ledgerock Ltd. (Owen Sound Quarry)	Keppel Tp. (Dolostone)	Dolostone is produced for use as custom cut and architectural cut stone, masonry, ledgerock wallstone, marble tiles and slabs and landscape stone.
38	Owen Sound Ledgerock Ltd. (Hope Bay Quarry)	Albemarle Tp. (Dolostone)	Dolostone is produced for use as custom cut and architectural cut stone, masonry, ledgerock wallstone, marble tiles and slabs and landscape stone.
39	Rama Stone Quarries Ltd. (Fleming Quarry)	Rama Tp. (Gneiss)	The quarry is operated by Fowler Construction. Granitic gneiss is quarried for use as flagstone, building, landscaping, masonry and crushed stone.
40	Rice and McHarg Ltd. (Rice and McHarg Quarry)	Esquesing Tp. (Sandstone)	Grey and buff sandstone is produced for use as flagstone, masonry and landscaping stone.
41	Rockleith Quarry Ltd. (Rockleith Quarry)	Severn Tp. (Limestone)	Beige, tan and blue-gold limestone and dolomitic limestone is produced for use as dimensional building stone.
42	Speiran Quarries Ltd. (Speiran Quarry)	Rama Tp. (Limestone)	The quarry is operated by Gott Natural Stone ’99 Inc. White limestone is produced for use as flagstone, landscaping stone, waterfall slabs, retaining wall blocks and steps.
43	Stone Cottage Inn Ltd. (Attia/Rama Quarry)	Rama Tp. (Dolostone)	Stone is quarried for use as flagstone, landscaping and masonry stone. Stone from this site has been successfully tested for use in an engineered stone. The owner is currently seeking partnership to develop new plant.
44	Wiarton Stone Quarry Inc. (Wiarton Stone Quarry)	Amabel Tp. (Dolostone)	Light brown, grey/beige and black dolostone is quarried for use as flagstone, steps, waterfall stone, curbing stone.
45	Volarock Inc. (Volarock/Ted Young Quarry)	Keppel Tp. (Dolostone)	Brown–beige dolostone is produced for use as flagstone, building stone, ashlar, steps, landscape and armour stone.
46	Volarock Inc.	Clavering Tp. (Dolostone)	Dolostone is quarried to produce landscaping and dimension stone. Inactive

Table 3. Value and volume of selected industrial mineral production in the Southern Ontario Region, 2006–2010.

	2010 [P] Quantity ($\times 10^6$ tonnes)	2010 [P] Value ($ million)	2009 Quantity ($\times 10^6$ tonnes)	2009 Value ($ million)	2008 Quantity ($\times 10^6$ tonnes)	2008 Value ($ million)	2007 Quantity ($\times 10^6$ tonnes)	2007 Value ($ million)	2006 Quantity ($\times 10^6$ tonnes)	2006 Value ($ million)
Nonmetals										
Gypsum (1)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Salt (1)	6.8	383	9.9	339	9.5	327	7.6	244	8.3	260
Nepheline syenite(1)	0.6	59	0.5	53	0.7	60	0.8	67	0.7	66
Structural Materials										
Clay products (1)	N/A	119	N/A	97	N/A	146	N/A	162	N/A	185
Cement (1)	4.8	550	4.7	522	5.7	630	5.9	650	6.0	667
Lime (1)	0.8	126	0.6	83	0.9	121	0.9	118	1.0	120
Sand and Gravel	89.2	556	82.2	443	98.8	543	99.6	490	94.3	432
Stone**	56.0	594	53.0	578	64.2	665	61.8	629	59.4	627
Total, Ontario Industrial Minerals (Nonmetals)		**$2.89 billion**		**$2.49 billion**		**$3.04 billion**		**$2.49 billion**		**$2.49 billion**

(1) all production from Southern Ontario. **Abbreviations:** [P] = preliminary data; N/A = data not available, single producer.
** production represents quarry shipments of crude or undressed stone, crushed stone and dressed stone, if the latter is prepared by the quarry operators, at values as reported by operators – this category includes crushed rock aggregate, trap rock, specialty aggregate, dimension stone and calcium carbonate

(*after* MNDMF, *Ontario Mineral Production Facts*, March 2010, January 2011; Natural Resources Canada, *Mineral Yearbook, Preliminary Statistics 2010*)

An estimated 5000 people were directly employed in mineral extraction and on-site processing plants in southern Ontario. Preliminary figures for 2010 (Table 3) indicate that southern Ontario industrial mineral production was valued at over $2.89 billion, representing 39% of the total value of minerals produced in the province.

Provincewide, the value of nonmetallic minerals produced in 2010 represented 39% of the total value of minerals produced.

All Ontario oil and gas production occurs in the Southwestern Ontario District. For information on oil and gas exploration and development activity in Ontario in 2010, please refer to the report of the Petroleum Resources Centre (this volume).

Salt

Sifto Canada Inc. and the Canadian Salt Company each operate underground mines and brine fields in Goderich and Windsor, respectively. Rock salt taken from the mines is used mostly for road de-icing, for feedstock and in industry, where it is used in making chemicals and plastics. Food and chemical grade salt are produced from the brine operations.

In 2010, Sifto Canada completed a $70 million expansion program of the Sifto salt mine in Goderich, a project that was initiated in 2008 to increase the hoisting capacity and salt storage capacity in response to increasing demand for road salt in markets throughout the Great Lakes region. The investment has allowed the company to increase production capacity from 7 million tonnes per year in 2009 to 9 million tonnes per year in 2011 and has resulted in the recall of 69 of the 80 employees laid off early in 2010 (*Goderich Signal Star*, article, "Salt business booming", January 6, 2011).

The company employs a total of 470 people in the Goderich facilities and the number is expected to rise to 500 by 2012. The Goderich Mine is the largest underground salt mine in the world. It has been operating for more than 50 years, producing 150 million tonnes of salt and has defined resources for an additional 100 years of production (*Goderich Signal Star*, article, "Goderich salt mine celebrates 50th anniversary", January 21, 2010).

The Canadian Salt Company Limited, also known as Windsor Salt (www.windsorsalt.com), is a part of Morton International Inc., located in Chicago, Illinois. Windsor Salt is a leader in modern salt processing methods, and is now Canada's largest salt manufacturer. It produces both rock salt from the underground Ojibway Mine and vacuum salt from nearby brine wells in Windsor. Salt products include road de-icing, water softening, agricultural and chemical fine salt. The Ojibway Mine and brine field employ a total of 322 people. (Windsor Salt Ontario Facilities, 2010, www.windsorsalt.com/careers/sites_ontario.html)

Brick and Shale

In 2010, there were 4 companies operating clay brick/tile plants in southwestern Ontario, all of which use Queenston Formation shale as raw material.

Hanson Brick Ltd. (www.hansonbrick.com) operates 2 plants in Burlington and 1 in Aldershot, with shale quarries at Niagara-on-the-Lake, Burlington and Aldershot. Hanson is North America's largest brick manufacturer with a total capacity of more than 1.7 billion bricks per year, 415 million of which are produced in Ontario. Following a significant decline in production as a result of decreased demand from the residential construction industry in 2009, the company reported a marginal increase in sales in 2010 and expects little change in 2011 (L. Steffler, Hanson Brick Ltd., personal communication, January 2011). The company employs a total of 130 people at its Ontario facilities.

Brampton Brick Ltd. operates North America's single largest clay brick plant in Brampton, with production capacity of 300 million units per year. About 500 000 t of Queenston shale are extracted annually from the Cheltenham quarry for the plant, which employs 75 people. Net sales of masonry products for the first 9 months of 2010 were $39.6 million, an increase of $13.3 million (50.2%) over the same period in 2009—the result of a significant increase in the level of residential construction activity (Brampton Brick Ltd., Third Quarter Report 2010, www.bramptonbrick.com).

In December 2008, the company applied for re-zoning in order to open a shale quarry at Norval, about 10 km west of Brampton. In 2002, the "Northwest Brampton Shale Resources Review", initiated by the City of Brampton, recommended to reduce the area designated as the Norval Deposit of Queenston Shale from 1377 to 180 ha. Brampton Brick purchased a 35 ha portion of the deposit and propose to create an excavation area of 11.4 ha. In addition to providing security of shale supply for the Brampton plant, the Norval shale contains lower amounts of chlorides and sulphates than the Cheltenham shale. The company will blend the 2 shales to produce a new product line of buff-burning bricks (Town of Halton Hills, Information Report: Update on the Norval Quarry application by Brampton Brick, January 22, 2009). In December 2010, the application was still under review by the municipality.

Brampton Brick has initiated a program of recycling mineral wool substrate used in greenhouse growing operations. The material, which is usually discarded at the end of a growing cycle, is now replacing 20% (by volume) of the shale used in the brick-making process, thereby extending the life of the quarry and decreasing the amount of substrate that is disposed of in landfills (Greenhouse Canada, "A blue box for substrates", www.greenhousecanada.com/content/view/2276/67/).

Paisley Brick and Tile Co. Ltd. quarries shale from the Hungry Hollow quarry (owned by Brampton Brick) in Williams Township for its plant in the village of Paisley. The operation employs 14 people.

Century Brick Ltd. operates a plant in Hamilton and shale quarry near Georgetown. The plant employs 28 people.

Cement

There are 6 quarries and 6 modern processing plants in southern Ontario between Kingston in southeastern Ontario and St. Marys in the southwest. Production figures for 2009 show cement production in Ontario was valued at more than $520 million, representing over 40% of the total value of cement production in Canada (Kitching and Greenwell 2010).

With the exception of Federal White Cement, each company has port facilities for Great Lakes shipping. The Bath, Picton, Bowmanville and Mississauga plants export significant production to the United States.

Combined, the companies have 11 cement kilns with a total clinker production capacity of over 8.1 Mt per year. Primary-stage clinker production is more indicative of ultimate cement production capacity because this is the most capital and energy-intensive stage and clinker can be stockpiled for later use or sale (Natural Resources Canada, *Canadian Minerals Yearbook, 2005*).

The Cement Association of Canada released a report in 2010, titled "Canadian Cement Industry Sustainability Report", documenting environmental improvements by cement producers. From 2003 to 2008, sulphur dioxide emissions decreased by 40%, and nitrogen oxides by 28%. Between 1990 and 2008, energy efficiency improved by 16% and carbon dioxide production per tonne of cement was reduced by 9.7%. Canadian cement and concrete sales are valued at over $3.2 billion annually and provide over 27 000 direct and indirect jobs.

Demand for cement in 2010 increased by about 10% over 2009 levels, assisted by residential and stimulus infrastructure spending. A more modest increase of 2.5% is expected in 2011 (Portland Cement Association, Economic Forecast Analysis for Cement, Concrete and Construction, Canadian Forecast, Fall 2010, www.cement.org).

St. Marys Cement (Canada) Inc., a subsidiary of Votorantim Cimentos, operates limestone quarry and cement plant complexes at Bowmanville and St. Marys. In 2009, both facilities experienced a decrease in demand for cement and announced temporary lay-off of 50 to 60 employees. All employees at the St. Marys plant returned to work in January 2010. At the Bowmanville operation, 86 workers were on strike for 20 weeks from March to July, 2010. St. Marys Cement employs a total of 245 people at its Ontario facilities.

In 2009, the St. Marys plant installed a carbon dioxide remediation and renewable fuel production system as a pilot project with Pond Biofuels of Scarborough. The system diverts part of the emissions from the plant's exhaust stack into a half-acre "algae farm" of tubes. The algae absorb carbon dioxide and release oxygen and will be harvested to be tested as a source of biofuel for the plant and company vehicles. Testing of the system continued in 2010 and the next stage will involve increasing the percentage of emissions diverted to the algae plant (*St. Marys Journal Argus*, article, "Greener pastures for cement plant", August 4, 2010, www.stmarys.com/news/article/91145).

Lafarge Canada Inc., a subsidiary of Lafarge North America, operates limestone quarry and cement plant complexes at Bath near Kingston and near Woodstock. In 2008, the company ceased clinker production at the Woodstock plant, retaining it as a grinding and packing plant only. At the Bath plant, the company has recently initiated a program with biotechnology firm, Performance Plants, to grow biomass crops on about 2500 acres of land surrounding the cement plant. The crops will be harvested and used as fuel to replace a portion of the 110 000 t of coal and petroleum coke required by the plant each year (www.todaysconcretetechnology.com/lafarge-cement-plant-tackles-co2-with-biomass.html). The company employs 101 people at the Bath site.

Holcim (Canada) Inc. (formerly St. Lawrence Cement Inc.) operates a cement plant and adjacent shale quarry in Mississauga. Limestone is shipped to this cement plant from the company's Ogden Point quarry located on Lake Ontario at Colborne. The total number of employees at these operations is about 200. The company closed its Mount Royal office in 2007 and moved all corporate administrative functions to Concord, Ontario, following minority acquisition by the Swiss company, Holcim Ltd., one of the world's largest suppliers of cement and aggregates. Sales of cement and ready-mix concrete in 2010 surpassed 2009 levels; however, the company expects little change in demand in the North American market in 2011 (Holcim (Canada) Inc., "Third Quarter Results 2010 and Outlook", www.holcim.com).

ESSROC Canada Inc., a subsidiary of Italcimenti Group, operates a quarry and cement plant at Picton with production capacity of about 1.2 million tonnes of clinker. In 2009, the company spent about $10 million on the plant facilities, primarily in improvements to the bag house filter system in order to comply with new particulate matter emission limits. The new system ensures that all kiln dust is returned to the kiln process, reducing dust emissions and eliminating the need for removal of the material to landfill sites (Cement Association of Canada, Canadian Cement Industry Sustainability Report 2010, www.cement.ca). The company employs 136 people at the Picton site.

Federal White Cement Ltd. operates a specialized white architectural cement plant near Woodstock using limestone purchased from local quarries. The plant employs about 50 people.

Calcium Carbonate

OMYA (www.omya.com) is a leading global producer of industrial minerals, mainly fillers and pigments derived from calcium carbonate and dolomite. The company's major markets are the paper, plastics, paint, coating and adhesives industries as well as construction, environment, agriculture, food and pharmaceuticals.

A private company, founded in 1884 in Switzerland, OMYA now has more than 100 locations in over 50 countries and 7000 employees, including 2 locations in Canada.

The **OMYA Canada Inc.** plant in Perth provides easy access to customers in the St. Lawrence Seaway corridor. The high-quality dry ground calcium carbonate products produced at this plant are used by the paint, plastics and building products industries. The slurry grades are used by paper and packaging manufacturers in Canada and the United States.

High-purity calcitic marble of exceptional brightness is mined at the company's Tatlock quarry and trucked to the plant in Perth where it is ground to produce high-purity, fine-grind calcite for mineral filler. Terrazzo chips and landscaping stone are secondary products. Annual production is 250 000 tons and quarry reserves currently stand at over 5 000 000 tons.

In 2000, a 5-year expansion program was completed at the quarry and plant that represented one of the largest mine and plant development projects in the province during that time period. However, challenges faced by the paper industry in recent years have had a negative impact on the Perth operations. In 2010, sales were flat, reaching approximately 1/3 of peak volume in 2005. A multimillion dollar capital investment in a new separation technology to increase stone utilization from the quarry, develop new products and increase sales is underway. Additional capital dollars were spent at the Tatlock Quarry to remove overburden and caprock to better access high-purity reserves.

The company also owns an adjacent marble dimension stone quarry, formerly known as the OMEGA Blue quarry. Although this quarry is currently inactive, a resource has been identified, quarry blocks are stockpiled onsite and, in 2010, OMYA explored the possibility of having a contractor resume operations at the Blue quarry. (T. Lalonde, OMYA Canada Inc., personal communication, February 2011).

Talc

In August 2010, **Sherritt International** announced the closure of the company's Canada Talc Mine in Madoc (Figure 3) and mill in Marmora. The majority of the 50 workers terminated as of August 2010. A skeleton crew will remain onsite for the next 2 to 4 years to complete decommissioning and rehabilitation in accordance with the Closure Plan on file with the Ministry of Northern Development, Mines and Forestry.

Unexploited high-purity talc resources have been defined at Canada Talc, but underground development and mining of these resources would require a capital investment that would be difficult to justify under current market conditions. Although there has been some recent interest shown in the mine and mill by other companies, at this time, plans are to proceed with closure.

During the 1990s, a new high-purity talc resource was identified, the Marmora mill upgrade was completed and new underground mine development was planned to access the newly defined resource. In the 1990s to 2000s, the deposit changed ownership from Highwood Resources to Dynatec Corporation. In 2007, Sherritt International acquired Dynatec Mining Corp and incidentally gained ownership of Canada Talc.

The slowdown of the United States and world economies continues to affect the talc industry. Major market sectors have declined and competition from offshore sources limits the development of domestic resources. The closure of this operation leaves only 1 producing talc mine in Canada, the Rio Tinto Minerals Group, Penhorwood mine and micronizing plant in northeastern Ontario. That deposit is currently being offered for sale.
(Sources: United States Geological Survey, *USGS Commodity Summary 2010*; D. Loucks, Sherritt International, personal communications, September 2010; Natural Resources Canada, *NRCan Commodity Summary 2007*; Southern Ontario Regional Resident Geologist Office, Mineral Deposit Inventory files)

Figure 3. Canada Talc Mine, *circa* 1921. Photo courtesy of Sherritt International.

Dimension and Building Stone

WIARTON AREA QUARRIES

The largest concentration of dimension stone producers in Ontario is in the Owen Sound–Wiarton area. In 2010, 15 operations extracted Eramosa Member dolostone for dimension, building, landscaping and flagstone markets. Two operations quarried Amabel Formation dolostone for dimension and building stone and 1 quarry extracted Guelph Formation dolostone for building and landscaping stone. There are several additional sites in the Wiarton area that are currently in preparation for licencing under the *Aggregate Resources Act*.

OTTAWA–CARLETON QUARRIES

The Ottawa–Carleton region in southeastern Ontario is one of the most significant aggregate producing areas in the province. Information provided by the Ministry of Natural Resources indicates that, in 2010, there were 36 quarries operating in the area with a total licenced area of over 1900 ha. Most of the quarries extract limestone, dolostone and/or sandstone of Ordovician age to produce high-quality crushed stone aggregate.

Companies holding aggregate licences include AECON Construction and Materials Ltd., Cornwall Gravel Co. Ltd., Lafarge Canada Inc., R.W. Tomlinson Ltd., Smiths Construction Ltd., Warren Paving and Materials Group Ltd. and Thomas Cavanagh Construction Ltd. The 36 quarries are located in the geographic townships of Cumberland, Fitzroy, Gloucester, Goulbourn, Huntley, Nepean and Osgoode.

These are large operations with 7 of the quarries having “unlimited” maximum annual tonnage and the remaining 29 sites having an average licenced maximum annual tonnage of over 1 Mt.

In 2011, the Ontario Geological Survey will begin an aggregate resource inventory mapping project of the area, in conjunction with the City of Ottawa.

ORILLIA AREA QUARRIES

Five companies operate a total of 6 dimension stone quarries in Rama Township near Orillia. Paleozoic limestone of the Gull River Formation is extracted for a variety of applications including landscape, masonry and armour stone. Each of the companies has some form of onsite processing to split and/or cut stone to customer specifications. There has been some recent research completed into the use of waste rock from this area in the manufacture of an engineered stone product. (Sources: *Ontario Dimension Stone Directory, 2010*; E. Attia, Stone Cottage Industries, personal communication, January 2010)

ADVANCED EXPLORATION

Gold

UPPER CANADA GOLD CORPORATION – DINGMAN PROSPECT

The Dingman property straddles the boundary between the townships of Madoc (Concession I, Lot 19) and Marmora (Concession XI, Lot 19) several kilometres north of the historic Deloro mines, which produced about 14 000 ounces of gold prior to 1908.

Gold was discovered on the property in 1985 in a small granitic body about 800 m north of the Deloro granite. Noranda Exploration acquired the property in 1986 and conducted surface exploration followed by diamond-drilling program of 38 holes, totalling 5027 m, in 1987 and 1988. Noranda calculated probable and possible reserves (non-National Instrument (NI) 43-101–compliant) of 8.5 million tons grading 0.043 ounces gold per ton (1.48 g/t Au) (King 1988), which is significantly more gold than the total of all past production in southeastern Ontario (200 000+ ounces versus 38 000 ounces). Gold occurs as fine, native grains within quartz stringers and at quartz-sericite grain boundaries in altered granite (Figure 4). Combined pyrite-chalcopyrite content locally reaches 15 to 25% over core lengths of up to 3 m. Pyrrhotite and magnetite occur in minor amounts, as does fluorite in quartz stringers. The strongest alteration and quartz veining are within north-northeast-trending shear zones, containing green sericite and blue quartz eyes, which cut across an earlier 060° foliation in the granite. Wollastonite and magnetite occur in skarn zones within the surrounding marble, and large blocks of granite occur within a footwall breccia (King 1988).

In 1997, Deloro Minerals Ltd. purchased the property and drilled 14 holes, totalling 2053 m. The property was inactive for a number of years, allowed to lapse and subsequently re-staked by prospectors.

Figure 4. Gold-bearing, altered granodiorite with visible gold and fluorite in quartz vein, Dingman property, Upper Canada Gold Corporation. Core diameter is 4.75 mm. Photo by J. Chard.

In 2007, the property was acquired by Opawica Explorations Inc. A diamond-drill program, totalling 4634 m in 19 holes, confirmed previous estimates of average grade and width of the mineralized zone, about 375 m long and 80 m wide to a depth of 275 m.

A complete NI 43-101 report released by Opawica on March 25, 2009, reports resource calculations on the Dingman property as Indicated Resource of 8 801 000 t at 0.97 g/t Au (275 000 ounces gold) and Inferred Resource of 5 673 000 t at 0.76 g/t Au (138 000 ounces gold), using a cut off grade of 0.40 g/t Au. The report also states that preliminary processing tests done on core samples by Gekko Systems indicates that a combination of gravity and flotation recovery stages can produce a gold concentrate with 97.7% recovery. The company also estimated that there are 14 million tonnes of granite and limestone (marble) aggregate on the property that could be developed as part of the proposed open pit mining operation (Palmer, Greenough and Laakso 2009).

An additional 3926 m of diamond drilling in 16 holes were completed by Opawica on the property in February to April, 2009. Several deeper holes confirmed that the gold zone widens and remains open at depth and that the mineralization remains consistent at about 1.0 g/t Au. Hole DI-09-01, drilled to a vertical depth of about 575 m, intersected 131 m of mineralized, altered granite containing a 95 m core length averaging 1.0 g/t Au. Hole DI-09-05 intersected 133 m averaging 1.0 g/t Au. The results of this program were not included in the NI 43-101 report released in March, 2009. The following revised resource estimate was released following receipt of drill core analyses: Indicated Resources remain unchanged, at 8 801 000 t grading 0.97 g/t Au and Inferred Resources are increased to 11 301 000 t at 0.98 g/t Au (Opawica Explorations Inc., news release, July 16, 2009).

In February 2010, Upper Canada Gold Corporation acquired the mineral rights to the Dingman property from Opawica Explorations Inc. for the sum of $40 000 and 37% of the shares of Upper Canada Gold. Upper Canada Gold Corporation began a diamond-drilling program in March 2010 to test the Dingman gold zone at depth and add NI 43-101–compliant gold resources within the open pit area defined by previous exploration programs. The program, consisting of 24 holes totalling 6556 m, was completed in July, 2010.

A revised NI-43-101 mineral resource report was completed for Upper Canada Gold Corporation in December, 2010, by Scott Wilson Roscoe Postle Associates Inc. (Scott Wilson RPA). The following information is summarized from that report in a press release by Upper Canada Gold Corporation:

> The updated estimate used the 2010 Upper Canada drill holes as well as 88 holes drilled by previous property holders and results of previous channel sampling. The mineral resource estimate, at a cut-off grade of 0.40 g/t Au, is
>
> - Indicated mineral resources of 11.6 million tonnes averaging 0.97 g/t (361 000 ounces contained Au).
> - Inferred mineral resources of 1.7 million tonnes averaging 0.73 g/t (40 000 ounces contained Au).
>
> The Indicated Resource has increased approximately 31% as a result of the 2010 Upper Canada drilling from the 8.8 million tonnes at 0.97 g/t Au (275 000 ounces) reported by Opawica Explorations in 2009. Some of the previous Inferred Resource has been converted to Indicated Resource by the Upper Canada drilling and the remainder is outside of the preliminary open pit area that Scott Wilson RPA used to constrain the mineral resource. In addition to the mineral resources defined within the open pit design area, Scott Wilson RPA estimates an additional exploration target on the Dingman property of 8 million to 14 million tonnes at an average grade of 0.8 g/t to 1.0 g/t Au with potential for 200 000 to 450 000 contained ounces of gold, based upon diamond drill intersections at depth and along strike.
> (Upper Canada Gold Corporation, news release, February 8, 2011, www.canadianminingjournal.com/press-releases/story.aspx?id=4537987)

The report recommends that a preliminary assessment be carried out to assess the potential economics of mining the Dingman gold deposit by open pit and that the potential for by-product production of aggregate from waste rock from the potential open pit gold mining operation should be examined during the preliminary assessment. As part of this assessment, the company plans to extract a bulk sample for metallurgical testing in 2011 (T. Sills, Upper Canada Gold Corporation, personal communication, February 8, 2011).

Wollastonite

CANADIAN WOLLASTONITE – ST. LAWRENCE DEPOSIT

In 2010, Canadian Wollastonite (www.canadianwollastonite.com) continued to work toward the development of the St. Lawrence wollastonite deposit north of Kingston. The size of the deposit is estimated at over 9 million tons and, when it is fully developed, it will be the first active source of wollastonite production in Canada.

The company will be submitting a Closure Plan to the Ministry of Northern Development, Mines and Forestry in the spring of 2011 to bring the deposit into production under the *Mining Act*. Plans are for a phased development of the deposit with the first phase being a pilot plant operation to prove markets for top-grade wollastonite before moving into full production.

The last several years have seen the company pass a number of important milestones:

- 2004 - site preparation, 3 shallow pits and plant engineering initiated
- 2005 - development of beneficiation process for the wollastonite ore
- 2006 - detailed engineering for the final process and plant design initiated
- 2007, 2008 - process engineering modified, final environmental testing undertaken, plans prepared for construction pilot plant and evaluation of low-iron diopside as potential co-product
- 2009 - municipal zoning and permitting issues resolved
- 2010 - successful testing of diopside for markets in metallurgical process and in plant and animal nutrition products; successful testing of granite host rock as high-quality friction aggregate (Ontario Ministry of Transportation)

Canadian Wollastonite is a private company that was incorporated in Ontario in 2001. To date, the company has invested several million dollars in up-front developmental activities in anticipation of successful commercialization of the wollastonite deposit (B. Vasily, Canadian Wollastonite, personal communication, February 2011).

DANFORD GRANITE LTD. – BRIDGEWATER TRAP ROCK

In 2010, notice was given to the Ministry of Northern Development, Mines and Forestry of intent to reactivate the Bridgewater Trap Rock Mine in Elzevir Township. Danford Granite Ltd. will operate the quarry under an 18 month option agreement with the owner, 1085499 Ontario Ltd. In preparation for the re-opening, the owner provided modifications to the Mine Closure Plan that had initially been accepted in 2000, including Notice of Material Change (moving the quarry entrance road), Notice of Project Status (inactive to active), provision of Financial Assurance, and held a public information meeting.

The 81 ha property was issued a Mining Lease in 1986 following surface exploration and diamond drilling of a talc-bearing zone. It was concluded that, although the quantity and grade of talc was insufficient for economic extraction, the rock may have potential as a source of raw material for the manufacture of rock wool insulation products. In 1989, several thousand tonnes of rock were quarried and tested with positive results in the production of rock wool.

The property is underlain by a series of mafic metavolcanic rocks and layered mafic to ultramafic intrusions which host zones of talc-carbonate-serpentine alteration. The rocks trend northwesterly along the western margin of the Elzevir tonalite. The company proposes to extract 20 000 to 30 000 tonnes of gabbroic rock for the production of rock wool and additional testing as concrete aggregate, railway ballast and other aggregate uses, beginning in February, 2011 (J. Byer, 1085499 Ontario Ltd., personal communication, January 2011).

EXPLORATION ACTIVITY

Assessment files received for the Southeastern Ontario District are listed in Table 4. Exploration activity is listed in Table 5 and locations of exploration projects are shown in Figure 5.

Table 4. Assessment files received in the Southeastern Ontario District in 2010.

Abbreviations

AEM ..... Airborne electromagnetic survey
AM ..... Airborne magnetic survey
ARA ..... Airborne radiometric survey
Beep ..... Beep Mat survey
Bulk ..... Bulk sampling
DD ..... Diamond drilling
DDH ..... Diamond-drill hole(s)
DGP ..... Down-hole geophysics
GC ..... Geochemical survey
GEM ..... Ground electromagnetic survey
GL ..... Geological survey
GM ..... Ground magnetic survey
GRA ..... Ground radiometric survey
Grav ..... Gravity survey
HLEM ..... Horizontal loop electromagnetic survey
HM ..... Heavy mineral sampling
IM ..... Industrial mineral testing and marketing
IP ..... Induced polarization survey
Lc ..... Line cutting
Met ..... Metallurgical testing
OD ..... Overburden drilling
ODH ..... Overburden drill hole(s)
OMIP ..... Ontario Mineral Incentive Program
OPAP ..... Ontario Prospectors Assistance Program
PEM ..... Pulse electromagnetic survey
PGM ..... Platinum group metals
Pr ..... Prospecting
RES ..... Resistivity survey
Samp ..... Sampling (other than bulk)
Seismic ..... Seismic survey
SP ..... Self-potential survey
Str ..... Stripping
Tr ..... Trenching
UG ..... Underground exploration/development
VLEM ..... Vertical loop electromagnetic survey
VLFEM ..... Very low frequency electromagnetic survey

No.	Township or Area (Commodity)	Company Name	Year	Type of Work	AFRO Number	Resident Geologist Office File Designation
1	Anglesea (Au)	Marc T. Forget	2009	Samp, GC, Pr	2.43171	42
2	Ashby (Kimberlite, Au, Mineral Specimens)	Robert Lawrence	2008, 2009	Pr, Samp	2.46089	22
3	Bedford (Graphite)	Cardinal Explorations Inc.	2009	AEM, AMAG	2.42026	46
4	Belmont (Base Metal, PGM)	First Nickel Inc.	2010	Samp, Pr, GL	2.46581	25
5	Brougham (Mo)	Douglas Lalonde	2009	Pr, Samp	2.43435	19
6	Burgess, North (Graphite)	Cardinal Explorations Inc.	2009	AEM, AMAG	2.42035	27
7	Butt (Graphite)	Ontario Graphite Ltd.	2009	Pr, GEM	2.42499	8
8	Canonto, South (Fe)	Paul R. Lystiuk	2009, 2010	GL	2.46179	16
9	Cardiff (U, REE)	Skead Holdings Ltd.	2009	GRA	2.42475	240
10	Cardiff (U, REE)	Skead Holdings Ltd.	2009	Pr	2.44561	242
11	Cardiff, Monmouth (U, REE)	CJP Explorations Inc.	2009	Pr	2.45332	241, 169
12	Cavendish (Mineral Specimens)	David J. Ross	2009	Str	2.42685	158
13	Cavendish (Vermiculite)	Regis Resources Inc.	2009	Manual	2.42227	159
14	Darling (Au)	Vernon Rampton	2009	DD, Samp	2.42764	84
15	Dungannon (Mineral Specimens)	Wolverine Exploration & Mineral Recovery	2010	Pr	2.45333	50
16	Effingham (PGM, Au)	Robert D. Lawrence	2009	Pr, Samp	2.44144	12
17	Elzevir (Soapstone)	Diane Milligan, Clare Myles	2009, 2010	Str	2.46327	33
18	Grimsthorpe (Au, U)	James Chard, Robert Dillman	2010	GRA	2.44490	88
19	Lake (Base Metal, PGM)	First Nickel Inc.	2010	Pr	2.44913	30
20	Lake (Base Metal, PGM)	First Nickel Inc.	2010	Samp	2.45178	31
21	Limerick (Base Metal, PGM)	First Nickel Inc.	2010	Pr	2.44945	18
22	Limerick (Base Metal, PGM)	First Nickel Inc.	2010	Samp	2.44981	19
23	Limerick (Base Metal, PGM)	First Nickel Inc.	2009	Pr, Samp, DD, GL, Enviro	2.45048	20
24	Limerick, Wollaston (Base Metal, PGM)	First Nickel Inc.	2010	Pr, Samp, GL	2.45296	21, 14
25	Madoc (Basalt)	Alan A. Reed	2010	Pr, Precut	2.46134	163
26	Madoc (Limestone, Trap)	IKO Industries Ltd.	2006, 2007	Enviro	2.43138	162

No.	Township or Area (Commodity)	Company Name	Year	Type of Work	AFRO Number	Resident Geologist Office File Designation
27	Marmora (Au)	Edward Neczkar	2008, 2009	Samp, GC	2.45806	100
28	Marmora (Au, Fe)	Carol C. Cook	2009	GL, Samp	2.44707	98
29	Marmora (Base Metal, PGM)	First Nickel Inc.	2010	GL, Samp, Pr	2.45747	99
30	Marmora (Base Metal, PGM)	First Nickel Inc.	2010	Pr, Samp	2.45782	101
31	Marmora (Base Metal, PGM)	First Nickel Inc.	2010	Pr, Samp	2.45746	102
32	Marmora (Base Metal, PGM)	First Nickel Inc.	2010	Pr, Samp	2.45783	103
33	Marmora (Base Metal, PGM)	First Nickel Inc.	2010	Samp, Pr	2.46044	104
34	Methuen (Gabbro)	Trigan Resources Inc.	2009	GC	2.44099	54
35	Methuen (Granite)	Drain Bros. Excavating Limited	2009	Bulk, IM	2.42913	52
36	Methuen (Granite)	Norway Asphalt Limited	2009	Lc, GM, GEM	2.42822	53
37	Methuen (Granite)	Norway Asphalt Limited	2010	Bulk	2.46047	55
38	Raglan (Base Metal, PGM)	First Nickel Inc.	2008, 2009	Pr, Samp, GL, DD	2.45069	33
39	Raglan (Base Metal, PGM)	First Nickel Inc.	2008, 2009	Pr, Samp, DD, GL, Enviro	2.44306	34

Table 5. Exploration activity in the Southeastern Ontario District in 2010 (keyed to Figure 5).

Abbreviations

AEM ..... Airborne electromagnetic survey
AM ..... Airborne magnetic survey
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Bulk ..... Bulk sampling
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PEM ..... Pulse electromagnetic survey
PGM ..... Platinum group metals
Pr ..... Prospecting
RES ..... Resistivity survey
Samp ..... Sampling (other than bulk)
Seismic ..... Seismic survey
SP ..... Self-potential survey
Str ..... Stripping
Tr ..... Trenching
UG ..... Underground exploration/development
VLEM ..... Vertical loop electromagnetic survey
VLFEM ..... Very low frequency electromagnetic survey

No.	Company/Individual	Township/Area (Commodity)	Exploration Activity
1	Adroit Resources Inc.	Denbigh, Lyndoch (Cu, Zn)	DD, Samp
2	Archibald, F.	Belmont (Au)	Pr
3	Bancroft Chamber of Commerce	Monmouth (Mineral Specimens)	Tr, Pr
4	Bancroft Gem and Mineral Club	Dungannon (Mineral Specimens)	Pr
5	Bassermann, R.	Butt (Graphite)	GL, GEM
6	Blakely, G.	Elzevir, Hungerford, Kaladar, Darling (Dimension Stone)	Pr, Samp, IM
7	Burnett, A.	Bancroft (Mineral Specimens)	Pr
8	Byer, J.	Elzevir, Hungerford (Trap, Granite)	Str, Pr
9	Canadian Wollastonite	Pittsburgh, Leeds & Lansdowne (Wollastonite)	Pr, IM
10	Chard, J.	Marmora (Au)	Pr
11	CJP Exploration Inc.	Cardiff, Monmouth (U, REE)	Pr
12	Crawford, G.	Lyndoch (Mineral Specimens)	Pr

No.	Company/Individual	Township/Area (Commodity)	Exploration Activity
13	Creighton, W.	Kennebec (Au)	Pr
14	Crushcor Ltd.	Glamorgan (Nepheline)	IM
15	Dan Patrie Exploration	Butt (REE)	IP
16	Davis, S.	Eastern Ontario	Pr
17	Dillman, R., Chard, J.	Grimsthorpe (Au)	Pr
18	First Nickel Inc.	Belmont, Lake, Limerick, Marmora, Wollaston (Base Metal, PGM)	GL, Pr, Samp
19	Forget, M.	Anglesea, Barrie (Au, Base Metal)	Pr, Samp, Beep
20	Fulton-Bell, Y.	Hindon (Base Metal)	Pr
21	Golden Jaguar	Marmora (Fe)	Pr
22	Golden Phoenix Minerals	Griffith (Mo)	GL, Lc
23	Hanes, D., Shank, M.	Dungannon, Mayo (Fe, Mineral Specimens)	Pr
24	Hill, R. / Extender Minerals	Huntingdon, Belmont, Elzevir	Pr, IM
25	IKO Industries Ltd.	Madoc (Trap Rock, Limestone)	IM
26	International Graphite	Butt (Graphite)	
27	Lafarge Canada	Eastern Ontario	Pr
28	Lawrence, R.	Ashby, Effingham (Au, Base Metal, Kimberlite)	Pr, Samp
29	Leblanc, A, Morrison, D.	Ashby	Pr
30	Lester, G.	Eastern Ontario	Pr
31	Lystiuk, P.	South Canonto (Fe)	GL
32	McBride, D.	Limerick (Ni, Cu)	Pr, GL
33	McCance, J., Beckett, R.	Faraday, Monmouth (Mineral Specimens)	Pr, Samp
34	Melkior Resources Inc.	Raglan (Base Metal)	GL, Pr, Samp
35	Milligan, D., Myles, C.	Elzevir (Soapstone)	Str
36	Murray Brook Minerals Inc.	Belmont (Calcium Carbonate, Marble)	Pr, Samp
37	Neczkar, E., Baird, D.	Marmora (Au)	Pr
38	Norway Asphalt Limited	Methuen (Granite)	Bulk
39	Ontario Graphite Ltd.	Butt (Graphite)	Pr
40	Orvacz, J.	South Canonto (Magnetite)	IM
41	Patterson, D.	Lyndoch (Mineral Specimens)	Pr
42	Reed, A.A.	Madoc (Basalt)	Pr, Precut
43	Sangster, D.	North Burgess (Mica)	GL
44	Schweighardt, J.	Kaladar (Marble)	Pr
45	Senator Stone	Elzevir, Faraday (Marble)	Samp, IM
46	Trigan Resources Inc.	Methuen (Trap Rock)	Pr
47	Upper Canada Gold Corporation	Marmora (Au)	DD, GL, Samp
48	Upper Canada Stone	Mayo, Cashel, Madoc (Marble)	Pr
49	Vatcher, K.	Cavendish (Vermiculite)	IM
50	Veeley, H.	Kennebec (Au)	Pr
51	Wilson, M.	Camden East (Dimension Stone)	Samp, IM
52	Windover, N.	Cavendish (Dimension Stone)	Pr
53	Drain Bros. Excavating Ltd.	Methuen (Granite)	IM

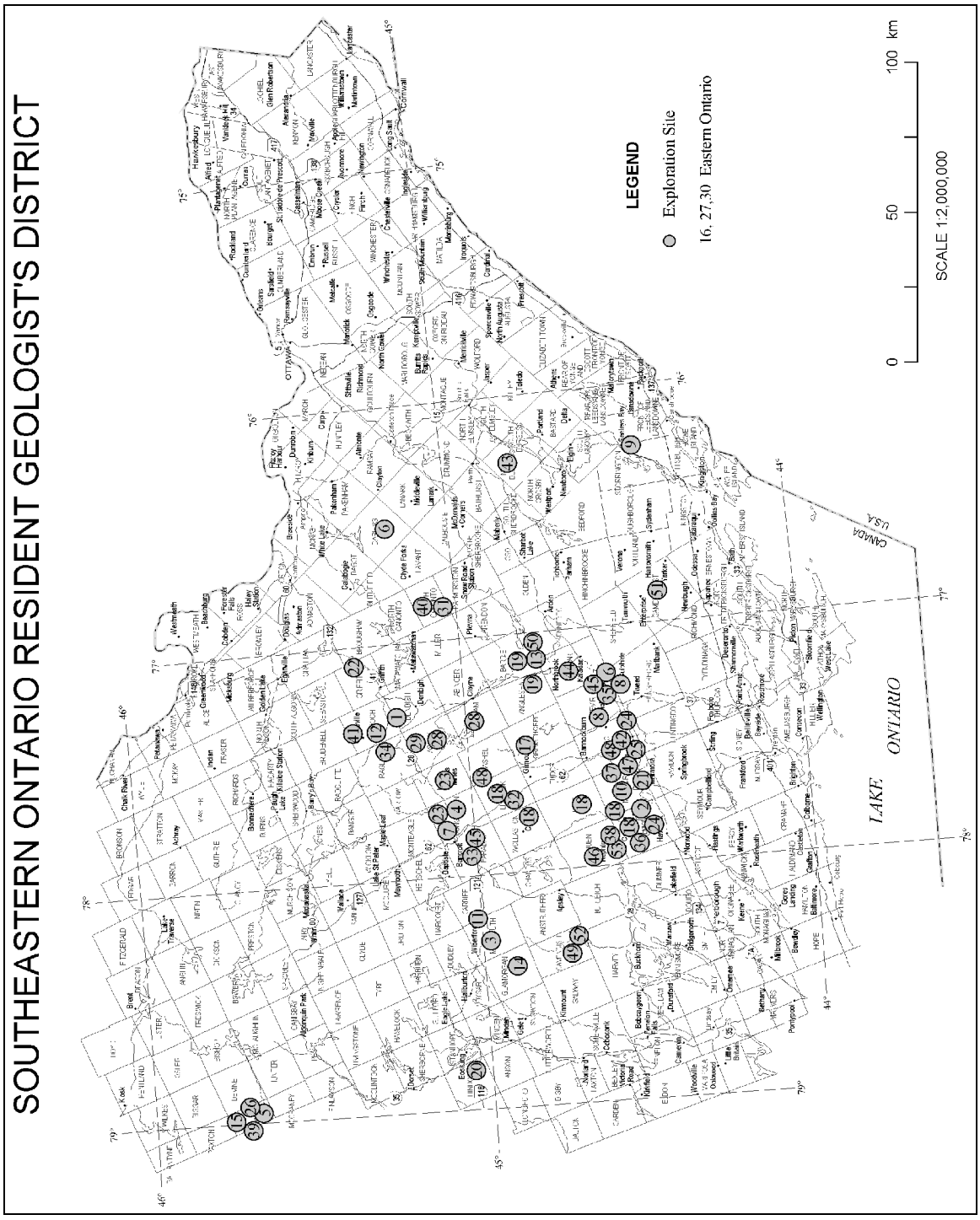

Figure 5. Exploration activity in the Southeastern Ontario District in 2010 (keyed to Table 5).

Nickel-Copper-Platinum Group Elements

FIRST NICKEL INC. – RAGLAN HILLS PROPERTY

The First Nickel Inc. exploration target is a Voisey's Bay–model nickel-copper-platinum group element deposit.

There has been only limited mineral exploration in Raglan Township area since it was first mapped by the Geological Survey of Canada in 1897. Until regional airborne geophysical surveys were completed by the company in 2008, there was no modern airborne geophysical coverage of the area.

The Raglan Hills metagabbro complex was first mapped in detail by Hewitt (1954), who identified pyroxenite and olivine pyroxenite portions of the predominantly gabbroic complex and suggested that the rock has potential as a host rock for magnetite ore. Subsequent exploration work within the complex resulted in the discovery of 2 zones of copper-nickel mineralization in Raglan Township: the Landolac and Raglan occurrences. The following descriptions are summarized from a report by Carter, Colvine and Meyn (1980).

In 1956, Landolac Mines Limited performed trenching and packsack diamond drilling on a zone of disseminated chalcopyrite and pyrrhotite in gabbro in lots 4 and 5, Concession 2. Grab samples gave assays of up to 1.5% Cu and 4.6% Ni. A chip sample across a 7.6 m width of the zone gave 0.21% Cu and 0.45% Ni.

Geological mapping, ground geophysical surveys and approximately 3000 m of diamond drilling was completed by Raglan Nickel Mines Ltd. in 1956. The company reported a diamond-drill hole intersection of 30 feet of 0.25% Cu and 0.32% Ni that included 4 feet of 0.77% Cu and 1.08% Ni.

Property

The property comprises 2752 ha held in 21 unpatented mining claims in Raglan, Mayo and Carlow townships. It is located approximately 32 km east-northeast of Bancroft, Ontario, and is accessed via unpaved roads connecting to Highway 28.

Geology

The Raglan Hills property is underlain by gneissic carbonate metasedimentary rocks, gneissic siliceous metasedimentary rocks and felsic to intermediate metavolcanic rocks, all intruded by sill-like bodies ranging in composition from granite to diorite. The main intrusive body within the property package is the Raglan Hills intrusion that consists of metagabbro with minor mafic and ultramafic schists. The units have been exposed to medium- to high-grade regional metamorphism. The area has undergone folding and recrystallization associated with the metamorphism with a northeast structural trend. The area is crosscut by several west-northwest- and northeast-trending brittle faults.

Mineralization

Four nickel-copper showings have been identified within the Raglan Hills intrusion hosted in metagabbro to metapyroxenite containing up to 30% pyrite, pyrrhotite, pentlandite and chalcopyrite. The 4 sulphide occurrences have been named the Landolac, Ameranium, Genricks Lake and Raglan showings.

Based on the association of nickel-copper sulphide mineralization with more mafic pyroxenite-bearing rocks, First Nickel believes potential exists for larger accumulations of nickel-copper sulphide mineralization within the conduit system that supplied the magma to the Raglan Hills intrusive complex.

Exploration

An airborne geophysical survey consisting of a magnetometer survey and AeroTEM III electromagnetic system was completed on the Raglan Hills property in early 2008. This is the first modern airborne electromagnetic survey of regional scope to be completed over Grenville Province rocks in southeastern Ontario. The data were acquired by the Ontario Geological Survey and released in 2010 (Ontario Geological Survey 2010a-e).

First Nickel Inc. completed a total of 1979 m of diamond drilling on the Raglan Hills property in 2009 to test 7 targets identified by the airborne survey. A new zone of platinum and palladium mineralization on the ML North target was discovered and the presence of nickel and copper mineralization on the Raglan Nickel Mines Ltd. showing was confirmed. Borehole UTEM® geophysical surveys were completed on all drill holes. Additional exploration is planned for 2011.

FIRST NICKEL INC. – HENDERSON PROPERTY

In 2009, First Nickel Inc. entered into an option agreement with Melchior Resources to explore that company's Henderson property immediately to the east of the Raglan Hills property in Raglan Township. In 2010, First Nickel undertook a 500 m diamond-drill program to test 3 conductive bodies defined by a surface TEM geophysical survey. Borehole TEM was completed on all 3 diamond-drill holes. No significant mineralization was identified by the diamond-drill program. Additional exploration is planned for 2011. (Sources: First Nickel Inc., www.FirstNickel.com: "Management's Discussion and Analysis Report for the Six Month Period ended June 30, 2010", August 5, 2010; and "Report for Nine Month Period ending September 30, 2010", November 10, 2010.)

FIRST NICKEL INC. – BELMONT PROPERTY

The Belmont project property comprises approximately 7000 ha in 81 unpatented mining claims in 12 separate blocks in Limerick, Wollaston, Lake, Marmora and Belmont townships. The unpatented mining claims staked encompass many documented nickel and copper occurrences and have the potential to host deposits similar to the Vale Voisey's Bay and Kennecott Eagle deposits.

A regional airborne geophysical survey consisting of approximately 6000 line-kilometres of magnetometer survey and AeroTEM III electromagnetic system was completed in 2008.

In 2009, diamond drilling, reconnaissance mapping and prospecting were completed on the property, including examination of historic nickel sulphide occurrences and the airborne electromagnetic anomalies sites. A total of 13 holes representing 2885 m of diamond drilling tested a total of 6 nickel-copper targets on the Belmont project in 2009. Drilling targeted coincident electromagnetic conductors with high magnetic responses identified in the 2008 airborne geophysical survey testing for feeder type ultramafic dikes. No significant results were observed in the 2009 diamond-drill program. Additional exploration is planned for 2011.

In 2010, the focus was on completion of assessment requirements on high-priority claims. Surface prospecting and sampling has been completed on selected claims. Low potential claims will be allowed to lapse. Additional claims were recorded in Limerick and Wollaston townships. Additional exploration is planned for 2011. (Sources: First Nickel Inc., www.FirstNickel.com: "Management's Discussion and Analysis Report for the Six Month Period ended June 30, 2010", August 5, 2010; and "Report for Nine Month Period ending September 30, 2010", November 10, 2010). Sangster et al. (2010) provides a detailed summary of exploration completed in 2009.

Molybdenum

GOLDEN PHOENIX MINERALS INC. – NORTHERN CHAMPION PROPERTY

The Northern Champion property consists of approximately 880 acres in Griffith and Brougham townships in Renfrew County, northeast of Bancroft. Historic records indicate that molybdenum was actively mined on the property during the last century. In 2006, Golden Phoenix Minerals Inc. acquired 5 unpatented mining claims totalling 22 units on the Northern Champion property together with a NI 43-101 Technical Report and Feasibility Study describing the molybdenum deposit within the area of the claims. A gross average grade of 3.75 pounds MoS_2 per ton or 0.19% MoS_2, inclusive of mined waste rock was reported (Burden 2005).

In early November 2010, the company announced that line cutting and geological mapping would be completed on the property to facilitate development efforts planned for 2011. Unfortunately, due to adverse weather conditions, only approximately 70% of the work was completed. Positive initial results were announced including the comment that the structure in larger than had originally been thought.

Once the mapping is complete, the company expects to begin Phase II planning for trenching, geochemical sampling and/or drilling of previously identified zones to the east of the current open-cut mine. An induced polarization anomaly to the north of the open-cut zone will also be investigated.

The company is exploring the opportunities to list in Canada and exploration activities planned for 2011 are fully funded (Golden Phoenix Minerals Inc., press release, November 4, 2010; teleconference, January 24, 2011).

Calcium Carbonate

MURRAY BROOK MINERALS INC. – WHITNEY CALCITE PROPERTY

In 2006, Murray Brook Minerals Inc. acquired 2 mining leases covering the Whitney calcite property in Belmont Township from Novagold Resources as part of a transaction that included the Murray Brook massive sulphide deposit in New Brunswick. The leases were due to expire in October, 2010, but were renewed by the company for another 21 year period after an inquiry into the exploration history of the property was made to the Southern Ontario Regional Resident Geologist's Office in Tweed.

The high-purity marble prospect was evaluated for industrial mineral potential in the late 1970s by Northumberland Mines and Preussag Canada Ltd. A report by Kilborn Limited (1976) stated reserve estimates of about 1.9 million tonnes of high-calcium marble and 4.7 million tonnes of calcitic/dolomitic marble, both zones containing less than 0.5% SiO_2 + Fe_2O_3 and averaging 93% brightness. A subsequent report by Canadian Bechtel Limited (1978) examined the feasibility of converting the Marmoraton iron mine processing plant to a high-purity calcium carbonate plant to process ore extracted from the Whitney property.

Murray Brook Minerals is currently reviewing reports of previous work done on the property in an attempt to determine its potential for development, possibly in partnership with a company experienced in industrial minerals production (J.J. Treyvaud, Murray Brook Minerals Inc., personal communication, November 2010). The Marmoraton plant site has most recently been used to process talc ore from the Canada Talc Mine at Madoc, which ceased operations in 2010, and is a potential site for processing marble from the Whitney property.

For detailed geology of the property, *see* "Property Examinations".

Iron

GOLDEN JAGUAR EXPLORATIONS LTD. – MAYO TOWNSHIP IRON

Golden Jaguar Explorations Ltd. has entered an option agreement with Freymond Lumber of Bancroft, owners of the mineral rights to a parcel of land in Mayo Township covering the Bessemer, Rankin and Childs iron deposits in Mayo Township. The Bessemer Mine was active from 1902 to 1913, producing about 100 000 tonnes of ore from both open pit and underground workings. At about the same time, the Rankin and Childs deposits produced a total of less than 10 000 tonnes of ore from open cuts (Shklanka 1968).

The deposits consist of magnetite-rich lenses in skarn zones within interlayered marble and paragneiss of the Dungannon Formation along the margin of the Bessemer granite. Frobisher Exploration Company Ltd. carried out exploration, including diamond drilling, on all 3 properties in 1941 and 1942. Ore reserves at the Bessemer Mine were estimated to be about 700 000 tonnes grading 42% iron. The Childs and Rankin properties were reported to contain larger deposits of lower grade material (Hewitt and James 1956). A report by Canadian Bechtel Limited, done in 1978 to examine the feasibility of producing high-grade magnetite products from the same 3 properties, estimated reserves at the Rankin and Childs deposits to be 15.7 million tonnes grading 15% iron and 6.2 million tonnes grading 19% iron, respectively.

In 2008, Royal Crown Ventures Group of Vancouver, BC, conducted magnetometer surveys and a diamond-drilling program on the property and reported reserves of 2.2 million tonnes containing 32% magnetite, or 1.45 million tonnes containing 43% magnetite. The total reserves of the Bessemer, Rankin and Childs deposits were estimated to

contain 27.5 million tonnes of magnetite. Exploration work proposed by Golden Jaguar Explorations for 2011 includes bulk sampling of the magnetite zones for evaluation as both iron ore and high-density aggregate (D. Maine, Golden Jaguar Explorations Ltd., personal communication, February 2011).

RESIDENT GEOLOGIST STAFF AND ACTIVITIES

The Southern Ontario Regional Resident Geologist, located in Tweed, is the only Resident Geologist Program office south of the French River. The office is staffed by P.J. Sangster, Regional Resident Geologist, P.S. LeBaron, District Geologist and D.A. Laidlaw, Regional Land Use Geologist. The position of Regional Geographic Information Specialist is currently vacant. A.C. Wilson holds the recently created position of Mineral Deposit Compilation Geologist – Northeast, based in Timmins and will have some ability to update and review the southern Ontario Mineral Deposit Inventory database. A detailed description of the activities of this position has been provided by A.C. Wilson and is included in this report.

Additional support was provided by S. Peelow, Administrative Assistant to the Senior Manager, Resident Geologist Program, Sudbury. J. Bremner provided on-call contract administrative assistance throughout the year and V.C. Papertzian was hired on an on-call contract basis to assist with upgrades to the Drill Core offsite and Drill Core database maintenance. Summer Experience Program students M. Reynolds and S. Haggerty provided field season support.

The Southern Ontario Regional Resident Geologist office in Tweed offers access to a complete collection of Ontario Geological Survey publications for southeastern and southwestern Ontario.

The Resident Geologist Program monitors, stimulates and facilitates mineral exploration and the sustainable development of Ontario's mineral resources. Program services and functions are grouped into key areas including

- geological consultation and advisory services to promote and stimulate mineral exploration
- public access to geoscience databases and other resource materials
- report on mineral exploration and development activity
- input into land-use planning issues and initiatives to maximize the land base available for mineral exploration and development
- public education forums to promote the mineral sector

The Southern Ontario Regional Resident Geologist Program also provides support to the ministry's Mining Lands Section (www.mndmf.gov.on.ca/mines/lands/default_e.asp) front-counter client services and works with the MNDMF Aboriginal Relations Unit to assist in fostering relations between the mineral industry and First Nation communities (www.mndmf.gov.on.ca/mines/aboriginal_relations_unit/fnminerals_e.asp).

Staff of the Southern Ontario Regional Resident Geologist's Office (Tweed) assisted in the development and presentation of the Ontario booth at the Prospectors and Developers Association of Canada Annual Convention in Toronto and the Resident Geologist Program poster presentation at the Ontario Exploration and Geoscience Symposium in Sudbury.

In April, the Resident Geologist gave presentations to the Northwestern Ontario Mines and Minerals Symposium and the Northeastern Ontario Mines and Minerals Symposium in Thunder Bay and Sault Ste. Marie, respectively. In October, the Resident Geologist and Regional Land Use Geologist – Northeast Region presented a weekend poster session and talks to several hundred elementary school students as part of the Ancaster Gem and Mineral Show.

In June, the Resident Geologist joined Peter Russell, University of Waterloo, in a dimension stone study of the Cambridge area in southwestern Ontario. A "podcast" (i.e., online media broadcast) was created for the dimension stone of Galt and a future survey is planned for the Perth area in southeastern Ontario. In a related project, the Resident Geologist provided technical support and information to the Rideau Canal World Heritage project and the Murphy's Point Silver Queen Mica Mine project.

In March, the District Geologist presented a poster at the Sustainable Living Symposium hosted by Quinte Conservation at Loyalist College in Belleville. The booth featured the use of Ontario building stone and other mineral-based products (brick, cement, gypsum wall-board) that qualify for Leadership in Energy and Environmental Design (LEED) points in construction projects.

Other presentations by the District Geologist in 2010 included a display of industrial minerals and their uses in association with a quarry tour and information session given by MRT Aggregates to the Kasshabog Lake Cottagers' Association; a talk on the history and art of carving gemstones, at the Bancroft Gemboree; a field trip for 10 local stone sculptors to several stone quarries in southeastern Ontario in October; and an oral presentation on Mineral Resources of Southern Ontario prepared by the Regional Resident Geologist, at the Ontario Exploration and Geoscience Symposium in Sudbury.

On the Civic Holiday weekend, staff from the RGP–Tweed office presented a booth highlighting Ontario diamond occurrences and the new diamond industry at the 2010 Bancroft Gemboree. The four-day event traditionally hosts 8000 to 10 000 attendees.

Table 6 provides a five-year summary of program activity and Table 7 lists new publications added to the Resident Geologist Program office technical library (in Tweed) during 2010.

Algonquins of Ontario

The Algonquins of Pikwàkanagàn (www.tanakiwin.com/about.htm##) received a Crown Patent in 1873 and became the Golden Lake First Nation. There are an additional 9 Algonquin First Nations in southeastern Ontario including Shabot Obaadjiwan (Sharbot Lake), Greater Golden Lake, Antoine, Bancroft, Ottawa, Mattawa/North Bay, Snimikobi (Ardoch) and Bonnechere. The Algonquins of Ontario assert that they have Aboriginal rights and title that have never been extinguished, and that they have continuing ownership to the Ottawa River watershed in Ontario and its natural resources (www.aboriginalaffairs.gov.on.ca). During 2010, the Regional Resident Geologist worked as a technical expert, with staff of the Aboriginal Relations Unit, Ministry of Northern Development, Mines and Forestry, in a series of the meetings with the Algonquins of Ontario.

Diamond Drill Hole Database – 2010 Activities

The Resident Geologist Office maintains a drill core storage compound on Hunt Road approximately 2 km south of the Village of Tweed. In additional to core stored on traditional core racks, the site houses over 200 000 m of irreplaceable drill core from southern Ontario stacked on wooden pallets.

In 2010, 275 industry client visits were recorded to Drill Core offsite and onsite facilities in Tweed. During the summer, the Municipality of Tweed completed road maintenance and tree cutting along the Hunt Road frontage to the offsite area that has improved site functionality. A new culvert and gravel fill were installed that also improved site longevity and functionality.

V.C. Papertzian, former Drill Core Library Geologist, was hired on an on-call contract basis to assist in the rehabilitation of the site.

Some of the drill core is from exploration completed more than 40 years ago and was stacked on wooden pallets when the offsite facility was created.

An additional 1200 boxes of diamond-drill core were donated by the estate of C. Roger Young for the Tweed Drill Core Library. Most of the core is from the Cooper talc and Cooper gold prospect in Madoc Township. Drill core facilities were used from March to October by Upper Canada Gold Corporation for drill core examination and sampling. Drill core, from the Dingman gold prospect, has been integrated into the Tweed drill core database. A section of the offsite drill core storage area was levelled and 20 new core racks were installed to accommodate the additional drill core. Approximately 14 000 m of drill core was added to the Tweed Drill Core Library database in 2010.

Recent Changes to Government Policy and Legislation

Recent and ongoing changes to government legislation have come about in response to public concerns related to land ownership, health and safety, environment and clean energy. Legislation and policies have been developed, or are in the process of being developed, to address the following issues: land tenure, protection of species at risk and reversal of loss of habitats, improvement and reversal of loss of biodiversity in species, protection of drinking water quality, protection of source water and conservation of energy through the development of clean and renewable energy sources. By raising awareness of recent changes, prospectors and members of the mining industry will be provided with relevant information regarding regulatory requirements. Some of the issues related to new legislation are as follows:

- *Mining Amendment Act, 2009* is new legislation that modernizes the mineral development process, through amendments to the *Mining Act*, related regulations and policies. The Ministry of Northern Development, Mines and Forestry has consulted and will continue to work with Aboriginal communities and organizations and stakeholder groups in the development of related regulations. Anticipated changes to the Act within the next year will include introduction of a paper-staking system in southern Ontario, surface rights holders will be able to apply for exemptions from Mining Land tax under certain circumstances such as when the land is not being used for mining and new protection for sites of Aboriginal cultural significance. By 2012, a graduated exploration permitting system will be introduced and online claim staking is contemplated for 2013.
- Ontario's *Endangered Species Act, 2007* (ESA 2007) and Canada's *Species at Risk Act* (SARA 2002) provide for the protection of species-at-risk and their habitats. In Ontario, strategies to protect and recover species that are threatened or endangered have been developed to protect and restore populations. One example of an endangered species in southern Ontario is the butternut tree. Early consultation with the Ministry of Natural Resources to identify areas having high potential for containing the habitat of endangered or threatened species is recommended when planning a site alteration or development.
- In response to the need to protect and recover species that are threatened or endangered, the Ontario's Biodiversity Strategy was developed in 2005. The strategy includes a set of principles, goals and actions to conserve Ontario's biodiversity. In 2010, a review and renewal of the strategy was initiated to ensure that legislation and policy were up-to-date and to propose new strategic direction. One proposal for new direction is to enhance resilience by the protection of representative ecosystem types to achieve 17% target by 2020 as resolved by a decision made at the 2010 United Nations Convention on Biological Diversity in Nagoya, Japan (Convention on Biological Diversity, www.cbd.int/decision/cop/?id=12268).
- The Ministry of the Environment (MOE) administers the *Clean Water Act, 2006*, which helps protect drinking water from source to tap. The goal of this legislation is to prevent contaminants from entering drinking water at the source including lakes, rivers and aquifers. Further information and permit requirements may be attained by consulting with the Ministry of the Environment.
- The *Green Energy Act, 2009* is also administered by the Ministry of Environment. It was introduced to encourage energy conservation and develop alternate renewable energy sources. Nontraditional metals such as rare element and rare earth element minerals are important components of the emerging "Green" economy. Rare earth magnets, the world's strongest permanent magnets allow wind turbines to generate electricity. Rechargeable batteries containing cerium and lanthanum are used in hybrid and electric vehicles. Market demand for rare earth oxides is expected to increase to 2 million tonnes by 2025 to meet the requirements of hybrid, electric and hydrogen vehicles. Exploration for these commodities has seen increased activity in 2010.

Table 6. Program activity statistics for Southern Ontario Regional Resident Geologist office in Tweed, 2006–2010.

Activity	2006	2007	2008	2009	2010
Field Investigations / Property Visits	31	29	39	32	41
Field Trips Given / Field Guide Written	1	3	3	3	3
MDI Records Revised	183	623	362	61	125
Presentations to Ministry of Municipal Affairs and Housing, Ministry of Natural Resources, Ministry of Aboriginal Affairs	2	3	7	1	5
Clients Visits to RGP–Tweed Office	455	379	354	343	449
Drill Core Library Users	56	70	60	55	275
Client Communications / Interactions (Presentations/Poster Sessions)	>3000	>3000	>3000	>3000	>3000
OGS Publications Sold	129	136	33	47	47
Prospector's Licences Sold	10	21	17	30	9
Claim / Line Tags Sold	86	701	167	238	88

Table 7. Library acquisitions in 2010 by the Southeastern Ontario District (OGS publications of particular interest to the Southeastern Ontario District are shown in bold).

Title	Author	Type and Year of Publication
Summary of Field Work and Other Activities, 2010	**Ayer, J.A., Easton, R.M., Beakhouse, G.P., Stott, G.M., Kelly, R.I., Debicki, E.J., Parker, J.R. and Brown, T. (eds.)**	**Ontario Geological Survey, Open File Report 6260, 410p., 2010**
Index to Maps, Surficial Geology, 1991–2009, Southern Sheet	**Publication Services Section, Ontario Geological Survey**	**Ontario Geological Survey, scale 1:1 000 000, 2010**
Index to Maps, Bedrock Geology, 1991–2009, Southern Sheet	**Publication Services Section, Ontario Geological Survey**	**Ontario Geological Survey, scale 1:1 000 000, 2010**
Report of Activities 2009, Resident Geologist Program, Red Lake Regional Resident Geologist Report: Red Lake and Kenora Districts	Lichtblau, A., Ravnaas, C., Storey, C.C., Lockwood, H.C., Bongfeldt, J. and McDonald, S.	Ontario Geological Survey, Open File Report 6244, 77p., 2010
Report of Activities 2009, Resident Geologist Program, Thunder Bay North Regional Resident Geologist Report: Thunder Bay North District	Smyk, M.C., White, G.D. and Lockwood, H.C.	Ontario Geological Survey, Open File Report 6245, 48p., 2010
Report of Activities 2009, Resident Geologist Program, Thunder Bay South Regional Resident Geologist Report: Thunder Bay South District	Scott, J.F., Campbell, D.A., Lockwood, H.C., Brunelle, M.R. and Pelaia, R.	Ontario Geological Survey, Open File Report 6246, 90p., 2010
Report of Activities 2009, Resident Geologist Program, Timmins Regional Resident Geologist Report: Timmins and Sault Ste. Marie Districts	Atkinson, B.T., Pace, A., Beauchamp, S.A., Bousquet, P., Butorac, S., Draper, D.M. and Wilson, A.C.	Ontario Geological Survey, Open File Report 6247, 99p., 2010
Report of Activities 2009, Resident Geologist Program, Kirkland Lake Regional Resident Geologist Report: Kirkland Lake District	Guindon, D.L., Grabowski, G.P.B., Wilson, A.C. and van Zeyl, D.P.	Ontario Geological Survey, Open File Report 6248, 54p., 2010
Report of Activities 2009, Resident Geologist Program, Kirkland Lake Regional Resident Geologist Report: Sudbury District	Cosec, M., Farrow, D., Bardeggia, L.A. and Kitching, J.	Ontario Geological Survey, Open File Report 6249, 48p., 2010
Report of Activities 2009, Resident Geologist Program, Southern Ontario Regional Resident Geologist Report: Southeastern and Southwestern Ontario Districts, Mines and Minerals Information Centre, and Petroleum Resources Centre	**Sangster, P.J., Laidlaw, D.A., LeBaron, P.S., Carter, T.R., Fortner, L. and Lee, C.R.**	**Ontario Geological Survey, Open File Report 6250, 55p., 2010**
Surficial Geology of Southern Ontario	**Ontario Geological Survey**	**Ontario Geological Survey, Miscellaneous Release—Data 128 – Revised, 2010, 1 DVD**
Aggregate Resources Inventory of the Regional Municipality of Durham, Southern Ontario	**Rowell, D.J.**	**Ontario Geological Survey, Aggregate Resources Inventory Paper 185, 55p, 2010**

Title	Author	Type and Year of Publication
Aggregate Resources Inventory of the District Municipality of Muskoka	**Gao, C.**	**Ontario Geological Survey, Aggregate Resources Inventory Paper 182, 52p, 2010**
Aggregate Resources Inventory of the Regional Municipality of York, Southern Ontario	**Rowell, D.J. and Gao, C.**	**Ontario Geological Survey, Aggregate Resources Inventory Paper 179, 48p, 2010**
Airborne Magnetic and Electromagnetic Survey, Colour-filled Contours of the Residual Magnetic Field and Electromagnetic Anomalies, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 149, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Survey, Colour-filled Contours of the Residual Magnetic Field and Electromagnetic Anomalies, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 150, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Survey, Colour-filled Contours of the Residual Magnetic Field and Electromagnetic Anomalies, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 151, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Survey, Colour-filled Contours of the Residual Magnetic Field and Electromagnetic Anomalies, Bancroft Area-Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 152, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Survey, Colour-filled Contours of the Residual Magnetic Field and Electromagnetic Anomalies, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 153, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Surveys, Colour-filled Contours of the Apparent Conductance and Electromagnetic Anomalies, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 154, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Surveys, Colour-filled Contours of the Apparent Conductance and Electromagnetic Anomalies, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 155, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Surveys, Colour-filled Contours of the Apparent Conductance and Electromagnetic Anomalies, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 156, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Surveys, Colour-filled Contours of the Apparent Conductance and Electromagnetic Anomalies, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 157, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Surveys, Colour-filled Contours of the Apparent Conductance and Electromagnetic Anomalies, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 158, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Surveys, Colour-filled Contours of the EM Decay Constant and Electromagnetic Anomalies, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 159, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Surveys, Colour-filled Contours of the EM Decay Constant and Electromagnetic Anomalies, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 160, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Surveys, Colour-filled Contours of the EM Decay Constant and Electromagnetic Anomalies, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 161, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Surveys, Colour-filled Contours of the EM Decay Constant and Electromagnetic Anomalies, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 162, scale 1:20 000, 2010**

Title	Author	Type and Year of Publication
Airborne Magnetic and Electromagnetic Surveys, Colour-filled Contours of the EM Decay Constant and Electromagnetic Anomalies, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 163, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Surveys, Shaded Colour Image of the Second Vertical Derivative of the Residual Magnetic Field and Keating Coefficients, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 164, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Surveys, Shaded Colour Image of the Second Vertical Derivative of the Residual Magnetic Field and Keating Coefficients, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 165, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Surveys, Shaded Colour Image of the Second Vertical Derivative of the Residual Magnetic Field and Keating Coefficients, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 166, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Surveys, Shaded Colour Image of the Second Vertical Derivative of the Residual Magnetic Field and Keating Coefficients, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 167, scale 1:20 000, 2010**
Airborne Magnetic and Electromagnetic Surveys, Shaded Colour Image of the Second Vertical Derivative of the Residual Magnetic Field and Keating Coefficients, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Map 60 168, scale 1:20 000, 2010**
Ontario Airborne Geophysical Surveys, Magnetic and Electromagnetic Data, Grid and Profile Data (ASCII and Geosoft® Formats) and Vector Data, Bancroft Area—Purchased Data	**Ontario Geological Survey**	**Ontario Geological Survey, Geophysical Data Set 1234, 2010, 1 DVD**
Aggregate Resources Inventory of the City of Hamilton, Southern Ontario	**Marich, A.S.**	**Ontario Geological Survey, Aggregate Resources Inventory Paper 181, 40p., 2010**
Aggregate Resources Inventory of the County of Hastings, Southern Ontario	**Rowell, D.J.**	**Ontario Geological Survey, Aggregate Resources Inventory Paper 186, 86p., 2010**
The Subsurface Paleozoic Stratigraphy of Southern Ontario	**Armstrong, D.K. and Carter, T.R.**	**Ontario Geological Survey, Special Volume 7, 302p, 2010**
Ontario Mineral and Exploration Statistics – 2009 / 2009 Statistiques minières et d'exploration de l'Ontario	Kitching, J. and Greenwell, B.	Ontario Ministry of Northern Development, Mines and Forestry, 54p, 2010
Mineral Deposit Inventory – 2010	Ontario Geological Survey	Ontario Geological Survey, 2010, 1 CD
Precambrian Geology of Cavendish Township and Environs, Grenville Province	**Easton, R.M.**	**Ontario Geological Survey, Preliminary Map P.3605, scale 1:20 000, 2010**
Geological, Geochemical and Geophysical Data from Cavendish Township, Grenville Province, Ontario	**Easton, R.M.**	**Ontario Geological Survey, Miscellaneous Release—Data 240, 2010, 1 DVD**
Canadian & American Mines Handbook – 2010–2011	Giancola, D. (ed.)	BIG Magazines LP, Toronto, 816p., 2010
Canadian & American Mines Handbook – 2009–2010	Giancola, D. (ed.)	Business Information Group, Toronto, 800p, 2009
Hydrostratigraphic Model of the South Nation Watershed Region, Southeastern Ontario	Logan, C., Cummings, D.I., Pullan, S., Pugin, A., Russell, H.A.J. and Sharpe, D.R.	Geological Survey of Canada, Open File 6206, 2009, 1 DVD
Great Northern Ontario Mines	Barnes, M.	General Store Publishing House, Burnstown, Ontario, 138p., 1998
Metallogenesis and Tectonics of the Russian Far East, Alaska, and the Canadian Cordillera	Hendley, J.W., II (ed.)	United States Geological Survey, Professional Paper 1697, 397p., 2005

PROPERTY EXAMINATIONS

In 2010, a total of 39 property visits were conducted by staff of the Southeastern Ontario and Southwestern Ontario districts (Table 8; Figure 6).

Table 8. Property visits conducted by the Southern Ontario Regional Resident Geologist and staff in 2010 (keyed to Figures 6 and 7).

No.	Property/Operation	Commodity
	Southeastern and Southwestern Ontario	
1	Richardson Fission mine, Cardiff Township	U, REE
2	Tonkin, Cardiff Township	Graphite
3	Amalgamated Rare Earth prospect rehabilitated site, Monmouth Township	U, REE
4	McDonald mine, Monteagle Township	Feldspar, Mineral Specimens
5	Calabogie mine, Bagot Township	Magnetite
6	Marmoraton mine, Marmora Township	Magnetite
7	Wolfe Island, Kingston area	Limestone
8	Canada Talc mine, Huntingdon Township	Talc
9	Milligan prospect, Elzevir Township	Soapstone
10	Upper Canada Stone Co. Ltd. processing plant, Madoc Township	Marble
11	Scotch Settlement Rd. quarry, Madoc Township	Marble (chocolate)
12	International quartz, McClintock Township	Quartz
13	Tweed Marble quarry, Hungerford Township	Marble, Dimension Stone
14	Carbroc quarry, Elzevir Township	Dolomite
15	OMYA Canada Inc., Tatlock quarry, Darling Township	Calcitic Marble
16	AECON, Marmora Township	Limestone
17	Westport area, North Burgess Township	Scientific Interest
18	Canada Talc, dolomite quarry, Huntingdon Township	Dolomite Mineral Filler
19	Tomclid (Ferromin) mine, South Canonto Township	Magnetite
20	Perry mine, Madoc Township	Fluorite (mine hazard)
21	MRT Aggregates, Methuen Township	Trap Rock
22	IKO Industries Ltd. quarry, Madoc Township	Trap Rock
23	Dominion Mine, Madoc Township	Iron
24	Tyendinaga caverns and caves, Tyendinaga Township	Scientific Interest
25	Whitney occurrence, Belmont Township	Calcitic Marble
26	Mono Gold prospect, Madoc Township	Gold
27	Staffa quarry, Hibbert Township	Aggregate
28	Galt, North Dumfries Township	Dimension Stone
29	Preston, Waterloo Township	Dimension Stone
30	Stone Cottage Industries quarry, Rama Township	Ledgerock
31	St. George, South Dumfries Township	Dimension Stone
32	Credit Valley quarries, Chinguacousy Township	Dimension Stone (Sandstone)
33	Bowmanville quarry, Darlington Township	Cement
34	East Madoc quarry, Madoc Township	Marble
35	JC Rock Crookston Quarry, Huntingdon Township	Limestone, Dimension Stone
	Outside Southeastern Ontario and Southwestern Ontario Districts	
	Mote quarry, Garrow Township	Dimension Stone
	Unimin quarry, Badgeley Island area	Silica
	NaturStone quarry, McAusland Township	Dimension Stone
	Root River quarry, Taretorus Township	Dimension Stone

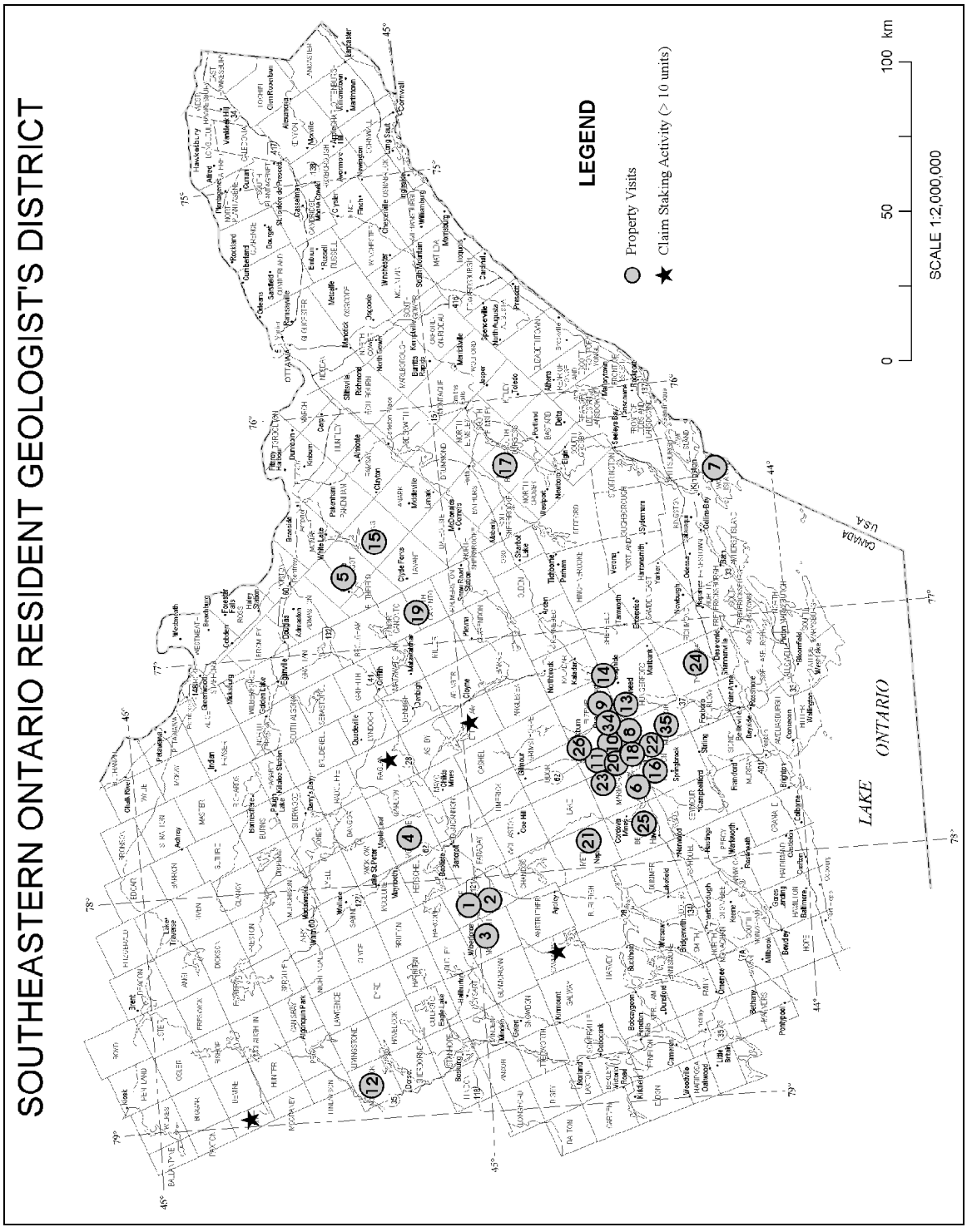

Figure 6. Property visits (keyed to Table 8) and claim staking activity in the Southeastern Ontario District in 2010.

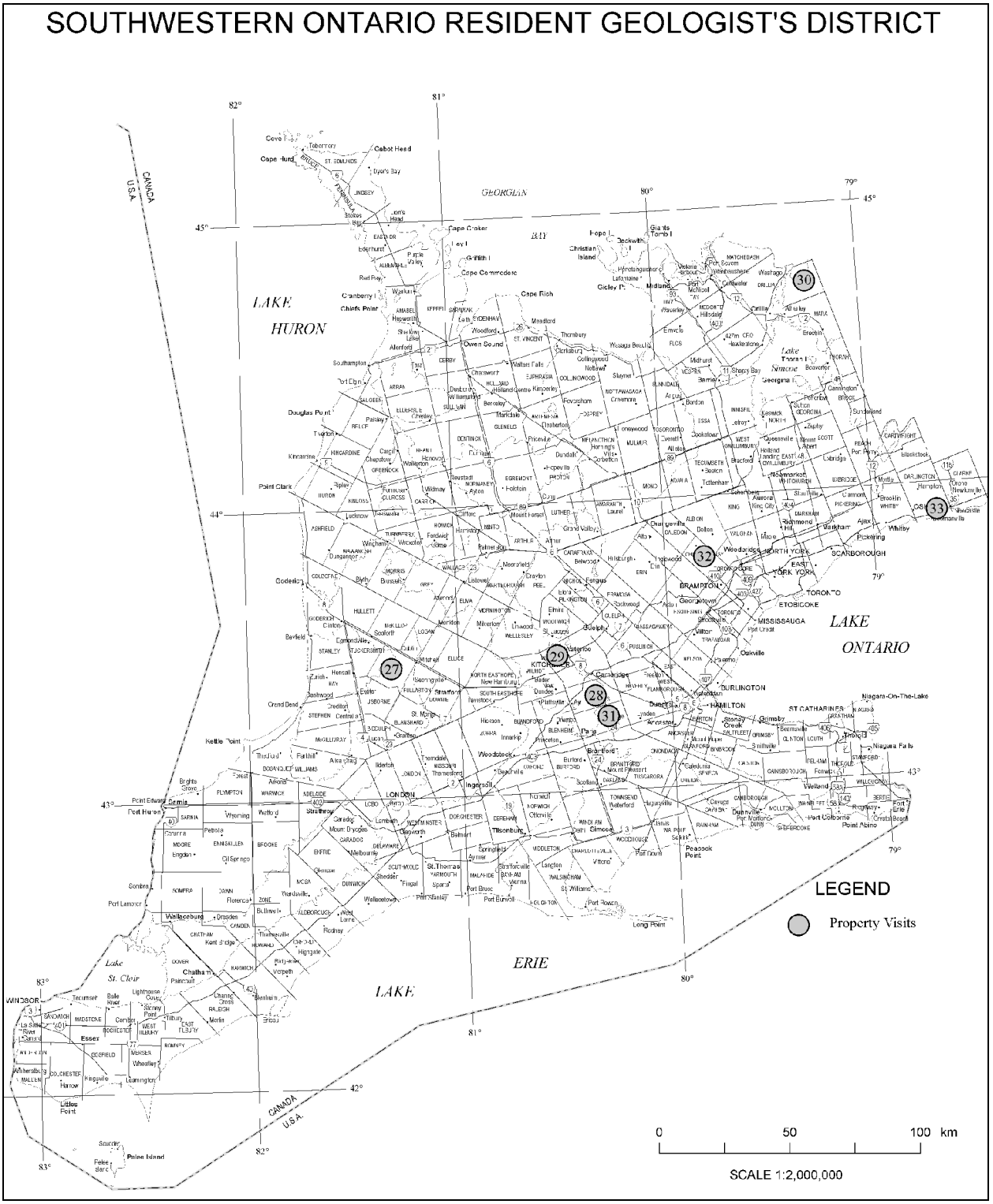

Figure 7. Property visits and claim staking activity in Southwestern Ontario District in 2010 (keyed to Table 8).

International Quartz Property

In June 2010, the Regional Resident Geologist accompanied J. Schosser, Ministry of Natural Resources Aggregate Resources Officer, on a visit to the International Quartz property in McClintock Township (Figure 8). At the quarry, we were met by Mr. Floyd Jones, aggregate licencee and claim holder.

LOCATION AND ACCESS

The property comprises 3 leased mining claims and 2 unpatented mining claims totalling 5 claim units covering the south half of Concession VII, lots 22 to 24 and the north half of Concession VI, lots 23 and 24, McClintock Township. International Quartz holds an aggregate permit for a 0.31 ha area on Concession VII, lots 23 and 24. The quarry site is located at UTM co-ordinates 671504E 5024066N, Zone 17. The permit has a maximum annual tonnage of 5000 t.

The site can be accessed by taking Highway 35 north from the Village of Dorset approximately 1 km to the junction with County Road 12. County Road 12 is followed north past lower Fletcher Lake for a distance of 13.2 km to Hydon Road. Hydon Road is taken for approximately 250 m to a haul road that follows the north shore of Fletcher Lake to end at the quarry site.

EXPLORATION HISTORY

Ownership 1989 to present (as of February 9, 2011): Mr. Floyd E. Jones holds mining leases and unpatented claims as well as permit under *Aggregate Resources Act*.

Additional information from assessment files, Southern Ontario Regional Resident Geologist Office, Tweed:

- 1990–1995: Documentation of manual and mechanical stripping, drilling and blasting to sample quartz vein was submitted to meet assessment work requirements to hold claims in good standing.
- 2001: In May, 5 diamond-drill holes, totalling 120 m, were drilled from the quarry floor to test the continuity of the quartz zone. Drilling results indicate that the deposit is typical zoned pegmatite consisting of a central quartz core surrounded by zones of coarse feldspar. The central quartz core is of exceptional purity. The report also identifies the host rock as foliated biotite gneiss and probable mafic orthogneiss. Diamond-drill core from this drilling program is on file with the Southern Ontario Regional Resident Geologist Office in Tweed.
- 2003: Documentation of additional power stripping was submitted to meet assessment work requirements to hold claims in good standing.

Figure 8. International Quartz quarry, McClintock Township, 2010, showing high-purity silica zone.

GEOLOGY

McAuley (1996) provides a detailed description of the geology of the site. The mineralization has been described variously as a vein quartz or pegmatite-related deposit. Additional observations are provided by Martin (1983), Goad (1990) and Sangster et al. (1999). There has not been any geological mapping completed over the claim group. The extent and/or continuity of the quartz mineralization, apart from the exposed quarry area, are unknown.

A stockpile of quartz boulders has been removed since McAuley visited the site in 1995 and the owner reports that "black granite" has been sold to local users for landscaping and road fill on an on-demand basis.

This site produced the highest average normalized SiO_2 values of any site tested during a 1995 Ontario Geological Survey study to evaluate high-purity silica sources across the province. It is thought that, with some beneficiation, it could produce very high-purity silica specifications (McAuley 1996).

There does not appear to have been any significant removal of material from the site since it was last visited by the author in 1999. Mr. Jones has decided to retire from the business and, in 2010, put the quarry and claims up for sale. The current growing demand for high-purity silica makes this relatively unexplored and untested prospect an interesting target for further work.

Murray Brook Minerals Inc. – Whitney Prospect

In October 2010, the District Geologist accompanied J. Treyvaud and I. Valiquette of Murray Brook Minerals Inc. on an examination of the company's high-purity marble prospect in the vicinity of a test quarry excavated by previous owners in the 1970s.

LOCATION AND ACCESS

The property consists of 2 mining leases, 106093 and 106094 (formerly EO28495 and EO28496), in Concession VI, Lot 31, Belmont Township, Peterborough County, about 500 m north of Little Whitney Lake. The test quarry is located about 200 m west of County Road 46 at a point 18.5 km north of its intersection with Highway 7 at Havelock. The UTM co-ordinates of the quarry are 270764E 4939726N, Zone 18.

EXPLORATION HISTORY

The property was staked as a high-purity marble prospect and was taken to lease after geological mapping, diamond drilling and minor test quarrying by local prospectors C. Roger Young and J.D. Cumming in the 1960s.

In 1975, Northumberland Mines Limited optioned the property and completed geological mapping, diamond drilling, and beneficiation tests on an 18 tonne bulk sample. A report prepared for the company by Kilborn Limited (1976) estimated reserves at about 1.9 million tonnes of high-calcium marble and 4.7 million tonnes of combined high-calcium/dolomite marble. The company also conducted both dry and flotation beneficiation tests, the results of which are described below.

Between 1977 and 1980, the property was optioned to Englehard Minerals and Chemicals Corp. and Preussag Canada Ltd. Both companies completed limited diamond-drilling programs, but did not report revised reserve estimates. However, a feasibility study done for Northumberland Mines in 1978, which includes the results of additional drilling done in 1978, reports high-calcium reserves of about 1.9 million tonnes, in agreement with the Kilborn Limited (1976) report (Canadian Bechtel Limited 1978).

Northumberland Mines acquired 100% ownership of the property in 1978. The company was taken over by Novagold Resources in 1988. In 2006, Murray Brook Minerals Inc. acquired the Whitney property from Novagold as part of a package that included the Murray Brook massive sulphide deposit in New Brunswick and, in 2010, began reviewing reports of past work as part of an evaluation of the industrial mineral potential of the property.

GEOLOGY

The property lies within an area of metavolcanic and siliceous metasedimentary rocks and marbles of the Belmont domain, a subdivision of the Elzevir terrane in the Central Metasedimentary Belt. Metamorphic grade is lower greenschist to upper amphibolite. The geology of the area is described in Bartlett and Moore (1985) and is shown by Lumbers and Vertolli (2000).

Within the immediate area of the Whitney property, a narrow, northeasterly trending marble belt has been tectonically thickened to a width of about 1 km in the core of an easterly plunging syncline. The belt is flanked by mafic and felsic metavolcanic rocks to the east and west (Bartlett and Moore 1985). The marble zones of interest lie west of Road 46 on mining lease EO28495, with high-calcite marble in the northern part of the claim and interlayered calcitic-dolomitic marble in the southern part.

The marble units strike 055 to 060° and dip vertically to steeply southward. Relatively impure, dolomitic marble is well exposed in rock cuts along Road 46 south of a gated access road that leads to a hunting camp located about 50 m west of the test quarry. These rocks are medium to coarse grained, white to grey, buff-weathering and exhibit metre-scale variations in silicate content – predominantly quartz lenses, phlogopite disseminations and tremolite aggregates. Tremolite crystals in radial fan-like aggregates up to several centimetres long are common.

West of Road 46, a ridge, from 5 to 10 m high and about 200 m wide, trends northeasterly across the property. The eastern half of the ridge is wooded and has relatively low exposure of dolomitic marble outcrops. Toward the western side of the top of the ridge, more calcite-rich marble is exposed as smooth, dark grey-weathering outcrops lacking the banding and differential weathering of the impure dolomitic marble. On fresh surface, the calcitic marble is medium grained, white and equigranular with few silicate impurities (phlogopite, tremolite).

The test quarry in the west side of the ridge at the base of the slope is an open cut about 7 m long and 5 m wide with a maximum wall height of 3 m. The exposed rock is high-purity, calcitic marble. One narrow (5 cm) rusty seam containing pyrite and minor chalcopyrite was observed at the eastern end of the cut. The exposed width of the high-purity calcitic zone is about 20 m. However, this apparently represents only the eastern margin of the zone, which extends westward beneath overburden and is indicated by diamond drilling by Northumberland Mines to be about 70 m wide and 350 m long to a depth of at least 70 m (Kilborn Limited 1976).

Diamond-drill core from the property, drilled by Preussag Canada Limited in 1980 and stored at the Tweed Drill Core Library, was also examined. Substantial widths (up to 30 m) of both high-purity calcitic and dolomitic marbles were observed, separated by impure zones containing various amounts of quartz, phlogopite, tremolite, serpentine, hematite, graphite and pyrite.

Although surface exposures and diamond drilling indicate that zones of high-purity calcitic and dolomitic marble are present, additional drilling may be required to accurately define high-grade zones. In a review of reserve calculations, Canadian Bechtel Limited (1978) stated that, while sufficient to establish an indicated reserve of calcium and magnesium carbonates, the work done to that date was insufficient to establish with assurance the positions and extents of high-grade zones in the deposit. However, the report also states that at least 400 000 t of high-purity marble could be located easily by drilling closely spaced, short holes in areas of previous high-grade intersections.

BENEFICIATION AND POTENTIAL APPLICATIONS

The Kilborn Limited (1976) report describes the results of beneficiation tests done on drill-core samples from the property. Average brightness of drill-core samples without flotation beneficiation was 90, and with flotation was 93. Many applications for ground calcium carbonate, such as animal feed, tile, sealant, putty, joint compound and carpet backing do not require brightness of more than 90. Specialty applications such as paint, paper as plastics require ground calcium carbonate products of higher chemical purity, brightness and whiteness obtained by the removal of silica and iron from the ground marble by flotation beneficiation. Based upon requirements of the industry and the results of beneficiation tests, the report concluded that high-purity marble from the Whitney property has potential applications in tile filler, sealant and putty, carpet and joint compound, adhesives, ceramics, plastics, rubber, stucco, paint and paper. In addition, both high-grade and lower grade material have potential applications in precast concrete, landscaping stone and decorative aggregate.

RECOMMENDATIONS FOR EXPLORATION

Gold and Iron Oxide-Hosted Rare Earth Element Potential, Deloro Granite Area, Southeastern Ontario

The Deloro granite occupies the western half of a roughly circular structure about 10 km in diameter in Madoc and Marmora townships (Figure 9). The eastern half of the structure was mapped by Hewitt (1968) as metavolcanic rock (andesite and rhyolite), overlain in part by Ordovician limestone. However, Easton (1989) reinterpreted the metavolcanic rocks as a combination of fine-grained intrusive rocks related to the Deloro granite and silicified and altered metasedimentary rocks, suggesting that the granite occupies more of the eastern half of the structure than previously shown, either at surface or at a shallow depth.

The intrusion is associated with a range of mineralization types and minor element enrichment, described in Sangster et al. (2008) in the section "Iron Oxide-Copper-Gold Potential, Deloro Granite, Southeastern Ontario". It is part of the Methuen suite of alaskitic, anorogenic granites emplaced between 1250 and 1240 Ma in the Central Metasedimentary Belt of the Grenville Province (Easton 1992). It is a complex intrusion, including granitic, syenitic and gabbroic phases, relatively enriched in REE and fluoride, and exhibits evidence of postmagmatic, hydrothermal albitization (Abdel-Rahman and Martin 1987). Deposits of gold, barite-fluorite, iron and copper are associated with the Deloro granite and smaller satellite bodies of granite, syenite and diorite.

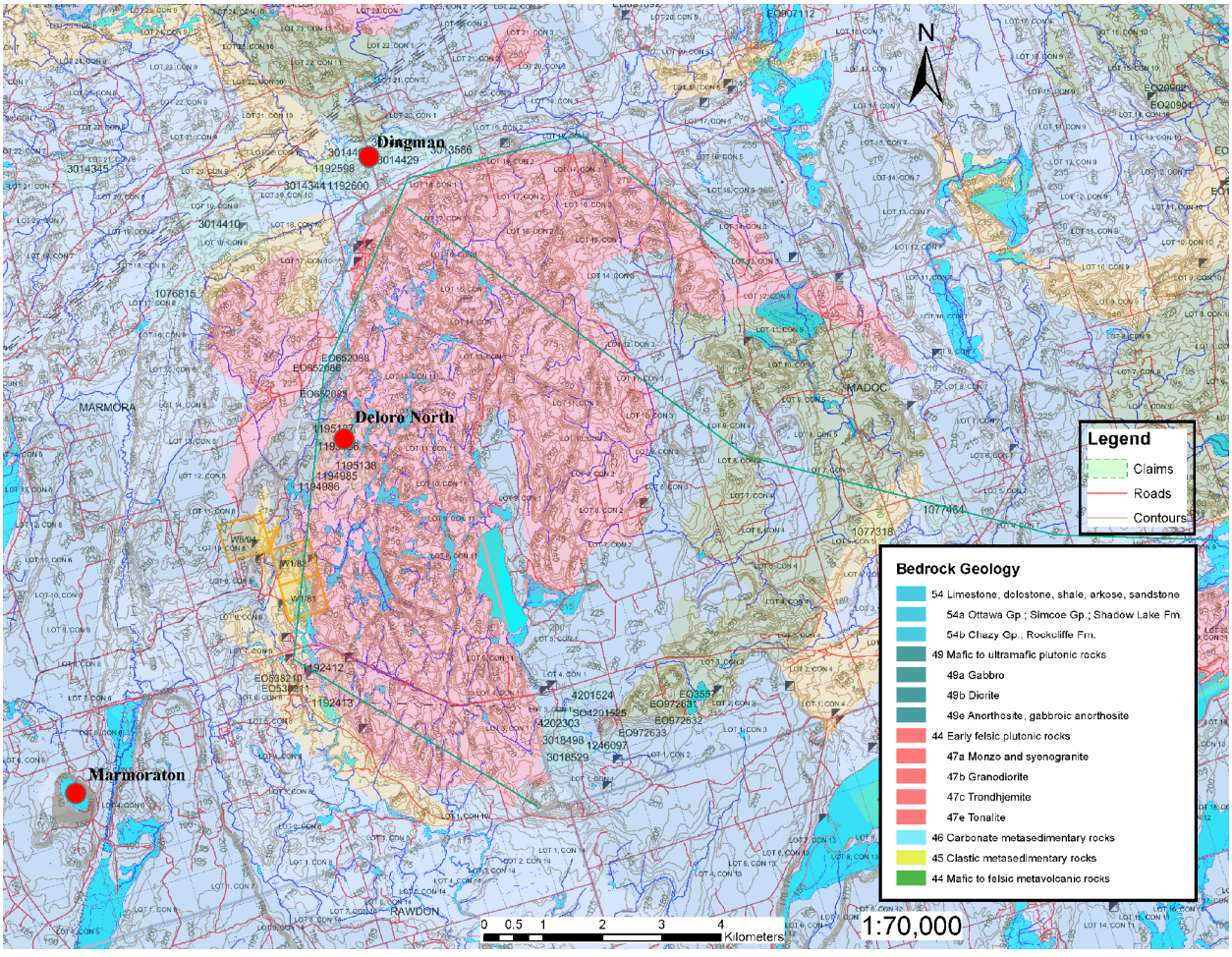

Figure 9. Geology of the Deloro granite and surrounding area, showing locations of the Dingman and Deloro North gold prospects and the Marmoraton iron mine. Geology *from* Ontario Geological Survey (2003).

Based upon recent exploration work (1986 to present) on gold prospects associated with the Deloro granite, research by staff of the Ontario Geological Survey and field investigations by staff of the Southern Ontario Regional Resident Geologist Office, several indications of potential for gold mineralization and for rare earth element mineralization within and proximal to the Deloro granite have been identified. These include

- association of gold mineralization with north-northeast-trending shear zones containing strong, pale green sericite alteration in marginally more mafic (granodioritic?) rocks within and proximal to the Deloro granite
- U/Pb geochronology establishing the age of the Dingman (granodioritic) gold prospect at about 20 million years younger than the Deloro granite and the presence of similar rocks within the Deloro granite
- similarities of lithologies in the Deloro granite to other differentiated alkalic (gabbro-syenite-granite) complexes which host rare earth element mineralization
- the presence of a dike within the Deloro granite containing an assemblage of calcite, plagioclase, chlorite, apatite and iron oxide. On the Deloro North gold prospect in Concession X, Lot 11, Marmora Township, a diamond-drill hole intended to test gold mineralization within the granite intersected a 5.3 m width of dark dike material identified by N. McKay, Lakefield Research, as lamprophyre (kersantite), and by L. Bailey, Queen's University, as carbonatite (Southern Ontario Regional Resident Geologist's Office, Tweed, assessment file AFRO# 2.19266, R. Ross, diamond-drill log).
- association of REE-bearing magnetite mineralization with alkalic complexes, such as the Clay–Howells alkalic complex in the Cochrane District in Ontario, and the presence of magnetite deposits proximal to the Deloro granite.

These points and the results of an initial field investigation done in 2010 by staff of the Southern Ontario Regional Resident Geologist's Office, Tweed, are discussed in more detail below.

GOLD

Several gold-arsenopyrite deposits along the western margin of the Deloro granite were mined prior to the early 1900s, producing about 30 000 t of ore averaging about 10 g/t Au. Mineralization is confined to quartz veins within north-northeast-trending shear or fracture zones within highly altered granite, syenite and diorite. Feldspars are extensively altered to a fine-grained mass of pale green sericite, leaving the quartz grains intact with the appearance of quartz-eye porphyry. Concentrations of magnetite close to the gold mineralization are common.

The Eldorado copper mine, located about 1.5 km northeast of the Deloro granite, consisted of a small sulphide lens about 50 m long and 8 m wide at the contact between a small granite body and dolomitic marble. The upper 25 m were oxidized to hematite and mined as iron ore prior to 1906. The underlying sulphides, containing chalcopyrite, pyrite and chalcocite, were mined by open cut to a depth of 100 m, averaging about 7% Cu, 9 g/t Ag, and 1 g/t Au (LeBaron 1991). About 1 km to the east, in the same granite body, is the site of Ontario's first gold discovery, the Richardson Mine. This small deposit, mined in 1866, consisted of native gold associated with brannerite, a black, titaniferous uranium oxide (Steacy et al. 1973), at the contact between siliceous dolomite and granite.

In 1985, gold was discovered in a granitic body about 800 m north of the Deloro granite (the Dingman prospect, LeBaron 1991). Exploration programs by several companies since 1986 have resulted in the definition of a large, low-grade gold deposit. The most recent resource estimate, documented in this report (*see* "Advanced Exploration", "Upper Canada Gold Corporation – Dingman Gold Prospect"), is 11.6 million tonnes averaging 0.97 g/t Au, equivalent to 360 000 ounces of contained gold - significantly more gold than the total of all past production in southeastern Ontario (38 000 ounces). Gold mineralization is not confined to quartz veins, as it is in other deposits in the Deloro granite, but is disseminated throughout the strongly sheared and sericitized granite. A late series of shear zones trending north-northeast cuts across the earlier east-northeast foliation and is distinguished by intense green sericite alteration, the presence of blue quartz eyes and discontinuous quartz stringers. These zones contain higher than average gold mineralization, commonly with native gold in the quartz stringers. Accessory minerals include pyrite, chalcopyrite, pyrrhotite, magnetite and fluorite. Wollastonite and magnetite occur in skarn zones within the surrounding marble, and large blocks of granite occur within a footwall breccia (King 1988). In the Upper Canada Gold Corporation diamond-drilling program of 2010, gold mineralization was encountered in marble bordering the Dingman intrusion (M. Leahy, Upper Canada Gold Corporation, personal communication, 2010).

A small zone of similar alteration and gold mineralization, also discovered in the 1980s, occurs within the western margin of the Deloro granite. The Deloro North occurrence exhibits granite-diorite breccia, xenoliths of calcareous and siliceous metasedimentary rocks, up to 15% magnetite in marble at the contact with syenite of the Deloro granite, and green sericite alteration. Within the altered granite, irregular, hematite-stained quartz veins 1 to 5 cm wide contain pyrite (locally up to 15%, but averaging less than 1%), trace amounts of arsenopyrite and chalcopyrite, and rare visible gold. Similar green sericite alteration was noted in at least 9 north-northeast-trending shear zones on the property, several of which border linear topographic lows with coincident magnetic highs within the granite (LeBaron 1990).

A number of other north-northeast-trending topographic lows within the Deloro granite are evident on a geological map of the area (*see* Figure 9). A preliminary field investigation into the potential for gold and rare earth elements in the Deloro granite, consisting of geological mapping, rock sampling and a spectrometer survey, was done in 2010 in an area east and north of Jarvis Lake and along Highway 7 between Madoc and Marmora. One new zone of green, sericitic alteration, gossan and quartz veining, similar to that associated with Dingman and Deloro gold mineralization, was located along the eastern margin of an extensive, 60 m wide, north-northeast-trending swamp at UTM co-ordinates 296342E 4933333N, Zone 18. Gold assays for 2 samples taken at this location were not significant (6 and 4 ppb Au). However, the exposure may represent only the western margin of a wider zone of alteration with potential for gold mineralization.

Easton, Kamo and Sangster (2007) report the age of the Dingman granitic intrusion, determined by U/Pb geochronology, as 1218 Ma – more than 20 million years younger than the age of the Deloro granite. Several narrow dike-like structures composed predominantly of green, sericitic feldspar and about 25% grey quartz grains, similar to zones within the Dingman granitic intrusion, are exposed in rock cuts along Highway 7 within the Deloro granite between Madoc and Marmora. The structures, which from a distance appear to be mafic dikes, are alteration zones exhibiting gradational contacts over 1 cm with the surrounding pink granite and are bordered by red (potassic?) alteration halos. Fine, perthitic lamellae, which can be seen in the pink, unaltered feldspar, are also evident in the green, sericite-altered feldspar. Further investigation is warranted to determine whether there is a correlation between these dike-like alteration zones and the north-northeast-trending zones of green sericite and/or quartz-eye alteration in the Deloro and Dingman granites and whether fluids associated with this late phase of alteration are related to a gold mineralizing event that postdates both intrusions. The north-northeast-trending topographic lows in the Deloro granite and surrounding rocks are potential targets for this type of mineralization.

RARE EARTH ELEMENTS

Previous recommendations for rare earth element (REE) exploration in the Deloro granite and other areas of the Central Metasedimentary Belt have been presented in Sangster et al. (2010). These recommendations focussed on the potential for REE mineralization associated with Methuen Suite granites and related pegmatites. Easton (1989) suggested that there may be potential for niobium-tantalum-REE mineralization associated with granophyric and brecciated phases of the Deloro granite along the eastern margin of the intrusion.

Also associated with many of the Methuen Suite granites are skarn magnetite deposits such as the Marmoraton, Dominion, Dufferin, Coe Hill and Bessemer mines. The largest known concentration of magnetite—the Marmoraton iron mine deposit, which produced 25 million tonnes grading 43% Fe—is situated at the contact between a diorite-syenite body and interlayered carbonate and siliceous metasedimentary rocks about 3.5 km southwest of the Deloro granite. Easton (1989) suggests that the diorite-syenite may be connected at depth to the Deloro granite. Iron oxide deposits associated with alkali-rich intrusive rocks may contain major quantities of barite, fluorite, sulphides, light rare earth elements (LREE), uranium and precious metals (Hauck 1990). Of this list, only significant concentrations of LREEs have not been previously documented in the Deloro area.

The Clay–Howells alkalic complex in northern Ontario hosts a 10 million tonne massive to semi-massive magnetite deposit, outlined by diamond drilling in the 1950s. No REE analyses had been done until Rare Earth Metals Inc. acquired the property in 2009 and tested the material for REE content, with positive results. A 2010 drill hole intersected 105 m grading 58% iron oxide, 0.69% total rare earth oxides (TREO) and 0.14% niobium oxide, including a 4.9 m width of 2.45% TREO. Preliminary metallurgical tests indicate that a high-grade iron concentrate and a REE concentrate can be produced (Rare Earth Metals Inc., Clay–Howells Project, Property Summary, www.rareearthmetals.ca/article/clayhowells-project-117.asp). The magnetite zone and associated carbonatite rocks are not exposed in outcrop.

Similarities between the Clay–Howells (CH) complex and the Deloro granite (DG) complex include the following.

- The presence of gabbroic, syenitic and granitic phases of the intrusion. The Clay–Howells complex consists largely of pyroxene syenite, but contains zones of pyroxene granite. Whole rock analysis of green, sericite-altered dike-like structures in the Deloro granite (Southeastern Ontario District Geologist's files, Tweed, unpublished analysis from 2010 field work) correlates well with whole rock analysis of the Clay–Howells pyroxene granite (Sage 1988), taking into account a slightly higher percentage of quartz and higher iron and magnesium in the Deloro granite than is present in the aegerine-augite-bearing (higher Na and Ca) granite of the Clay–Howells complex. These dike-like structures gave slightly elevated spectrometer readings of 1100 cps, and spectrometer-generated assays of 20 to 25 ppm U and 50 to 60 ppm Th (RS-125 spectrometer in assay mode).
- The presence of a dike containing calcite, plagioclase, chlorite, apatite and iron oxide in a topographic low within the Deloro granite. The dike does not crop out and no similar material has been reported by previous workers within the Deloro granite. This very soft rock may be present within other topographic low areas of the granite and may be the Deloro granite equivalent of the Clay–Howells silicocarbonatite.
- The spatial (and genetic?) association of magnetite deposits with the granitic intrusive rocks and the presence of elevated REE content within the magnetite. Magnetite deposits associated with the Deloro granite include the Marmoraton, Dominion, Dufferin and St. Charles mines and numerous smaller occurrences described by Hewitt (1968).

Two samples of magnetite taken from the Marmoraton iron mine waste pile in 2010 by Tweed RGO staff were analyzed for REE content. One sample, consisting of about 80% magnetite, 5% combined pyrite and chalcopyrite, and minor biotite, chlorite and ankerite, contains no anomalous levels of REE. However, a second sample consisting of about 75% magnetite and 25% epidote with traces of pyrite and pyrrhotite, contains 1840 ppm La, 1720 ppm Ce, and anomalous levels of praseodymium and neodymium (121 ppm Pr and 282 ppm Nd, respectively). These values, converted to rare earth oxide content, are 2158 ppm La_2O_3 and 2014 ppm Ce_2O_3, or about 0.4% combined REO.

One additional zone within the Deloro granite, north of Jarvis Lake, gave anomalously high values of REEs. A zone of red granite that appears to be an alteration zone less than 1 m wide containing smoky grey quartz grains and 3 to 5% magnetite, was located by relatively high readings on the RS 125 spectrometer of 1250 to 1650 cps, 54.2 ppm U and 228.8 ppm Th. A sample of the material (sample 08-24-2, UTM co-ordinates 295742E 4934899N, Zone 18) is anomalous in most REEs (Table 9). The zone lies near the base of a slope between an area of granitic outcrop to the west and a 30 m wide north-trending swamp to the east.

Table 9. Rare earth element content in samples collected in 2010 from the Deloro granite and the Marmoraton Mine site.

	Element (ppm)														
Sample No.	**Y**	**La**	**Ce**	**Pr**	**Nd**	**Sm**	**Eu**	**Gd**	**Tb**	**Dy**	**Ho**	**Er**	**Tm**	**Yb**	**Lu**
Deloro Granite															
08-11-7	94	56.2	143	16.1	63.8	14.7	1.53	14.6	2.7	16	3.6	10.7	1.78	11.9	1.83
08-11-8	69	29.8	67.3	8.8	36	8.9	1.38	9.6	1.9	11.4	2.5	7.6	1.28	9.0	1.5
08-24-2	445	96.7	226	29.9	123	39.6	2.61	51.7	13.2	93.6	21.7	66.5	11.7	75.9	11.2
08-25-1	183	88.1	183	23.5	86.9	17.3	1.0	15.6	3.2	22.9	6.0	19.6	3.64	25.2	4.35
08-25-2	151	82.3	156	19.6	73.8	17	0.93	18.1	3.6	22.3	5.1	15.4	2.65	18.4	3.08
08-25-3	120	42.3	80.6	10.1	37.2	9.1	0.61	10.6	2.6	18.5	4.5	14.1	2.48	17.7	2.81
08-25-5	86	37.1	83.6	12.3	54	13.8	3.64	14.3	2.6	15.5	3.1	9.3	1.51	9.9	1.55
Marmoraton Iron Mine															
Mar-10-1	124	1840	1720	121	282	24.3	2.22	17.9	1.8	8.9	1.7	4.8	0.66	4.2	0.69
Mar-10-5	33	6	10.3	1.29	5.3	1.0	0.15	1.1	0.2	0.9	0.2	0.5	0.07	0.5	0.08

SUMMARY

Gold mineralization is associated with north-northeast-trending green, sericitic alteration zones in the Deloro granite and proximal intrusions. Exposures of this type of alteration are present bordering linear topographic lows within the granite. These areas have potential for more extensive mineralization that is not exposed in outcrop. As indicated by the presence of gold mineralization in marble adjacent to the Dingman granitic intrusion, it is possible that structures hosting the auriferous alteration zones extend into the country rocks bordering the intrusions.

Magnetite occurrences in the area of the Deloro granite have not previously been tested for rare earth element content. Preliminary sampling indicates that there may be significant concentration of some LREEs (La and Ce) in these deposits. Other magnetite occurrences in the area should be similarly tested, including those not obviously associate with alkalic intrusive rocks. The Clay–Howells REE-bearing magnetite zone and associated carbonatitic rocks lie well within the intrusion, at least 250 m from the margin and are not exposed in outcrop. Magnetic highs within topographic lows in the interior of the Deloro granite should be considered as exploration targets. Skarn and/or hydrothermal mineralization associated with late-stage fluids enriched in iron oxide and REEs may have been deposited at the margins of the intrusive bodies or in shear zones within the intrusions.

Other granites of the Methuen Suite that should be considered for REE potential associated with magnetite mineralization are the Methuen, Coe Hill and Bessemer granites, Elzevir terrane; the Cheddar granite, Bancroft terrane; and the Barber's Lake granite, Sharbot Lake terrane, which is also fluorite bearing and elevated in U and Th (Easton 1992).

Exploration for Mineral Collecting Sites, Southeastern Ontario

Southeastern Ontario has long been valued by rockhounds for the wide variety of rocks and minerals that are available for collecting. There continues to be interest in mineral collecting by geologists, mineral dealers and amateur collectors and by municipalities in developing mineral tourism opportunities.

The Ontario Highlands Tourism Organization (OHTO) is one of 13 regions established in 2010 under the Ministry of Tourism and Culture's Destination Development and Marketing campaign to enhance tourism in Ontario. In support of this initiative, OHTO has received $1.75 million from the Provincial Government to develop a variety of tourism opportunities over the next 2 years and has identified mineral collecting and recreational geology as one of the key markets to be developed.

The OHTO encompasses the counties of Renfrew, Haliburton, Lanark, and the northern parts of Hastings, Lennox and Addington and Frontenac, an area which hosts most of the historic mines, prospects and mineral occurrences of southeastern Ontario. Most of the area's well-known mineral occurrences were discovered through exploration and development of economic mineral deposits such as fluorite, uranium, molybdenite, apatite, quartz and feldspar, which, in the early to mid-1900s could be mined profitably on a relatively small scale. With some exceptions, such as rare earth elements and high-purity silica, these small vein and pegmatite dike-hosted deposits are not considered to have high potential for metallic or industrial mineral production, but may be valuable as mineral collecting sites. However, in recent years, many of the sites are either becoming exhausted of reserves or have become inaccessible due to changes in property ownership, rehabilitation of old mines and prospects, land development and the creation of new parks and protected areas. The Phase One goals of the OHTO mineral tourism development group, as described in the Geological Recreation Guide Project Proposal (Southern Ontario District Geologist's files, Tweed) are to

- identify and document potential mineral and geology assets
- rehabilitate existing mineral collecting sites as required
- secure access to old sites and to key new sites
- develop and/or enhance key sites and attractions to a market-ready state

One of the most prospective areas for the discovery of new mineral collecting sites is the Bancroft terrane of the Central Metasedimentary Belt. The town of Bancroft, known as the Mineral Capital of Canada, hosts the annual Rockhound Gemboree, Canada's largest gem and mineral show. The Bancroft terrane is an area of low to upper amphibolite-grade metamorphism dominated by a sequence of marbles and quartzofeldspathic gneisses. A suite of

carbonatite rocks, granitic pegmatites and fenites occurs in a belt running the length of the Bancroft terrane (Figure 10), roughly coincident in distribution with an older suite of nepheline syenites (Easton 1992). The fenitizing fluids of the younger suite introduced sodium, potassium, calcium, iron, titanium, phosphorus, fluorine, chlorine, uranium, thorium, rare earth elements, zirconium, barium and molybdenum into the country rocks (Lumbers et al. 1990). The resulting assemblage of carbonatites, pegmatites, nepheline syenites and associated veins and skarns host many of the past producers (uranium, molybdenum, beryllium, mica, feldspar, quartz, corundum, apatite) and current mineral collecting sites. A partial list of the minerals associated with each rock type is

- **nepheline syenite**: nepheline, sodalite, cancrinite, corundum
- **carbonatite dikes**: calcite, apatite, titanite, hornblende, biotite, microcline, fluorite, fluorrichterite, tremolite, actinolite
- **pegmatite dikes**: quartz, rose quartz, feldspar (perthite, moonstone, amazonite), tourmaline, mica, hornblende, beryl, euxenite, columbite, molybdenite

In addition to the wide variety of minerals that occur in the Bancroft terrane, well-formed crystals of minerals in carbonatites and pegmatites can be exceptionally large. Hewitt (1959), in descriptions of mineral deposits and occurrences in Cardiff and Faraday townships, reports apatite crystals up to 60 cm in length, corundum up to 7 cm in diameter, mica and feldspar up to 60 cm in width, and betafite crystals up to 8 cm in diameter.

The relatively small size and discontinuous nature of the favourable host rocks present some challenges for exploration. The carbonatites are generally small, elongate bodies less than 1 m wide, but a few, such as the Silver Crater carbonatite in Faraday Township, crop out as circular masses less than 100 m in diameter. The pegmatite dikes range in length from less than 1 m to hundreds of metres and in width, from several centimetres to tens of metres. They are tabular to irregular in shape and may pinch and swell and exhibit branching (Goad 1990). Ground

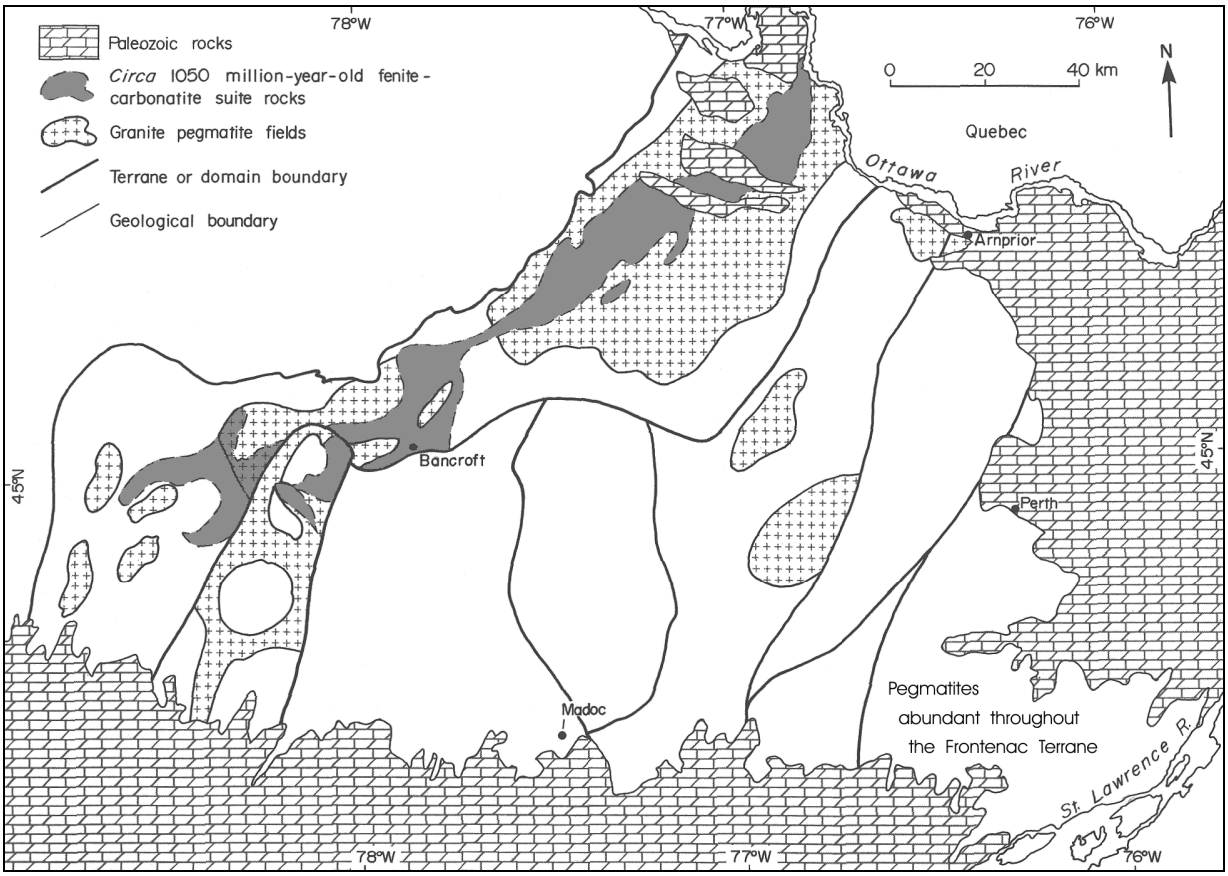

Figure 10. Distribution of carbonatite-fenite and granite pegmatite suites within the Bancroft terrane and adjacent terranes of the Central Metasedimentary Belt (*from* Easton 1992).

radiometric surveys are likely to assist in the detection of uranium- and REE-bearing pegmatites and carbonatites. Soil sampling for mineral dispersion train mapping may also be a useful exploration tool, as many of the rare silicate minerals are resistant to both chemical and mechanical weathering. In particular, soils in the vicinity of carbonatites may contain concentrations of resistant minerals released by erosion of the soft and more soluble calcitic host rock. Recent new discoveries of carbonatite and pegmatite dikes in the Bancroft terrane, some of which contain spectacular mineral specimens, indicate that there is potential for locating new mineral collecting sites in southeastern Ontario.

Ontario Sand Deposits – Potential New Source of Proppants

The process of hydraulic fracturing has been used to enhance production in oil and gas wells since the 1940s. In the last decade, significant changes in the technology of horizontal drilling and fracturing technology coupled with growing energy demands have changed the focus of the oil and gas industry. Shale is now seen as the main source of oil and gas both for the present and for the future. Shale plays dominate the market in North America from south Texas to British Columbia. Similar formations are known to exist outside of North America; it is believed that they will play an even bigger part in the global market in the near future.

Proppant (frac sand) is the sized particles mixed with fracturing fluid to hold fractures open after a hydraulic fracturing treatment. Proppant materials are carefully sorted for size and sphericity to provide an efficient conduit for production of fluid from the reservoir to the well bore. Hydraulic fracturing is used both in the drilling and development of new wells and in the stimulating of old wells to increase or prolong production.

Proppant or frac sand is a crucial component of the hydraulic fracturing process. The past 10 years have seen unprecedented growth in the frac sand demand and known supplies can no longer meet the demand. The North American drilling market is showing healthy demand for proppants at present with year-on-year increases of 40% (North America), 16% (Canada) and 45% (USA) (Roberts 2011).

Several sand producers in the United States are undergoing expansion programs and temporary arrangements are being made to import frac sand from as far away as China. There are limited suitable deposits in the United States and most of the known deposits have been investigated. The frac sand potential of neighbouring provinces is under exploration and the opportunity exists to develop a new sand resource in Ontario, close to the US market.

SPECIFICATIONS

Not all sand can be used as proppant. Physical characteristics of the sand are the primary consideration as to whether or not it will be suitable for proppant. Grain size, sphericity, crush resistance and mineralogy are critical factors to be considered. The International Organization for Standardization (ISO) has compiled a document that is the basic guideline for qualifying a proppant: ISO 13503-2:2006 “Petroleum and Natural Gas Industries—Completions Fluids and Materials—Part 2: Measurement of Properties of Proppants used in Hydraulic Fracturing and Gravel Packing Operations”. The document has also been adopted by the American Petroleum Institute (API) as ANSI/API RP 19C, “Measurements of Proppants Used in Hydraulic Fracturing and Gravel-Packing Operations, First Edition” (ISO13503-2:2006, Identical). The testing for the flow capacity or performance of the proppant is outlined in ISO 13503-5:2006, “Petroleum and Natural Gas Industries –Completions Fluids and Materials—Part 5: Procedures for Measuring the Long-Term Conductivity of Proppants”.

The 20 to 40 mesh or 0.84 to 0.42 mm is the most widely used size; however, some literature suggests that finer grain size may be equally or more effective. Table 10 shows some recognized size classes recommended by the American Petroleum Institute.

Sphericity and roundness are an estimate of how closely the sand grain conforms to a spherical shape and its relative roundness. The API recommends sphericity and roundness of 0.6 or larger. Crush resistance, solubility and turbidity are also properties of silica sand specified by the API.

Table 10. Proppant grain sizes.

Mesh#	8/12	10/20	20/40	70/140
Screen size	2.38–1.68 mm	2.00–0.84 mm	0.84–0.42 mm	210–105 µm
US Standard sieves	6	8	16	40
	8	10	20	70
	10	16	30	100
	12	20	40	140
	16	30	50	200
	Pan	Pan	Pan	Pan

ONTARIO SANDSTONE DEPOSITS

Selected Ontario sandstone deposits appear to meet the requirements for silica content (minimum 99%), grain size, roundness and sphericity. Additional testing including crush resistance, solubility and turbidity is warranted for those deposits of similar geology known to produce industrial sand in other jurisdictions.

Keith (1949) completed a review of the Potsdam (Nepean) Formation sandstone in Frontenac, Leeds and Lanark counties to assess its potential of industrial silica sand production. At that time, there were active quarries in the area that produced industrial silica sands for a variety of applications.

Southeastern Ontario contains extensive deposits of sandstone with physical and chemical properties that make it suitable as source material for industrial silica sand. The potential suitability of this material for proppants should be evaluated. Significant deposits of sandstone have been identified in municipal official plans as areas of mineral resource. Although some deposits have been lost to competing land use, substantial areas of potential resource remain available.

Other sandstone deposits in Ontario with potential for the development of industrial silica sand resources include Mesozoic silica or kaolin deposits in the Moose River Basin in the James Bay Lowland and selected Proterozoic sandstone deposits in the Sault Ste. Marie area in northeastern Ontario.

The following additional references are suggested reading: American Petroleum Institute (1995), International Organization for Standardization (2006a, 2006b) and Zdunczyk (2007).

Exploration for High-Purity Marble Deposits, Southeastern Ontario

Marble belts of the Grenville Province in southeastern Ontario (Figure 11) contain zones of high-purity calcitic and dolomitic marble which are currently quarried as sources of mineral filler for the paint, paper, plastics and pharmaceutical industries and for terrazzo, decorative stone and landscaping stone. Until recently, a deposit of high-magnesium dolomitic marble was extracted and refined to produce magnesium metal.

Although calcium carbonate is one of the most widely used industrial minerals, most applications (cement, agriculture, flue gas desulphurization, construction aggregate) utilize a high-volume, low-cost product derived from Paleozoic limestone. Specialty markets requiring a higher purity and/or higher whiteness/brightness ground calcium carbonate (GCC) product, most commonly derived from high-purity marble deposits, include

- paper: globally, the leading specialty market for GCC. Although the market has been depressed in recent years, Canada's paper industry is expected to experience a modest recovery in 2011 (www.breakbulk.com/forest-products/canadian-paper-industry-looks-2011).
- joint compounds: drywall and other construction compounds contain up to 80% GCC by weight
- paint: GCC is used in the production of house paint, traffic paint and stucco
- plastics: GCC in polyvinyl chloride (PVC) plastics provides impact strength, stiffness and heat resistance. Ultrafine grades, such as those produced by OMYA Canada Inc. at Perth in southeastern Ontario, are used in polyethylene films and polyester.
- other uses: adhesives, carpet-backing, rubber, food, pharmaceuticals and animal feedstock

The market for ground calcium carbonate (GCC) grew from about 56 Mt in 2004 to 72 Mt in 2007 and was forecast to continue to grow at an annual growth rate of 4% to 2012 (Roskill Information Services 2008). Although the demand for GCC decreased in 2009–2010 as construction activity declined, the construction industry is expected to begin a slow recovery in 2011 (construction.ecnext.com/coms2/summary_0249-360828_ITM_analytics).

The only current producer of GCC from southern Ontario marble is OMYA Canada Inc. White, calcitic marble is extracted from a zone about 85 m wide at the company's Tatlock Quarry in Darling Township for its processing plant at Perth. In high-demand years, the company quarries about 250 000 t from the deposit, which is estimated to contain an additional 5 million tonnes of reserves.

High-purity dolomitic marble was quarried for the production of magnesium metal in Ross Township at Haley Station near Renfrew. The deposit consisted of a 75 m wide zone of coarsely crystalline dolomite containing less than 1% impurities (chondrodite, talc, tourmaline and tremolite) and was quarried over a strike length of over 700 m (LeBaron and MacKinnon 1990). The quarry and plant were operated originally by Dominion Magnesium Limited and later by Timminco Metals for a total of 63 years before ceasing production in 2007. Canada currently has no magnesium metal production. Magnesium and its alloys are used in the production of every type of vehicle because of their combination of high tensile strength, elastic modulus and low density as manufacturers try to improve energy efficiency (Brown 2009).

Two other properties in southeastern Ontario host significant drill-indicated reserves of high-purity marble. The Whitney calcite property in Belmont Township, explored by Preussag Canada Ltd. and Northumberland Mines Ltd. between 1975 and 1980, contains 1.9 million tonnes of high-calcium marble and 4.7 million tonnes of calcitic/dolomitic marble, both zones containing less than 0.5% SiO_2 + Fe_2O_3 and averaging 93% brightness (LeBaron and MacKinnon 1990). Murray Brook Resources Inc. holds the mineral rights under a Mining Lease and is currently re-evaluating the industrial mineral potential of the property (J.J. Treyvaud, Murray Brook Resources Inc., personal communication, November 2010).

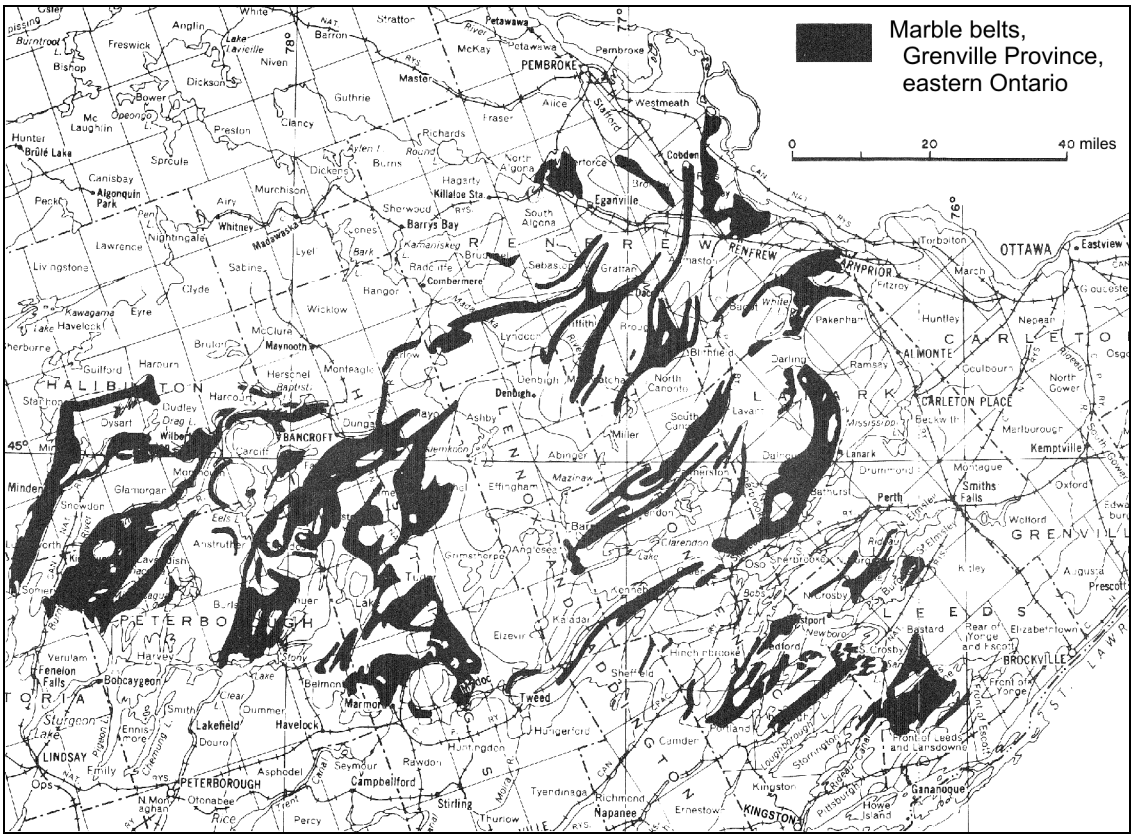

Figure 11. Distribution of major marble belts in the Central Metasedimentary Belt, Grenville Province, southeastern Ontario (Hewitt 1964).

The Lockwood property in Elzevir Township, diamond drill tested by OMYA Canada Inc. in 1974, is estimated to contain 3 million tonnes of white, high-calcium marble averaging less than 2% acid insoluble content. The footwall of the calcitic zone is a 50 m thick dolomitic zone, visually estimated to contain less than 3% impurities (LeBaron and MacKinnon 1990). OMYA Canada Inc. continues to hold the mineral rights to the property.

Although there is potential for the discovery of high-purity marble in all of the marble belts of southeastern Ontario, the following areas in particular are recommended for exploration (LeBaron and MacKinnon 1990):

- Ross–Horton–McNab townships: Ross Township occurrences contain large widths of high-purity, white dolomitic marble.
- Lanark–Darling–Ramsay townships: Extending southwestward into Dalhousie and Bathurst Townships, this belt contains several occurrences of high-purity calcitic and dolomitic marble.
- Griffith–Brougham townships: Wide zones of interlayered calcitic and dolomitic marbles contain narrow widths of very high purity and brightness.
- Belmont–Madoc–Hungerford–Elzevir townships: Several occurrences exhibit adjacent zones of high-purity calcitic and dolomitic marble.

In addition to the potential for specialty products from high-purity marbles, lower grades of both calcitic and dolomitic marble have potential applications in the stone industry as terrazzo, decorative aggregate, landscaping stone and lower-specification mineral fillers.

The geology and geochemistry of Grenville marble belts and specific prospects are documented in several Ontario Geological Survey reports (Grant, Papertzian and Kingston 1989; LeBaron and MacKinnon 1990; Kelly 1996).

Tables 11 through 18 provide details on currently inactive mineral deposits with identified resources and past-producing mineral occurrences.

Table 11. Historic production of copper, lead, zinc – Southeastern Ontario District.

Mine	Township	Operating	Tons Milled	Production
Kingdon	Fitzroy	1884–1885, 1914–1931	905 000	76 821409 pounds Pb concentrate; 857 312 pounds Zn concentrate; 60 074 072 pounds Pb recovered
Long Lake	Olden	1897–1925, 1973–1974	3442, not available	$41 550 ore value, 9467 tons Zn valued at $1 227 000
Eldorado Copper	Madoc	1906	not available	234 000 pounds Cu matte containing 230 ounces Au, 182 ounces Ag, 109 000 pounds Cu
Hollandia Lead	Madoc	1903–1906	not available	2 653 365 pounds Pb

Table 12. Historic production of gold – Southeastern Ontario District.

Mine	Township	Operating Years	Tons Milled	Ounces Produced	Grade (oz/ton)
Big Dipper	Barrie	1907–1909	52	17	0.33
Cook	Marmora	1901–1904	1483	289	0.26
Cordova	Belmont	1892	120 670	22 774	0.19
Craig	Tudor	1905–1906	1850	248	0.13
Deloro	Marmora	1897–1902	39 143	10 360	0.26
Gatling 5 Acre	Marmora	1900–1903	6114	2353	0.38
Gilmour	Grimsthorpe	1909–1910	550	172	0.31
Golden Fleece	Kaladar	1919–1922	unknown	480	unknown
Ledyard	Belmont	1893–1994	55	13	0.24
Pearce	Marmora	1893–1908	239	302	1.26
Richardson	Madoc	1866–1868	unknown	75 – 100	0.408
Sophia	Madoc	1900–1941	1800	110	0.06
Sovereign	Marmora	1878 1892–1900	unknown 1962	970 370	unknown 0.19
Star of the East	Barrie	1905–1907	976	134	0.14
		Total	**174 894**	**38 592**	

Table 13. Historic production of fluorite – Southeastern Ontario District.

Mine	MDI Number	Township	Operating Years	Total Production (Tons)
Bailey	31C06NW00003	Madoc	1907, 1916, 1917, 1944–1950	25 000
Blakely	31C06NW00019	Huntingdon	1918–1920, 1928, 1941–1947	5026
Coe	31C06NW00008	Huntingdon	1941–1942	114
Dwyer	31E01SE00091	Cardiff	1918–1920, 1943, 1944	97
Herrington South	31C05NE00009	Huntingdon	1917	13
Howard, Fred Hill	31C06NW00014	Huntingdon	1918, 1920, 1929, 1940–1942, 1944	2500
Johnston	31C06NW00013	Huntingdon	1943, 1944–1947, 1949	187
Keene	31C06NW00004	Huntingdon	1918–1919, 1943, 1944, 1950	5000
Kilpatrick	31C06NW00005	Huntingdon	1944, 1953–1959	11 566
Lee Junior	31C05NE00008	Madoc	1917, 1940, 1943–1945	2000
Lee Senior	31C05NE00006	Madoc	1916–1918, 1942, 1943	1600
McIlroy	31C05NE00003	Madoc	1917–1918, 1923, 1944	540
Miller	31C05NE00005	Madoc	1917–1919	460
Noyes	31C06NW00011	Huntingdon	1917–1920, 1941–1943	25 000
Palmateer	31C06NW00016	Huntingdon	1942	44
Perry	31C06NW00009	Huntingdon	1915–1920, 1941–1943	8000
Perry Lake	31C06NW00007	Huntingdon	1910, 1913, 1915, 1917, 1952, 1960	4000
Ponton	31C05NE00004	Madoc	1929–1942	1500
Rogers	31C06NW00018	Huntingdon	1909–1914, 1943-51	45 000
Rooks	31C12SE00003	Madoc	1916–1918	100
South Reynolds	31C06NW00010	Huntingdon	1917–1918, 1943	100
Wallbridge & Herrington	31C05NE00007	Madoc	1920–1922, 1941–1943	6600
William Reynolds	31C12SE00002	Madoc	1941–1942	88

Fluorspar, a commercial fluorite product, is used as a flux in the making of steel and ceramics, as a constituent in the electrolytic process of making aluminum and in the production of hydrofluoric acid (HF). During World War II, a Canadian Government assistance program in the form of loans and drill hole explorations stimulated development of the Madoc deposits (Guillet 1964, p.1).

Table 14. Historic production of iron – Southeastern Ontario District.

Mine	Township	Operating Years	Tons Milled	Grade (% Fe)
Calabogie	Bagot	1883–1901	10 000	26
Martel	Bagot	pre-1890	2000	58.71
Williams (Black Bay)	Bagot	1880–1890	25 000	51.89
Black Lake	Bedford	1882–1884	4000	40
Glendower	Bedford	1873–1895	50 000	50 – 60
Belmont (Ledyard)	Belmont	1899–1900, 1911–1913	8433	51.2
Blairton	Belmont	1820–1875	300 000	51.8
Playfair (Dalhousie)	Dalhousie	1866–1871	11 100	57.6
Radnor	Grattan	1901–1907	18 824	47.5
Eagle Lake (Blessington)	Hinchinbrooke	1887–1891	700	65.55
Tomahawk (Mag-Iron)	Lake	1947, 1950–1957	2096	50.9
Wilbur	Lavant	pre-1900, 1907–1908	146 892	56.69
Magnetawan	Lount	1910–1912	6000	59.55
Paxton	Lutterworth	pre-1910	1000	not available
Miller	Madoc	1899	6823	not available
Wallbridge	Madoc	1900–1901, 1919, 1921	3421	not available
Marmoraton	Marmora	1952–1978	28 000 000	40
Bessemer	Mayo	1902–1913	99 613	42.18
Childs	Mayo	1913	9649	38.7
McNab	McNab	1873–1874	15 000	68
Robertsville & Mary	Palmerston	1895, 1900–1901, 1918–1909	13 477	70.5
Fournier	S. Sherbrooke	1873	600	60
Howland	Snowdon	1880–1882	1500	58
Victoria	Snowdon	1882	unknown	58.35
Dog Lake	Storrington	1899	600	51.12
St. Charles	Tudor	1900–1902	5186	57 – 60
Coe Hill	Wollaston	1884–1914	100 000	51.4
		Total	**28 841 914**	

Table 15. Past-producing magnetite mines – Southeastern Ontario District.

Deposit / Township	Mineral Deposit Inventory Number / Status	Description	Reference
Belmont (Ledyard) Belmont Tp.	MDI31C12SW00004 (Past Prod. w Reserves)	Drilling from 1906 indicated 200 000 tons of concentrating ore	MRC 11, p.287
Bessemer Mayo Tp.	MDI31F04SE00012 (Past Prod. w Reserves)	Reserves estimated at 2 480 819 tons averaging 28.62% recoverable Fe from 4 deposits	MRC 11, p.167
Black Lake Bedford Tp.	MDI31C10SE00026 (Past Prod. w/o Reserves)	Disseminations and massive magnetite in exposed widths from 10 to 50 feet	MRC 11, p.134
Blairton Belmont Tp.	MDI31C05NW00026 (Past Prod. w Reserves)	1914 reserves calculated at 1 800 000 tons of 51.8% Fe and 0.5 million tons of 54.9% Fe	MRC 11, p.288
Bluff Point Bagot Tp.	MDI31F07SE00011 (Past Prod. w/o Reserves)	Two main magnetite-bearing zones, each about 500 feet long and 40 feet wide	MRC 11, p.313
Calabogie Bagot Tp.	MDI31F07SE00009 (Past Prod. w Reserves)	The deposit contains 27 200 000 tons of ore grading 22.28% Fe proven by diamond drilling, recoverable by open pit	MDC 20, p.67
Chaffey South Crosby Tp.	MDI31C09NW00011 (Past Prod. w Reserves)	Reserves estimated to a depth of 500 feet are 11 110 000 gross tons averaging 29.76% Fe	MRC 11, p.258
Childs Mayo Tp.	MDI31F04SE00013 (Past Prod. w Reserves)	Reserves estimated at 6 193 330 tons averaging 19.25% recoverable Fe	MRC 11, p.169
Coe Hill Wollaston Tp.	MDI31C13SW00010 (Past Prod. w Reserves)	Reserves estimated in 1914 at 600 000 tons averaging 51.4% Fe	MRC 11, p.177-178
Glendower Bedford Tp.	MDI31C10SE00022 (Past Prod. w/o Reserves)	Early drilling indicated massive and disseminated ore at a depth of 500 feet	MRC 11, p.135
Grattan (Radnor) Grattan Tp.	MDI31F06NE00017 (Past Prod. w Reserves)	Proven reserves of 3 639 600 tons to a vein depth of 363 feet and indicated reserves of 9 099 000 tons to a vertical depth of 600 feet, averaging 27.74% Fe	MDC 20, p.98
Howland Snowdon Tp.	MDI31D15SE00096 (Past Prod. w/o Reserves)	Magnetite in a zone 25 feet in diameter at surface and larger with depth	MRC 11, p.149
Marmoraton Marmora Tp.	MDI31C05NE-00014 (Past Prod. w Reserves)	27 966 762 tons of ore averaging 42.8% Fe produced	OFR 5515, p.322
Martel Bagot Tp.	MDI31F07SE00013 (Past Prod. w/o Reserves)	Magnetite body 20 feet thick, dipping 60° southeast	MRC 11, p.317
Matthews North Crosby Tp.	MDI31C09NW00009 (Past Prod. w Reserves)	Estimated reserves to depth of 400 to 500 feet are 33 727 000 gross tons averaging 25.08% Fe, which includes 11 861 000 gross tons averaging 31.36% Fe	MRC 11, p.257
Radenhurst and Caldwell Lavant Tp.	MDI31F02NE00012 (Past Prod. w Reserves)	Main zone with indicated tonnage of 6500 tons of ore per slope foot averaging 32.77% Fe. Three additional zones totalling 1600 feet in length, averaging 17.08%, 16.71% and 25.50% Fe	MRC 11, p.251
Rankin Mayo Tp	MDI31F04SE00016 (Past Prod. w Reserves)	Reserves estimated at 15 691 599 tons containing 15.3% recoverable Fe	MRC 11, p.170
Robertsville Palmerston Tp.	MDI31C15NE00005 (Past Prod. w/o Reserves)	Two zones, Robertsville Mine is 700 feet long and 50 feet wide and the Mary Mine 900 feet to northwest	MRC 11, p.141
St. Charles Tudor Tp.	MDI31C13SE00014 (Past Prod. w/o Reserves)	Three main deposits within an area of approximately 13 500 square feet	MRC 11, p.176
Summit Lake (Tomclid) South Canonto Tp.	MDI31F02SW00032 (Past Prod. w Reserves)	Published reserves in 1993 estimated at 3 Mt averaging 40% Fe; reserve estimate has not been adjusted to reflect production from the deposit in late 1990s	MP 161, p.377
Tomahawk Lake Tp.	MDI31C12NW00002 (Past Prod. w Reserves)	Lenses and patches of magnetite occur over a strike length of approximately 1000 feet	MRC 11, p.155
Victoria Snowdon Tp.	MDI31D15SE00098 (Past Prod. w/o Reserves)	Deposit was worked from a trench 240 feet long and 16 feet wide	MRC 11, p.150
Wilbur Lavant Tp.	MDI31F02SE00009 (Past Prod. w/o Reserves)	Nine workings reported	MRC 11, p.252
Williams Bagot Tp.	MDI31F07SW00027 (Past Prod. w/o Reserves)	Two zones of magnetite, approximately 800 and 240 feet long, 20 feet wide	MRC 11, p.318
Yuill Darling Tp.	MDI31F02NE00009 (Past Prod. w/o Reserves)	Lens of high-grade magnetite, 30 m long and 9 m wide, mined to a depth of 21 m	MDC 20, p.92

Note: The resource estimates listed in this table are historic figures generated by past workers and do not follow the required disclosure for reserves and resources as outlined in National Instrument 43-101.

Table 16. Uranium deposits not currently being mined in the Southeastern Ontario District in 2010.

Deposit Township	MDI Number	Commodity	Reserve	Reserve Reference
Zenmac Burleigh, Anstruther Tps.	MDI31D09NE-00033 (Developed Prospect w Reserves)	U, Th	Indicated and inferred reserves are estimated at 406 000 tons grading 1.77 pounds U_3O_8 per ton	OFR 5311, p.461
Pole Star Burleigh, Anstruther Tps.	MDI31D09NE-00042 (Prospect)	U	Estimated size and grade from diamond drilling is 370 000 tonnes averaging 0.8 kg U_3O_8 or double using a lower grade of 0.6 kg/tonne	OFR 5635, p.199-200
Canadian Dyno Cardiff Tp.	MDI31D16NE-00032 (Past Prod. w Reserves)	U, Th	Reserves of possible ore were estimated at 500 000 tons grading 0.065% U_3O_8	OFR 5311, p.71-72
Bicroft (Centre Lake) Cardiff Tp.	MDI31D16NE-00043 (Past Prod. w Reserves)	U, Th	Estimated reserves above 1200 foot level: 559 000 tons grading 2.0 pounds U_3O_8 per ton before dilution (1960)	OFR 5311, p.66-67
Blue Rock Occurrence Monmouth Tp.	MDI31D16NE-00143 (Developed Prospect w Reserves)	U, REE	Reserves estimated at 292 444 tons at 0.095% U_3O_8 within 500 feet of shaft & to a depth of 600 feet; 56 720 tons at 0.120% U_3O_8 to a depth of 200 feet in the Lake Zone	OFR 5311, p.132, 133
Empire B Zone Monmouth Tp.	MDI31D16NE-00146 (Developed Prospect w Reserves)	U, Th, F	Drilling has indicated reserves of 2 179 166 tons grading 0.726 pounds U_3O_8 per ton	OFR 5311, p.135
Kenmac Chibougamau Cardiff Tp.	MDI31D16NE-00165 (Prospect)	U, Th	Estimated reserves: 200 000 tons averaging 0.20% U_3O_8 (1955)	OFR 5311, p.101
Rare Earth #1 Monmouth Tp.	MDI31D16NW-00195 (Developed Prospect w Reserves)	REE, U, Th	Official estimated reserves 541 821 tons indicated averaging 0.116% U_3O_8 (1957)	MRC 4, p.26
Farcroft Anstruther Tp.	MDI31D16SE-00059 (Developed Prospect w/o Reserves)	U	not known	
Garland Anstruther	MDI31D16SW-00093 (Prospect)	U, Th	not known	
Cavendish Cavendish Tp.	MDI31D16SW-00099 (Prospect)	U, Th	Estimated reserves: 435 624 tons grading 0.096% U_3O_8 (chemical)	OFR 5311, p.476
Bicroft (Croft) Cardiff Tp.	MDI31E01SE-00224 (Prospect)	U	Estimated reserves in 3 zones: 979 810 tons grading 1.20 pounds U_3O_8 per ton	OFR 5311, p.84-85
Fission Cardiff Tp.	MDI31E01SE-00235 (Prospect)	U, Th, F	not known	
Baumhour–Campbell Faraday Tp.	MDI31E01SE0-0248 (Prospect)	U, Th	not known	
Mell–Quirke Monteagle Tp.	MDI31F04NE-00067 (Prospect)	U, Th	not known	
Greyhawk Mine Faraday Tp.	MDI31F04SW-00036 (Past Prod. w Reserves)	U, Th	Estimated reserves of 0.2 million tons grading 0.065% U_3O_8	MDC 23, p.62
Faraday/Madawaska Mine Faraday Tp.	MDI31F04SW-00037 (Past Prod. w Reserves)	U, Th	Proven and probable reserves of 1 023 086 tons at 0.145% U_3O_8 (1976)	MDC 23, p.60

Note: The resource estimates listed in this table are historic figures generated by past workers and do not follow the required disclosure for reserves and resources as outlined in National Instrument 43-101.

Table 17. Mineral deposits not currently being mined in the Southeastern Ontario District in 2010. (Note: table does not include nepheline syenite, trap rock, REE and dimension stone deposits.)

Abbreviations

AF ..... Assessment Files
AR ..... Annual Report
CAMH ..... *Canadian and American Mines Handbook*
CMH ..... *Canadian Mines Handbook*
GR ..... Geological Report
MDC ..... Mineral Deposit Circular [No.15–]
[*formerly* Mineral Resources Circular, No.1-14]
MDI ..... Mineral Deposit Inventory
MLS ..... Mining Lands, Sudbury
MP ..... Miscellaneous Paper
NM ..... *The Northern Miner*
OFR ..... Open File Report
PC ..... Personal Communication
Status: A; E; I; M ..... Active; Exploration; Inactive, Mining

Deposit Township	MDI File Number	Status	Commodity	Reserves	Reserve Reference
Ore Chimney Prospect Barrie Township	MDI31C14SE-00142 (SO 1130)	I	Ag, Au, Zn, Pb	11 000 tons above the 500-foot level Averages. 0.2 ounces per ton Au, 5.64 ounces per ton Ag, 2.0% Zn, 1.0% Pb	MDC 12, p.132 MDC 18, p.33
Macassa Nickel Limerick Township	MDI31C13SE-00099 (SO 0595)	I	Ni, Cu	2 000 000 tons @ 1.0% Ni, 0.25% Cu	MDC 12, p1.38
Renfrew Zinc (Renprior) Admaston Township	MDI31F07NE-00063 (SO 0286)	AE	Zn	16 000 tons @ 10.5% Zn to a depth of 30 m; Breakwater Resources optioned the property to Noranda Mining and Exploration in 1996	MDC 12, p.226 MDC 20, p.17
Harvey Simon Prospect Lyndoch Township	MDI31F03NW-00044 (SO 0259)	AE	Cu, Fe, Zn	250 000 tons @ 1.1% Cu to 350 feet	MDC 12, p.226 MDC 20, p.45
Clyde Forks Deposit Lavant Township	MDI31F02SE-00064 (SO 0351)	I	Cu, Sb, Ag, Hg	60 000 tons @ 0.67% Cu, 0.37% Sb, 0.03% Hg, 1.32 ounces per ton Ag	MDC 20, p.36
Twin Lakes Diorite Methuen Township	MDI31C12NW-00114 (SO 3840)	I	Ti	13.2 Mt of 21.7% TiO_2, recoverable from open pit to a depth of 165 m, with rock:ore ratio = 0:54. Diorite wall rock is currently being mined by MRT Aggregates for trap rock.	Kingston, MacKinnon and Caley (1990, p.99)
Grattan Deposit Grattan Township	MDI31F06NE-00017 (SO 0270)	AE	Fe	Proven: 3 639 600 tons to a vein depth of 363 feet . Indicated: 9 099 000 tons to a vertical depth of 600 feet @ average grade of 27.74% Fe	MDC 20, p.98
Radenhurst–Caldwell Deposit Lavant Township	MDI31F02NE-00012 (SO 0349)	I	Fe	Main lens 2000 feet long by 31.3 feet wide; contains 6500 tons per slope foot at a grade of 32.77% Fe; 3 additional zones totalling 1600 feet in length average 17%, 16.7% and 25.5% Fe	MDC 20, p104
Bessemer Deposit Mayo Township	MDI31F04SE-00012 (SO 0235)	AE	Fe	No.4 deposit 2 480 819 tons @ 28.62% recoverable Fe. In 2007–2008, deposit was evaluated as source of iron.	MDC 20, p.110
Childs Deposit Mayo Township	MDI31F04SE-00013 (SO 0236)	AE	Fe	6 193 330 tons @ 19.25% recoverable Fe. In 2007–2008, deposit was evaluated as source of iron.	MDC 20, p.114
Calabogie Magnetite Property / Algoma Ore Prop. Ltd. Bagot Township	MDI31F07SE-00009 (SO 0353)	AE	Fe	Reserves of 45 million tons @ 25% Fe to 500 feet and 28% Fe to 1000 feet	MDC 11, p.314
Buckhorn Deposit Bagot Township	MDI31F07NE-00069 (SO0362)	I	Mo	Largest of numerous small lenses contains 1500 tons @ 1% MoS_2	MDC 20, p.132
Bannockburn (Madoc Mining Company Ltd.) Madoc Township	MDI31C12NE-00195 (SO 7274)	I	Au	225 000 tons grading 0. 267 ounces per ton Au	MP 161, p.377
Cooper Spruce Ridge Resources Ltd. Elzevir Township	MDI31C11SW-00044 (SO 2679)	I	Au, talc	3 Mt @ 30–33% recoverable talc and 40 000 t @ 8.0 g/t Au	OFR 5945, p.92; OFR 5808, p.79
Dingman Deposit Marmora Township	MDI31C12SE-00040 (SO 3590)	AE	Au	7 Mt @ 1.8 g/t Au	OFR 5958, p.11-13

Deposit Township	MDI File Number	Status	Commodity	Reserves	Reserve Reference
Hawley Ram Petroleum Limited Olden Township	MDI31C10NW-00117 (SO 4057)	AE	Wollastonite	2.5 Mt @ 32% wollastonite to a vertical depth of 75 m	OFR 5943, p.337
Marmora Gitennes Exploration Inc. Marmora Township	MDI31C12SE-00096 (SO 3729)	I	Wollastonite	450 000 t (open pit) @ 47% wollastonite, plus 680 000 t @ 39% wollastonite in a separate zone	OFR 5715, p.50
Trudeau C. Roger Young Hungerford Township	MDI31C11SW-00049 (SO 1192)	A	Calcite, dolomite	4 Mt high-purity dolomite; no reserve estimate available for the calcite zone	OFR 5958, p.11-11
Verona–Kirkham Stewart Lake Resources Inc. Bedford Township	MDI31C10SE-00023 (SO 1244)	I	Graphite	1.6 Mt grading 9.5% graphite in 2 separate zones	MDC 33, p.16
Cal Graphite Corp. Butt Township	MDI31E11NE-00004 (N0129)	I	Graphite	Reserves of 60 Mt grading 3% graphitic carbon	MDC 33, p.10
Globe Graphite Mine North Elmsley Township	MDI31C16SE-00016 (SO 1604)	I	Graphite	500 000 t of approximately 7% graphite below mined out portion to the 300-foot level	MDC 33, p.25
Cordova Mine Belmont Township	MDI31C12SW-00005 (SO 1670)	I	Gold	115 982 tons grading 0.21 ounces per ton Au	OFR 5808, p.43
Newboro Prospect North and South Crosby townships	MDI31C09NW-00009 (SO1466) MDI31C09NW-00011 (SO1469)	I	Iron, titanium	45 Mt proven and probable averaging 26.24% Fe, 6.60% TiO_2	OFR 5515, p.316
Madawaska Mine Faraday Township	MDI31F04SW-00037 (SO0223)	I	Uranium	Measured reserve of 385 193 short tons grading 0.143% U_3O_8, 1 098 283 pounds U_3O_8; indicated reserve of 450 988 short tons grading 0.158% U_3O_8, 1 427 195 pounds U_3O_8, total reserves of 836 181 short tons grading 0.151% U_3O_8, 2 525 478 pounds U_3O_8	OFR 5515, p.393
Addington Mine Kaladar Township	MDI31C11NE-00010 (SO0882)	I	Gold	Total geological reserve of 758 000 tons grading 0.14 ounces per ton Au	OFR 5808, p.71
Dominion Magnesium (Timminco) Deposit Ross Township	MDI31F10SE-00002 (SO0068)	I	Dolomitic marble (magnesium metal)	Production rate was 1000 tons of dolomite weekly. No reserve estimate available. Production from purchased feedstock ceased in 2008.	OFR 6222, p.6

Note: The resource estimates listed in this table are historic figures generated by past workers and do not follow the required disclosure for reserves and resources as outlined in National Instrument 43-101.

Table 18. Mineral deposits not currently being mined in the Southwestern Ontario District in 2010.

Abbreviations

AF ..... Assessment Files
AR ..... Annual Report
CAMH ..... *Canadian and American Mines Handbook*
CMH ..... *Canadian Mines Handbook*
GR ..... Geological Report
IMR ..... Industrial Mineral Report
MDC ..... Mineral Deposit Circular [No.15–]
[*formerly* Mineral Resources Circular, No.1-14]
MDI ..... Mineral Deposit Inventory
MLS ..... Mining Lands, Sudbury
MR ..... Mining Recorder
NM ..... *The Northern Miner*
OFR ..... Open File Report
PC ..... Personal Communication
PRW ..... Petroleum Resources Well No.

Deposit Name / NTS	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References*	Status
Amherstburg Quarry silica prospect (40J/03SE)	Silica	20 m thick over 66 ha (20–26 $\times 10^6$ t @ 94% SiO_2)	Amherst Quarries (1969) Ltd.	OFR 5861, p.32 IMR 9, p.29, 31	Inactive
Big Creek 1 (40J/03SE)	Silica	19.5 m thick @ 25 m (10×10^6 t of sandstone)	N/A	IMR 9, p.29	Inactive
Big Creek 1 (40J/03SE)	Silica	14.6 m thick @ 34.4 m (10×10^6 t of sandstone)	N/A	IMR 9, p.29	Inactive
Dow–Moore 2-20-12 (40J/16NW)	Salt	21 m thick @ 698 m 73 m thick @ 582 m 114 m thick @ 410 m	N/A	PRW Dow–Moore 2-20-XII	Inactive
Eastnor–Lindsay prospect (41H/03SW)	Dolomite	60×10^6 t dolomite @ <0.10% impurities (SiO_2+Fe_2O_3+Al_2O_3)	N/A	PRW OGS Lindsay 7-III W	Inactive
Imperial Oil No.560, Sombra 2-12-H, Gormlay No. 1 (40J/090NW)	Salt	32.2 m thick @ 612.6 m 84.1 m thick @ 490.7 m 46.9 m thick @ 388.6 m	N/A	PRW Sombra 2-12-H	Inactive
Imperial Oil No.597, Logierait No.1-Y-R, R.C. Fleck No. 2B (40J/16NW)	Salt	29.6 m thick @ 680 m 87.8 m thick @ 544 m	N/A	PRW Imperial Oil No. 597B	Inactive
Lindsay prospect (41H/03SW)	Dolomite	>35 $\times 10^6$ t dolomite @ <0.10% impurities (SiO_2+Fe_2O_3+Al_2O_3)	N/A	PRW OGS Lindsay 31-VIII W	Inactive
Patton Farm (40J/03SE)	Silica	5.4 m thick @ 10.1 m	N/A	IMR 9, p.29	Inactive
Sunburst GB #7 McGillivray 41-NB (40P/04NE)	Salt	88.7 m thick @ 363.6 m 5.8 m thick @ 339.5 m	N/A	PRW Sunburst GB #7	Inactive
Tobermory prospect (41H/04NE)	Dolomite	60×10^6 t dolomite @ <0.10% impurities (SiO_2+Fe_2O_3+Al_2O_3)	N/A	PRW OGS St. Edmunds 47-III W	Inactive
Union Gas–Enniskillen No. 29, D.V.L.A. No. 1 (40J/16SW)	Salt	25.6 m thick @ 610.8 m 78.6 m thick @ 485.5 m	N/A	PRW Union Gas–Enniskillen No. 29	Inactive
Union Gas–Moore No. 12 P&I Williams No. 1 (40J/16SW)	Salt	26.2 m thick @ 577.3 m 70.7 m thick @ 456.6 m	N/A	PRW Union Gas-Moore No. 12 P&I Williams No. 1	Inactive
Union–Moore No. 22 (40J/16SW)	Salt	36 m thick @ 580 m 32 m thick @ 437 m	N/A	PRW Union Moore No. 22	Inactive

Note: The resource estimates listed in this table are historic figures generated by past workers and do not follow the required disclosure for reserves and resources as outlined in National Instrument 43-101.

OGS ACTIVITIES AND RESEARCH BY OTHERS

Two projects in the Grenville Province of southeastern Ontario were completed by staff of the Precambrian Geoscience Section, Ontario Geological Survey, during the 2010 field season.

R.M. Easton conducted a study of newly recognized Flinton Group exposures in the eastern part of the Mazinaw terrane. Lithological and geochemical studies were done in order to correlate the stratigraphy of the new exposures with previously mapped Flinton Group rocks in the central and western parts of the terrane. Easton (2009) identified a new area of Flinton Group metasedimentary rocks in close proximity to the Renprior zinc occurrence and suggested that the unconformity surface between the Grenville Supergroup and Flinton Group rocks may have been an important channel for fluid movement, creating pore space in the dolomitic marbles in which sphalerite was later deposited by hydrothermal solutions. Other large areas of dolomitic marble adjacent to the Flinton Group should be considered as potential hosts for zinc mineralization and the new exposures extend the area prospective for such mineralization.

M. Duguet completed a one-year geological mapping project in the Hungry Lake area of Frontenac County. The project was undertaken in order to 1) update the geological knowledge of the area, which had not been mapped in detail since the 1940s; 2) evaluate the potential for gold mineralization associated with the Robertson Lake mylonite zone; and 3) understand the setting and mineral potential of the pegmatite-hosted uranium and thorium occurrences in the area.

Details of the projects described above are presented in the following articles, published in *Summary of Field Work and Other Activities, 2010* (Ayer, Easton et al. 2010):

- Newly Recognized Flinton Group Exposures in Southeastern Mazinaw Terrane, Central Metasedimentary Belt, Grenville Province; by R.M. Easton
- Geology and Mineral Potential of the Hungry Lake Area, Mazinaw and Sharbot Lake Domains, Grenville Province; by M. Duguet, S. Gordon and R.M. Easton

A number of OGS studies related to Paleozoic geology, Quaternary geology, aggregate resources and groundwater resources in southern Ontario were in progress in 2010. Detailed descriptions of the following projects by staff of the Sedimentary Geoscience Section are included in *Summary of Field Work and Other Activities, 2010* (Ayer, Easton et al. 2010):

- Aggregate Resources Inventory of the County of Simcoe, Southern Ontario; by D.J. Rowell
- Aggregate Resources Inventory of the County of Lanark, Southeastern Ontario; by V.L. Lee
- Three-Dimensional Mapping of Quaternary Deposits in the Southern Part of the County of Simcoe, Southern Ontario; by A.F. Bajc and D.R.B. Rainsford
- Orangeville Moraine Project: Buried Valley Targetted Gravity Study; by A.K. Burt and D.R.B. Rainsford
- Investigation of the Dundas Buried-Bedrock Valley, Southern Ontario; by E.H. Priebe, A.S. Marich, T.S. Patterson and W.G. Zwiers
- Update of Early Silurian Sequence Stratigraphy, Sedimentology and Bedrock Aquifer Mapping of Niagara Escarpment Cuesta; by F.R. Brunton, C. Brintnell, E.H. Priebe and M. Bingham
- The Ambient Groundwater Geochemistry Program: Completion of Sampling of Southwestern Ontario; by S.M. Hamilton, C.N. Freckelton and R. Mariotti
- A 1000 km^2 Region of Breathing Wells North of London, Ontario; by C.N. Freckelton, S.M. Hamilton and F.J. Longstaffe
- Southern Ontario Stream-Sediment Geochemistry Survey; by R.D. Dyer, R. Fletcher and E.J. Reiner
- Shale Gas Assessment Project, Southern Ontario: Preliminary Results from the Kettle Point Formation; by C. Béland Otis

The following research projects by faculty and graduate students of Ontario universities were in progress in 2010.

- Dr. C. Eyles and graduate student S. Puckering of McMaster University are examining bedrock elevation data obtained from bedrock outcrops and fully cored boreholes and from GSC and OGS sources which are being incorporated into geographic information system (GIS) software and database to determine the extent and geometry of buried-bedrock valleys (primarily in the Queenston Shale) in the Georgetown area of southern Ontario. This information will be used to enhance understanding of the origin of large-scale bedrock erosion features in southern Ontario and will also be applied to groundwater exploration programs. Landforms and processes of subglacial bedrock erosion are also being investigated at other sites across Ontario (Whitefish Falls, Vineland, Pelee Island) and on Kelley's Island, Ohio. Subglacial landforms and features identified at these field sites are being compared and analyzed to identify spatial controls on the development of these landforms. Preliminary work has been documented in Puckering and Eyles (2009).

- Dr. N. Culshaw of Dalhousie University has been working on the following projects in southern Ontario:

  Algonquin Park and environs (with co-operation with Algonquin Park Authorities):

  - Geochronological, metamorphic and structural study of amphibolite-facies shear zone bounding Kiosk and Bonfield domains of Central Gneiss Belt (MSc, John Foster; ongoing; in conjunction with R.A. Jamieson, Dalhousie University and C. Gerbi, University of Maine)
  - Geochronological, metamorphic and structural study of late, low-grade shear zone within shear zone bounding Kiosk and Bonfield domains (BSc, L. Ratcliffe; ongoing; in conjunction with R.A. Jamieson, Dalhousie University and C. Gerbi, University of Maine)
  - Metamorphism of interior Kiosk domain (BSc, D. McLeish, completed 2008; in conjunction with R.A. Jamieson, Dalhousie University)
  - Gravity study of interior Kiosk domain (BSc, H. Archibald, completed 2008)
  - Geochronology of interior Kiosk domain (N. Culshaw, in conjunction with C. Gerbi, University of Maine and J. Marsh, Colby College)

  Georgian Bay:

  - Field-based studies of rheological change in orogenic mid-crust, Parry Sound and Britt domains of Central Gneiss Belt (N. Culshaw, in conjunction with C. Gerbi, University of Maine and J. Marsh, Colby College)

- University of Windsor PhD student O. Haeri-Ardakani, supervised by Dr. I. Al-Aasm and Dr. M. Coniglio (University of Waterloo), is studying the geochemistry and origin of diagenetic fluid and the paleohydrology of Paleozoic carbonates in southwestern Ontario.

  The Paleozoic oil and gas reservoirs in southwestern Ontario consist of carbonates ranging from Ordovician to Devonian age. Previous studies on diagenesis of the carbonate succession from Ordovician to Devonian strata in different regions have indicated that a late phase of hydrothermal saline fluid was responsible for precipitation of dolomite cement, pore-filling saddle dolomite, minor calcite, fluorite, anhydrite and pyrite. These studies have focussed on particular time spans with no broad stratigraphic context to decipher the fluid flow pattern and source of fluid(s) in the whole package of Paleozoic strata. Based on structural and geophysical studies, basement faults penetrated upward into the overlying Paleozoic strata and had a major role in migration of petroliferous fluids.

  The proposed study is a detailed investigation of the Paleozoic carbonate successions in southwestern Ontario to determine their diagenetic history (with emphasis on late-stage events), origin of the fluid(s) involved, their evolutionary pathways and paleohydrology of the system in southwestern Ontario and their effects on porosity and permeability modification. Integration of geochemical data with field and petrographic evidence of diagenetic minerals that were formed during this hydrothermal event could provide insights into the origin of fluids and their subsurface migration and geochemical evolution. Main tools that will be use in this study are O, C and Sr stable isotopes, in conjunction with radiogenic Sr isotopes and fluid inclusion microthermometric measurements.

- Dr. B.A. Cheadle of the University of Western Ontario is supervising graduate students in the following 2 projects in southwestern Ontario:
    - Investigation of the suitability of the Upper Devonian Kettle Point shale as a source of organic matter for endemic or inoculated methanogenic microbial consortia. The project is being conducted in co-operation with Catherine Béland-Otis (OGS, Sudbury) using a core sample from one of the Kettle Point core holes (OGS-SG10-02 / Lic #: T012027) drilled by the OGS in 2010 in Sombra Township, Lambton County. The sample is being evaluated to assess the presence of endemic methanogenic microbial consortia that may be responsible for generation of biogenic methane in the Kettle Point Formation. If no such endemic organisms are detected, the suitability of the disseminated organic matter to support cultured methanogens in various growth media will be evaluated. Expected completion date is April 15, 2011.
    - Origins of an enigmatic circular structure - Liberty Torque #2, Sombra 4-2-XII. The project integrates well log, three-dimensional (3D) seismic, aeromagnetic (supplemented by a new ground-based magnetometer survey) and gravity data in order to determine the origin of an enigmatic circular structure that was targeted by the Liberty Torque #2 well in Sombra Township. Expected completion date is September 30, 2011.

REGIONAL LAND USE GEOLOGIST ACTIVITIES

Land Use Planning Activities

The southern Regional Land Use Geologist, based in Tweed, co-ordinates input into land use planning activities in the Southeastern Ontario and Southwestern Ontario Resident Geologist districts, and the part of the Sudbury District south of the French River, including Manitoulin Island. Following a competition for the vacant southern Regional Land Use Geologist position, D.A. Laidlaw was the successful applicant.

The objectives of the position are to

- effectively represent mineral-related values in the context of competing interests for land use;
- optimize the land base available for mineral exploration and development; and
- raise awareness within the mineral sector of the implications of legislation and regulations other than the *Mining Act* on their activities.

The competing interests for land use vary across the province, but most have potential to restrict the availability of land, access to it, and/or the activities on it. In 2010, the southern Regional Land Use Geologist dealt with a variety of land use planning issues throughout the Southern Region.

Crown Lands

The southern Regional Land Use Geologist responded to requests to comment on and review environmental site assessments related to utility and waterpower projects and Ministry of Transportation highway work. A number of energy-related projects including waterpower projects on the Petawawa River, and the Okikendawt transmission line project south of the French River are in the planning phase. In addition, the Ministry of Transportation is planning to carry out 5 pavement rehabilitation projects north of Toronto, including a section along Highway 400. The data provided to support planning for these initiatives included mining-related hazards, past mineral production, known mineral resources, mining land tenure and current and past exploration activity.

Other Crown land use planning supported by the southern Regional Land Use Geologist included responding to inquiries related to Crown-owned mining rights where surface rights are privately held, and mineral development and exploration.

On April 30, 2009, withdrawal order W-SO-54/09 came into effect for lands in southern Ontario. It applies to properties south of the south shores of the French River, Lake Nipissing and the Mattawa River where the surface rights are privately held, but the mining rights are held by the Crown. The mining rights of those properties have been withdrawn from prospecting, staking, sale and lease. It is expected that, in 2011, new regulations will come into effect under the *Mining Act* whereby the owners of those surface rights can apply to the Minister to have the mining rights on their properties reopened for staking.

Municipal / Private Lands

The Ministry of Northern Development, Mines and Forestry supports municipal and private land use planning through the One Window Planning Service led by the Ministry of Municipal Affairs and Housing (MMAH). When requested, the southern Regional Land Use Geologist provides input into, and reviews draft Official Plans, Official Plan Amendments, draft plans of subdivision, and consent (severance) applications to ensure that Provincial mineral interests are appropriately considered in the planning process.

In 2010, the southern Regional Land Use Geologist reviewed, commented on and/or supplied data and expertise for consent (severance) applications for 13 lower tier municipalities and 17 Official Plans and related planning initiatives during the year, and 13 new or updated Draft Official Plans. The municipalities involved in these planning initiatives are listed in Table 19.

Table 19. Municipal planning initiatives with MNDMF input, southern Ontario, 2010.

Consent (Severance) Applications	Completed Official Plans and Related Initiatives	Official Plan and Related Initiatives Under Development
Barrie, Township of	Beckwith, Township of	Brockville, City of
Bathurst, Township of (3)	Brant, County of	Cornwall, City of
Carlow/Mayo, Township of (2)	Brighton, Municipality of	Cramahe, Township of
Darling, Township of	Central Elgin, Municipality of	Guelph, City of
Dungannon, Township of	Central Frontenac, Township of	Highlands East, Municipality of
Faraday, Township of	Dutton/Dunwich, Township of	Huron, County of
Madoc, Township of	Greater Napanee, Town of	Joly, Township of
Marmora and Lake, Municipality of	Grey, County of	Lanark, County of
Rideau Lakes, Township of	Hamilton, Township of	Parry Sound, Town of
Ross, Township of	Hastings, County of	Perry, Township of
South Burgess, Township of	Lanark Highlands, Township of	Prince Edward County, City of
Tay Valley, Township of	Malahide, Township of	Quinte West, City of
Tweed, Municipality of	North Frontenac, Township of	Wellington, County of
	Oro-Medonte, Township of	
	Renfrew, County of	
	South Algonquin, Township of	
	St. Thomas, City of	

The southern Regional Land Use Geologist provided assistance to staff from MMAH by facilitating group discussions at the Eastern Ontario public information workshops held in Ottawa and Kingston that were held to generate open discussion on the five-year review of the "Provincial Policy Statement, 2005" (PPS).

Other Activities

The southern Regional Land Use Geologist responded to requests to review and comment on environmental site assessments related to proposed wind farms on private lands including sites at Grantham Township near St. Catharines, Mitchell, Port Stanley area and Springwood (Fergus). Mineral values and land tenure information were also provided for a solar power development in Burgess Township. With the implementation of the *Green Energy Act, 2009* (in 2009), projects producing clean, renewable sources of energy, including wind, solar, hydro, biomass and biogas have been encouraged.

The southern Regional Land Use Geologist also supported the Ontario Public Service (OPS) Biodiversity Network by attending teleconferences and a conference, and advising MNDMF programs of biodiversity-related initiatives that might be of interest to them. The OPS Biodiversity Network is intended to provide an interministry forum where the Ministry of Natural Resources', Biodiversity Branch can exchange information, facilitate discussion, and strategically plan for biodiversity-related activities, policies, processes and projects across the Province.

During 2010, the southern Regional Land Use Geologist assisted the Southern Ontario Regional Resident Geologist, who has been working with Aboriginal Relations Unit, Ministry of Northern Development, Mines and Forestry as a technical expert in support of the Algonquin First Nation land claim discussions, by preparing technical resource materials.

The southern Regional Land Use Geologist also helped prepare display materials highlighting mineral production and exploration activity in Ontario. These display materials, including posters and mineral commodity pamphlets, were on display at various conferences and shows including the Prospectors and Developers Association of Canada Annual Convention, the Blendon Industrial Minerals Conference and the Bancroft Gemboree. With between 8000 and 12 000 attendees, each year, the Bancroft Gemboree is the largest Gem and Mineral Show in Canada. It provides staff from the Resident Geologist Program with an opportunity to share information regarding the mineral sector with mineral collectors and the general public.

Throughout 2010, the southern Regional Land Use Geologist assisted clients from the mineral sector, municipal and provincial government agencies and ministries with accessing publications, assessment and mineral deposit inventory files housed at the Southern Ontario Regional Resident Geologist office and on the GeologyOntario Web site. The southern Regional Land Use Geologist also assisted in hosting a Southern Ontario Prospectors Association (SOPA) day-long meeting in Actinolite. The meeting provided members of SOPA with information on relevant topics related to mining and exploration, changes to government regulations, and new research and mapping projects planned by Ontario Geological Survey's Precambrian and Sedimentary Geoscience sections.

MINERAL DEPOSIT COMPILATION GEOLOGIST, NORTHEASTERN ONTARIO – ACTIVITIES

The Mineral Deposit Inventory (MDI) database is a dynamic compilation of over 19 000 records describing most of the documented mineral occurrences in the Province of Ontario. The MDI database is an important reference tool for companies and individuals interested in exploring and acquiring mining properties in Ontario. It can be used in combination with a variety of Ontario Geological Survey digital databases, maps and geological reports. The MDI database is also used to assist land use planning decisions.

The Southern Ontario portion of the MDI database contains documentation of over 6000 mineral occurrences. Hard-copy files indexed by geographic township contain published reference materials, staff property visits and information donated by companies and individuals. The earliest records date back to the mid-1800s. Files are cross referenced to other MNDMF databases including the Assessment File Resource Inventory (AFRI), Abandoned Mines Inventory System (AMIS) and the Drill Core Library database. The Mineral Deposit Inventory is the principal search method used by the Resident Geologist Program client group. Staff of the Resident Geologist Program office completes ongoing review and updates to the MDI files to ensure accuracy and completeness.

In 2010, 2 Mineral Deposit Inventory (MDI) Compilation Geologist positions were created to be based in Thunder Bay and Timmins. The Compilation Geologist – Northeast investigates and documents mineral deposits and occurrences in the northeastern region and will also share responsibilities for the Southern Ontario database. The Compilation Geologist works with regional staff to ensure that the MDI database is regularly updated.

In 2010, the Compilation Geologist – Northeast trained all regional and district geological staff in the use of the MDI methodology and database entry techniques; updated the MDI data entry and compilation manuals; and worked with a committee that co-ordinated the release of an updated MDI database on CD (Ontario Geological Survey 2010f) at the Ontario Exploration and Geoscience Symposium in December, which was the first update since 2004. In January 2011, the updated MDI database also was made available through the Ministry Web site. The MDI data are searchable through the Ministry's GeologyOntario Web site and through OGS Earth. The entire digital data set is available as Ontario Geological Survey "Mineral Deposit Inventory—2010".

The MDI manuals prepared by the Compilation Geologist – Northeast have proven to be invaluable to the Southern Ontario Regional Resident Geologist Program staff in their continued upgrade of the MDI database.

At the request of the Precambrian Geoscience Section, the Compilation Geologist – Northeast reviewed and updated MDI records for the following maps: Préfontaine et al. (2010); Duguet, Préfontaine, Brown et al. (2010); Ayer, Chartrand et al. (2010); and Duguet, Préfontaine, Cole et al. (2010).

Total contributions to the MDI database in 2010 included 302 updated records, 127 records deleted and 39 new records.

ACKNOWLEDGMENTS

The authors would like to thank all producers, exploration companies, prospectors and developers who provided access to their operations or supplied information throughout 2010. Strong communication links between stakeholder groups and government ministries is essential to effective program delivery and ultimately improves the delivery of government services.

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Ontario

Ontario Geological Survey
Regional Resident Geologist Program

Petroleum Resources Centre—2010

by

L. Fortner and T.R. Carter

2011

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Petroleum Resources Centre—2010

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Petroleum Resources Centre—2010

Oil and Gas Exploration and Development Activity in Ontario in 2010

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INTRODUCTION

Drilling activity in Ontario in 2010 decreased compared to 2009, with production levels also falling. The price for light sweet crude oil began 2010 around $80 per barrel and averaged about $70 for the year. This was significantly higher than the average for 2009. The price of natural gas in North America ranged between $6 and $3 per MMBTU in 2010, finishing the year over $4. Greatly reduced industrial usage of natural gas during and following the recent economic recession has resulted in less total gas consumption in North America since mid-2008. In addition to this reduced consumption, new onshore supplies in North America from recently exploited shale gas continue to suppress natural gas prices.

Production figures compiled from annual production reports submitted to the Petroleum Resources Centre indicate annual oil production declined 7.5% to 83 779 m^3 in 2010 with an estimated value of $42.6 million, compared to 90 535 m^3 with an estimated value of $38.8 million the previous year. Results for natural gas production had not been compiled at the time of writing. The decline in oil production is directly related to reduced levels of drilling activity since 2004, such that there is insufficient new production to replace that from existing wells. The cash value of production decreased substantially from 2008 to 2009, but increased again in 2010 with oil prices stabilizing at a level consistently above the 2009 low.

EXPLORATION ACTIVITY

A total of 15 licences to drill and operate new wells were issued by the Ministry of Natural Resources in 2010, compared to 46 in 2009. An additional 33 licences were issued for plugging of existing wells. Nine existing wells were licenced for oil production and one for injection in historical oil fields.

Drilling of 23 new wells was reported in 2010, compared to 28 wells in 2009. These consisted of 5 exploratory wells, 10 development wells and 8 service wells. The 8 service wells consisted of 2 natural gas storage wells, 4 stratigraphic tests, 1 brine disposal well and 1 observation well. One of the natural gas storage wells was drilled horizontally, as was one of the stratigraphic tests. No other horizontal wells were drilled during the year.

Successful development drilling in 2010 resulted in 2 wells reported to be potential oil producers, 1 suspended natural gas well, 1 capped well with gas show and 6 active private gas wells. Successful development drilling in 2009 was materially better, with 5 wells reported to be active oil producers, 2 as active gas producers, 1 as a potential gas well, 1 as a potential oil well, 1 as an active private gas well and 1 as a suspended private gas well. The 4 commercial development wells drilled in 2010 were located in Elgin, Lambton and Welland counties. No wells were drilled offshore Lake Erie in 2010.

Exploratory drilling in 2010 resulted in 1 well reported as an active gas producer, 1 active oil producer, 2 potential oil wells (Table 1; Figure 1) and 1 dry hole. In comparison, exploration results in 2009 were more gas-weighted, with 2 wells reported as active gas producers, 1 suspended gas well, 2 potential gas wells, and 1 plugged and abandoned well with oil show. The number of successful exploration wells drilled in Ontario was 4, down from 5 in 2009. Three wells were drilled by Ontario General Energy in Lambton County and one by NRG in Oxford.

Cambrian Play

One exploratory well was drilled in Oxford County to test Cambrian targets for oil and gas in 2010. It was reported as a potential oil producer. There had been 1 potentially successful Cambrian exploratory test in 2009 reported as suspended with gas show.

One development well was drilled into the Cambrian in Elgin County and reported as a potential producer with oil show. There had been no development wells drilled to Cambrian targets in 2009.

Ordovician Play

As in 2009, no exploration wells tested Ordovician targets in 2010. There were also no development wells drilled in 2010. There had been 1 development well reported as a potential Ordovician oil producer in 2009.

Silurian Sandstone Play

No exploration wells tested Silurian sandstone targets in 2010. In 2009, 2 exploration wells were reported to be active gas producers from Silurian sandstones in Norfolk County.

Eight development wells were drilled for Silurian sandstones in 2010. Six were private gas wells, all currently active; and 2 were commercial wells: 1 reported as suspended in Welland County and the other as a capped well with gas show in Elgin County.

Of the development wells targeting Silurian sandstones in 2009, there were 2 commercial wells reported as active gas producers and 1 commercial well reported as a potential gas well. There was also 1 active private gas well and 1 suspended private gas well.

Silurian Carbonate Play

Four exploratory wells were drilled to test Silurian Guelph reef and/or Salina Group targets in 2010. These resulted in 1 active oil well, 1 active natural gas well, 1 potential producer with oil show and 1 dry hole, all in Lambton County.

In 2009, 1 exploratory well was reported as a potential gas producer and 1 well was abandoned with an oil show in Lambton County. A third exploration well was reported as a potential gas producer in Elgin County.

One development well was drilled for Silurian Guelph–Salina targets in 2010. It was reported as a potential oil producer in Lambton County. There were no development wells drilled for these targets in 2009.

Devonian Play

No exploration or development wells tested Devonian targets in 2010. There were 5 Devonian development wells all reported as active oil producers in 2009, but no exploration wells drilled in 2009.

RECOMMENDATIONS FOR EXPLORATION

Recent exploration has been focussed on the proven Silurian sandstone and carbonate reservoirs. High natural gas prices greatly enhance the economics of all gas plays in Ontario. Unfortunately, North American natural gas prices dropped dramatically during 2009 and remained relatively low throughout 2010. Exploration activity focussing on oil has not increased in spite of consistently robust oil prices in 2010.

Activity in Ontario has been reduced to a minimum by the constraints of commodity prices. Consistently low natural gas prices have clearly restricted exploration and development operations in the province. Ironically, sustained higher oil prices also negatively impact activity in Ontario by increasing the attractiveness of larger and more expensive projects in other provinces as well as internationally. Recommendations for future exploration have not changed in this report for several years and will remain unchanged until exploration activity increases and new plays and fairways are tested by industry.

Exploration in the Ordovician play has declined considerably in the past several years with a focus on extension or development drilling of known trends. Essex County and southern Kent County are still the most attractive onshore locations, but exploration will need to expand to the north and east if oil production is to be maintained. There is considerable remaining untested potential for natural gas in this play beneath the eastern basin of Lake Erie and onshore east and north from Kent County to the Niagara Escarpment. A 2005 reassessment of potential in this play by the Ministry of Natural Resources indicates potential remaining undiscovered resources totalling 201 billion cubic feet (5.7 billion m^3) of natural gas and 16.6 million barrels (2.64 million m^3) of oil. There also may be potential for trapping of natural gas in sandy facies of the Ordovician Shadow Lake Formation over the crest of the Algonquin Arch.

There is potential for discovery of Cambrian gas or oil pools along the pinch-out edge of the Cambrian sandstone in the subsurface or in fault-controlled structures. There may be considerable unrealized potential in fault-related structural traps in the Salina A-1 and A-2 carbonate units in Kent, Elgin and Middlesex counties. There was a significant increase in drilling in the Lower Silurian sandstone play in 2006, but that activity has declined from 2007 onward.

Table 1. Successful oil and gas exploration wells in southern Ontario in 2010 (*see* Figure 1 for well locations).

Well #	Well Name	Results	Target	TD	Latitude	Longitude	TD Date
1	OGE #4, Brooke 4 - 5 - XIV	OP - ACT	SAL	663.0	42.92329083	-81.97064861	04/05/2010
2	OGE #5, Sombra 6 - 21 - XIV	GP - ACT	SAL	670.0	42.74404278	-82.31454833	24/08/2010
3	OGE #3, Plympton 3 - 3 - II	OS - POT	SAL	750.0	42.95211250	-82.21551000	12/02/2010
4	NRG 10-01 Oxford on the Thames, East Oxford 6 - 20 - VIII	OS - POT	CAM	997.6	43.03751389	-80.71781944	16/12/2010

Abbreviations: ACT = active; CAM = Cambrian; GP = gas producer; OP = oil producer; OS = oil show; POT = potential; SAL = Silurian Salina Group; TD = total depth (in metres).

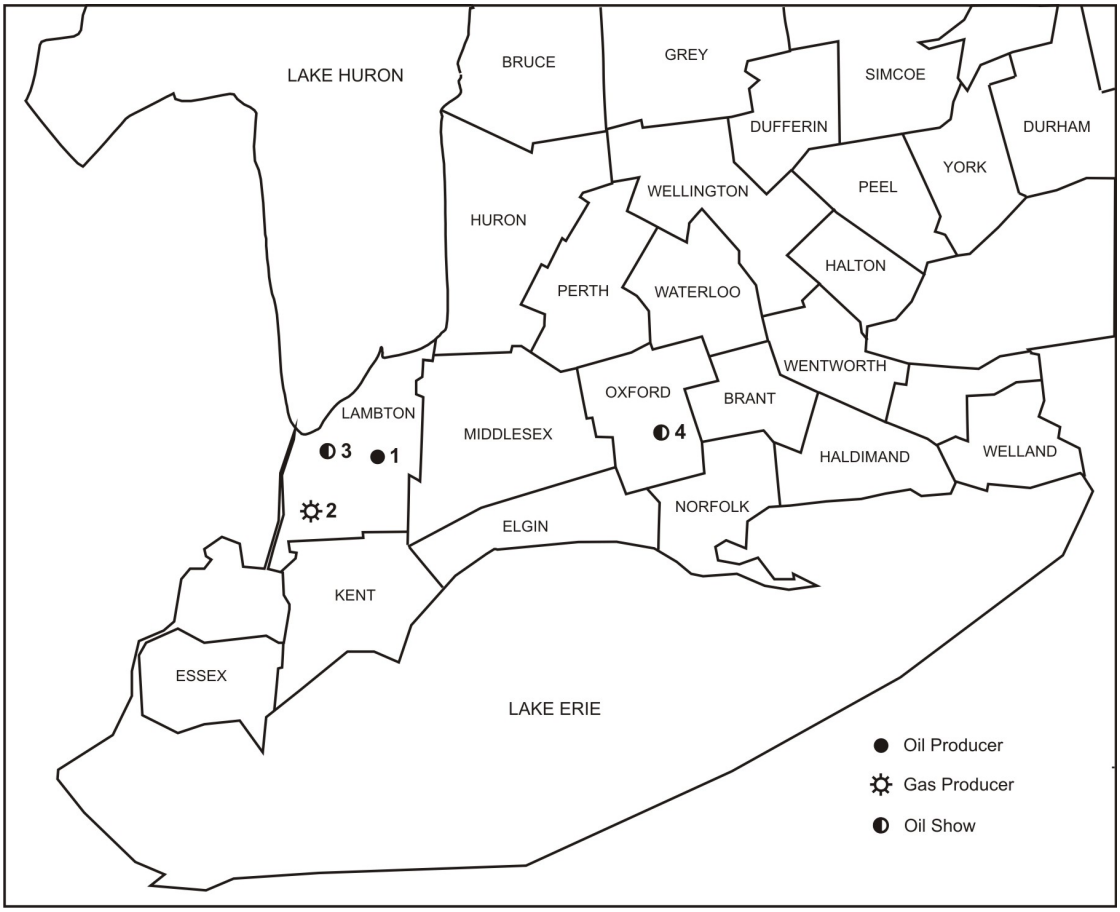

Figure 1. Successful oil and gas exploration wells in southern Ontario in 2010.

Metric Conversion Table

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	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	0.061 023	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	1.307 951	cubic yards	1 cubic yard	0.764 554 86	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	0.035 273 962	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 747	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 622 6	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 3	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 90**	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)	31.103 477	grams per ton (short)
1 gram per ton (short)	0.032 151	ounces (troy) per ton (short)
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.

ISSN 1484-9402 [print]
ISBN 978-1-4435-6303-1 [print]

ISSN 1916-6168 [online]
ISBN 978-1-4435-6304-8 [PDF]