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Ontario Geological Survey
Open File Report 6277

Report of Activities, 2011
Resident Geologist Program

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

2012

ONTARIO GEOLOGICAL SURVEY

Open File Report 6277

Report of Activities, 2011
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, S.J. Charbonneau, D.A. Laidlaw, A.C. Wilson,
T.R. Carter and L. Fortner

2012

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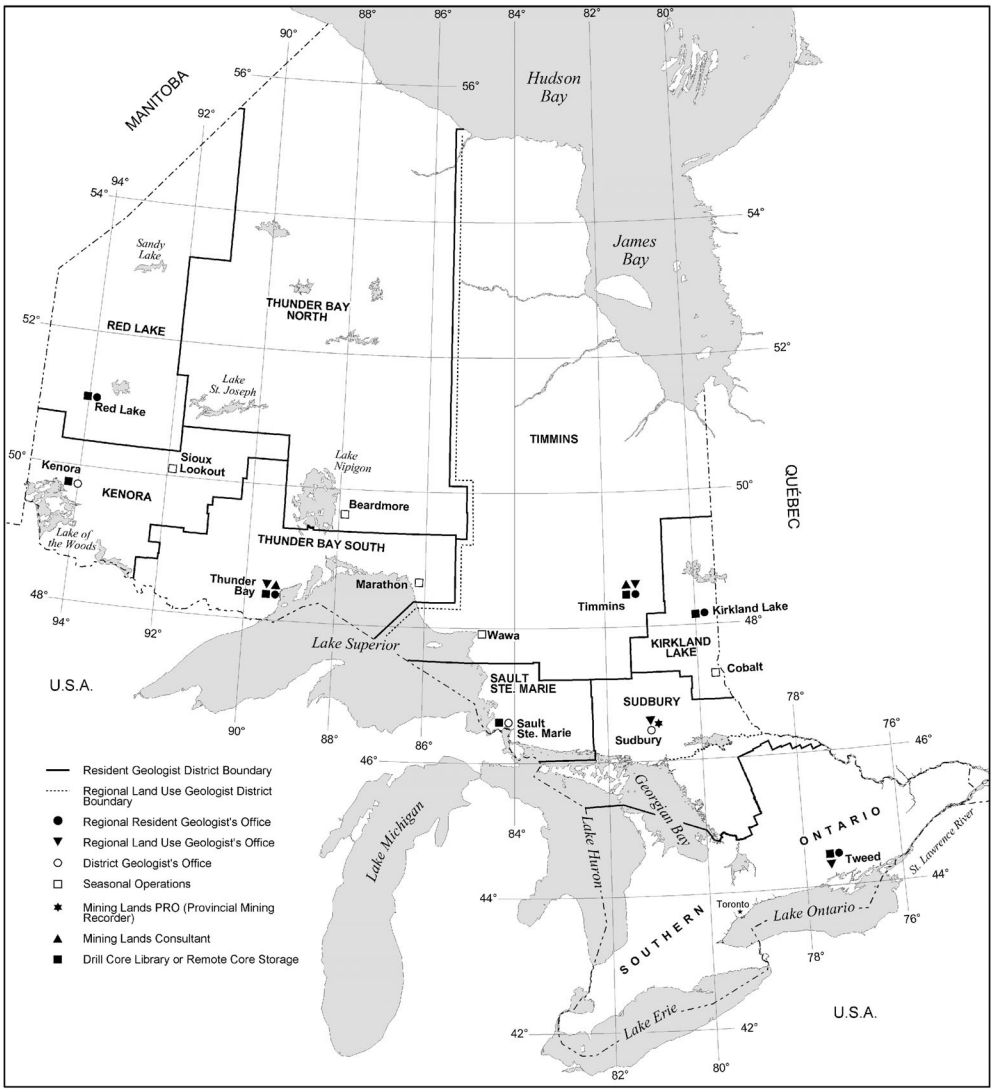

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Ontario Geological Survey

Resident Geologist Program

Report of Activities—2011

SOUTHERN ONTARIO
REGIONAL RESIDENT GEOLOGIST REPORT

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Ontario Geological Survey
Regional Resident Geologist Program

Southern Ontario Regional Resident Geologist
(Southeastern Ontario and Southwestern Ontario Districts)—2011

by

P.J. Sangster, P.S. LeBaron, S.J. Charbonneau, D.A. Laidlaw and A.C. Wilson

2012

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Southern Ontario Regional Resident Geologist (Southeastern Ontario and Southwestern Ontario Districts)—2011

P.J. Sangster[1], P.S. LeBaron[2], S.J. Charbonneau[3], D.A. Laidlaw[4] and A.C. Wilson[5]

[1]Regional Resident Geologist, Southern Ontario Region, Ontario Geological Survey

[2]District Geologist, Southeastern Ontario District, Ontario Geological Survey

[3]District Geological Assistant, Southeastern Ontario District, Ontario Geological Survey

[4]Regional Land Use Geologist, Southern Ontario Region, Ontario Geological Survey

[5]Mineral Deposit Compilation Geologist, Resident Geologist Program, Ontario Geological Survey

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 2011, the common boundary between the Resident Geologist Program Sudbury District and the Southern Ontario Region, which previously bisected the townships of Ballantyne, Paxton, Butt, McCraney and Finlayson, was adjusted to include the whole townships in Southern Ontario. All pertinent data on these townships previously on file in the Sudbury District Geologist office have been transferred to the Southern Ontario Region.

Production from mines and quarries continued throughout southern Ontario within both the Grenville Province and in the Paleozoic rocks in the southwest and southeast. With the exception of salt mining and brine field operations in southwestern Ontario, all mining operations within the Paleozoic rocks are for commodities the development of which is designated under the *Aggregate Resources Act* administered by the Ministry of Natural Resources.

From April 4, 2011, until June 3, 2011, the surface and mining rights for all unalienated Crown land south of the French River, Lake Nipissing and the Mattawa River were withdrawn from staking for a 60-day period to allow for transition from ground staking to map staking. On June 3, 2011, these lands were reopened for staking using a paper-based map-staking system for areas that have been subdivided into lots and concessions. Ground staking is still required in unsubdivided townships in southern Ontario, using special staking rules for designated areas.

Despite concerns expressed by local associations and in spite of a truncated period for recording claims, southern Ontario prospectors and developers appear to have adapted to the new map-staking system. In the ten-month period during which claims could be recorded, a total of 1369, 16-hectare claim units were recorded. A large portion of the claim recording activity was related to the acquisition of graphite prospects with identified resources and areas with high potential for the discovery of new graphite deposits. Claim staking activity is shown in Figure 4.

Tables 8 through 16 provide details on currently inactive mineral deposits with identified resources and past-producing mineral occurrences. Note: Unless otherwise stated, resource figures given in these tables and elsewhere in this report, refer to historic resources only and are not National Instrument (NI) 43-101 compliant.

The authors note that, for ease of reading, all Web addresses were accessed March 26–29, 2012, unless otherwise noted.

MINING ACTIVITY

During 2011, there were over 100 mineral extraction operations in southern Ontario, including 14 industrial mineral operations, 2 trap rock producers, 7 cement producer's quarries, 7 brick producer's quarries, 3 gemstone and mineral specimen sites and 64 dimension stone quarries. 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.

An estimated 5000 people were directly employed in mineral extraction and on-site processing plants in southern Ontario. In 2011, Ontario non-metallic mineral production was valued at $3.16 billion – representing 30% of the total value of mineral production in the province. Five of the top 10 commodities produced in 2011 were industrial minerals. Most of this production came from southern Ontario mines and quarries.

The future for Ontario industrial minerals looks bright with world-class producers, new commodities under development and high potential for new discoveries.

Salt

Salt has been produced in Ontario since 1866. There are extensive beds of rock salt found in the Silurian Salina Formation (Group) rocks in parts of southwestern Ontario, west of London.

Although there were numerous historic producers in southwestern Ontario, only a few produced more than 100 000 tonnes of salt from brine well operations. Salt is the only Ontario mineral commodity for which the market and production are directly controlled by weather. Salt for de-icing is extracted from underground as warranted by the market demand.

Provincial and municipal governments are the main market for de-icing salt. The Ontario Ministry of Transportation reports that MTO salt usage is highly dependent upon weather conditions, varying from 500 000 to 600 000 tonnes of salt annually.

In 2011, Ontario produced 8.2 million tonnes of salt valued at $498 million. Salt remains one of the top 10 minerals in the province by value of production.

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

In 2010, Sifto Canada (www.siftocanada.com), a Division of Compass Minerals, completed a $70 million expansion program of the Sifto salt mine in Goderich. The project 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.

The company employs 490 people in the Goderich facilities and the number is expected to rise to more than 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).

In August 2011, the Sifto Canada salt mining operations sustained substantial damage when an F3 tornado devastated the Town of Goderich. The company is committed to rebuilding the damaged infrastructure with restoring power and boat-loading capacity being among the top priorities.

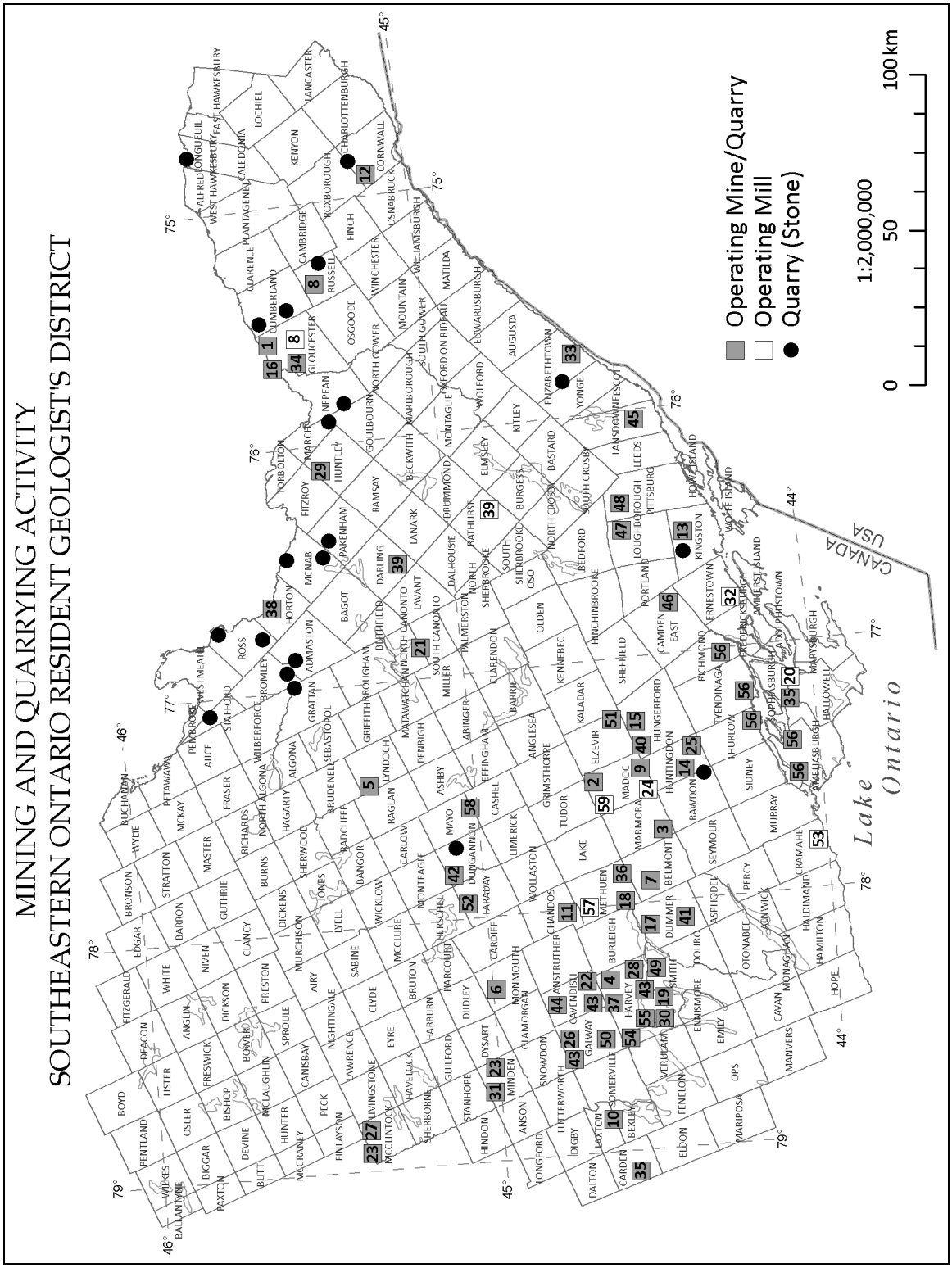

Figure 1. Mining activity in the Southeastern Ontario District in 2011 (keyed to Table 1).

Table 1. Mining activity in the Southeastern Ontario District in 2011 (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 Corp. (Belmont Rose Granite Quarry)	Belmont (Dimension stone)	Granite is quarried for dimension stone, curb stone, landscaping stone, crushed decorative stone and exposed aggregate.
8	Canada Brick (now Taggart Construction Ltd.)	Russell, Gloucester (Clay products)	Until 2007, red shale was quarried for Hanson Brick plant in nearby Gloucester. The brick plant was closed in 2007. At the time of writing, activity at the quarry could not be verified.
9	Canada Talc Division (Henderson Mine)	Huntingdon (Talc, dolomite)	Upgrading and expansion of processing lines at the Marmora processing plant has allowed for the increased volume of ground and micronized talc and dolomite products, as well as the processing of other mineral filler products, principally barite. Canada Talc has ISO 9001:2000 certification for design and production of minerals to varying product specifications. The facility now produces all of its high-end barite filler products for high-end industries located in the United States and South America.
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. Their 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	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.

No.	Company/Individual (Mine Name)	Township(s) (Commodity)	Mining Activity
22	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.
23	Haliburton Stone Works	McClintock, Minden (Granite, dolomite and limestone)	A variety of granite and limestone dimensional and landscape stone are produced from 2 quarries.
24	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.
25	JC Rock (Crookston Quarry)	Huntingdon (Limestone)	Historic producer; in 2010, saw dimension stone removed for restoration project in Belleville.
26	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.
27	John Bacher Construction Limited	McClintock (Granite, gneiss)	Building stone, flagging stone, and landscaping stone.
28	Johnston Quarry	Galway (Limestone)	Gull River Formation limestone is removed for use as landscaping stone, flagstone and building stone.
29	Karson Kartage & Konstruction Ltd. (Clarke Quarry)	Huntley (Limestone)	The quarry produces limestone for use as road aggregate.
30	Kawartha Rock Quarry Inc.	Harvey (Limestone)	Limestone is quarried to produce armour stone and flagstone.
31	Keystone Granite	Minden (Granite)	Granite is quarried for use as armour, flags, steps and dimension stone.
32	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.
33	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.
34	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.
35	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.
36	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.
37	Nelson Windover Quarries (Windover, Buckhorn Quarry)	Harvey (Limestone)	Grey limestone is quarried as a seasonal operation for the production of flagstone.
38	Nesbitt Aggregates	Horton (Granite)	Granite river stone is quarried, sorted and split for use as flagstone, fieldstone, landscaping and masonry stone. The majority of production is exported to the United States.
39	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.

No.	Company/Individual (Mine Name)	Township(s) (Commodity)	Mining Activity
40	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.
41	Payne, E.W. (Payne Quarry)	Dummer (Limestone)	Flagstone is produced seasonally from this quarry.
42	Princess Sodalite Mine	Dungannon (Sodalite)	Decorative stone, landscaping stone, mineral specimens including fee for collecting.
43	Redstone Quarries	Galway, Harvey, Cavendish (Limestone, sandstone)	Beige limestone and red sandstone are quarried for weathered landscaping stone and armour stone blocks.
44	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.
45	Rideauview Contracts Ltd. (Ellisville Quarry)	Rear Leeds & Lansdowne (Sandstone)	Sandstone produced for flagstone, granite blocks and masonry stone.
46	Rideauview Contracts Ltd. (Pettworth & Renaud Quarries)	Camden East (Limestone)	Limestone was quarried for building restoration work in Kingston.
47	Rideauview Contracts Ltd. (Rideauview Quarry)	Storrington (Sandstone)	Red sandstone is produced for ashlar and flagstone.
48	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.
49	Rigbe's Quarry	Harvey (Limestone)	Buff limestone is removed for use as weathered armoury and rockery, crushed aggregates and landscape stone.
50	Royel Paving	Galway (Granite)	Granite is quarried and crushed on site for road aggregate.
51	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.
52	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.
53	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.
54	Stone Cottage Inn Ltd. (Attia Quarries)	Harvey (Limestone)	Grey limestone is quarried for dimension stone.
55	Stonescape Quarry	Harvey (Limestone)	Limestone flagstone and ledgerock are quarried north of Buckhorn.
56	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.
57	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.
58	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.
59	Upper Canada Stone Co. Ltd. Upper Canada Minerals Inc.	Madoc, 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.

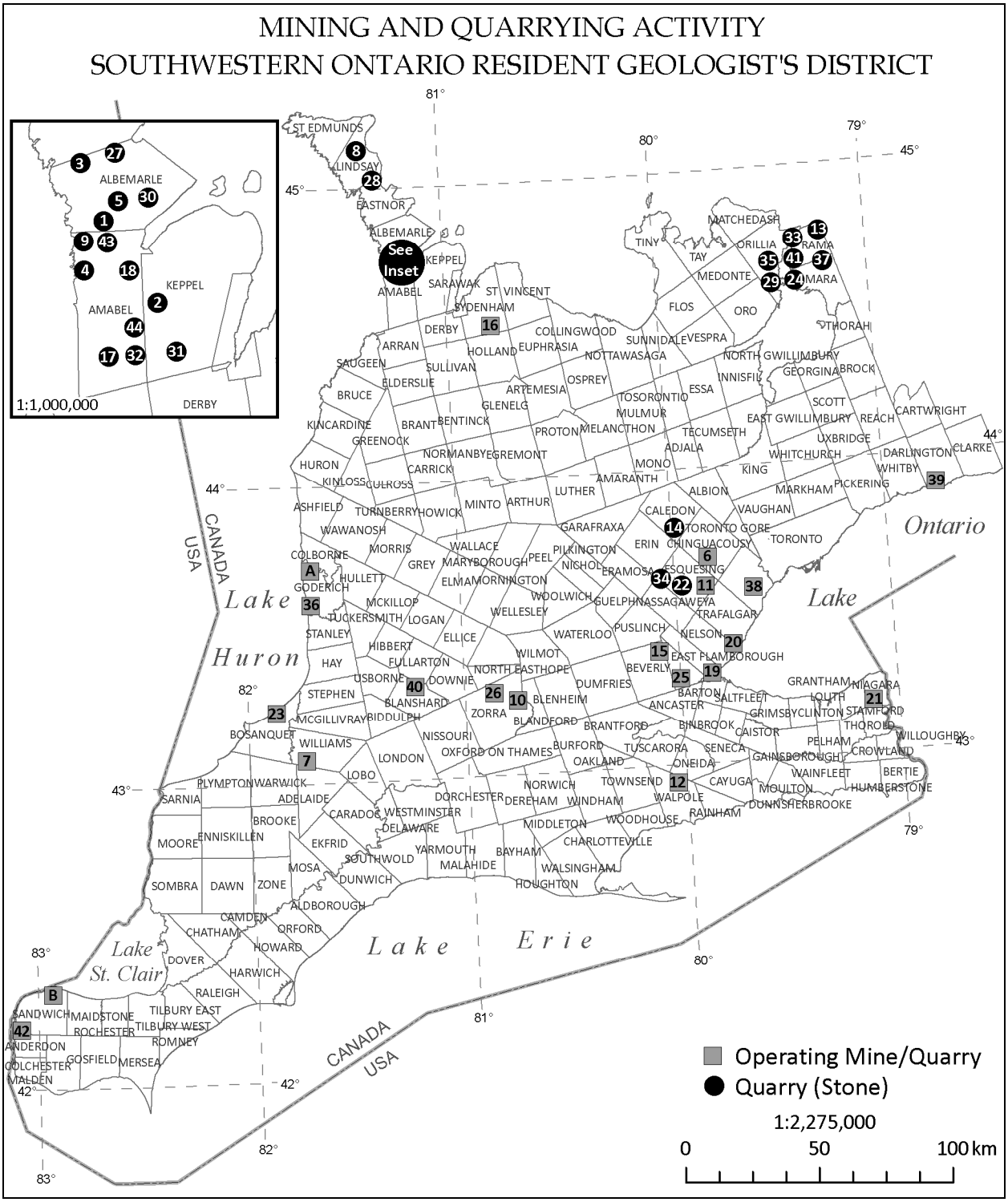

Figure 2. Producing mines and quarries in the Southwestern Ontario District in 2011 (keyed to Table 2).

Table 2. Producing mines and quarries in the Southwestern Ontario District* in 2011 (keyed to Figure 2).

No.	Company/Individual (Mine or Quarry Name)	Town/Township (Commodity)	Mining Activity
1	1590361 Ontario Ltd. (operated by Amsen Quarries Ltd.)	Albemarle Tp. (Dolostone)	Crushed stone aggregate is produced.
2	A & A Natural Stone Ltd. (A & A Quarry)	Keppel Tp. (Dolostone)	Grey dolostone is produced for use as flagstone, landscape stone and specialty aggregate.
3	Amsen Quarries Ltd. (Mar Quarry)	Albemarle Tp. (Dolostone)	Light and dark brown dolostone is produced for use as flagstone and building stone.
4	Amsen Quarries Ltd. (Wiarton Quarry)	Amabel Tp. (Dolostone)	Light and dark brown dolostone is produced for use as flagstone and building stone).
5	Arriscraft International Inc. (Adair Marble Quarries)	Albemarle Tp. (Dolostone)	Dolostone is produced for use as architectural stone.
6	Brampton Brick Ltd. (Cheltenham Quarry)	Chinguacousy Tp. (Shale)	Queenston Formation shale is extracted for use in the company's brick plant.
7	Brampton Brick Ltd. (Hungry Hollow North Quarry)	Williams Tp. (Shale)	Shale is extracted for use in the company's brick plant.
8	Bruce Peninsula Stone Ltd. (Lindsey Quarry)	Lindsey Tp. (Dolostone)	Dolostone is produced for landscaping and building stone products.
9	Bruce Peninsula Stone Ltd. (Wiarton Quarry)	Amabel Tp. (Dolostone)	Dolostone is produced for landscaping and building stone products.
10	Carmeuse Lime Canada (Beachville Quarry)	Zorra Tp. (Limestone)	Limestone is extracted, crushed and processed in on-site lime plant.
11	Century Brick (Georgetown Quarry)	Esquesing Tp. (Shale)	Queenston Formation shale is extracted for use in the company's brick plant.
12	CGC Inc. (Hagersville Mine)	Hagersville (Gypsum)	An on-site wallboard plant utilizes gypsum from the mine.
13	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.
14	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.
15	Dufferin Aggregates (Flamborough Quarry)	West Flamborough Tp. (Dolostone)	Dolostone is produced for use as armour, landscaping and crushed stone.
16	E.C. King Contracting Ltd. (Sydenham Quarry)	Sydenham Tp. (Dolostone)	High-purity dolostone is crushed for aggregate.
17	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.
18	Georgian Bay Marble and Stone (Cook Quarry)	Amabel Tp. (Dolostone)	Dolostone is produced for use as landscaping stone, steps and building stone.
19	Hanson Brick Ltd. (Aldershot Quarry)	Burlington (Shale)	Queenston Formation shale is extracted for use in the company's brick plant.
20	Hanson Brick Ltd. (Burlington Quarry)	Burlington (Shale)	Queenston Formation shale is extracted for use in the company's brick plant.
21	Hanson Brick Ltd. (Niagara-on-the-Lake Quarry)	Niagara Tp. (Shale)	Queenston Formation shale is extracted for use in the company's brick plant.
22	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.
23	JADE Hardwoods Inc. (Thedford Quarry)	Bosanquet Tp. (Shale)	Shale is extracted.
24	James Lamb	Rama Tp. (Dolostone)	Crushed stone aggregate is produced.
25	Lafarge Canada Inc. (Dundas Quarry)	West Flamborough Tp. (Dolostone)	Dolostone is crushed for use as high-quality aggregate

No.	Company/Individual (Mine or Quarry Name)	Town/Township (Commodity)	Mining Activity
26	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).
27	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.
28	Lions Head Stone Quarry	Lindsey Tp. (Limestone)	Limestone is produced for use as splitface, landscape and armour stone and flagstone.
29	MAQ Aggregates (Hewitt Property Quarry)	Orillia Tp. (Limestone)	Operated by Gott Natural Stone '99 Inc.
30	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.
31	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.
32	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.
33	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.
34	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.
35	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.
36	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 2009, the mine continued a 5-year, $70M expansion program commenced in 2008.
37	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.
38	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.
39	St. Marys Cement Inc. (Bowmanville Quarry)	Darlington Tp. (Limestone)	Limestone quarry and cement plant at Bowmanville.
40	St. Marys Cement Inc. (St. Marys Quarry)	Blanshard Tp. (Limestone)	Limestone quarry and cement plant complex at St. Marys.
41	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.
42	The Canadian Salt Company Ltd. (Ojibway Mine)	Windsor (Salt, salt in brine)	Underground workings are adjacent to international border.
43	The Wiarton Buckskin Quarry Co. Ltd.	Amabel Tp. (Dolostone)	Brown-beige dolostone is produced for use as flagstone, steps, slabs and curbing stone.
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.

**All oil and gas production in Ontario occurs in the Southwestern Ontario District. For information on oil and gas exploration and development activity in Ontario in 2011, please refer to the report of the Petroleum Resources Centre (this volume).*

The Canadian Salt Company Limited, also known as Windsor Salt (www.windsorsalt.com), is a part of Morton International Inc. Windsor Salt is a leader in modern salt processing methods, and is now Canada's largest salt producer. It extracts both rock salt from the underground Ojibway Mine and vacuum salt from nearby brine wells in Windsor.

Salt was discovered in Windsor in 1891. The Ojibway underground mine has been in operation since 1955 and is currently mining salt at a level of 290 m beneath the city. The evaporation facility has been in operation since 1928. Salt products include road de-icing, water softening, agricultural and chemical fine salt.

Windsor is an ideal location for distribution of salt to the Great Lakes region in the United States and Canada. A deep-water port allows most of the production to be shipped by lake vessel, rail and road transportation. Windsor Salt employs over 300 people at the Ojibway Mine and adjacent brine well field. In February 2012, the company announced layoffs of probationary staff related to reduced demand for de-icing salt following mild winter weather conditions (*The Windsor Star*, February 8, 2012, www.windsorstar.com/business/Windsor+salt+mine+layoffs+blamed+weather/6118160/story.html).

Brick and Shale

In 2011, there were 4 companies operating clay brick or tile plants in southwestern Ontario, all of which extract Queenston Formation shale as raw material.

Hanson Brick Ltd. (www.hansonbrick.com) operates 3 brick plants in Burlington and 1 in Aldershot, with shale quarries located at Niagara-on-the-Lake, Burlington and Aldershot. Hanson, part of the Heidelberg Cement Group, is North America's largest brick manufacturer with a total capacity of more than 1.7 billion brick units per year. Of that total, 415 million units or approximately 25% are produced in Ontario. For the first 9 months of 2011, the company reported that North American sales of bricks, paving stones and roof tiles were significantly lower than in the same period in 2010 due to low levels of residential construction (Heidelberg Cement, "Interim Financial Report, January to September 2011", www.heidelbergcement.com). The company employs a total of 130 people at its Ontario facilities.

Hanson Brick utilizes clean brick waste for recycling as aggregate material for landscaping, green roof construction and for re-use in the brick-making process.

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 Formation 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 2011 were $43.01 million, an increase of $3.36 million over the same period in 2010, which was the result of a moderate increase in sales volume (Brampton Brick Ltd., news release, September 7, 2011, "Third Quarter Report 2011", www.bramptonbrick.com/files/2011_Q3_Press_release.pdf).

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 9.35 ha. The proposed extraction rate is 200 000 tonnes per year and total yield is projected to be 5.8 million tonnes. In addition to providing security of shale supply for the Brampton plant, the Norval shale contains lower amounts of chloride and sulphate than the Cheltenham shale. The company will blend the 2 shales to produce a new product line of buff-burning bricks. In January 2011, the application was appealed to the Ontario Municipal Board. As of October 31, 2011, no proceedings had been scheduled (Regional Municipality of Peel, Information Report by Development Services to Regional Council, December 8, 2011, "Update on Brampton Brick's Norval Quarry Proposal in the City of Brampton, Ward 6, October 31, 2011", www.peelregion.ca/council/agendas/pdf/rc-20111208/report-pw-a1.pdf).

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 (Buchan 2010).

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.

Jazbrick, a Canadian company with its head office in Toronto operates the Century Brick Ltd. plant in Hamilton and the Rexdale Brick plant in Rexdale. In November 2010, a subsidiary of Jazbrick, Limehouse Clay Products Ltd. that operates the Halton Hills shale quarry near Georgetown to supply shale for the Jazbrick plants, applied for a site plan amendment to deepen the quarry by 5 m with potential extraction below the water table. As of January 2012, no decision had been made on the proposed amendment (Regional Municipality of Halton, Planning and Public Works Committee, Meeting 01-12, January 11, 2012, agenda item Report No. LPS06-12 "State of Aggregate Resources within Halton Region", http://sirepub.halton.ca/pubmtgframe.aspx?meetid=899&doctype=MINUTES (when agenda item selected, PDF documents are available in "Supporting Materials" side panel)).

Cement

There are 6 quarries and 6 modern processing plants in southern Ontario between Kingston in the southeast 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 million tonnes 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*).

In 2010, the Cement Association of Canada released its third biennial report that documents environmental improvements by cement producers (Cement Association of Canada, *Canadian Cement Industry 2010 Sustainability Report*, www.cement.ca/images/stories/ENGLISH%20FINAL%202010%20SD%20Report%20Mar17.pdf). 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.

In 2011, cement production in the United States hit a 28 year low. In Canada, production fell from 14.4 million tonnes in 2007 to 11.6 million tonnes in 2010 and, for 2011, was projected at 11.0 million tonnes. In addition, Diekmeyer (2011) reported

> "In October, the industry announced a new, environmentally friendlier cement named Contempra, which requires less clinker – cement's energy-intensive main ingredient. The cement is comprised [sic] of 15 per cent ground limestone compared to only five per cent in regular Portland cement, yet it produces concrete comparable to traditional mixtures. Contempra, which promoters say reduces CO_2 emissions by 10 per cent, is recognized under the name Portland Limestone Cement by the Canadian Standards Association, the 2010 National Building Code of Canada and the building regulations of British Columbia, Manitoba, Ontario, Quebec and Nova Scotia.".

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 the 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 (Macko 2010).

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 (http://kingstonherald.com/tech/lafarge-cement-plant-reduce-c02-biomass-20103993). 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. In 2011, Holcim Canada reported that a decline in construction activity, rising price pressure, particularly in the ready-mix concrete business, and higher cement manufacturing costs had a negative impact on the income statement. In North America, Holcim expects a slight improvement in the construction sector in 2012 (Holcim Inc., news release, November 9, 2011, www.holcim.com/en/press-and-media/latest-releases/latest-release/article/media-release-on-third-quarter-2011.html).

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 2010 Sustainability Report*, www.cement.ca/images/stories/ENGLISH%20FINAL%202010%20SD%20Report%20Mar17.pdf). 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.

UPDATE ON AGGREGATE QUARRY PROPOSALS

In 2010, the Ministry of Natural Resources released a study on the "State of Aggregate Resources in Ontario". Some of the findings of the study are

- Over the past 20 years, Ontario has consumed over 3 billion tonnes of aggregate, or an average of 164 million tonnes (including recycling) per year. Given projected levels of economic and population growth, future consumption projections average about 186 million tonnes (including recycling) per year over the next 20 years, or 13% higher than in the past 20 years.
- The Greater Toronto Area (GTA) uses about one-third of the aggregate consumed in Ontario each year.
- Aggregates are required in large quantities in economically active regions and growth centres. Their high bulk and low per-unit value places constraints on the distances they are transported. Extracting the resource close to where it is being used avoids unnecessarily transferring the effects of extraction to other jurisdictions.
- Ontario has abundant and high-quality aggregate deposits close to high-demand areas. However, 93% of unlicenced bedrock resources have overlapping environmental, planning and agricultural constraints.
- Mega-quarries and underground mining are the most feasible alternative sources of aggregate.

Proposals to open 2 new aggregate quarries in Amabel Formation dolostone within 75 km of the GTA, as recommended in the "State of Aggregate Resources in Ontario" report, encountered opposition in 2011.

St. Marys Cement Ltd. is proposing to open a limestone quarry on 154 ha (380 acres) of land on Concession XI, lots 1, 2 and 3, City of Hamilton (former Township of East Flamborough). The St. Marys Flamborough Quarry is projected to produce 3 million tonnes of dolostone a year for the next 25 to 30 years. The proposal was initiated in 2004 by a previous owner and has been continued by St. Marys since purchasing the land in 2006. In April 2010, citing concerns over the threat to groundwater, wetlands and streams, the Minister of Municipal Affairs and Housing imposed a Minister's Zoning Order stating that the site must remain under the current land use designation, which is predominantly rural and conservation management. This is the first case in which a Minister's Zoning Order has been used in response to an aggregate permit application in Ontario. St. Marys Cement appealed this decision to the Ontario Municipal Board (OMB) and, in April 2011, the government issued a Declaration of Provincial Interest that gave it licence to overturn any Ontario Municipal Board decision. In May 2011, St. Marys filed a Notice of Arbitration under the North American Free Trade Agreement (NAFTA) seeking damages of not less than $US275 million in compensation for the loss, harm, injury, loss of reputation and damage imposed by various governments. The

company also filed an Application for Judicial Review by the Ontario Superior Court of Justice (St. Marys Cement Ltd., news release, September 16, 2011, www.flamboroughquarry.ca/media/110916Newsrelease.pdf).

In March 2011, The Highland Companies applied to the Township of Melancthon for a zoning by-law amendment in order to proceed with an application for an aggregate licence with the Ministry of Natural Resources within a 937 ha property near the town of Shelburne that is currently used by the company as potato farmland. The proposed quarry will have at least 150 million tonnes of reserves of Amabel Formation dolostone and capability to produce in excess of 10 million tonnes per year. Extraction will be done in 121 ha sections, with progressive rehabilitation and a return to agricultural uses on the quarry floor as quarrying of each section is completed (The Highland Companies, Proposed Melancthon Quarry Planning Rationale Report, *see* under "Aggregates", "The Application", "Planning", http://highlandcompanies.ca/images/uploads/pdf/application/02_Planning_Rationale_Report_and_Aggregate_Resources_Act_Summary_Statement.pdf). In July 2011, the Council of the Township of Melancthon passed a resolution to request that the Ministry of the Environment conduct a Full Environmental Assessment of the Highland Companies quarry application. In September, the Minister of the Environment and the Minister of Natural Resources agreed that the company will be required to complete a full Environmental Assessment for the proposed quarry.

Dimension and Building Stone

WIARTON AREA QUARRIES

The Wiarton area on the Bruce Peninsula in southwestern Ontario is the centre of the province's dimension stone industry. As of 2011, 22 quarries were licenced under the *Aggregate Resources Act* to extract dimension stone for building, landscaping and flagstone markets in the County of Bruce. An additional 13 quarries are licenced to extract stone in the neighbouring County of Grey. In April, Block and Stone Resource Group Inc. (www.bsrg.ca) opened a new quarry and plant to produce of high-quality dimension stone in northeastern Amabel Township from the Eramosa formation (Block and Stone Resource Group Inc., staff, personal communication, November 2011). There are several additional sites in the Wiarton area that are currently in preparation for licencing under the *Aggregate Resources Act*. Rowell (2012a) identifies, as provincially significant, bedrock resources in the County of Bruce and also provides details of national and provincial parks, physical, cultural and environmental constraints including the Niagara Escarpment Plan, which will limit development of resources within that area for dimension stone as well as crushed stone aggregate.

SANDSTONE QUARRIES

The first of many sandstone quarries near the Forks of the Credit River was opened in 1840. Edward Townsend and his sons operated the largest quarry in the area, which was sold to Torontonian Jack Murray in 1898 for $300 000, then later to Francis and William Rogers in 1909. William Norrie, who purchased the quarry in 1930, was the final owner, naming his operations Credit Valley Quarries. Previously, product from the area was known as Credit Valley stone.

Credit Valley stone was used in the construction of a number of notable projects in Toronto including Old City Hall, the Parliament Building, pillars at Union Station, and the Timothy Eaton Memorial Church.

There is a perennial demand for Credit Valley sandstone for new projects as well as an overwhelming demand for restoration of many historic sandstone buildings in the Greater Toronto Area.

In southeastern Ontario near Kingston, Potsdam Formation sandstone (of Cambrian age) is quarried and processed as dimension stone in a variety of finishes for stone veneer, lintels, headers, steps, stone blocks and archways. The stone is used for restoration projects in Canada and the United States as well as for new building projects (www.rideauviewcontracts.com). Potsdam Formation sandstone is also a popular landscaping stone.

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 on-site processing to split and/or cut stone to customer specifications. Attia Quarries is developing a new quarry near Seabright to produce dimension stone from the Gull River Formation (*Ontario Dimension Stone Directory, 2011*; E. Attia, Attia Quarries, personal communication, July 2011).

ADVANCED EXPLORATION AND DEVELOPMENT

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.

In 1985, gold was discovered on the property in a small granodioritic body within a marble belt about 800 m north of the Deloro granite. Noranda Exploration acquired the property in 1986 and conducted surface exploration followed by a diamond-drilling program in 1987 and 1988. Noranda calculated probable and possible reserves (non-National Instrument 43-101–compliant) of 8.5 million tons grading 0.043 ounces gold per ton, 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 granodiorite. 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. Additional details of geology and past exploration programs are described by Sangster et al. (2008, 2010).

In 2010, Upper Canada Gold Corporation acquired the mineral rights to the Dingman property and completed a diamond-drilling program to test the Dingman gold zone at depth and to better define gold resources within the open pit area defined by previous exploration programs. An 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). Key information from that report was announced by Upper Canada Gold Corporation (Upper Canada Gold Corporation, news release, filed February 8, 2011 with SEDAR®, *see* SEDAR Home Page) and is summarized here:

> The updated estimate used the 2010 Upper Canada drill holes as well as data from 88 holes drilled by previous property holders and the 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).
>
> 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.

In 2011, the company contracted Dillon Consulting Limited of Toronto to begin a baseline environmental survey on the property (T. Sills, Upper Canada Gold Corporation, personal communication, October 2011). No additional exploration work was done in 2011.

Trap Rock

DANFORD GRANITE LTD. – BRIDGEWATER TRAP ROCK

In 2011, Danford Granite Ltd. reactivated the Bridgewater Trap Rock Mine in Elzevir Township under an 18 month option agreement with the owner, 1085499 Ontario Ltd. 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 that host zones of talc-carbonate-serpentine alteration. The rocks trend northwesterly along the western margin of the

Elzevir tonalite. The company recognized the potential of the more massive, gabbroic zones on the property as material for construction aggregate and, in 2010, provided modifications to the Mine Closure Plan that had initially been accepted in 2000 as part of a proposal to expand the operation to include aggregate production.

Stripping of the proposed quarry area and construction of an access road and berm began in May 2011. The first quarry blast was completed in August 2011, breaking about 20 000 tonnes of gabbroic rock for testing as concrete aggregate, railway ballast and other aggregate uses (A. Danford, Danford Granite Ltd., personal communication, October 2011).

Graphite

In 2011, 3 companies continued advanced exploration and development of graphite projects in eastern Ontario: Northern Graphite's Bissett Creek deposit, Maria Township; Ontario Graphite's Kearney deposit, Butt Township; and Mega Graphite Inc.'s Bedford Township and Burgess Township deposits.

ONTARIO GRAPHITE LTD. – KEARNEY MINE

Ontario Graphite Ltd. (www.ontariographite.com) is a privately owned Canadian mining company currently re-commissioning the Kearney Mine in Butt Township, near Huntsville. The company reports that this is the largest confirmed graphite mineral resource prospect in North America and one of the largest individual deposits in the world. The company plans to begin production in mid 2012. MNDM has been working with the company to resolve the closure plan.

NORTHERN GRAPHITE CORPORATION – BISSETT CREEK DEPOSIT

Northern Graphite Corporation continues evaluation of the company's graphite deposit in Maria Township. The property is located in the northern part of the County of Renfrew, which is part of the Southern Ontario Mining Division, but is approximately 2 km north of the boundary of the Southern Ontario Resident Geologist Region. In October 2011, staff from the Southern Ontario Resident Geologist Program visited the site. For observations and details of the development project, *see* "Property Visits" "Northern Graphite Corporation – Bissett Creek Deposit, Maria Township".

MEGAGRAPHITE INC. – BEDFORD PROJECT AND BURGESS PROJECT

In 2011, Mega Graphite Inc. (www.megagraphite.com) acquired the Bedford and Burgess graphite prospects previously held by Cardinal Explorations Inc. Both properties contain flake graphite in marble and paragneiss and are described in detail by MacKinnon and LeBaron (1992).

The Bedford property consists of 37 contiguous claims in Bedford Township, approximately 45 km north of Kingston and includes the Burridge (Graphite Mountain) property. Historic diamond drilling of the Meadow zone, consisting of 18 holes, totalling 900 m, indicates a potentially large deposit of high-grade, coarse flake graphite occurring along a 300 m strike length. Values of over 17% graphitic carbon have been reported in graphitic schist. An NI 43-101–non-compliant resource of 3 million tonnes at a grade of 3.5% graphitic carbon was published by previous owners. Other graphite zones are known to occur within the property, although, to date, only a few of these have been subjected to preliminary testing.

The North Burgess property consists of 14 contiguous claims situated approximately 25 km northeast of the Bedford property, near the town of Westport and includes the Timmins graphite mine site, which produced 2500 tonnes of graphite concentrate in 1919. When the prospect was explored further in the 1950s, a deposit was outlined by exploratory diamond drilling and trenching over a strike length of 140 m, reported to be 8% graphitic carbon. Subsequent exploration in the 1980s identified additional graphite-bearing zones. From that work, an estimated graphite resource of 940 000 tons @ 7% Cg[6] was reported (non-NI 43-101 compliant). Processing and separation tests were also conducted at that time (McKinnon and LeBaron 1992).

Airborne geophysical surveys have recently been completed over the entire property and an NI 43-101 report has been completed.

[6] "Cg" is a calculated value: graphite as carbon = total carbon less the amount of carbon present as CO_2.

Wollastonite

CANADIAN WOLLASTONITE – ST. LAWRENCE DEPOSIT

Canadian Wollastonite (www.canadianwollastonite.com) is a privately held company incorporated in Ontario in 2001. The company owns just over 110 ha encompassing a large portion of the St. Lawrence wollastonite deposit north of Kingston near the community of Seeley's Bay. The company's sole objective is the commercial development of this deposit. To date, the company has invested just over $3 million (B. Vasily, Canadian Wollastonite, personal communication, October 2011) used to complete

- over 150 bench and continuous flow trials of grinding and beneficiation methods resulting in a new breakthrough processing technology
- sampling and orebody definition
- 11 environmental and social impact assessment studies
- planning and permits

In 2011, Canadian Wollastonite continued to work toward the development of the St. Lawrence wollastonite deposit. 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 has announced that it expects to start mining in 2012. Initial commercial production will be under 20 000 tonnes of ore that will be sold to non-traditional markets including for cement, plant and animal nutrition products. The company has also developed a diopside co-product with environmental applications (Canadian Wollastonite, open house presentation, October 2011).

Construction of a beneficiation and milling plant to produce high aspect ratio wollastonite products is planned for 2013 (*Industrial Minerals*, February 7, 2012, online article).

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)
- 2011: submission of Closure Plan to MNDM as required to advance 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.

EXPLORATION ACTIVITY

Assessment files received for the Southeastern Ontario District are listed in Table 3. Exploration activity is listed in Table 4 and locations of exploration projects are shown in Figure 3. The vast majority of exploration in southwestern Ontario occurs on private land where there is no requirement for the submission of assessment work.

Table 3. Assessment files received in the Southeastern Ontario District in 2011.

Abbreviations

AEM ..... Airborne electromagnetic survey
AM ..... Airborne magnetic survey
ARA ..... Airborne radiometric survey
Beep ..... Beep Mat survey
Bulk ..... Bulk sampling
BM ..... Base metals
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
PGE ..... Platinum group elements
PGM ..... Platinum group metals
Pman .... Physical work (manual, other than stripping/trenching)
Pr ..... Prospecting
REE ..... Rare earth elements
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)	J. Chard, R. Dillman	2011	GRA	2.49045	45
2	Anglesea (Au)	M. Forget	2010	Assay, Pman	2.48041	44
3	Anglesea (Au)	M. Forget	2009, 2010	Assay, Pr, GC	2.45999	43
4	Ashby (Garnet)	A. Leblanc, D. Morrison	2010	Pr, Samp	2.47198	23
5	Bedford (Graphite)	Cardinal Explorations Inc.	2010	Samp, Beneficiation, Pman	2.46425	47
6	Bedford (Graphite)	Mega Graphite Inc.	2011	Beneficiation, Assay, IM, Pr	2.48243	48
7	Belmont (BM, PGE)	First Nickel Inc.	2010	GL, Samp	2.46966	26
8	Butt (U, REE)	Dan Patrie Exploration Ltd.	2010	Lc, GM	2.47216	9
9	Cardiff (U, REE)	Skead Holdings Ltd.	2009	GL, Pr	2.48112	243
10	Cardiff, Monmouth (U)	CJP Exploration Inc.	2011	GL	2.48852	244, 170
11	Denbigh, Lyndoch (Cu, Zn)	Adroit Resources Inc.	2008	DD, Samp, Assay	2.43681	12, 51
12	Dungannon (Mineral Specimens)	Bancroft Gem and Mineral Club	2011	Pr	2.49023	51
13	Effingham (PGM, Au, Diamond)	R. Lawrence	2010	Pr	2.48276	13
14	Elzevir (Soapstone, PGM)	D. Milligan, C. Myles	2010	GC	2.47916	34
15	Glamorgan (Nepheline)	Crushcor Limited	2008	DD	2.46610	32
16	Grimsthorpe (Au, U)	J. Chard, R. Dillman	2010, 2011	GRA	2.47418	89
17	Lake (BM)	First Nickel Inc.	2011	GL, Pr, Assay	2.48499	32
18	Limerick (BM, PGM)	D. McBride, J. McBride, J. Ryder	2010	GL, Lc	2.48555	23
19	Limerick (BM, PGM)	First Nickel Inc.	2010	Pr, Samp, Assay	2.47957	22

No.	Township or Area (Commodity)	Company Name	Year	Type of Work	AFRO Number	Resident Geologist Office File Designation
20	Limerick, Wollaston (BM, PGM)	First Nickel Inc.	2011	Assay, Pr	2.48870	24, 15
21	Maria (Graphite)	Northern Graphite Corporation	2011	Enviro	2.49083	1
22	Marmora (BM, PGM)	First Nickel Inc.	2011	Assay, Pr	2.48806	108
23	Marmora (BM, PGM)	First Nickel Inc.	2011	Assay, Pr	2.48801	107
24	Marmora, Belmont (BM, PGM)	First Nickel Inc.	2011	Assay, Pr	2.48799	106, 27
25	Methuen (BM)	Trigan Resources Inc.	2010	GC, Assay	2.47697	56
26	Murchison (Mineral Specimens)	A. Reed	2011	Pr	2.49344	7
27	North Burgess (Graphite)	Cardinal Explorations Inc.	2009	Beneficiation	2.43742	29
28	North Burgess (Graphite)	Cardinal Explorations Inc.	2010	Assay, Str	2.46420	28
29	Raglan (BM, PGM)	First Nickel Inc.	2010	Pr, GL, Assay	2.47894	37
30	Raglan (Cu, Ni, PGM)	First Nickel Inc.	2009	Pr, Lc, Samp, GEM	2.47083	35
31	Raglan (Cu, Ni, PGM)	First Nickel Inc.	2010	DD, Samp, Assay, Logging	2.46959	36
32	South Canonto (Magnetite)	P. Lystiuk	2011	GM	2.47898	17

Table 4. Exploration activity in the Southeastern Ontario District in 2011 (keyed to Figure 3).

Abbreviations

AEM ..... Airborne electromagnetic survey
AM ..... Airborne magnetic survey
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Beep ..... Beep Mat survey
Bulk ..... Bulk sampling
DD ..... Diamond drilling
DDH ..... Diamond-drill hole(s)
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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	Brunette, B.	Maria, Clara	Pr
6	Burnett, A.	Bancroft (Mineral Specimens)	Pr
7	Byer, J.	Elzevir (Trap)	IM
8	Canadian Wollastonite	Pittsburgh, Leeds, Lansdowne (Wollastonite)	IM
9	CJP Exploration Inc.	Cardiff, Monmouth (Rare earth elements)	GL
10	Crawford, G.	Lyndoch	Str, DD
11	Creighton, W.	Kennebec (Au)	Pr

No.	Company/Individual	Township/Area (Commodity)	Exploration Activity
12	Crushcor Ltd.	Glamorgan (Nepheline)	IM
13	Dan Patrie Exploration	Butt (REE)	IP
14	Danford Granite	Hungerford	GC
15	Dubeau, R.	Brougham	PR
16	Ferromin	South Canonto(Magnetite)	Pr, IM
17	First Nickel Inc.	Belmont, Lake, Limerick, Marmora, Wollaston (Base Metal, PGM)	AM, AEM, DD
18	Forget, M.	Ashby, Barrie, Kennebec (Au, Base Metal)	Pr, Samp, GL
19	G. Collins Geoscience Inc.	Herschel	Pr
20	Gallaugher, E.	Murchison	Pr
21	Glanfield, M.	Barrie(Au)	Pr
22	Gold Insight	Marmora (Au)	Pr
23	Golden Jaguar	Marmora (Fe)	Pr
24	Golden Phoenix Minerals	Griffith (Mo)	Pr
25	Graaf, W.	Faraday (Marble)	IM
26	Hanes, D., Shank, M.	Dungannon, Mayo (Fe, Mineral Specimens)	Pr
27	Hill, R. / Extender Minerals	Huntingdon, Belmont, Elzevir	Pr, IM
28	J.D. Exploration Inc.	Hindon, McConkey	Pr
29	Lafarge Canada	Eastern Ontario	Pr
30	Laidlaw, J.	Grimsthorpe	Pr
31	Lawrence, R.	Ashby, Effingham (Au, Base Metal, Kimberlite)	Pr, Samp
32	Leblanc, A.	Ashby	Pr
33	Lystiuk, P.	South Canonto (Fe)	Mag
34	McBride, D.	Limerick (Ni, Cu)	Pr, GL, Lc
35	Mega Graphite	Burgess, Bedford	IM
36	Melkior Resources Inc.	Raglan (Base Metal)	GL, Pr, Samp
37	Milligan, D.	Barrie, (Au) Elzevir (Soapstone)	Pr, IM
38	Murray Brook Minerals Inc.	Belmont (Calcium Carbonate, Marble)	Pr, Samp
39	Norway Asphalt Limited	Methuen (Granite)	IM
40	Ontario Graphite Ltd.	Butt (Graphite)	IM
41	Orocan Resources Corp	Matawatchan, Lyndoch (Graphite)	AM, AEM
42	Patterson, D.	Lyndoch (Mineral Specimens)	Pr
43	Penziwal, G.	Madoc	Pr
44	Reed, A.A.	Murchison	Pr
45	Skead Holdings	Cardiff, Monmouth	Pr
46	The Corporation of the County of Haliburton / The Corporation of the Municipality of Highlands East	Cardiff, Glamorgan, Monmouth (Gemstones)	GL, Pr
47	Thompson, G.	Bangor	Pr
48	Trigan Resources Inc.	Methuen (Trap Rock)	Assay, GC
49	Union Glory Gold	Tudor, Grimsthorpe (Au)	DD
50	Upper Canada Gold Corporation	Marmora (Au)	Environmental Baseline Studies
51	Upper Canada Stone	Mayo, Cashel, Madoc (Marble)	Pr, IM
52	Vatcher, K.	Cavendish (Vermiculite)	IM
53	Veley, H.	Kennebec (Au)	Pr
54	Walker, V.	Lake	Pr
55	Watson, D.	Methuen	Pr
56	Wilson, M.	Sheffield (Dimension Stone)	Pr

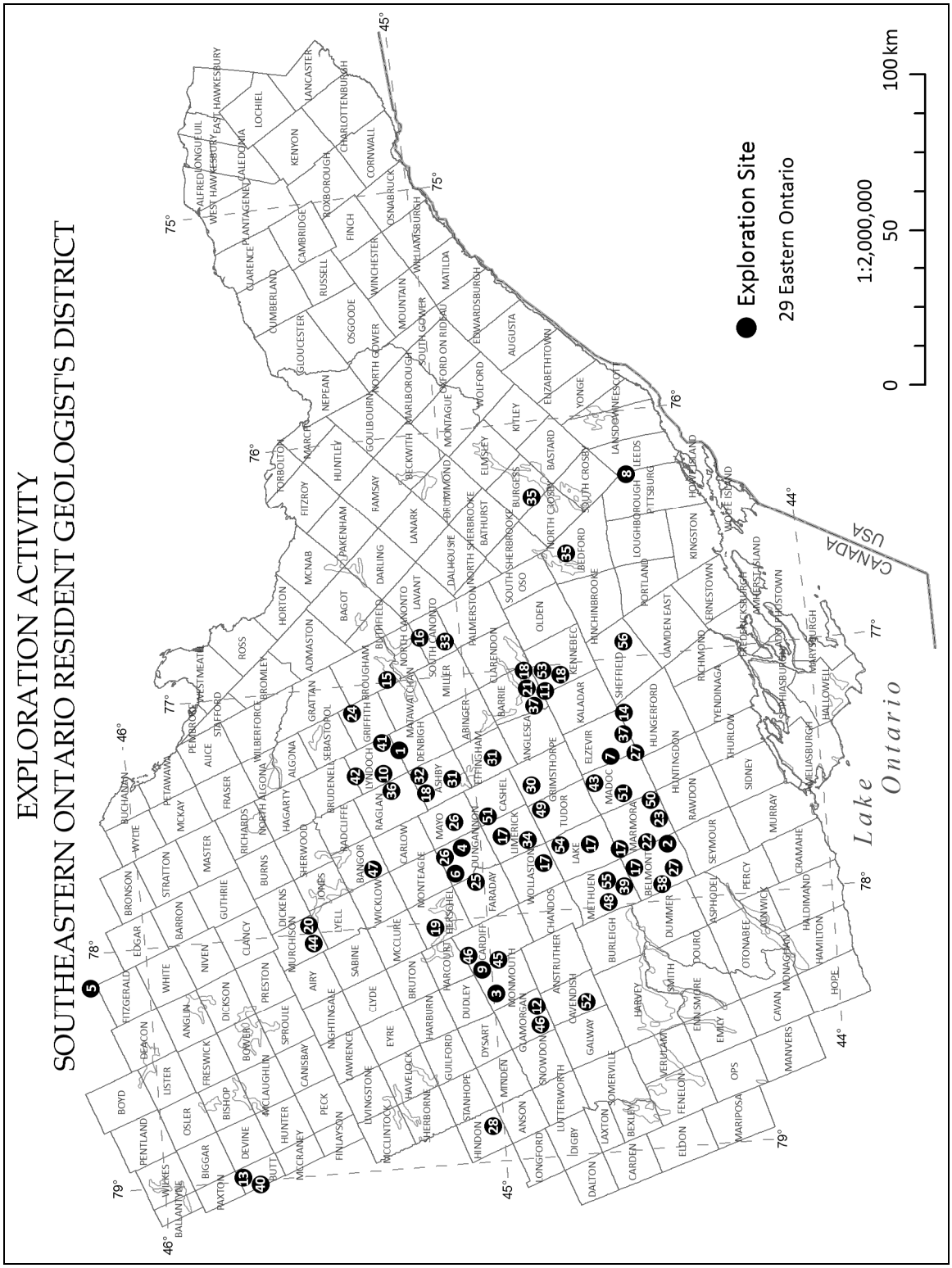

Figure 3. Exploration activity in the Southeastern Ontario District in 2011 (keyed to Table 4).

Gold

UNION GLORY GOLD LTD. – TUDOR TOWNSHIP

The Tudor gold property consists of a group of unpatented mining claims covering about 1000 ha extending from the northeastern quadrant of Tudor Township into Grimsthorpe and Anglesea townships. In 2011, Union Glory Gold Ltd. entered into an option agreement with property owners R. Dillman and J. Chard and completed a diamond-drill program consisting of 10 holes totalling 1675 m.

The program was designed to test the "Main Zone" of gold mineralization at a vertical depth of about 100 m over a strike length of 500 m. All holes are reported to have intersected gold mineralization, however, complete assay results are not yet available (D. McBride, Union Glory Gold Ltd., personal communication, January 2012).

Most of the previous work on the property has focussed on the Main Zone in Tudor Township, a zone of sheared felsite with arsenopyrite, quartz stringers and silicification that has been delineated by stripping and diamond drilling over a strike length of greater than 3.5 km. Gold mineralization occurs in anastomosing shear zones that follow the strike of the felsite unit and dip steeply west. The shear zones are partially silicified, carbonatized and mineralized with pyrite, arsenopyrite and quartz-carbonate stringers, which follow the shearing. Assays of sheared felsites from previous drilling programs returned gold values ranging from 0.20 to 10.82 g/t Au and included 1 spectacular assay of 1012 g/t Au. High gold values occur in narrow zones measuring less than 1 m wide, which are contained within broader sections of sheared felsite with lower, but persistent, gold values generally greater than 0.5 g/t Au. Native gold has been observed in the core from several drill holes. Details of the geology and exploration history of the property are described by Sangster et al. (2009: *see* "Property Visits", "Opasatika Mining Corporation – Tudor Gold Property").

Prior to the 2011 drilling program, the felsite unit hosting the Main Zone had been tested by 27 holes, totalling 2364 m, all of which have intersected gold mineralization. The following table shows some of the more significant intersections obtained in a 2008 drill program within the Main Zone of the Tudor property (R. Dillman, personal communication, February 2010).

Drill Hole No.		Gold (g/t)	Width (m)	Including (g/t Au / m)
MZ-08-03		3.67	1.60	7.81 / 0.70
	and	314.20	2.90	1012 / 0.90
	and	0.77	4.60	8.7 / 0.43
	and	2.27	1.44	
MZ-08-05		0.70	74.25	1.46 / 7.4; 4.61 / 1.5; 1.43 / 4.73; 0.83 / 39.35; 5.83 / 0.25
MZ-08-08		0.82	68.90	1.43 / 8.85; 1.56 / 12.76; 10.82 / 0.5

CROWN WILLIAM MINING CORP. – MADOC GOLD PROPERTY

The Madoc property of Crown William Mining Corp. consists of 200 mining claims covering about 55 500 acres or 225 km^2 in the townships of Tudor, Grimsthorpe, Cashel and Effingham in southern Ontario. During 2011, D. Hunter, chief consulting geologist for the company, conducted a review of past exploration work on the property, including examination of diamond-drill core stored at the Tweed Drill Core Library. In 2012, the company plans to expand gold exploration activities on the Madoc property.

In 2011, Crown William Mining also purchased 100% of a B.C. corporation owning 2 mining leases and a patented lot comprising more than 250 additional acres near Bannockburn. This new acquisition (the "Bannockburn" project) covers the Mono gold prospect, which was the site of advanced gold exploration, including extensive diamond drilling, underground exploration and bulk sampling during the 1980s and 1990s, resulting in a non-NI 43-101–compliant historical indicated and inferred resource estimate of 372 154 tons grading 0.395 ounces gold per ton (Sawyer Consultants Inc. 1987). During 2012, Crown William Mining plans to re-evaluate the property with a focus on gold and conduct sufficient exploration activities to bring the resource estimate into compliance, along with additional exploration on surrounding lands. The company is looking at acquiring additional property.

The Madoc and Bannockburn project areas lie within a belt of predominantly mafic metavolcanic rocks trending northward along the western margin of the Elzevir tonalite and the Lingham Lake gabbroic to dioritic complex. The belt hosts several gold occurrences, including the Mono (Bannockburn) prospect and the Tudor gold prospect described in this report (*see* "Advanced Exploration" "Union Glory Gold Ltd. – Tudor Township"). Gold mineralization is associated with quartz veins and carbonate alteration in mafic metavolcanic rocks and with quartz vein and/or arsenopyrite zones in silicifed and sericite-altered felsite within the volcanic sequence.

GOLD INSIGHT RESOURCES LTD. – BELMONT TOWNSHIP

In December 2011, staff of the Resident Geologist Office were present as Gold Insight Resources Ltd. extracted a bulk sample of about 8 t from a waste rock pile near the No. 3 shaft at the Cordova Gold mine site in Concession I, Lot 20, Belmont Township. The rock was to be crushed and trucked to TTL Mills in Cobalt for concentration and processing to determine the gold content. A report by W.G. Wahl Limited (1981) estimated that the rock pile adjacent to the No. 3 shaft contains over 8000 t of rock grading 0.072 ounce gold per ton (2.46 g/t Au). Results of the bulk sample test are not yet available.

VANITY CAPITAL CORP. – ORE CHIMNEY PROPERTY, BARRIE TOWNSHIP

In December 2011, Vanity Capital Corp. began a diamond-drill program on their newly acquired Ore Chimney property located in Barrie Township.

The Ore Chimney prospect consists of a gold- and silver-bearing quartz vein system containing pyrite, chalcopyrite, galena and sphalerite, within hornblende-biotite-garnet schist near the contact between the mafic metavolcanic rocks of the Tudor Formation and the unconformably overlying quartzite and conglomerate of the Flinton Group.

The program, expected to total about 1000 m, is designed to drill off the "Main Vein" zone, which historically returned significant grades of gold, silver, copper, lead and zinc mineralization. Values returned have been as high as 0.39 ounce gold per ton, 75.45 ounces silver per ton, 2.2% copper, 1.4% lead and 5.3% zinc. The former Ore Chimney Mine first operated in 1909 and was further developed and explored by subsequent owners such as Bey Mines Ltd. (1932), East Webb Mines Ltd., Cavalier Mining Corporation Ltd. (1957), Banirwin Mining and Explorations Ltd. (1983) and Sands Minerals Corp. (1987). There was sporadic production from 1909 to the early 1920s and from 1932 to 1936 with the depth of the shaft continuing to 500 feet and development of 2174 feet of underground lateral workings on 7 levels.

To mid-February 2012, 7 diamond-drill holes were completed to an average depth of 50 m for a total of over 300 m. Analytical results will be available following completion of the drill program (J. Archibald, Vanity Capital Corp., personal communication, February 2012).

Graphite

Demand for graphite began to increase in 2009 and continued to increase into 2011 as a result of the improvement of global economic conditions.

During 2011, the majority of the world's graphite was produced by China.

The United States Geological Survey (USGS 2012, p.69) predicts that "advances in thermal technology and acid-leaching techniques ...[will] lead to development of new applications for graphite in high-technology fields. Such innovative refining techniques have enabled the use of graphite in carbon-graphite composites, electronics, foils, friction materials, and special lubricant applications. Flexible graphite product lines ... are likely to be the fastest growing market." Graphite also has many important new applications, such as lithium ion batteries, fuel cells, and nuclear and solar power, that have the potential to create significant incremental demand growth. "Large-scale fuel-cell applications are being developed that could consume as much graphite as all other uses combined."

There has been a revolution in science and technology that has further revitalized interest in natural flake graphite as an exploration target, not just in Canada, but around the world. It is anticipated that the demand will only continue to grow. In 2010, the Nobel Prize® in Physics was awarded to 2 scientists at the University of Manchester "for groundbreaking experiments regarding the two-dimensional material graphene" (www.nobelprize.org/nobel_prizes/physics/laureates/2010/).

Graphene is an allotrope of carbon just one atom thick. It is a superior conductor of both electricity and heat. It is almost completely transparent, yet so dense that not even helium, the smallest gas atom, can pass through it. There is considerable speculation as to a host of potential practical applications for graphene including the creation of new materials and the development of innovative electronics.

There are currently 3 advanced exploration and development graphite projects in southern Ontario and a growing number of grassroots projects.

OROCAN RESOURCE CORP. (STANDARD GRAPHITE CORP.) – BLACK DONALD, LITTLE BRYAN AND LYNDOCH GRAPHITE PROPERTIES

In November 2011, Orocan Resource Corp. announced the acquisition of 3 graphite properties in southeastern Ontario including the Black Donald, Little Bryan and Lyndoch graphite properties.

The following is a summary of the Black Donald and Little Bryan properties (Standard Graphite Corp., *from* www.standardgraphite.com/s/black_donald.asp; *from* www.standardgraphite.com/s/little_bryan.asp):

- The 9000 ha property covers a substantial area of favourable geology surrounding the past producing Black Donald Mine
- The Black Donald Graphite Mine was one of the largest and richest graphite deposits in North America. It had reported historic ore grades of up to 80% Cg. During the last 10 years of mine life, the average reported grade was 25-30% Cg
- Some 94% of the total value of Ontario graphite production came from the Black Donald Mine
- The Little Bryan project encompasses 3250 ha [with] excellent infrastructure
- Previously explored by Harrington Sound Resources [in] 1989
- Hosted in pyritic gneisses, the known graphite mineralization extends over 1.3 km in a general east-west direction. Historic grab samples ranged from a reported 0.63% to 34.06% Cg. Average grade [was] 10.94% Cg

In January 2012, Orocan Resource Corp. announced that it had begun exploration on the Black Donald, Little Bryan and Lyndoch graphite properties. A 1492 line-kilometres, low-altitude, time-domain electromagnetic (TDEM) survey was flown by Prospectair Geosurveys over the 3 properties and the survey results will both help to evaluate the extent of the known mineralization and potentially lead to new discoveries. Additional exploration planned for 2012 includes: prospecting, trenching and diamond drilling. In early February 2012, Orocan Resource Corp. announced a name change to Standard Graphite Corp. (Standard Graphite Corp., news release, February 2, 2012, www.standardgraphite.com/s/news.asp?ReportID=505211).

Magnetite

FERROMIN INC. – SOUTH CANONTO TOWNSHIP

Ferromin Inc. conducted geological mapping and magnetic surveys over the company's property in South Canonto Township. The company extracts magnetite from an open pit on Concession III, Lot 14 at the northeastern end of Summit Lake. Magnetite is crushed on site and marketed as high-density aggregate. The company is evaluating the economic feasibility of deepening the existing pit and is exploring the remainder of the property for additional zones of magnetite mineralization (P. Kriens, Ferromin Inc., personal communication, February 2012).

Nickel-Copper-Platinum Group Elements

FIRST NICKEL INC. – RAGLAN HILLS PROPERTY, BELMONT PROPERTY, HENDERSON PROPERTY

First Nickel Inc. (www.firstnickel.com) is exploring 3 nickel-copper-platinum group element (PGE) prospects in southeastern Ontario. A detailed description of property geology, mineralization and exploration activities from 2008 to 2010 is provided by Sangster et al. (2010).

The Raglan Hills project exploration model is the Voisey's Bay-type nickel-copper mineralization and low sulphide PGEs associated with mafic and ultramafic intrusions. 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 and is accessed via unpaved roads connecting to Highway 28.

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 encompass many documented nickel and copper occurrences and have the potential to host nickel-copper deposits formed in a dynamic magma conduit system similar to the aforementioned Voisey's Bay deposit and the Eagle deposit of the Midcontinent Rift (cf. Ware, Cherry and Ding 2008).

In 2009, First Nickel Inc. entered into an option agreement with Melkior Resources to explore that company's Henderson property immediately to the east of the Raglan Hills property in Raglan Township.

In November 2011, First Nickel Inc. contracted GeoTech Ltd. to fly a helicopter-assisted VTEM survey starting in late November or early December 2011 over 3 of the company's properties: the Belmont claims, the Raglan Hills–Moccasin Lake North and the Henderson claims. This survey was designed to complement their previous helicopter geophysical surveys from 2009 and to aid in 2012 exploration programs. (S. Halladay, First Nickel Inc., personal communication, November 2011)

RESIDENT GEOLOGIST STAFF AND ACTIVITIES

The Southern Ontario Regional Resident Geologist's office, located in Tweed, is the only Resident Geologist Program office south of the French River. The office is staffed by P.J. Sangster, *P.Geo*., Regional Resident Geologist, P.S. LeBaron, *P.Eng*., District Geologist, D.A. Laidlaw, *P.Geo.*, Regional Land Use Geologist and S.J. Charbonneau, who assumed the position of District Geological Assistant in September, 2011. Beginning in November 2011, M. Forget and D. Milligan worked on a short-term contract as part of an ongoing Drill Core off-site maintenance project. A.C. Wilson, Mineral Deposit Compilation Geologist – Northeast, based in Timmins, contributes to updates and review of 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. From January to March, J. Bremner provided on-call contract administrative assistance and V.C. Papertzian was hired on an on-call contract basis to assist with upgrades to the Drill Core off site and Drill Core database maintenance. Summer Experience Program students R. Bremner and G. Laidlaw provided field season support.

The Southern Ontario Regional Resident Geologist's 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
- provision of public access to geoscience databases and other resource materials
- documentation of mineral exploration and development activity
- land-use planning issues and initiatives
- public education

The Southern Ontario Regional Resident Geologist's office also provides support to the ministry's Mining Lands Section front-counter client services and works with the MNDM Aboriginal Relations Branch to assist in fostering relations between the mineral industry and First Nation communities.

During 2011, activities co-ordinated by the Aboriginal Relations Branch included introductory meetings with the Regional Resident Geologist, Mineral Development and Lands Branch staff and First Nation representatives. The following First Nations were visited: Curve Lake, Alderville, Hiawatha, Saugeen Ojibway Cape Croker and Chippewa Hill. In March, the District Geologist provided a review of the geology, mineral deposits and exploration activities in southeastern Ontario at the Algonquins of Ontario consultation office in Pembroke.

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, and presented meetings for regional clients including the Southern Ontario Prospectors' Association in March and in December, featuring updates on Mining Act Modernization by R. Denomme, Senior Manager, Mining Lands and C. Stephenson, Provincial Mining Recorder. Other presentations included a Micro-Blaster demonstration and talk on Canadian gemstone-bearing pegmatite deposits given by B. Wilson of Alpine Gems Ltd., Kingston.

The Resident Geologist and District Geologist attended a four-day course on sediment-hosted hydrothermal ore deposits at the University of Ottawa in February, sponsored by the University of Ottawa and the Mineral Exploration Research Centre, Laurentian University; a three-day field trip examining the geology in the vicinity of the Black Lake shear zone in northern New York State, hosted by the Friends of the Grenville in September; a two-day Industrial Minerals Conference in Toronto, presented by Blendon Information Services in October; a joint Ministry of Northern Development and Mines–Ministry of Natural Resources field trip in the North Bay–Mattawa area in October, which included a tour of the Northern Graphite Inc. Bissett Creek graphite deposit in Maria Township; and the Ontario Exploration Geoscience Symposium in November. The District Geologist also attended the three-day Geological Association of Canada–Mineralogical Association of Canada convention in Ottawa in May; a mini-symposium on porphyry copper deposits in Toronto, presented by the Toronto Geological Discussion Group in July; and a soil gas hydrocarbon workshop in Sudbury, presented by Activation Laboratories Limited in November.

In October, the Resident Geologist presented talks to 300 elementary school students and, with the District Geologist, provided a weekend poster and sample display as part of the Ancaster Gem and Mineral Show. In addition, in October, the Resident Geologist and the District Geologist presented a poster session and slide show on Ontario Industrial Minerals to delegates at the International Symposium on the Marketing of Industrial Minerals in Toronto.

In June and in November, the Resident Geologist provided a one-evening workshop on Ontario Industrial Minerals as part of a course presented by the Sudbury Prospectors and Developers Association at Laurentian University in Sudbury.

Presentations by the District Geologist in 2011 included the following: a poster and rock and mineral display at the Sustainable Living Symposium hosted by Quinte Conservation at Loyalist College in Belleville, featuring 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 (April); a poster and sample display at the Northeastern Ontario Mines and Minerals Symposium in Timmins, featuring exploration highlights and opportunities in southeastern Ontario (April); and a talk and sample display illustrating the history of iron ore exploration in southeastern Ontario in association with a quarry tour and information session given by MRT Aggregates to the Kasshabog Lake Cottagers Association (July).

On the August Civic Holiday weekend, staff from the Southern Ontario Resident Geologist's office presented a booth highlighting the history and geology of iron mining and smelting in the County of Hastings, including the role of the industry in developing the historic eastern Ontario railway network at the 2011 Bancroft Gemboree. The four-day event traditionally hosts 8000 to 10 000 attendees.

Table 5 provides a five-year summary of program activity and Table 6 lists new publications added to the Resident Geologist Program office technical library (in Tweed) during 2011.

DIAMOND DRILL CORE LIBRARY PROJECT

The Resident Geologist Office maintains a drill core storage compound on Hunt Road approximately 2 km south of the Village of Tweed. In addition 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.

V.C. Papertzian, former Drill Core Library Geologist, was hired on an on-call contract basis from January to April to assist in the rehabilitation of the site and maintenance of the database. Eight new core racks were assembled and installed in 2011.

An additional 613 boxes of diamond-drill core were received and stored at the compound in 2011. The core is from 2 diamond-drill programs completed on the Tudor Township gold prospect of R. Dillman and J. Chard by Opasatika Mining Corporation in 2008 (9 holes, 1010 m) and by CW Glory Gold Limited in 2011 (10 holes, 1675 m).

A multi-year program of rehabilitation at the Hunt Road site was initiated in 2011. Some of the drill core is from exploration completed more than 40 years ago and was stacked on wooden pallets when the off-site facility was created. Of a total of about 600 drill-core pallets, about 200 show severe deterioration of core boxes. M. Forget and D. Milligan were contracted to begin the task of replacing boxes, re-labelling and re-stacking the boxes on new pallets. Over a period of 6 weeks in November and December, 1560 core boxes were replaced. The contract also included the construction of sheet metal roofing on new core racks that were installed in 2010 and 2011.

Table 5. Program activity statistics (five-year summary) for the Southeastern Ontario District.

Activity	2007	2008	2009	2010	2011
Field Investigations / Property Visits	29	39	32	41	42
Field Trips Given / Field Guide Written	3	3	3	3	3
Mineral Deposit Inventory Records Revised	623	362	61	125	875
Presentations to Ministry of Municipal Affairs and Housing, Ministry of Natural Resources, Ministry of Aboriginal Affairs, others	3	7	1	5	19
Clients Visits to Resident Geologist Program office in Tweed	379	354	343	449	430
Drill Core Library Users	70	60	55	275	40
Client Communications / Interactions (Presentations/Poster Sessions)	>3000	>3000	>3000	>3000	>3000

Table 6. Library acquisitions in 2011 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 2011	**Easton, R.M., Burnham, O.M., Berger, B.R., Beakhouse, G.P., Bajc, A.F., Parker, J.R., Kelly, R.I. and Debicki, E.J. eds.**	**Ontario Geological Survey, Open File Report 6270, 378p., 2011**
Index to Published Reports, Maps and Digital Data, 1993 to 2010	Ontario Geological Survey	Ontario Geological Survey, Miscellaneous Paper 177, 303p., 2011
Geographic Index to Published Reports, Maps and Digital Data, 1994 to 2010	Ontario Geological Survey	Ontario Geological Survey, Miscellaneous Paper 178, 522p., 2011
Index to Maps, Surficial Geology, 1991–2010, Southern Sheet	**Ontario Geological Survey**	**Ontario Geological Survey, scale 1:1 000 000, 2011**
Index to Maps, Bedrock Geology, 1991–2010, Southern Sheet	**Ontario Geological Survey**	**Ontario Geological Survey, scale 1:1 000 000, 2011**
Report of Activities 2010, Resident Geologist Program, Red Lake Regional Resident Geologist Report: Red Lake and Kenora Districts	Lichtblau, A.F., Ravnaas, C., Storey, C.C., Bongfeldt, J., McDonald, S., Lockwood, H.C., Bennett, N.A. and Jeffries, T.	Ontario Geological Survey, Open File Report 6261, 93p., 2011
Report of Activities 2010, Resident Geologist Program, Thunder Bay North Regional Resident Geologist Report: Thunder Bay North District	Smyk, M.C., White, G.D., Lockwood, H.C. and Bennett, N.A.	Ontario Geological Survey, Open File Report 6262, 47p., 2011
Report of Activities 2010, Resident Geologist Program, Thunder Bay South Regional Resident Geologist Report: Thunder Bay South District	Scott, J.F., Campbell, D.A., Lockwood, H.C., Bennett, N.A., Brunelle, M.R. and Pelaia, R.	Ontario Geological Survey, Open File Report 6263, 60p., 2011

Title	Author	Type and Year of Publication
Report of Activities 2010, Resident Geologist Program, Timmins Regional Resident Geologist Report: Timmins and Sault Ste. Marie Districts	Atkinson, B.T., Bousquet, P., Pace, A., Burnett, S., Butorac, S., Draper, D.M., Metsaranta, D.A. and Wilson, A.C.	Ontario Geological Survey, Open File Report 6264, 127p., 2011
Report of Activities 2010, Resident Geologist Program, Kirkland Lake Regional Resident Geologist Report: Kirkland Lake District	Guindon, D.L., Grabowski, G.P.B., Wilson, A.C., Metsaranta, D.A. and Greenfield, M.J.	Ontario Geological Survey, Open File Report 6265, 49p., 2011
Report of Activities 2010, Resident Geologist Program, Kirkland Lake Regional Resident Geologist Report: Sudbury District	Cosec, M., Farrow, D.G., Alemany, R.M., Sangster, P.J., Debicki, R.L., Metsaranta, D.A. and Wilson, A.C.	Ontario Geological Survey, Open File Report 6266, 44p., 2011
Report of Activities 2010, 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., LeBaron, P.S., Laidlaw, D.A., Wilson, A.C., Carter, T.R. and Fortner, L.**	**Ontario Geological Survey, Open File Report 6267, 65p., 2011**
Three-Dimensional Modelling of Surficial Deposits in the Barrie-Oro Moraine Area, Southern Ontario	**Burt, A.K. and Dodge, J.E.P.**	**Ontario Geological Survey, Groundwater Resources Studies 11, 2011**
A Geological and Hydrological Investigation of the Dundas Buried Bedrock Valley, Southern Ontario	**Marich, A.S., Priebe, E.H., Bajc, A.F., Rainsford, D.R.B. and Zwiers, W.G.**	**Ontario Geological Survey, Groundwater Resources Studies 12, 2011**
Surficial Geology of Southern Ontario	**Ontario Geological Survey**	**Ontario Geological Survey, Miscellaneous Release—Data 128 – Revised, 2010**
Geochemical and Brick Testing Results for the Queenston and Cabot Head Formations from Drill Hole 09OGS-DDH-15, Bruce County, Southern Ontario	**Rowell, D.J. and Brunton, F.R.**	**Ontario Geological Survey, Miscellaneous Release—Data 279, 2011**
Ambient Groundwater Geochemistry Data	**Hamilton, S.M.**	**Ontario Geological Survey, Miscellaneous Release—Data 283, 2011**
Geological, Geochemical and Geophysical Data Related to the Zinc Scoping Project, Grenville Province	**Easton, R.M.**	**Ontario Geological Survey, Miscellaneous Release—Data 286, 2011**
Geological, Geochemical and Geophysical Data Related to the Hungry Lake Area, Grenville Province	**Duguet, M.**	**Ontario Geological Survey, Miscellaneous Release—Data 287, 2011**
Precambrian Geology of the Hungry Lake Area, Grenville Province	**Duguet, M. and Gordon, S.**	**Ontario Geological Survey, Preliminary Map P.3760, scale 1:20 000, 2011**
Airborne Geophysical Survey, Essex, Ontario (Gamma-Ray Spectrometric Data) 8 maps	**Carson, J.M., Ford, K.L. and Harvey, B.J.A.**	**Geological Survey of Canada, 2010**
Airborne Geophysical Survey, South-Central Ontario (Gamma-Ray Spectrometric Data) 9 maps	**Carson, J.M., Ford, K.L. and Harvey, B.J.A.**	**Geological Survey of Canada, 2010**
Canadian & American Mines Handbook 2010–2011	Giancola, D. ed.	BIG Magazines LP, Toronto, 816p., 2010
Canadian & American Mines Handbook 2011–2012	Giancola, D. ed.	BIG Magazines LP, Toronto, 872p., 2011
Compilation of Reanalyses and New Analyses of Lithogeochemistry - Abitibi Greenstone Belt, Ontario and Quebec	Hillary, E.M. and Grunsky, E.C.	Geological Survey of Canada, Open File 6623, 2010
Field Guide to Meteors and Meteorites	Norton, O.R. and Chitwood, L.A.	Springer-Verlag London Limited, 287p., 2008
Geochemistry Database for Carbonaceous and Sulphidic Metasediment Horizons of the Western Neoarchean Kidd–Munro Assemblage, Abitibi Subprovince, Ontario	Chapman, J.B. and Peter, J.M.	Geological Survey of Canada, Open File Report 6550, 2010
Geological History of Southern Africa	Haughton, S.H.	Geological Society of South Africa, 535p., 1969
Geology of the Manitoulin Area	**Sanford, J.T. and Mosher, R.E. eds.**	**Michigan Basin Geological Society, 1978**
Landscapes of Newfoundland and Labrador - A Collection of Aerial Photographs	Batterso, M. and Liverman, D.	Government of Newfoundland and Labrador, 133p., 1999
Life of the Past: An Introduction to Paleontology	Simpson, G.G.	Bantam Science and Mathematics, 194p., 1953
Red Lake – Golden Treasure Chest	Barnes, M.	General Store Publishing House, 2008
Rocks from Space, Second Edition	Norton, O.R.	Mountain Press Publishing Company, 447p., 1998

PROPERTY EXAMINATIONS

In 2011, a total of 36 Southern Ontario Region properties were visited by Resident Geologist Program staff. An additional 5 visits were completed to properties outside the Region (Table 7; Figures 4 and 5).

Table 7. Property visits conducted by the Southern Ontario Regional Resident Geologist and staff in 2011 (keyed to Figure 4).

No.	Property/Operation	Commodity
	Southeastern and Southwestern Ontario Districts	
1	Marmoraton mine site, Marmora Township	Magnetite
2	Canada Talc mine site, Huntingdon Township	Talc (Closure Plan)
3	Upper Canada Stone Co. Ltd. processing plant, Madoc Township	Marble
4	Scotch Settlement Rd. Quarry, Madoc Township	Marble (chocolate)
5	Jade Marble Quarry, Madoc Township	Dimension Stone
6	Tweed Marble Quarry, Hungerford Township	Marble, Dimension Stone
7	Carbroc Quarry, Elzevir Township	Dolomite
8	Canada Talc, dolomite quarry, Huntingdon Township	Dolomite Mineral Filler
9	MRT Aggregates, Methuen Township	Trap Rock
10	Unimin Canada, Blue Mountain Operations, Methuen Township	Nepheline Syenite
11	Attia Rama Quarry, Rama Township	Ledgerock
12	Attia Seabright Quarry, Rama Township	Ledgerock
13	Owen Ledgerock Quarry and Plant, Amabel Township	Dimension Stone
14	Block and Stone Resources Group, Amabel Township	Dimension Stone
15	Maitland prospect, Albemarle Township	Dimension Stone
16	Petroglyphs, Methuen Township	Scientific Interest, Consultation
17	Canadian Wollastonite, Pittsburgh and Leeds Townships	Wollastonite
18	Richardson mine site, Madoc Township	Gold, Geotourism, Scientific Interest
19	Trigan Resources, ilmenite prospect, Methuen Township	Titanium (ilmenite)
20	Hwy 46 “Fossil Hill”, Methuen Township	Scientific Interest
21	Bridgewater mine, Elzevir Township	Trap Rock
22	St. Lawrence Park, Kingston Township	Sandstone, Dimension Stone
23	LaFarge Canada Inc. Bath Quarry and Plant, Ernestown Township	Cement
24	Rockport Frontenac Arch, Front of Escott Township	Scientific Interest
25	Upper Brewers Lock, Pittsburgh Township	Scientific Interest
26	MacDonald feldspar mine site, Monteagle Township	Feldspar (AMIS investigation)
27	Perry mine site, Huntingdon Township	Fluorite (AMIS investigation)
28	Coe Hill iron mine site, Wollaston Township	Magnetite (geotourism)
29	Dingman property/Upper Canada Gold, Madoc and Marmora Townships	Gold
30	Mono gold prospect, Madoc Township	Gold
31	Coe Hill gold occurrence, Wollaston Township	Gold, Magnetite
32	Whitney calcite prospect, Belmont Township	Calcite/Dolomite Marble
33	Pay Rock occurrence, Barrie Township	Gold
34	Addington mine site, Kaladar Township	Gold
35	Gold base (H. Veley) prospect, Kennebec Township	Gold
36	Cordova mine site, Belmont Township	Gold
	Outside Southeastern Ontario and Southwestern Ontario Districts	
	Northern graphite, Maria Township	Graphite
	Rutter nepheline syenite, Bigwood Township	Nepheline Syenite
	Edgar Taillefer prospect, Aylmer Township	Dimension Stone
	Mattawa eclogite, Mattawa Township	Garnet, Scientific Interest
	Black Lake shear zone, Alexandria, New York	Scientific Interest

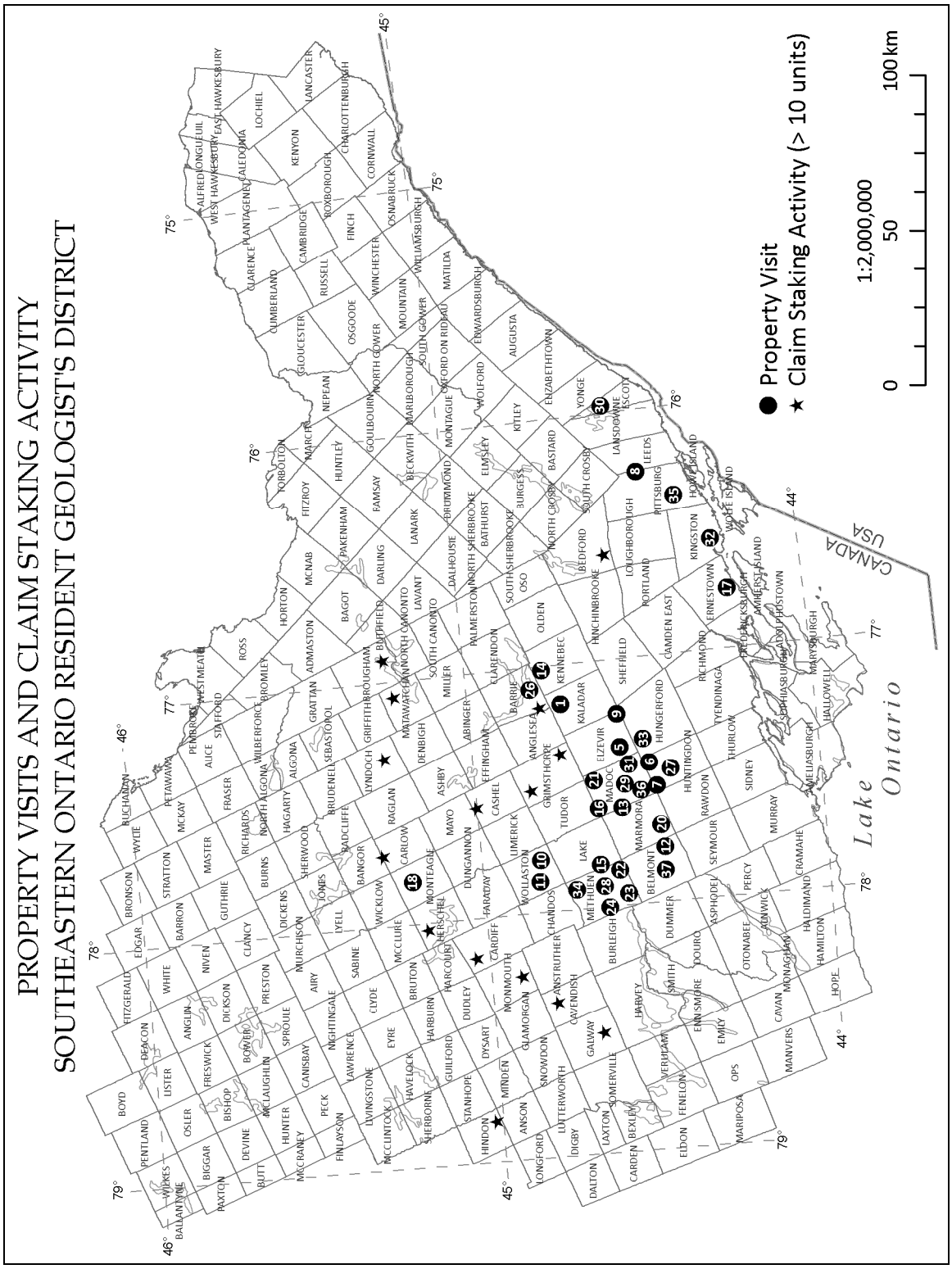

Figure 4. Property visits (keyed to Table 7) and claim staking activity in the Southeastern Ontario District in 2011.

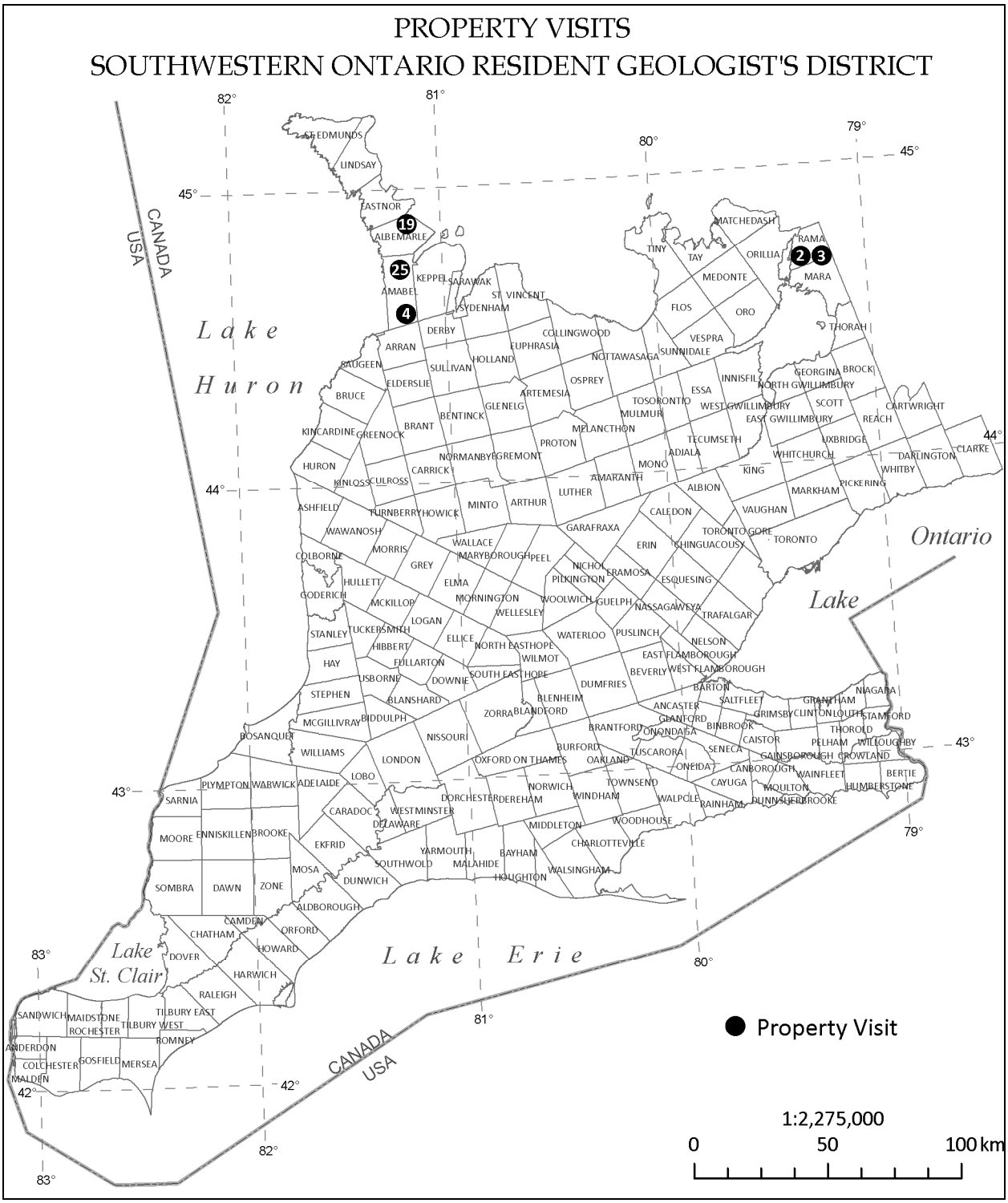

Figure 5. Property visits (keyed to Table 7) in the Southwestern Ontario District in 2011.

Pay Rock Gold Occurrence, Barrie Township

In August 2011, the District Geologist accompanied M. Glanfield on an examination of a gold prospect on his mining claims in Barrie Township. Gold mineralization is associated with a zone of hematitic alteration and quartz veining in dolomitic marble, which is exposed in several old trenches and pits known as the Pay Rock gold occurrence.

LOCATION AND ACCESS

The property consists of 2 unpatented mining claims, 1192268 and 4207175, in Concession I, Lot 16, Barrie Township, about 45 km northeast of Tweed. Access is by Highway 41 north from Highway 7 at Kaladar for a distance of 14.3 km to the Harlowe Road; east 8.2 km to the stop sign in Harlowe; continue east for another 1.7 km on Gull Lake Road to the intersection with Thompson Road, where post #4 of claim 1192268 is on the south side of Gull Lake Road. The old trenches of the Pay Rock gold occurrence, located in the southern quarter of claim 4207175, are approximately 900 m south of the road. The most easterly of the trenches (No. 1) is located at UTM co-ordinates 337407E 4962301N (NAD83, Zone 18).

EXPLORATION HISTORY

Gold was first discovered in the Harlowe area in 1936. Meen (1944, p.42) provides the following description of a gold discovery by the Pay Rock Gold Syndicate:

> In 1936 a number of trenches and shallow pits were put down in tracing a rusty zone in the dolomite in lot 16, about 500 feet north of the south boundary of the township. Numerous discontinuous quartz stringers occur in the rusty zone and the adjacent dolomite. Native gold was observed in the rusty dolomite in one of the western pits. An altered basic dike, probably a lamprophyre, occurs as a 1-foot strip along the length of the development. The tracing of a payable zone here will be a case of following assay values, since there is no definite vein and the gold is not restricted to the quartz alone.

From 1986 to 1991, Homestake Mineral Development Company explored several of the Harlowe area gold occurrences, including the Pay Rock property. Geological mapping, soil sampling and geophysical surveys (magnetic and VLF-EM) were completed and the results were summarized by Bending, Henry and Parent (1989) as follows:

> The moderate conductor in the south half of claim EO840291 corresponds with the Pay Rock showing, an auriferous shear zone in dolomitic marble with minor quartz-hematite veins, intruded by a mafic dike. The data tend to suggest that the Pay Rock zone extends to the east but do not provide systematic coverage to the west. 1987 soil geochemical surveys suggest a westerly extension of the Pay Rock zone south of the coverage of the VLF survey.

M. Glanfield staked and prospected the claims between 1996 and 1999. Assays of grab samples taken by M. Glanfield and MNDM staff from the old Pay Rock trenches ranging from 0.11 to 1.12 ounces gold per ton (3.8 to 38.3 g/t Au) were reported (Glanfield 2000). The claims were allowed to lapse and were re-staked by Mr. Glanfield in March 2011.

REGIONAL GEOLOGY

The property is located in the Mazinaw terrane of the Central Metasedimentary Belt, Grenville Province. Several gold occurrences, including the Pay Rock, lie within the Flinton Synclinorium, an easterly trending structure in which older metavolcanic and metasedimentary rocks of the Grenville Supergroup are unconformably overlain by, and tightly folded with, clastic metasedimentary rocks of the Flinton Group (conglomerate, quartzite and pelitic schist) along the northern margin of the Northbrook granodioritic pluton. Metamorphic grade is upper greenschist to mid-amphibolite. The geology of the area is described by Moore and Morton (1986) and is shown on a compilation map by Easton (2001).

A spatial association of gold mineralization with the Flinton Group unconformity in Kaladar, Barrie and Kennebec townships has been recognized by Moore and Morton (1986) and others. The occurrences are hosted by 1 of 2 settings: either 1) mafic schist of the Ore Chimney Formation, which lies at the unconformity between underlying mafic metavolcanic rocks and overlying conglomerate and quartzite. The Ore Chimney Formation is interpreted as a

paleoregolith that locally underlies the basal units of the Flinton Group. Examples of this type of gold mineralization are the Ore Chimney deposit in Barrie Township west of Harlowe, and the Addington deposit located east of Flinton in Kaladar Township, which host gold mineralization in quartz veins with tourmaline, pyrite, chalcopyrite, galena and sphalerite. Or 2) narrow bands of dolomitic marble below the unconformity, as at the Dome, Pay Rock and Gold Base occurrences in the Harlowe area, which host auriferous quartz veins, generally with minor sulphides (pyrite, chalcopyrite, tetrahedrite).

PROPERTY GEOLOGY

On the Glanfield property, the northern claim (1192268) is underlain predominantly by andesitic to dacitic metavolcanic rocks, including agglomerate, breccia and porphyry dikes. Bedrock in the northern half of the southern claim (4207175) consists of Flinton Group metasedimentary rocks, predominantly conglomerate. About 450 m south of the common boundary between the 2 claims, a low ridge of conglomerate striking 070° drops about 7 m to the south. The old Pay Rock trenches are located on a low outcrop ridge of dolomitic marble about 30 m south of the conglomerate outcrop area. At least 11 trenches and small pits have been excavated in bedrock along a 200 m long section of the ridge, from the centre to the eastern boundary of the southern claim.

The trenches follow a rusty-weathering zone trending 070° within buff to pale grey dolomitic marble. The zone is at least 10 m wide and contains narrow (20 to 30 cm) zones of quartz veining that strike 070° and dip about 80° south, with intense hematitic alteration in the marble bordering the veins. The veins are generally 1 to 3 cm wide, contorted and boudinaged within the zones. Other than a trace of chalcopyrite in marble adjacent to a mafic dike in trench #3, no sulphides were observed in the quartz veins or wall rock. The mafic dike, possibly a lamprophyre (Photo 1), was observed in all trenches examined and is from 5 to 60 cm wide, is mica rich (biotite and muscovite) with fine-grained white feldspar and minor calcite. Hematite alteration and quartz veining occur in, but are not restricted to, marble bordering the dike. Descriptions, locations and assay results of samples taken during the property examination are provided (*see* table below).

Sample ID	Location*	Description	Assay Value**
PR-1	North end of Trench #1 (337407E 4962301N)	East wall of trench, quartz stringer zone in buff dolomitic marble with strong hematite alteration bordering quartz stringers; chip sample of quartz vein/hematitic dolomite material; no visible sulphides	<0.01 oz/ton Au
PR-2	South end of Trench #1 (about 2 m south of PR-1)	Similar quartz vein/hematitic dolomite zone; no visible sulphides	<0.01 oz/ton Au
PR-3	Trench #3 ("Main Trench") (337383E 4962177N)	Silicified, grey marble containing minor quartz vein material with trace chalcopyrite bordering (north contact) an 8 cm wide mafic dike; strong hematite alteration and recessive weathering along contact with dike	0.24 oz/ton Au
PR-5	Trench #3	Silicified dolomitic marble with 10% quartz stringers and pale green tremolite from east wall, 1 m north of mafic dike; no visible sulphides	0.03 oz/ton Au
PR-6	Trench #5 (337318E 4962177N)	Quartz vein material from 2 m wide quartz stringer zone in dolomitic marble along the north contact with a 0.8 m wide biotite-chlorite-rich (lamprophyre?) dike; minor gossan, no visible sulphides	0.03 oz/ton Au

*Locations provided using UTM co-ordinates, NAD83, Zone 18.
**Samples analyzed by lead-fire assay with gravimetric finish at the Ontario Geological Survey Geoscience Laboratories in Sudbury.

CONCLUSIONS AND RECOMMENDATIONS

Gold mineralization is present within a quartz vein–hematite alteration zone in dolomitic marble close to the unconformity between metavolcanic and metasedimentary rocks of the Grenville Supergroup and metaconglomerate of the Flinton Group. With the exception of soil geochemical and VLF-EM surveys in the 1980s, very little exploration work has been done since the initial discovery of gold on the property in 1936. Additional work is warranted on the Pay Rock occurrence. Cleaning and re-sampling of the old trenches, combined with stripping of overburden will assist in delineating structures associated with the gold mineralization, including the relationship of mineralization to the mafic dike that is present in the trenches.

Gold occurs in both silicified mafic, volcanic-derived schist and dolomitic marble close to the unconformity in Kaladar, Barrie and Kennebec townships. An outcrop of biotite-rich amphibolite schist was observed by the District Geologist just north of the marble unit between trenches #1 and #3. This unit, exposed between the marble and

overlying Flinton Group conglomerate, may be equivalent to the Ore Chimney Formation and may host gold mineralization similar to that of the auriferous "sulphide zone" and "biotite zone", described as quartz-biotite-pyrite gneiss in a report on the Harlowe area properties by Homestake Mineral Development Company (Lloyd and Bending 1989). About 2.5 km southwest of the Pay Rock property, pyritic mafic schist intersected in a diamond-drill hole by Rio Algom Exploration Inc. in 1990 averaged 5.4 g/t Au over 3.65 m, including 1.0 m at 10.0 g/t Au (R. Knowles, Rio Algom Exploration Inc., diamond-drill log, Hole No.502, Flinton–Boegel property, 1990; Southern Ontario Drill Core Library (Tweed) database). There were no quartz veins in the zone and the unit lies between dolomitic marble and black, matrix-supported conglomerate, which grades into clast-supported conglomerate down-hole – a lithological sequence similar to that observed on the Pay Rock property. The potential for gold mineralization associated with mafic schist and marble units close to the Flinton Group unconformity in other parts of the Pay Rock property should be evaluated with detailed geological mapping and soil geochemistry.

Photo 1. Sample from Pay Rock gold occurrence trench #3, now part of the Glanfield property, showing dolomitic marble in contact with possible lamprophyre dike. Sample width is 17 cm.

Northern Graphite Corporation – Bissett Creek Graphite Deposit, Maria Township

In October 2011, the District Geologist and Resident Geologist examined drill core and surface geology at the Bissett Creek graphite deposit of Northern Graphite Corporation in Maria Township, as part of a field trip organized by the Resident Geologist and D. Webster, Senior Conservation Geologist with the Ministry of Natural Resources. A tour of the site and information on the advanced exploration program was provided by M. Taner, consulting geologist for the company.

LOCATION AND ACCESS

The Bissett Creek property is located in Maria Township, approximately 80 km northwest of Pembroke. It consists of a group of 6 unpatented mining claims covering approximately 624 ha and a mining lease (#106693) covering 565 ha. The property is centred at UTM co-ordinates 727170E 5112025N (NAD83, Zone 17) on NTS map sheet 31 L/1.

Access from Highway 17 to the property is by way of the Bissett Creek Road, a well-maintained gravel forestry road that intersects the highway about 53 km east of the town of Mattawa and about 2 km east of the village of Bissett Creek. At 13 km south of the highway, the road branches east and leads another 4 km to the deposit area.

EXPLORATION HISTORY

The following information is summarized from a report by SGS Canada Inc. (2010, p.9-45) unless otherwise noted.

The property was first staked by Frank Tagliamonti and Associates in 1980. In 1981, Hartford Resources Inc. optioned the property and staked an additional 24 claims.

In 1984, Princeton Resources Corp. acquired the property and carried out a program of mapping, trenching, surveying and diamond drilling, resulting in a non-NI 43-101–compliant reserve estimate of 10 million tonnes of 3% graphite.

In 1986, North Coast Industries Ltd. entered into an option agreement with Princeton whereby North Coast would earn a 58% interest in the property by completing a batch testing plant, completing the bulk sampling and producing flake product for end-user tests. The company processed 4900 tons of ore and produced 36 tons of graphite concentrate. The results of these tests indicated the Bissett Creek graphite deposit could be concentrated to high-grade, high-value flake product. In 1989, North Coast acquired 100% interest in the property and completed a feasibility study, reporting a minimum of 20 million tonnes of graphitic material grading 3.18% C. Exploration work included detailed geological mapping, trenching, 2100 m of diamond drilling and percussion drilling.

In 2002, Industrial Minerals Canada Inc. acquired the property and attempted to develop a dry process for graphite recovery. In 2007, Industrial Minerals Inc., through a new management group, contracted Systèmes Geostat International Inc. to produce an NI 43-101 report and began negotiations to install a process plant on site. In order to complete the report, the company undertook a program of diamond drilling (6 holes, 247 m) and drill-hole collar surveying to confirm grade and graphite flake size in an area that had been investigated in the 1980s. Industrial Minerals Inc. staked additional claims in 2007, adding 950 acres (380 ha) and increasing the total property area to 3250 acres (1304 ha). Following the 2007 report, Industrial Minerals Inc. planned to install a 1 tonne-per-hour pilot plant on the property in 2008 and a full-size 2500 tonnes-per-day commercial plant producing 20 000 tonnes per year of high-grade, high-quality graphite flakes by 2010. The work was not completed.

Industrial Minerals Canada Inc. changed its name to Northern Graphite Corporation in December 2009 (a subsidiary of Industrial Minerals Inc.) and, in 2010, completed a 51-hole diamond-drilling program, totalling 2927 m, to confirm the results of historical drilling, upgrade some of the existing inferred resources to indicated resources and to expand the area of the resource. An NI 43-101–compliant technical report prepared by SGS Canada Inc. in July 2010, and revised in February 2011, lists indicated resources of 14.6 million tonnes grading 2.24% Cg at a 1.5% cut-off and inferred resources of 18 million tonnes grading 2.21% Cg at a 1.5% cut-off (Northern Graphite Corporation, news release, May 17, 2011, www.northerngraphite.com/wp-content/uploads/2011/05/May-17-2011-PR.pdf).

REGIONAL GEOLOGY

The property lies within the Central Gneiss Belt of the Grenville Province. The area's geology is characterized by quartzofeldspathic gneiss that has undergone upper amphibolite-grade regional metamorphism. Mapping by Lumbers (1976) indicates that the property and surrounding area are underlain predominantly by migmatitic biotite gneiss and coarse- and medium-grained biotite-potassium feldspar-quartz-plagioclase gneiss, which are high-grade metamorphic equivalents of impure sandstone and arkose. These highly deformed and recrystallized rocks have been folded about multiple northwest-trending, northeast-plunging fold axes.

PROPERTY GEOLOGY

The property is underlain by variations of quartz-feldspar-biotite gneiss that have been subdivided by the company geologists, for mapping purposes, into graphite gneiss, transitional graphitic gneiss and barren gneiss. Sections of barren gneiss observed in drill core include pale grey, quartz-rich, pale to dark green-grey, diopside-rich and brownish biotite-amphibole-garnet-bearing varieties. The graphitic gneiss is calcareous biotite-amphibole-quartzofeldspathic gneiss with disseminated graphite, pyrite and pyrrhotite throughout. Graphite occurs in concentrations visually estimated to be from 1 to 10% as disseminated flakes ranging from 1 to 6 mm in diameter. Sulphide content ranges from 1 to 5%, commonly concentrated along graphite-rich cleavage surfaces. The graphitic unit is pale to dark grey in colour, depending on graphite content and flake size and weathers yellow-brown (Photo 2).

The Bissett Creek graphite deposit consists of 1 large zone with a length (north-south) of 2.1 km and width (east-west) up to 1.2 km. Diamond drilling indicates the thickness to be at least 76 m, with one or two layers of higher grade material contained within the graphitic envelope. The zone is uniformly mineralized by low-grade flake graphite in the range of 1 to 2% and higher grade sections (up to 10%) from 3 to 30 m thick occurring within and near the structural base of the unit. The graphite gneiss has a moderate dip to the east from 5 to 30°, lying between the upper barren, non-calcareous gneiss that forms the hanging wall of the deposit (Photo 3b)and similar lower barren gneiss that forms the footwall (SGS Canada Inc. 2010). Photo 3a shows a test pit in a high-grade graphite zone with a shallow eastward dip at the western end of the proposed initial open pit area.

Two intrusive units were observed: a coarse-grained quartz-feldspar pegmatite dike about 1 m wide and a dark green, 5 cm wide lamprophyre dike. Both intrusive types are exposed in the north wall of the East Pit (UTM location: 727613E 5112066N, NAD83, Zone 17).

The graphite mineralization is interpreted as the product of high-grade metamorphism of an originally organic-rich sediment (SGS Canada Inc. 2010). The original depositional environment may have been a shallow shelf setting near the transition zone from continental siliciclastic material to marine carbonate deposition. In the Frontenac Arch area of eastern Ontario, marble-hosted graphite occurrences interlayered with paragneiss are interpreted to have a similar origin (MacKinnon and LeBaron 1992). Minor carbonate content and the presence of calc-silicate rocks in higher grade metamorphic rocks of the Bissett Creek deposit may be remnants of original carbonate interlayered with arkosic sediment.

PROPOSED DEVELOPMENT

In January 2012, Northern Graphite Corporation announced the results of pilot plant flotation tests done by SGS Mineral Services in Lakefield on a 130 t bulk sample taken from the proposed initial open pit area. Recoveries ranged from 90.5 to 94.4%, averaging almost 80% +80 mesh at 96.7% graphitic carbon, including 50% of the concentrate at +48 mesh flake. A Mine Closure plan is expected to be submitted in the first quarter of 2012. Environmental and mine permitting requirements are expected to be completed in the second quarter of 2012. The proposed operation is expected to process 870 000 t of ore to produce 20 000 t of graphite per year. (Northern Graphite Corporation, news release, January 11, 2012, www.northerngraphite.com/wp-content/uploads/2010/01/January-2012-PP-final.pdf)

Photo 2. Varieties of graphitic gneiss, Bissett Creek property (hand lens, for scale, width is 3 cm).

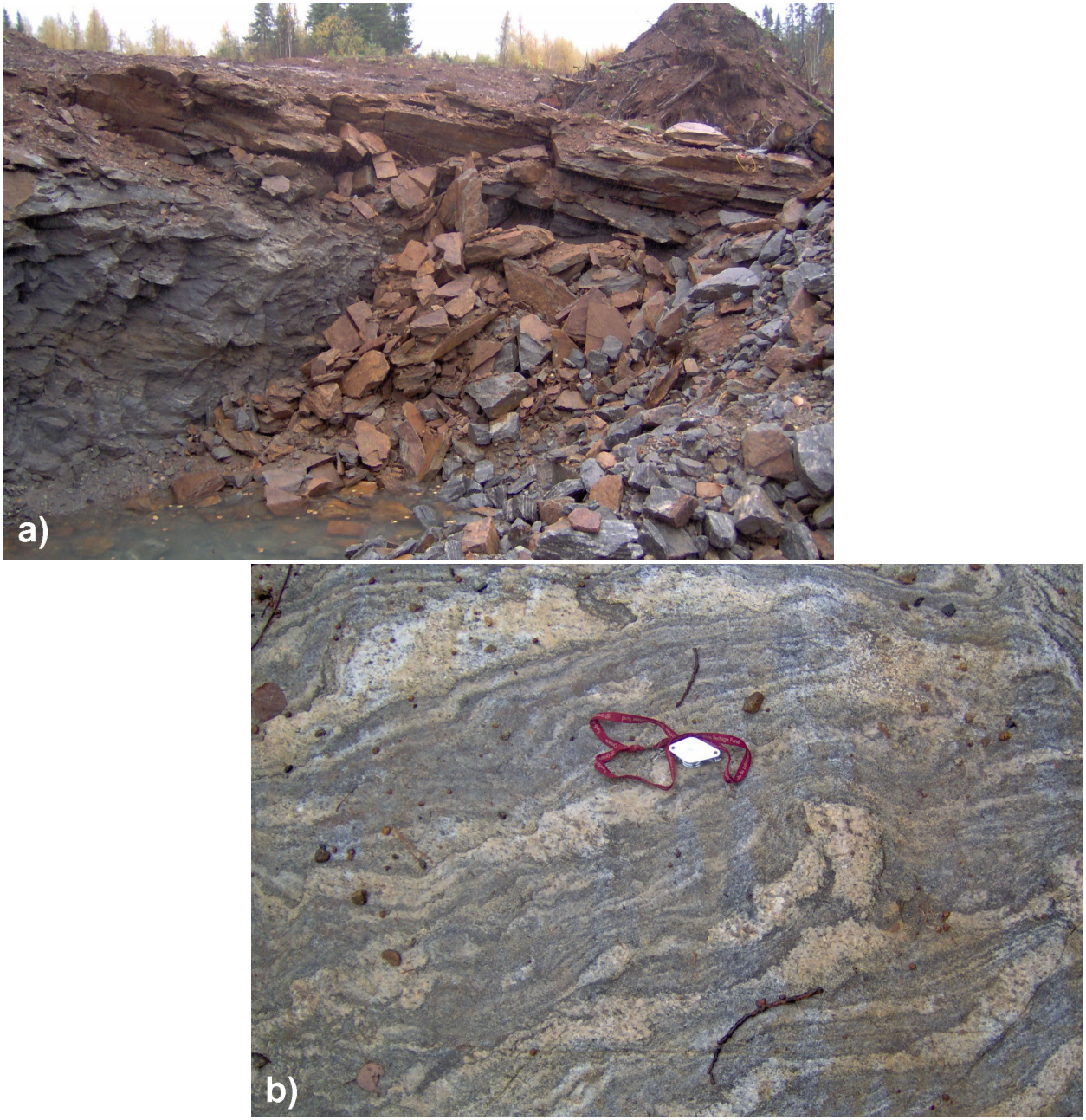

Photo 3. Bissett Creek graphite deposit: a) pit in high-grade graphite zone (rock face is 3 m high); and b) hanging-wall barren, quartz-feldspar-biotite gneiss with granitic leucosomes (hand lens for scale, width is 3 cm).

Maitland Dimension Stone Prospect, Albemarle Township

During the fall of 2011, the Southern Ontario Resident Geologist visited the Maitland property on 3 occasions. One visit was with the property owner and a local stone producer and the remaining 2 visits were with MNDM Mines Group Mineral Development staff and MNDM Aboriginal Relations Branch staff.

The Wiarton area on the Bruce Peninsula in southwestern Ontario is the centre of the province's dimension-stone industry. As of 2011, 22 quarries were licenced under the *Aggregate Resources Act* to extract dimension stone in the County of Bruce. An additional 13 quarries are licenced to extract dimension stone in the neighbouring County of Grey. The Maitland property is approximately 1.5 km south of the Arriscraft International quarry where Paleozoic dolostone is extracted and marketed as one of Ontario's best known dimension stones.

Exploration is underway on the Maitland dimension-stone prospect to determine if the same formation and quality of dolomite can be extracted commercially from the property.

LOCATION AND ACCESS

The prospect is located on Concession VIII, Lot 10 in the geographic township of Albemarle in the County of Bruce. Overburden has been stripped to expose bedrock (UTM location: 487662E 4968520N, NAD83, Zone 17). To access the site, Bruce County Road 9 is taken approximately 11 km north from the community of Colpoys Bay. The road to the property is gated and trespassing is not allowed.

EXPLORATION HISTORY

Mining rights and surface rights to the property are privately owned by the applicant and there is no requirement to submit records of exploration done on the property. The owner first became aware of the dimension stone potential of the property in 1998.

From discussions with the property owner, it has been confirmed that exploration of the site has been confined to stripping and limited diamond drilling. For a number of years, the owner has been trying to bring the site to licence under the *Aggregate Resources Act*, administered by the Ministry of Natural Resources, and has completed several studies including noise, dust, hydrological and environmental baseline studies that are part of the licencing requirements. However, a basic exploration and evaluation program of the deposit to determine the volume and suitability of the stone for various applications remains to be completed.

Surface boulders and loose broken rock from the site have been successfully used as landscaping stone. Sample sections of core have been successfully cut and polished and, in appearance, are similar to dimension stone produced in the area.

Ideally, the owner wishes to develop a dimension stone quarry with crushing of lower quality stone and waste stone to be used for aggregate. Over the years, the owner has contacted local quarry operators and crushed stone aggregate producers who have expressed varying levels of interest in acquiring material from the site when it is brought into production and/or entering into partnership agreements to develop the site into an operating quarry.

More information about the nature of both the stone and the deposit has to be determined before a production decision can be made.

PROPERY GEOLOGY AND OBSERVATIONS

The property owner has stripped an area of approximately 30 by 90 m to expose the bedrock surface. The surface is fluted and polished, exhibiting prominent glacial striae trending 270°. Mapping by Ontario Geological Survey staff indicates that the property is underlain by middle Silurian Amabel Formation dolostone. Drift thickness in the area is generally less than 1 m (Rowell 2012b). The weathered surface is light grey, mottled, medium crystalline dolostone containing numerous fossils and with occasional dolomitized vugs. Beds appear to be thick and massive.

In November 2011, following the advice of stone consultant G. Palu, 30 m of diamond drilling in 3 shallow vertical holes was completed on the stripped area (Photo 4). Plans to drill an additional inclined hole were postponed due to equipment failure.

Drill core from one of the holes was available for viewing at the time of the visit. A brief description of features observed in the drill core follows:

- From 0 to 1.5 m, the core is broken, pale grey, bleached in appearance with some darker grey mottled and vuggy sections.
- From 1.5 to 15 m, the core is massive, blue grey mottled medium crystalline dolostone. One 0.8 m section (from 6 to 6.8 m) exhibits numerous tiny voids.
- At approximately 15 m, the core begins to gradually become a uniform tan to light grey brown in colour with less mottling, finer texture and is less massive. It is thought that this may indicate the intersection of the lower, Lion's Head Member of the Amabel Formation with the upper 15 m of the hole representing the Wiarton/Colpoy Bay Member.

The property owner plans to complete additional stripping and drilling in 2012 and to obtain permission from the Ministry of Natural Resources to extract a small block for testing. At the same time, work will continue to ensure proper municipal zoning is in place to allow for quarry development.

CONCLUSIONS AND RECOMMENDATIONS

The Maitland prospect is located in an area known to host successful dolostone dimension-stone operations. Attractive polished stone samples have been made and drill results have been positive. Preliminary indications are that this site has high potential for quarry development. Detailed geological mapping of the remainder of the property, additional diamond drilling and extraction of a test block will help to better define this potential.

Photo 4. Setup of diamond-drill rig on Maitland dimension stone prospect, Albemarle Township in November 2011.

Unimin Canada Ltd. – Blue Mountain Operations, Methuen Township

On June 16, 2011, the Regional Resident Geologist toured the Unimin Canada Ltd. Blue Mountain Operations in Methuen Township. The company hosted the tour for a delegation from the Curve Lake First Nation. Also in attendance were T. Ruthenberg and C. Ralph, MNDM, Sudbury and D. Webster, MNR, Peterborough.

The tour began with an orientation session providing background information on the history of the nepheline syenite operation, recent changes and future plans. First Nations representatives expressed their concerns and comments. Safety instructions were given and safety equipment was distributed prior to a tour of the operating quarry floor; an outlook over the quarry and plant and a tour of the tailings and upgraded tailings monitoring site.

Nepheline is 1 of 20 non-metallic minerals whose exploration and development is designated under the *Mining Act*, administered by the Ministry of Northern Development and Mines.

Nepheline syenite is a light-coloured feldspathic rock used primarily in making glass and ceramics, but with growing use as mineral filler in paints and plastics, and in new applications as an abrasive. In glass and ceramics, nepheline syenite provides alkalis that act as a flux to lower the melting temperature of a glass or ceramic mixture, prompting faster melting and fuel savings. In glass, nepheline syenite also supplies alumina, which gives increased resistance to scratching and breaking, improved thermal endurance and increased chemical durability.

Several nepheline syenite deposits have been documented in the Central Metasedimentary Belt (CMB) of the Grenville Province in southeastern Ontario. Historically, there had been minor production from several of these deposits. However, most were thought to contain too much iron for glass and ceramic applications.

At present, the Unimin Canada Ltd. Blue Mountain Operations near Peterborough is the only Ontario deposit in production. In recent years, there has been renewed interest and exploration and beneficiation testing of other deposits for alternate applications.

Historically, exploration and development of nepheline syenite deposits have been primarily in the Central Metasedimentary Belt. There has been ongoing exploration and evaluation of an isolated occurrence (in Bigwood Township) in the Central Gneiss Belt near the French River, south of Sudbury. A visit to the Nephco nepheline syenite prospect was made in 2011; a report of this visit is included in the Sudbury District Geologist's *Report of Activities 2011* (Farrow et al. 2012, p.41-43, *see* "Property Visits' "Nephco Nepheline Syenite Prospect, Bigwood Township").

The Blue Mountain nepheline syenite deposit has been in continuous production since 1935 and is 1 of 3 operations that dominate the global nepheline syenite market.

LOCATION AND ACCESS

The Unimin Canada Ltd. – Blue Mountain Operations is located in concessions VI and VII, lots 19 through 21 in west-central Methuen Township near Peterborough. To access the site, County Road 46 is taken north from the village of Havelock on Highway 7, a distance of approximately 4 km to the junction with County Road 44. County Road 44 is followed northward a distance of approximately 16 km to the junction with County Road 6. County Road 6 is followed northward to the junction with Northy's Bay Road a distance of 4 km. The Nephton road is followed northward for an additional 3 km to the mine gatehouse (UTM location: 737806E 4945788N, NAD83, Zone 17).

OPERATIONS

Nepheline syenite rock is mined and processed at the Blue Mountain Operations of Unimin Canada Ltd. Ore composed of 54% albite, 20% microcline and 22% nepheline is extracted using open-pit methods, crushed and beneficiated on site using dry magnetic separation to remove magnetite. Rejects from the magnetic circuit are mixed with water and pumped into a tailings pond. Overall recovery from the quarry, milling and beneficiation processes is over 75%.

This operation produces about 500 000 tonnes per year and has been in production for over 70 years. Important applications are in the glass and ceramic industry with a growing market for use as a mineral filler. Magnetite recovered from the beneficiation process is sold as iron ore. Guillet (1994) provides a detailed description of the Blue Mountain mining and milling operations.

EXPLORATION AND DEVELOPMENT HISTORY

For over 60 years, the northeast and southwest ends of the nepheline syenite body were developed and operated as 2 separate mines, the Blue Mountain Mine and the Nephton Mine, respectively. The following history is from Hewitt (1961).

- 1912: N. Davis tests nepheline syenite bodies in the Haliburton–Bancroft area for alumina content
- 1928–1929: Canadian Flint and Spar tests nepheline including magnetic separation for ceramic applications
- 1936: Canadian Flint and Spar acquires northeast end of nepheline syenite body, but, apart from some additional testing, this site remained inactive; the company choosing to produce nepheline from other area deposits
- 1935: Canadian Nepheline Ltd. opens quarry near southwest end of the deposit with mill in Lakefield; company pioneers use of nepheline as alternative to feldspar in glass and ceramics
- 1937: American Nepheline Corp. subsidiary formed to process and distribute nepheline from mill in Rochester, New York
- 1946: name changed to American Nepheline Ltd., primary milling transferred to Nephton with a fine grinding plant at Lakefield
- 1951: all milling consolidated to Nephton
- 1955: CPR spur built from Havelock
- 1956: new mill built at Nephton
- 1961: company name changed to Indusmin Ltd., which subsequently became a Division of Falconbridge Ltd.
- 1956: Canadian Flint and Spar, a Division of International Minerals and Chemical Corporation, brings the north end of the deposit into production
- 1985: Indusmin Ltd. purchases the International Minerals and Chemical Corporation operation
- 1990: Unimin Corporation purchased the combined operation and with this purchase, became the largest producer of nepheline syenite at the time

GEOLOGY

There has been considerable discussion regarding the origin of the Blue Mountain nepheline syenite. A metasomatic replacement origin has been considered. A more widely accepted belief is the deposit formed as an elongate, irregular shaped stock intruding into and partially replacing a syncline of metasedimentary rock. (Guillet 1994)

The nepheline has itself subsequently been intruded and replaced by a pink syenite and syenite pegmatite. The main body of the nepheline syenite intrusion has a length of 4 km along a northeast-trending axis and a width of 2 km. A long sill-like arm, 5 km in length and approximately 300 m wide, extends from the southwest edge of the main mass.

The nepheline syenite ore is a uniform, white, medium grained and has a granitic texture. On the weathered surface the rock exhibits pitting and greasy blue-grey mottled appearance typical of nepheline. Compositionally, the ore is 54% albite, 20% microcline, 22% nepheline and 4% mafic minerals. Biotite and magnetite are found on the fringes of the intrusion with hastingsite and magnetite more common in the interior part of the deposit. The interior is more massive in character, whereas the exterior sections exhibit foliation due to the alignment of dark minerals characteristic of the border facies.

It has been demonstrated that beneficiation of biotite-magnetite facies ore produces a consistent low-iron product suitable for the glass industry. Rock containing hastingsite is more difficult to beneficiate. (Guillet 1994)

Hewitt (1961) provides a detailed description of both regional and property scale geology. Guillet (1994) and McLemore (2006) provide detailed descriptions of the geology of the deposit.

OBSERVATIONS

Following the tour of the nepheline operations, members of the Curve Lake First Nation provided MNDM and MNR staff with a visit to the Petroglyphs Provincial Park in southeastern Burleigh Township. The Petroglyphs are of cultural and spiritual significance to the First Nation. The site is revered as an ancient place of teaching and vision, where speaking waters flowed beneath symbols carved in a weathered calcitic marble. The waters no longer speak and there was some thought that the silence may have been caused by some activity at the quarry.

The mine has been in operation since 1936 and it is thought that the waters may have stopped speaking sometime in the past 2 decades. The marble that hosts the Petroglyphs is subject to karsting. Subsequent research and testing by MNR confirmed that the flow of water beneath the outcrop has been influenced by local weathering and sediment deposition and is not related to mining activity.

RECOMMENDATIONS FOR EXPLORATION

Zinc, Copper and Copper-Nickel ± Platinum Group Elements Potential in the Vicinity of the Central Metasedimentary Belt Boundary Zone in Southeastern Ontario

Recent mapping by the Ontario Geological Survey has identified areas with potential for zinc, copper and copper-nickel ± platinum group elements (PGE) mineralization in the northeastern portion of the Central Metasedimentary Belt. The Admaston–Horton, Brudenell and Raglan OGS project areas lie approximately between Pembroke and Bancroft along the southeastern margin of the Central Metasedimentary Belt Boundary Zone (CMBBZ). The CMBBZ is an area of highly deformed and flattened gneisses that separates rocks of the Central Gneiss Belt to the northwest from those of the Grenville Supergroup in the Central Metasedimentary Belt to the southeast.

The Central Gneiss Belt consists mainly of upper amphibolite- to granulite-facies quartzofeldspathic gneiss, predominantly of igneous origin with subordinate paragneiss. Rocks of the Bancroft terrane of the CMB, adjacent to the CMBBZ, consist predominantly of calcitic and dolomitic marbles and marble tectonic breccia, intruded by tonalite, gabbro and syenite plutons. Easton, Duguet and Magnus (2011) present a model illustrating the possible transition from volcanic-dominated successions in the Mazinaw terrane to the south, the product of a mature volcanic arc sequence, to a carbonate-dominated basin with minor siliciclastic sedimentary rocks above partially eroded remnants of the arc sequence to the north, with potential for Mississippi Valley-type (MVT) and sedimentary exhalative-type (SEDEX) zinc mineralization. Intruding the carbonate basin are mafic to granodioritic plutons that have potential for magmatic copper-nickel-PGE and copper-molybdenum skarn mineralization, respectively.

Gauthier and Brown (1986) suggest that, on a regional scale, the Grenville Province zinc deposits of Quebec, Ontario and New York are located along 2 major structural lineaments that border the Central Metasedimentary Belt and define a first-order basin hosting the metasedimentary rocks of the Grenville Supergroup. The eastern zone includes the Balmat–Edwards zinc deposits of New York and the gold-zinc deposits of Montauban, Quebec. Along the western basin–margin lineament, bounded to the west by the CMBBZ, are the Calumet and Renprior deposits, described below, and the zinc deposits of the Maniwaki–Gracefield area, Quebec. These regional aspects, combined with the stratiform nature of mineralization at these deposits, are consistent with models of sediment-hosted, submarine-exhalative mineralization associated with basin–margin faults.

A surficial sediment sampling synoptic study by Kettles and Shilts (1996) shows a concentration of zinc, copper and nickel anomalies in till within the CMBBZ and adjacent rocks of the Central Gneiss Belt and the Central Metasedimentary Belt (Figure 6). The points shown represent the 95 to 100 percentile groups of the analyses by Kettles and Shilts (1996), corresponding to values of 225 to 4500 ppm Zn, 223 to 1115 ppm Cu and 86 to 950 ppm Ni. Other than a relatively small airborne geophysical survey (1750 line-kilometres magnetometer and AeroTem III electromagnetic survey) done in the area of the Raglan Hills mafic intrusion by First Nickel Inc. in 2008, there has been very little exploration work done in the area of the geochemical anomalies. Follow-up work by First Nickel in 2009 resulted in the discovery of a new zone of copper-nickel ± PGE mineralization in the Moccasin Lake gabbro (*see* “Copper-Nickel ± Platinum Group Elements”). There are no other documented mineral occurrences up-ice of the till anomalies, possibly due to the low level of past exploration activity in the area, but there are examples of zinc, copper and nickel mineralization in both the Central Gneiss Belt and the Central Metasedimentary Belt in the vicinity of the CMBBZ.

ZINC

- The New Calumet zinc deposit on Calumet Island, east of Pembroke and about 25 km east of the CMBBZ, produced 4 million tonnes of ore averaging 5.8% Zn, 1.6% Pb, 70 g/t Ag and 3 g/t Au between 1942 and 1968. The deposit lies conformably along a thin marble unit above siliceous biotite gneiss within a thick sequence of carbonate and siliciclastic metasedimentary rocks and amphibolite.
- The Renprior (Cadieux) zinc deposit, 7 km south of Renfrew, hosts drill-indicated, non-NI 43-101–compliant reserves of 800 000 t grading 10.2% Zn (Breakwater Resources Ltd. 1989). Zinc mineralization is concentrated in a siliceous dolomitic marble unit that contains sphalerite, galena, pyrite, pyrrhotite, graphite and 25% combined diopside, tremolite and quartz. Other units of calcitic and dolomitic marble host minor zinc mineralization. Patches of green serpentine and mauve anhydrite are also common in the main mineralized unit (Carter 1984).

COPPER-NICKEL ± PLATINUM GROUP ELEMENTS

- In 2009, First Nickel Inc. discovered a copper-nickel ± PGE mineral occurrence 40 km northeast of Bancroft, about 10 km southeast of the CMBBZ. Diamond-drill intersections of up to 0.76 g/t Pt and 1.22 g/t Pd over 5.0 m are associated with disseminated sulphides within the Moccasin Lake gabbro (Sangster et al. 2010; Easton, Duguet and Magnus 2011). The target model for the exploration program was magmatic copper-nickel ± PGE mineralization associated with mafic to ultramafic intrusions in proximity to sulphide-bearing metasedimentary rocks.

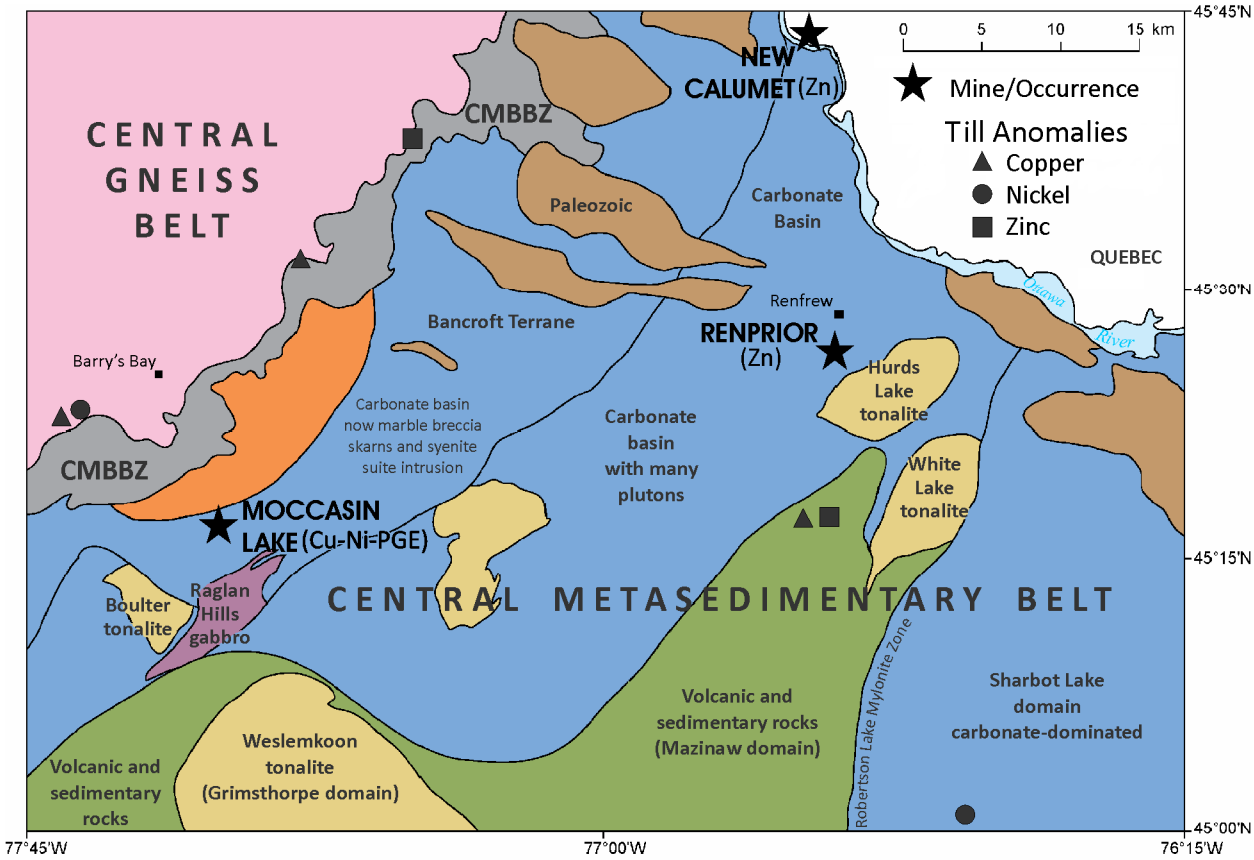

Figure 6. Locations of anomalous concentrations of copper, nickel and zinc in till (Kettles and Shilts 1996) and of zinc and copper-nickel ± PGE occurrences in bedrock in the vicinity of the Central Metasedimentary Belt Boundary Zone (CMBBZ), southeastern Ontario (figure *modified from* Easton, Duguet and Magnus 2011).

- Within the Central Gneiss Belt, copper-nickel mineralization is associated with mafic intrusive rocks at the Ellerington occurrence in McClintock Township and the Dupel occurrence in Hindon Township, both of which lie to the west of the area shown in Figure 6. Best drill-hole intersections at the Ellerington occurrence were 1.36% Ni and 0.2% Cu over 4.5 m (with a report of 1.12 g/t Pt in a grab sample) and, at the Dupel occurrence, 1.2% Cu over 5 m (Slocan Van Roi Mines Ltd. [no date]; Hanych 1997; A.S. Bayne & Company Consulting Engineers 1955).

Potential for mineralization in the northeastern part of the Central Metasedimentary Belt as suggested by Easton, Duguet and Magnus (2011) includes

- Mississippi Valley-type and SEDEX-type zinc mineralization in the carbonate basins of the Central Metasedimentary Belt
- copper ± molybdenum ± tungsten skarn mineralization associated with granodiorite to tonalite intrusions
- copper-nickel ± PGE mineralization in mafic intrusions

Based upon the presence of zinc, copper and nickel mineralization in bedrock, anomalous concentrations of copper and nickel in till and on the relatively low level of past exploration activity in the area, exploration for these types of deposits in gneissic rocks of the Central Gneiss Belt and in the carbonate-dominated basin of the Central Metasedimentary Belt adjacent to the CMBBZ is recommended.

Rare Earth Elements in Magnetite Skarn, Southeastern Ontario

Previous recommendations for rare earth element (REE) exploration in the Deloro granite and other areas of the Central Metasedimentary Belt are presented by Sangster et al. in "Rare Elements and Rare Earth Elements in the Central Metasedimentary Belt, Southeastern Ontario" (Sangster et al. 2010, p.36-39). 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. Another potential host rock for REE mineralization is iron oxide deposits associated with alkali-rich intrusive rocks, which may contain major quantities of barite, fluorite, sulphide, light rare earth elements (LREE), uranium and precious metals (Hauck 1990). Of this list, only significant concentrations of LREE have not been previously documented in the Deloro area. However, recent sampling of skarn material from the Marmoraton iron mine has indicated highly anomalous levels of light rare earth elements (Sangster et al. 2011, p.39).

Iron ore has been mined from skarn magnetite deposits in southeastern Ontario since 1821. Many of these deposits, such as the Marmoraton, Dominion, Dufferin, Coe Hill and Bessemer mines, are associated with Methuen Suite granites. 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, an alkali-rich intrusive complex that hosts past producers of fluorite, gold and iron. Easton (1989) suggests that the diorite-syenite may be connected at depth to the Deloro granite.

As reported in Sangster et al. (2011), 2 samples of magnetite taken from the Marmoraton iron mine waste pile in 2010 by Southern Ontario Resident Geologist's office 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 Pr and Nd (121 and 282 ppm, 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 rare earth oxide. High levels of LREE have been documented in 2 other magnetite skarn deposits in southeastern Ontario.

- A magnetite-bearing sample from the Victoria iron mine, located on Concession I, Lot 20, in Snowdon Township, contained 17 400 ppm La, 17 200 ppm Ce and 2560 ppm Nd. The mine produced an unknown amount of iron ore from an open cut about 8 m wide and 65 m long prior to 1883. Magnetite occurs in a skarn zone with pyroxene, carbonates, hornblende and garnet at the contact between calcitic marble and dioritic gneiss (Easton 1987).

- A sample from the Radenhurst–Caldwell magnetite deposit on Concession III, Lot 22, in Lavant Township, contained 1222 ppm La, 1434 ppm Ce and 385 ppm Nd (Easton 1988). The deposit is described as a series of *en échelon* lenses of disseminated to massive magnetite in an extensive unit of amphibolite schist adjacent to siliceous, dolomitic marble. The magnetite is intergrown with variable amounts of hornblende, pyroxene, carbonate, tremolite-actinolite and garnet. The amphibolite schist may represent either metamorphosed mafic volcanic rock or gabbro (Carter, Colvine and Meyn 1980).

Detailed descriptions of the mineralogy of the REE-bearing samples at the Victoria and Radenhurst–Caldwell deposits are not provided with the analytical results. Field visits to both properties will be made by Southern Ontario Resident Geologist's office staff in the 2012 field season in an attempt to confirm the REE content and determine the mineralogy of the REE-bearing material.

As follow-up to the 2010 sampling of waste rock at the Marmoraton iron mine that indicated anomalous LREE content, diamond-drill core from the Marmoraton and several other magnetite deposits was sampled in 2011. A total of 52 split-core samples were taken from holes drilled at the Marmoraton, Blairton and Pershing mines (past-producers in the Marmora area), the Allan Mills occurrence in Seymour Township and the Tomclid (Summit Lake) deposit of Ferromin Inc. in South Canonto Township. Samples were taken over 1.5 m lengths ranging in composition from high-grade, massive magnetite to lean, disseminated magnetite-epidote and epidotized syenitic to dioritic rock bordering the magnetite zones. Grab samples from 4 other occurrences were tested for REE mineralization: a magnetite occurrence (Coe Hill gold property) in Faraday Township; a past-producer (Coe Hill iron mine) in Wollaston Township; the Calabogie iron mine (past-producer) in Bagot Township; and an ilmenite occurrence (Trigan Resources property) in Methuen Township. All samples were analyzed for a range of minor and trace elements by inductively coupled plasma mass spectroscopy (ICP–MS) at the Ontario Geological Survey Geoscience Laboratories in Sudbury.

Although none of the samples contain REE levels in the range of those reported previously from the Marmoraton, Victoria and Radenhurst–Caldwell deposits (2000 to 35 000 ppm combined Ce + La), several observations, based upon a preliminary review of the data, can be made regarding the distribution of REE levels within the sample population.

- Elevated levels of Ce (50-225 ppm, median <10 ppm), La (20-95 ppm, median <5 ppm) and Nd (15-150 ppm, median <5 ppm) were obtained from samples containing weak to moderate (10-40%) magnetite mineralization and moderate to strong epidote alteration. Samples of high-grade magnetite are generally lower in REE content. For example, the Allan Mills samples consisted of massive magnetite with little to no epidote and contained no elevated REE concentrations (Ce + La <20 ppm).
- Intrusive rock adjacent to skarn magnetite mineralization may contain relatively elevated levels of REE. Samples of altered diorite with 30% epidote bordering a magnetite-bearing zone at the Coe Hill gold property and relatively unaltered quartz diorite bordering the Methuen Township ilmenite occurrence contain Ce, Dy, La, Nd, Pr, Sm and Rb levels comparable to the upper range of results obtained for the magnetite- and epidote-bearing samples.
- The magnetite zones may be characterized by distinct suites of REE and other trace element enrichment. Although all deposits, with the exception of the Allan Mills deposit, show elevated content of Ce, La and Nd, only the Coe Hill gold and Pershing sites also have elevated levels of Dy, Pr, Sm, Rb and V. The Tomclid deposit in South Canonto Township shows very low concentrations of REE, but elevated levels of Bi, Sn, Zn and V.

An association of REE mineralization with magnetite occurs at the Clay–Howells alkalic complex in northern Ontario. A magnetite deposit of 10 million tonnes, outlined by diamond drilling in the 1950s, was acquired by Rare Earth Metals Inc. in 2009 and tested for REE content. In 2010, during an 18-hole drill program, drill-hole CH-13 intersected 105 m grading 58% iron oxide, 0.69% total rare earth oxides (TREO) and 0.14% niobium oxide and drill-hole CH-09 included a 4.9 m width grading 2.45% TREO. Preliminary metallurgical tests indicate that a high-grade iron concentrate and a REE concentrate can be produced (Rare Earth Metals Inc., www.rareearthmetals.ca/article/clayhowells-project-117.asp, *see* "Clay Howells 2010 Composite Assays").

Magnetite occurrences in southeastern Ontario, including those not obviously associated with alkalic intrusive rocks, should be examined for REE content. Although samples from several occurrences analyzed for the Southern Ontario Resident Geologist's study in 2011 did not contain levels of REE with significant economic potential, the results confirmed that both magnetite skarns and the associated intrusive rocks are relatively enriched in REE, particularly

in low- to moderate-grade magnetite zones with moderate to strong epidote alteration. Additional analysis is required to determine the REE-bearing mineral phase and controls on REE concentration within the skarn zones. 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 intrusive bodies associated with magnetite skarn mineralization 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 at contact zones within complex intrusions.

A search of the Mineral Deposits Inventory database in GeologyOntario for magnetite in southeastern Ontario gives 190 records (Figure 7), of which very few have been analyzed for REE content.

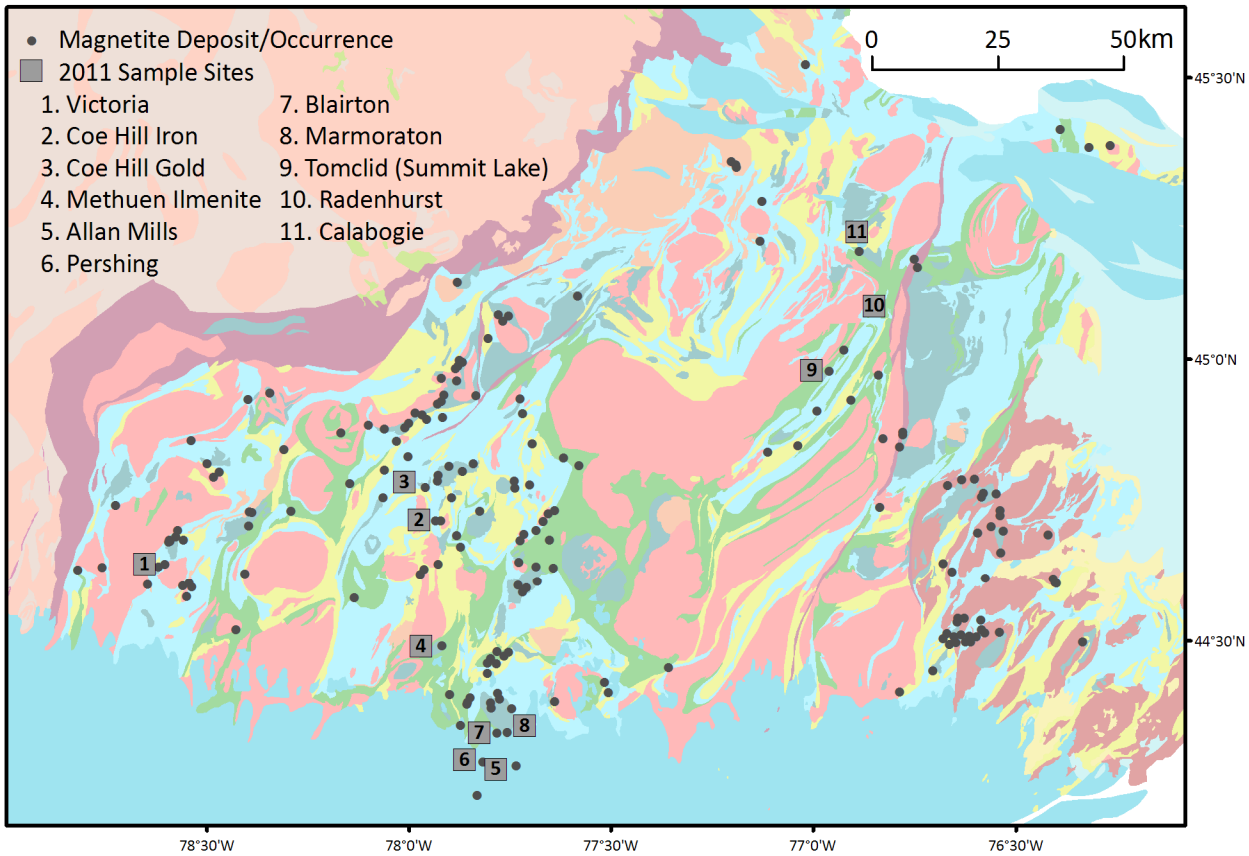

Figure 7. Locations of samples collected from magnetite skarns in 2011 in relation to the locations (from the Mineral Deposit Inventory database) of magnetite occurrences in southeastern Ontario (geology *from* Ontario Geological Survey 2006).

Tables 8 through 16 list currently inactive mineral deposits with identified resources and past-producing mineral occurrences.

Table 8. 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 9. 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 10. 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

Mine	MDI Number	Township	Operating Years	Total Production (Tons)
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 11. 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 12. 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 13. Uranium deposits not currently being mined in the Southeastern Ontario District in 2011.

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 14. Mineral deposits not currently being mined in the Southeastern Ontario District in 2011. (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)	AE	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)	AE	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
Hawley Ram Petroleum Limited Olden Township	MDI31C10NW-00117 (SO 4057)	I	Wollastonite	2.5 Mt @ 32% wollastonite to a vertical depth of 75 m	OFR 5943, p.337

Deposit Township	MDI File Number	Status	Commodity	Reserves	Reserve Reference
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)	AE	Graphite	Reserves of 60 Mt grading 3% graphitic carbon – Ontario Graphite Ltd. development project 2011	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)	AE	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 15. Mineral deposits not currently being mined in the Southwestern Ontario District in 2011.

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 $\times 10^6$ t of sandstone)	N/A	IMR 9, p.29	Inactive
Big Creek 1 (40J/03SE)	Silica	14.6 m thick @ 34.4 m (10 $\times 10^6$ 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

Deposit Name / NTS	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References*	Status
Eastnor–Lindsay prospect (41H/03SW)	Dolomite	60 $\times 10^6$ 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 $\times 10^6$ 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.

Table 16. Titanium, tantalum and REE occurrences compiled from MDI2 database – Southeastern Ontario District.

Name	Township	MDI File #	Commodity	Deposit Status
Harrington, Marsh Ore Bed	Marmora	MDI31C05NE00135	Au, Fe, Ti	Occurrence
Green Island Rutile	Huntingdon	MDI31C06NW00088	Ti	Occurrence
Matthews, Newboro Lake	North Crosby	MDI31C09NW00009	Fe, Ti	Past Producer with Reserves
Chaffey	South Crosby	MDI31C09NW00011	Fe, Ti	Past Producer with Reserves
Tommy Lake	North Crosby	MDI31C09NW00131	Ti	Occurrence
Ricketts	Lake	MDI31C12NE00109	Fe, Ti	Occurrence
Orton	Tudor	MDI31C12NE00122	Fe, Ti	Past Producer w/o Reserves
Hastings Road Magnetite	Tudor	MDI31C12NE00185	Fe, Ti	Occurrence
Harold White, Twin Lake	Methuen	MDI31C12NW00114	Fe, Ti	Occurrence
Horse Lake, Tripp	Methuen	MDI31C12NW00127	Fe, Ti	Occurrence
Maloney	Marmora	MDI31C12SW00002	Cr, Cu, Fe, Ni, Ti	Past Producer w/o Reserves
Canadian Nickel	Methuen	MDI31C12SW00121	Ti	Occurrence
Ridgway	Marmora	MDI31C12SW00122	Cu, Fe, Ti	Occurrence
Jocko Lake	Limerick	MDI31C13NE00107	Fe, Ti	Occurrence
Umfraville	Wollaston	MDI31C13NW00057	Co, Fe, phosphate, Ti	Occurrence
Canning Lake	Minden	MDI31D15NE00052	Fe, Ti	Occurrence
Pine Lake	Glamorgan	MDI31D16NW00215	Fe, Ni, Ti, V	Occurrence

Name	Township	MDI File #	Commodity	Deposit Status
Basin, Silver Crater (Basin)	Faraday	MDI31E01SE00054	Mica, Mo, Nb, Th, U, Ti	Past Producer w/o Reserves
Allen Lake	Harcourt	MDI31E01SE00306	Fe, Ti	Occurrence
Gal–Wood	Sabine	MDI31E08NE00010	Gd, Nb, Ta, Ti, U	Occurrence
Woodcox	Monteagle	MDI31F04NW00020	Ce, feldspar, Nb, U, Ta, Th, Ti, zircon	Past Producer w/o Reserves
Macdonald Mine	Monteagle	MDI31F04NW00023	Cu, feldspar, Mo, Nb, REE, Th, Ti, U, zircon	Past Producer w/o Reserves
Opeongo	Sebastopol	MDI31F06NE00093	Ag, Ce, Nb, Ta, Th, Ti, U, Y, zircon	Occurrence
East Rockingham	Brudenell	MDI31F06NW00085	Au, Ti	Occurrence
South Lamberts	Griffith	MDI31F06SE00161	Ti	Occurrence
Horton Twp, Ottawa River	Horton	MDI31F10SE00019	Fe, Ti	Occurrence
Mahoney and Morin	Sabine	MDI31E08SE00002	Feldspar, Nb, REE, Ta, U	Past Producer w/o Reserves
Genesee No. 2 South	Monteagle	MDI31F04NW00018	Feldspar, Nb, Si, Ta, Th, U	Past Producer with Reserves
Plunkett, Plunkett South	Monteagle	MDI31F04NW00019	Ce, feldspar, amethyst, Mo, Nb, Th, Ta, U	Past Producer w/o Reserves
Dubblestein	Bangor	MDI31F05SW00010	Nb, Ta, Th, U	Occurrence
Tooeys Lake, Tooley Lake	Brougham	MDI31F06SE00090	Nb, Ta, Th, U	Occurrence
Renfrew Minerals, Wal–Gem West Quarry	Lyndoch	MDI31F06SW00013	Be, feldspar, fluorite, Mo, Nb, REE, Si, Ta, Th, U, zircon	Producing Mine
Barr Feldspar Quarry, Woermke	Fraser	MDI31F14SW00003	Ce, feldspar, Nb, Ta, Th, U	Past Producer w/o Reserves
Quinn	Olden	MDI31C10NW00366	Cu, Ni, REE	Occurrence
Orser–Kraft	South Sherbrooke	MDI31C15SE00027	Feldspar, Nb, REE, Th, U	Past Producer w/o Reserves
Nobles Bay, Rogers, J.	North Burgess	MDI31C16SE00004	Mica, REE	Past Producer w/o Reserves
Maclaren, William L.	North Burgess	MDI31C16SW00017	Mica, phosphate, REE	Past Producer w/o Reserves
Christie Lake	South Sherbrooke	MDI31C16SW00142	Magnetite, Nb, REE	Occurrence
Drude South	Cavendish	MDI31D09NW00079	REE, Th, U	Occurrence
Copper Anomaly	Lutterworth	MDI31D15SE00151	Cu, REE, Sr, zircon	Occurrence
Rare Earth Anomaly	Lutterworth	MDI31D15SE00152	Cu, REE, Sr, zircon	Occurrence
North Rare Earth Anomaly	Lutterworth	MDI31D15SE00153	Cu, REE, Sr, zircon	Occurrence
Laurencin, Milhol	Cardiff	MDI31D16NE00160	Mo, REE, Th, U	Occurrence
McLennan, J.G.	Peck	MDI31E07NE00006	Nb, REE	Occurrence
Malcovitch, P.	Clyde	MDI31E08NW00003	Ce, REE, U	Occurrence
Gole, J.G.	Murchison	MDI31E09SE00004	Feldspar, Nb, REE, Si, U, zircon	Past Producer w/o Reserves
Cameron and Aleck	Murchison	MDI31E09SE00005	Feldspar, Nb, REE	Past Producer w/o Reserves
D'Eldona, Yankee Dam	Butt	MDI31E11NE00070	Nb, REE, U	Occurrence
Plunkett North	Monteagle	MDI31F04NW00185	Feldspar, REE, U	Occurrence
Lake Clear	Sebastopol	MDI31F06NE00092	REE, Th, U	Occurrence
Price, E.C., Quadeville	Lyndoch	MDI31F06SW00014	Be, feldspar, fluorite, Nb, phosphate, REE, Si, Th, U, zircon	Producing Mine
Universal Light Metals	Lyndoch	MDI31F06SW00065	Be, Ce, Nb, REE, Th, U	Occurrence
Lake Property, Lake Mine	Dickens	MDI31F12SW00006	Feldspar, REE	Past Producer w/o Reserves

Note: MDI2 database was queried for Ti, Ta and REE occurrences. This listing indicates the presence of the commodities, not necessarily their order of abundance. This list should be used as a preliminary guide only. Hard copies of these complete MDI files are located at RGP office in Tweed.

OGS ACTIVITIES AND RESEARCH BY OTHERS

Three multi-year mapping projects in the northeastern part of the Central Metasedimentary Belt, Grenville Province, were initiated by staff of the Precambrian Geoscience Section, Ontario Geological Survey during the 2011 field season, as follows:

1. M. Duguet began 1:20 000 scale mapping of the Admaston and Horton townships area with a focus on metallic and industrial mineral potential of marbles and an evaluation of pegmatite-hosted radioactive mineral occurrences.
2. Dr. R.M. Easton began 1:50 000 scale mapping of the Brudenell area with a focus on rare metals and radioactive mineralization associated with syenite suite rocks in the area and the potential for porphyry molybdenum mineralization.
3. S.J. Magnus, MSc student at Carleton University, began an OGS-supported project involving mapping, geochemical, isotopic and geochronologic studies on the Raglan Hills gabbro, adjacent to the southwest corner of the Brudenell area. First Nickel Inc. is currently doing exploration work to follow up on the company's recent discovery of gabbro-hosted nickel-copper-PGE mineralization in the area.

Dr. R.M. Easton is also working with Dr. S.D. Carr and MSc student J. Cutts of Carleton University on a thesis project involving geochemical, isotopic and geochronologic studies of several Westport-area granitic intrusions.

Details of the projects described above are presented in the following articles, published in *Summary of Field Work and Other Activities 2011* (Easton, Burnham et al. 2011).

- Geology and Mineral Potential of the Northeastern Central Metasedimentary Belt, Grenville Province; by R.M. Easton, M. Duguet and S.J. Magnus
- Characterization of Syntectonic to Posttectonic Intrusions of *Circa* 1090 to 1065 Ma Age in the Southeastern Central Metasedimentary Belt, Grenville Province; by J. Cutts, S.D. Carr 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 2011. Detailed descriptions of the following projects by staff of the Sedimentary Geoscience Section are included in *Summary of Field Work and Other Activities 2011* (Easton, Burnham et al. 2011).

- Aggregate Resources Inventory of the County of Bruce, Southern Ontario; by D.J. Rowell
- Aggregate Resources Inventory of the City of Ottawa, Southeastern Ontario; by V.L. Lee
- Surficial Geology of the Alliston Area, Southern Ontario; by R.P.M. Mulligan
- Preliminary Results: Shale Gas Assessment of the Devonian Kettle Point Formation and the Ordovician Shale Units, Southern Ontario; by C. Béland Otis
- The Orangeville Moraine Project: Preliminary Results of Drilling and Section Work; by A.K. Burt
- Three-Dimensional Mapping of Quaternary Deposits in the Southern Part of the County of Simcoe, Southern Ontario: A Progress Report; by A.F. Bajc and D.R.B. Rainsford
- Final Update of Early Silurian Stratigraphy of the Niagara Escarpment and Correlation with Subsurface Units Across Southwestern Ontario and the Great Lakes Basin; by F.R. Brunton and C. Brintnell
- Bedrock Aquifer Mapping of Niagara Escarpment Cuesta: Installation and Sampling of Multi-Level Monitoring Wells; by V.L. Lee, E.H. Priebe, F.R. Brunton, J. Piersol, M. Monier-Williams, B. Pendleton, M. Bingham, C. Keller and I. Sharp
- Ambient Groundwater Geochemistry Program: The 2011 Aurora–Orillia Study Area and Selected Results for the Bruce and Niagara Peninsulas; by S.M. Hamilton, E.J. Matheson, C.N. Freckelton and H. Burke

University Research and Collaborations

The following research projects by faculty and graduate students of various accredited universities were in progress in 2011.

- Dr. N.G. Culshaw of Dalhousie University has been working on the following projects in southern Ontario:
  - Northwestern Algonquin Park to Highway 11: relations between Kiosk and Powassan domains, structure, metamorphism and geochronology. This highlights Grenville age thrust stacking of polycyclic (previously metamorphosed and deformed) rocks of the Laurentian margin.
  - Georgian Bay: structure of the southwestern boundary of the Parry Sound domain. This is a detailed study of the mechanisms and role of transposition in formation of a major boundary shear.

- Queen's University MSc student A. Laidlow is working on a thesis entitled, "Characterization of Uranium Mobility and Attenuation in a Stream and Wetland System Downstream of a Uranium Tailings impoundment at the Bicroft Mine near Bancroft, Ontario", with Dr. H.E. Jamieson of Queen's University and Dr. M.B. Parsons of the Geological Survey of Canada. The Bicroft uranium mine, 19 km southwest of Bancroft, in late-tectonic granitic pegmatites of the Grenville Province, hosts 2 decommissioned tailings impoundments that drain into an engineered retention pond, then through a connecting tributary and finally into Deer Creek. Since the closure of the mine in 1963, the Bicroft site has acted as a passively attenuating stream and wetland system, sequestering the metal and radionuclide contaminants to achieve below-PWQO (Provincial Water Quality Objectives) levels of uranium, radium-226 and other trace metals where the surface water leaves the mine property and intercepts Deer Creek. The environmental conditions and physical, chemical and biological processes that control the mobility of metals and radionuclides at the Bicroft site are poorly understood. This project is using both conventional and unconventional analytical techniques to assess the chemistry and mineralogy of sediments, tailings and colloids, in co-ordination with a surface water study being conducted by Dr. Parsons. The main goal of these studies is to characterize the attenuation of uranium, trace metals (lead, REEs) and radionuclides (radium-226) in the environment. Detailed analyses of sediments and colloids in the stream and wetland system will enhance an ongoing study by the GSC to characterize the background geochemistry of the region, as well as develop models for environmental management of uranium and rare earth mine sites across Canada.

- Dr. W.M. Schwerdtner, assisted by undergraduate student B. Zeeman (University of Toronto), and Dr. C.J.S. (Toby) Rivers and undergraduate student M. Ahmed (Memorial University of Newfoundland) spent several weeks of the 2011 field season examining the structural geology of numerous rock cuts in the Bancroft, Haliburton and Barry's Bay regions of Ontario, and tried to assess the large-scale impact of Ottawan gravitational collapse on the structure of Grenville gneisses and associated rocks. Since 1980, Canadian geoscientific research on the 1090 to 1020 Ma Ottawan phase of the Grenvillian Orogeny has focussed mainly on documenting the assembly of deep-crustal thrust sheets and related processes of crustal thickening. Only recently have geologists paid much attention to the effects of gravitational collapse of the Ottawan thrust-sheet stack. Scientific results of collapse studies have led to significant changes, in particular, in the geological map pattern of the Grenville Province (Rivers 2011).

- Dr. F.J. Longstaffe and Dr. J. Potter of Western University (formerly The University of Western Ontario), in collaboration with T.R. Carter and A. Arnott of the Petroleum Resources Centre, Ministry of Natural Resources, are conducting a study of natural gas isotopic signatures of abandoned wells in southwestern Ontario. This research focusses on the stable isotopic chemistry of methane and higher hydrocarbon gases in the Paleozoic reservoir and related rocks of southwestern Ontario. The project is operated in conjunction with the Ministry of Natural Resources' Abandoned Works Project (AWP), which undertakes remediation of old, abandoned oil and natural gas wells. The research, together with a parallel study of Paleozoic formation waters (M. Skuce, MSc candidate), uses the stable isotopic compositions of carbon and hydrogen to identify the unit of origin for natural gases leaking from wells. Such identification facilitates efficient plugging of leaking wells. Pre-existing data are augmented by additional analysis of gases collected from reservoirs currently in production as well as seeps (as they are recognized). In the case of the study by M. Skuce, in addition to utilizing databases from previous investigations, new ground water samples from wells currently being drilled are being collected. These samples are analyzed for major ion chemistry and the oxygen, hydrogen and strontium isotopic compositions of water, the oxygen and sulphur isotopic compositions of dissolved sulphate, and the carbon isotopic composition

of dissolved inorganic carbon (DIC). In both studies, statistical analysis of the isotopic data, in conjunction with chemical and isotopic data for formation waters, will be used to determine the characteristic geochemical signatures of Paleozoic formations in southwestern Ontario. The isotopic data for the gases are also being used to evaluate the processes involved in gas generation and alteration, and the gas mixing relationships among reservoirs and related Paleozoic rocks in southwestern Ontario.

- MSc candidate C.N. Freckelton, under supervision of Dr. F.J. Longstaffe of Western University and S.M. Hamilton of the Ontario Geological Survey, is conducting a research project on spatial and temporal geochemical characterization of groundwater in a 1000 km^2 "breathing" well region in southwestern Ontario (Huron and Perth counties). Breathing wells can "inhale" or "exhale" large volumes of air, depending on fluctuations in atmospheric pressure. Expelled gases are commonly depleted of oxygen. Investigations of well and stratigraphic records suggest that the majority of the ground water wells affected by the breathing phenomena are drilled through the Mid-Devonian Dundee Formation and finished in the underlying Lucas Formation aquifer. As the "breathing" phenomenon requires a significant volume of unsaturated void space above the water level, a karstic system is presumed to exist within the limestone and dolostone of the Lucas Formation. Geochemical, statistical and spatial analysis techniques are being used to determine the distribution and degree of interconnectivity within the breathing well region, and more generally, to better understand this unique atmospheric-ground water connection.

- Doctoral (PhD) candidate D. Lowe, under the supervision of Professor R.W.C Arnott at the University of Ottawa, is conducting studies of the Upper Cambrian to Lower Ordovician Potsdam Group (also known as Potsdam Formation or Potsdam Sandstone in New York State). This is a basin-wide study, incorporating the entire Paleozoic Ottawa Embayment, and ongoing field investigations are taking place in eastern Ontario, northern New York State and the Montérégie–Montreal region of Quebec. This project is a follow-up to the recently published basin-wide lithostratigraphic framework proposed by Sanford (2007) and Sanford and Arnott (2010) who, in addition to many earlier investigators, recognized at least one, and possibly several, unconformities within this relatively thin unit, as well as interpreting environments of deposition that ranged from eolian to shallow marine. The current study focusses on elucidating the evolution of the Potsdam Group by understanding the origin and genetic significance of the major bounding discontinuities and their spatial and temporal relationship with the strata that comprise the group. Based on a comprehensive collection of field data, the study utilizes contemporary concepts in sequence stratigraphy, facies and ichnofacies analysis, sedimentary petrography and sedimentary provenance. Other fields of more detailed investigation might include sedimentary and ichnological studies of the Nepean Formation sandstone around the Ottawa area, as well as investigations of some anomalous sedimentary features such as the enigmatic Potsdam sandstone "pillars" in the Leeds–Grenville and Frontenac counties of eastern Ontario.

- E.B. Dugdale, an undergraduate (4th year) student at Western University, is investigating pegmatites in the country rock surrounding the uraniferous Barbers Lake intrusion, Sharbot Lake domain, Grenville Province, under the supervision of Dr. R.L. Linnen and Dr. D.E. Moser of Western University. This BSc thesis project aims to confirm or negate a genetic tie between each of the sampled pegmatites and the Barbers Lake pluton and to examine samples of the genetically related pegmatites for evidence of uranium and thorium mineralization. This will add to the understanding of magmatic uranium and thorium mineralization in the Grenville Province, and to the understanding of magmatism of the Dalhousie Lake area in general. Polished thin-section petrography will locate targets for electron microprobe analysis using energy dispersive and wavelength dispersive analyses to determine the presence of rubidium in potassium-bearing minerals of the pegmatites to compare with the high rubidium content of the Barbers Lake pluton. Analysis of samples using inductively coupled plasma mass spectroscopy will be used to determine the REE pattern of the pegmatites to compare with that of the Barbers Lake pluton and will, incidentally, provide uranium and thorium assay values for those samples.

Abandoned Mines Research

MINISTRY OF NATURAL RESOURCES BAT HIBERNACULA STUDY

Eight species of bats live in Ontario. Three species—the hoary bat, the silver haired bat and the eastern red bat—fall into the category of migratory species that summer in Ontario, but winter in the southern United States, Mexico and South America. Five of the 8 species—the little brown and big brown, the eastern small-footed, the northern long-eared and the eastern pipistrelle—live in Ontario year round and hibernate in rock crevices and caves. In southeastern Ontario, these species most frequently hibernate in abandoned mines.

Bat populations in Ontario have been declining for decades. In 1969, it was estimated that there were 10 000 bats hibernating in abandoned workings at the Craigmont corundum mine in Renfrew County. By 1984, the number had been reduced to less than 1000 (Gerson 1984). More recently, white nose syndrome, a fungus that has severely reduced the bat population in the United States, has spread into Ontario. It kills bats by aggravating them during their hibernation period, waking them up and forcing them to expend energy, which reduces their ability to survive the winter.

A. Cameron, Ministry of Natural Resources (MNR) – Pembroke District, has been studying bat populations in southeastern Ontario for several years in an attempt to determine where various species of bats are living, their health, their population sizes, what they are eating and where they are residing in the winter months. Part of the study accesses the MNDM Abandoned Mines Inventory System (AMIS) and Mineral Deposits Inventory (MDI) databases to research abandoned mine sites and conducting field examinations to determine whether bats are using the sites. To date, 15 abandoned mines in southeastern Ontario have been confirmed as bat hibernacula.

The Ministry of Natural Resources is having the sites examined by Dr. J. Archibald, The Robert M. Buchan Department of Mining, Queen's University, to determine the condition of adits and stopes and to perform rock scaling, if necessary, to ensure the safety of MNR employees entering the workings. In addition, MNR is consulting with MNDM Rehabilitation, Compliance and Inspection Office (including Abandoned Mines and Mine Hazards) staff regarding the installation of bat gates (steel grill-work barriers) at sites undergoing rehabilitation to allow bats continued access to the workings (A. Cameron, Ministry of Natural Resources, personal communication, February 2012).

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 Resident Geologist Program Southern Ontario Region, and the part of the Resident Geologist Program Sudbury District south of the French River, including Manitoulin Island. The southern Regional Land Use Geologist position was staffed throughout 2011 by D.A. Laidlaw, *P.Geo*.

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 from place to place across the province, but most have potential to restrict the availability of land, access to it, and/or the activities on it. In 2011, the southern Regional Land Use Geologist dealt with a variety of land use planning issues throughout the Southern Region.

CROWN LANDS

The Ministry of Northern Development and Mines (MNDM) engages with the Ministry of Natural Resources (MNR) when Crown land use planning activities have the potential to affect Provincial mineral interests. Such activities include Forest Management Planning and other initiatives related to Crown land.

Forest Management Planning

The forest management planning process includes consideration of a wide range of values including mineral values in the context of forestry activities, and the relevance of legislation other than the *Crown Forest Sustainability Act*, including the *Mining Act* on forest management plans.

The southern Regional Land Use Geologist normally provides input into the development of forest management plans, including

- the distribution of areas of high mineral potential, so that forestry planners are aware of areas where there may be pressures from the mineral sector for access for exploration;
- the locations of existing mining claims and leases, so that exploration workings such as grid lines are not inadvertently damaged or destroyed by forestry activities;
- information regarding current exploration and development activities in the area;
- the location of mining-related hazards, so that forestry workers are not put at risk; and
- the socio-economic impact of mineral exploration and mining in the forest management unit, so that its importance can be considered in the context of other sectors, such as tourism, that may be active within the forest management unit.

Formal comments and mineral values maps were provided for the Ottawa Valley Forest Management Plan 2011–2021. The data provided included past mineral production; known mineral resources; the locations of mining land tenure and mining-related hazards; and a discussion of current exploration activity.

Provincial Parks and Conservation Reserves

The southern Regional Land Use Geologist responded to requests for comments on several proposed provincial park designations in 2011. One was to add donated lands to the Hardy Lake Provincial Park located in the Gravenhurst area. The others were to designate Queen Elizabeth The Queen Mother M'Nidoo M'Nissing and Strawberry Island as provincial parks, and to add 251 ha to Misery Bay Provincial Park on Manitoulin Island. These proposals were posted by MNR on the Environmental Registry in 2011 for public comment, but no decision notices have been published.

Withdrawal Orders

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. As a result of the withdrawal order, the mining rights of those properties were withdrawn from prospecting, staking, sale and lease. In April 2011, Section 35.1 (5) of the *Mining Act* came into effect whereby the owners of surface rights of properties where the mining rights were withdrawn subject to withdrawal order W-SO-54/09 can apply to the Minister to have the mining rights on their properties re-opened for exploration.

From April 4, 2011, until June 3, 2011, the surface and mining rights for all unalienated Crown land (e.g., not regulated as a Provincial Park or Conservation Reserve, not withdrawn under some other withdrawal order, etc.) south of the French River, Lake Nipissing and the Mattawa River were withdrawn from staking under W-SO-39/11 for a 60-day transition period. On June 3, 2011, these lands were re-opened under O-SO-19/11 for staking using the new paper-based map-staking system for areas that have been subdivided into lots and concessions. Ground staking is still permitted in unsubdivided areas, using the special staking rules for designated areas.

MUNICIPAL AND PRIVATE LANDS

The Ministry of Northern Development and Mines supports municipal and private land use planning directly through the One Window Planning Service led by the Ministry of Municipal Affairs and Housing. MNDM input includes:

- providing data regarding mineral potential, mining claims and leases, exploration and mining activity and mining-related hazards to planning authorities, planning consultants and the Ministry of Municipal Affairs and Housing in support of the new municipal Official Plans, Official Plan Amendments, Zoning By-laws, and Consents (lot severances);
- reviewing land use policies proposed in municipal planning documents and providing comments on those policies to the Ministry of Municipal Affairs and Housing "One Window" planners for consolidation with feedback from other ministries; and
- supporting the development of municipal policies and guidelines, and working to enhance the availability of data to support wise planning decisions.

Municipal Planning

The Provincial Policy Statement, which guides municipal planning in Ontario, is issued under the provisions of the *Planning Act*. The Provincial Policy Statement was last modified in 2005. A compulsory five-year review of the Provincial Policy Statement was initiated in 2010 to ensure that it is up to date and meets current environmental standards, ensures human health and safety, and protects Ontario's cultural and natural heritage. The southern Regional Land Use Geologist's assistance with the Provincial Policy Statement review in 2011 included reviewing 10 existing Official Plans and commenting on how well they comply with the requirements of the Provincial Policy Statement, and reviewing articles in planning-related journals to determine whether they identify issues or trends related to MNDM's interests, or best practices or options for dealing with emerging issues. This work is helping to guide the revision of the Provincial Policy Statement.

In 2011, the southern Regional Land Use Geologist reviewed, commented on and/or supplied data and expertise for consent (severance) applications for 16 lower tier municipalities and 15 Official Plans and related planning initiatives during the year, and for 18 new or updated Draft Official Plans. The municipalities involved in these planning initiatives are listed in Table 17, with locations shown in Figures 8 and 9.

Niagara Escarpment

The Niagara Escarpment Plan (NEP) is a provincial plan that is the responsibility of MNR and is administered by the Niagara Escarpment Commission, an arms-length regulatory agency of the province. The Niagara Escarpment Commission is responsible for issuing development permits within the development control area of the Niagara Escarpment Plan. The Niagara Escarpment Commission is not part of the One Window Planning Service and is not subject to its protocol, but the Niagara Escarpment Commission has the authority to seek plan input and review from "One Window" ministries. The southern Regional Land Use Geologist provided responses to the Niagara Escarpment Commission regarding 5 proposed Plan amendments for areas near the City of Burlington, the Town of Caledon, the Town of Halton Hills, the City of Hamilton and the Town of Mono.

Exemptions from Mining Tax

As of January 1, 2011, Section 189(1) of the *Mining Act* allows for private landowners across the province to apply for exemption from paying Mining Land Tax on their mining rights if their land is not being used for mining-related purposes. The southern Regional Land Use Geologist reviewed and provided comments on 11 applications for exemption from Mining Land Tax in southern Ontario. All 11 applications were recommended for exemption.

Table 17. Municipal planning initiatives with MNDM input, Southern Ontario Region, 2011 (*see also* Figures 8 and 9).

Consent (Severance) Applications	Completed Official Plans and Related Initiatives	Official Plans and Related Initiatives Under Development
Barrie, Township of	Brighton, Municipality of	Addington Highlands, Township of
Carlow/Mayo, Township of	Burlington, City of	Belleville, City of
Hungerford, Township of (2)	Central Frontenac, Township of (2)	Bonfield, Township of
Madoc, Township of	Chisholm, Township of	Carleton Place, Town of
Marmora, Township of (2)	East Luther Grand Valley, Town of	Front of Yonge, Township of
Monteagle, Township of (2)	Hastings, County of	Joly, Township of
North Burgess, Township of (2)	Lanark, County of	Kearney, Town of
Rideau Lakes, Township of (2)	Melancthon, Township of	Machar, Township of
Stone Mills, Township of	Perry, Township of	Magnetawan, Municipality of
Tay Valley, Township of	Rideau Lakes, Township	McDougall, Township of
Walpole, Township of	South Bruce, Municipality of	North Bruce Peninsula, Municipality of
	South Frontenac, Township	Perth, Town of
	The Archipelago, Township of	Prescott and Russell, United Counties of
	Vaughn, City of	Renfrew, County of
		Seguin, Township of
		Tay Valley, Township of
		Whitestone, Municipality of
		Windsor, City of

FIRST NATIONS

During 2011, the southern Regional Land Use Geologist assisted the Southern Ontario Regional Resident Geologist, who has been working with the Aboriginal Relations Branch, MNDM, as a technical expert in support of the Algonquin First Nation land claim discussions, by preparing technical resource materials.

OTHER ACTIVITIES

The southern Regional Land Use Geologist also participated in a number of other initiatives in 2011, as outlined below.

Class Environmental Assessments

Class Environmental Assessments are documents that set out streamlined environmental assessment processes. They apply to routine projects that have predictable and manageable environmental effects. There are currently 10 Class Environmental Assessments in effect in Ontario, with regard to initiatives including the development of new infrastructure such as dams, transmission lines, pipelines, highway corridors, commuter rail stations and bus terminals, and sewer and water facilities; the establishment of new parks and conservation reserves; forest management plans; and Crown land dispositions.

The southern Regional Land Use Geologist responded to requests to review and comment on several proposed wind farms on private lands, including sites at Amherst Island near Napanee, Grand Bend, and near Amaranth in Dufferin County. With the implementation of the *Green Energy Act, 2009* (in 2009), the Province of Ontario has been encouraging projects producing clean, renewable sources of energy, including wind, solar, hydro, biomass and biogas. The southern Regional Land Use Geologist also commented on water-power project on the Petawawa River, where a new hydroelectric generating station is proposed.

Other work related to Class Environmental Assessments included commenting on proposals by the Ministry of Transportation to carry out four-lane expansion of Highway 17 near North Bay, and to reconstruct Highway 401 near the City of Cambridge. 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.

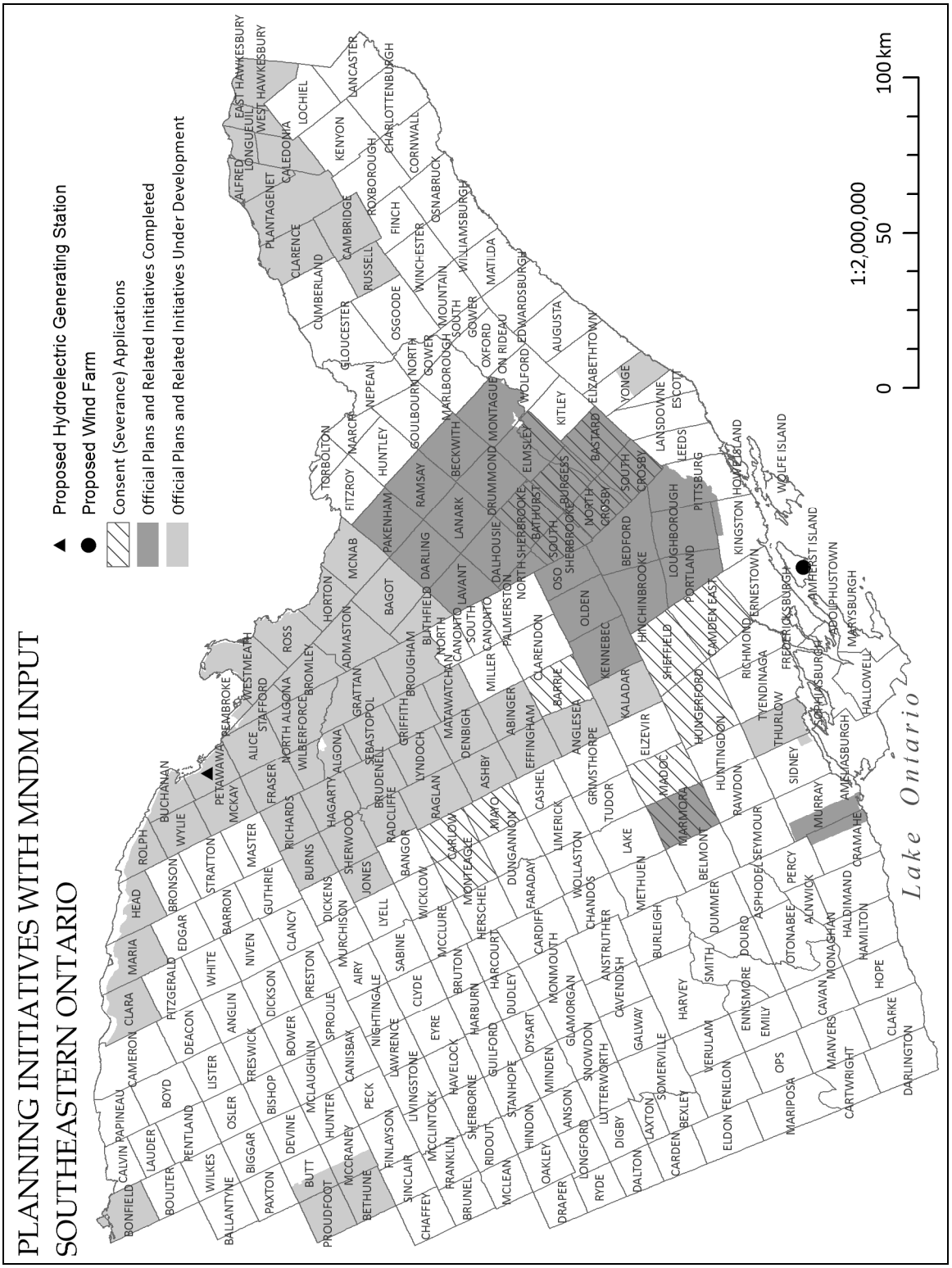

Figure 8. The locations of municipal planning initiatives with MNDM input, southeastern Ontario, 2011.

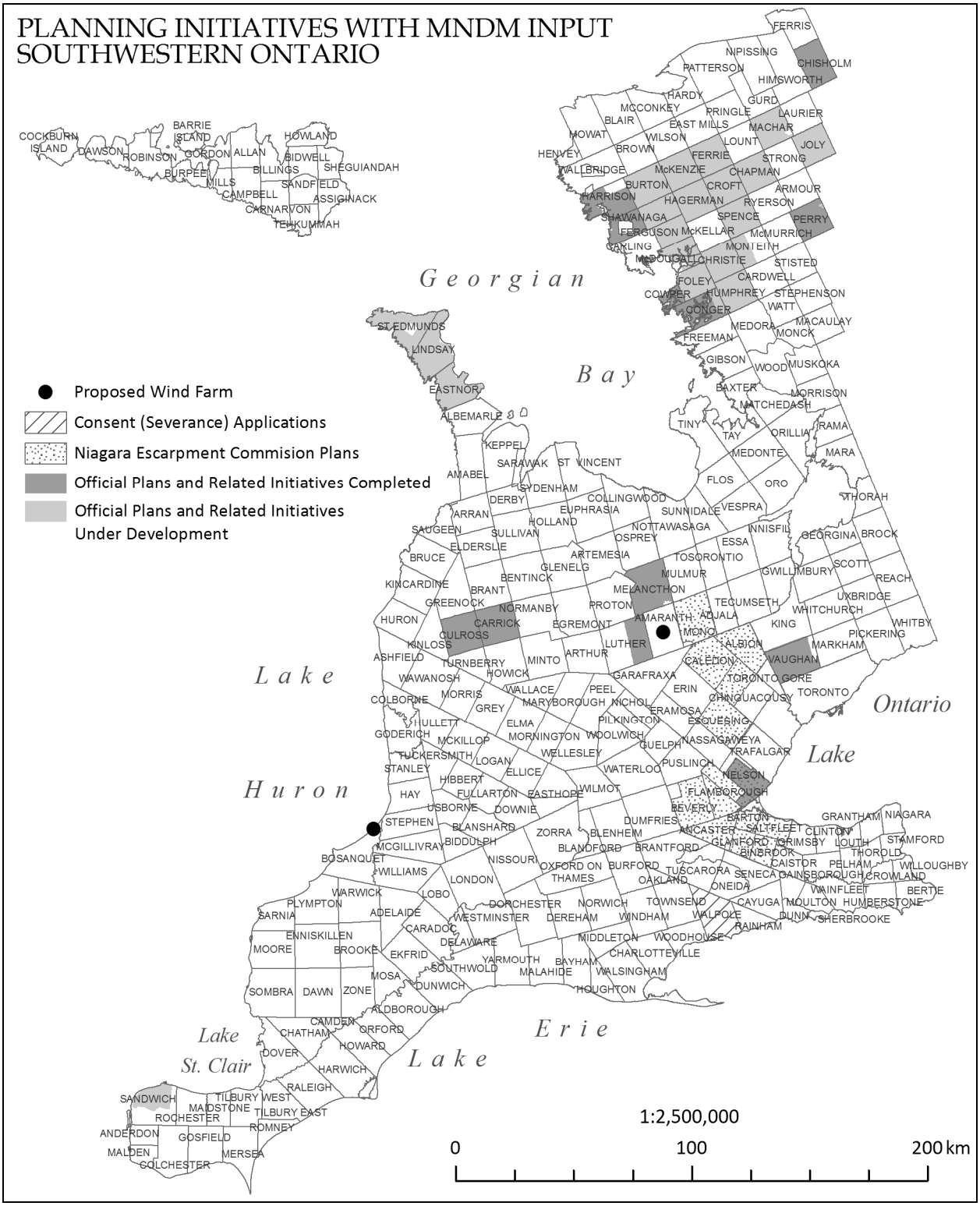

Figure 9. The locations of municipal planning initiatives with MNDM input, southwestern Ontario, 2011.

Ontario Biodiversity Strategy

The Ontario Public Service Biodiversity Network is an interministry forum in which the Biodiversity Branch of MNR can exchange information, facilitate discussion, and strategically plan for biodiversity-related activities, policies, processes and projects across the Province. The southern Regional Land Use Geologist also represented MNDM on the Ontario Public Service Biodiversity Network by attending teleconferences, workshops, meetings, and the public event celebrating the release of "Ontario's Biodiversity Strategy, 2011". The strategy itself was developed by the Ontario Biodiversity Council, a non-governmental organization. The southern Regional Land Use Geologist also worked with other MNDM representatives to identify Ministry programs that might support the achievement of the goals of the Ontario Biodiversity Strategy.

Data Committee

The Ministry of Natural Resources and the Ministry of Municipal Affairs and Housing jointly host an interministerial committee that is intended to identify and work to implement ways of making more data more readily available to support land use planning in Ontario, especially in the context of municipal planning. The southern Regional Land Use Geologist took over as MNDM's representative on the committee when the northeast Regional Land Use Geologist left her position in late 2011. In 2011, the committee prepared a draft data catalogue that will be used to develop a baseline for data available for municipal planning.

Contact with Clients

The southern Regional Land Use Geologist 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 trade shows including the Prospectors and Developers Association of Canada Annual Convention, the Blendon Industrial Minerals Conference and the Bancroft Gemboree. With between 8000 and 10 000 attendees each year, the Bancroft Gemboree is the largest gem and mineral show in Canada. It provides staff from the Resident Geologist Program with the opportunity to share information regarding the mineral sector with mineral collectors and the general public.

Throughout 2011, the southern Regional Land Use Geologist helped clients from the mineral sector, municipal and provincial government agencies and ministries access 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 with hosting Southern Ontario Prospectors Association day-long meetings in Tweed and Actinolite, which provided the Association's members with information on topics related to exploration and mining, and changes to government regulations.

Other 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 to mineral exploration and development.

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, Class Environmental Assessment for activities under the *Mining Act*, 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 and Mines has consulted and will continue to work with Aboriginal communities and organizations and stakeholder groups in the development of related regulations. Changes to the Act in 2011 included the introduction of a paper-staking system in southern Ontario and surface and mineral rights holders are now able to apply for exemptions from Mining Land tax under certain circumstances. In 2012, a graduated exploration permitting system will be introduced, sites of Aboriginal cultural significance will be protected and a *Mining Act* Awareness Program will be implemented. Online claim staking is contemplated for 2013.
- The Ministry of Northern Development and Mines is developing a Class Environmental Assessment under the *Environmental Assessment Act* for its activities under the *Mining Act*. These activities include discretionary tenure decisions related to surface rights, mining rights and chattels, and Ministry-administered mine rehabilitation activities. It is anticipated that this process will take 2 years to be completed and will be finalized by the end of 2012.
- Ontario's *Endangered Species Act, 2007* and Canada's *Species at Risk Act, 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. Building on the achievements of the 2005 Strategy, "Ontario's Biodiversity Strategy, 2011" was released. The Strategy sets out new and updated direction for the next 10 years. One target is to enhance resilience through the protection of terrestrial and aquatic 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, "Decision X/2 Strategic Plan for Biodiversity 2011-2020", www.cbd.int/decision/cop/?id=12268).
- The Ministry of the Environment 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. Non-traditional "metals", including rare metals and rare earth elements, are important components of the emerging "Green" economy. Rare earth magnets, the world's strongest permanent magnets, allow wind turbines to generate electricity more efficiently. 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 increased in 2011.

MINERAL DEPOSIT COMPILATION GEOLOGISTS—PROVINCIAL ACTIVITIES

The Mineral Deposit Compilation geologists (MDCG) investigate and document mineral deposits and occurrences across the province. Through field visits, comprehensive literature research and personal research, they work with regional and district Resident Geologist Program staff to ensure that the Mineral Deposit Inventory (MDI) database is regularly updated. Regular updates are required to ensure that the Ministry of Northern Development and Mines is using the most up-to-date information in making land-use planning and policy decisions. A.C. Wilson is the northeastern Ontario MDCG. N.A. Bennett was the northwestern Ontario MDCG until mid 2011.

In December 2011, an updated version of the MDI was released. In addition to being made available through the MNDM web site, through *GeologyOntario* and OGS Earth, the entire digital data set is also on CD as "Mineral Deposit Inventory—2011". All three have search capabilities.

In mid 2011, a new administrative layer was incorporated into the MDI database. This change was implemented in order to maintain consistency with the administrative layer (townships and areas) used by the Mining Lands Section (Mineral Development and Lands Branch, MNDM). As a result, a significant number of pre-existing records were revised to include a new township or area name. Significant contributors to the database in 2011 included J. Bongfeldt (Kenora), D.L. Guindon (Kirkland Lake), A. McKee (Red Lake), A. Pace (Sault Ste Marie), N.A. Bennett (Thunder Bay North and South), R.M. Cundari (Thunder Bay North) and P. Bousquet (Timmins).

Total contributions to the MDI database in 2011 included 2267 updated records, 519 records deleted and 390 new records. A breakdown of the provincial records revised by office is provided in Table 18.

Table 18. Mineral Deposit Inventory records revision in 2011.

Resident or District Office	Updates	Deletions	New
Kenora	175	2	99
Kirkland Lake	89		10
Red Lake	59		7
Sault Ste Marie	46	1	1
Southeastern Ontario	863	414	20
Southwestern Ontario	6	0	0
Sudbury	217	98	8
Thunder Bay North	214	1	66
Thunder Bay South	389	2	110
Timmins	209	1	69
Total	2267	519	390

The MDI database is a dynamic compilation of over 19 000 records describing most of the known mineral occurrences in Ontario. It is an important reference tool for explorationists interested in exploring and acquiring mining properties in Ontario. When used in conjunction with other spatial databases generated by the Ontario Geological Survey, it provides additional tools for making mineral discoveries in Ontario.

ACKNOWLEDGMENTS

The authors would like to recognize 2 colleagues for their contributions to this report. A.C. Wilson, Mineral Deposit Compilation Geologist, provided the summary, “Mineral Deposit Compilation Geologists – Provincial Activities”. R.L. Debicki, Land Use Planning and Policy Coordinator, provided a provincial perspective to the southern Regional Land Use Geologist contribution.

The authors would like to thank all producers, exploration companies, prospectors and developers who provided access to their operations or supplied information throughout 2011. Strong communication links between stakeholder groups and government ministries are essential for effective program delivery and ultimately improve the delivery of government services.

The Southern Ontario Resident Geologist’s office and the southern Ontario prospecting community lost 2 valued friends, colleagues and mineral enthusiasts in 2011.

Will Creighton was exposed to the mining industry through the company founded by his parents in 1966, Creighton Rock Drill Limited. After graduating from the University of Waterloo with a Bachelor of Science degree, Will joined the family business and was instrumental in marketing the gas-powered rock drill across Canada. Later, when he became involved in prospecting in southern Ontario, Will used his expertise with drills and heavy machinery to evaluate his own properties, such as the Ore Chimney Mine, and assisted other prospectors in their exploration work. His annual booth at the Bancroft Gemboree was a favourite attraction where, as “Prospector Will”, he entertained and educated rockhounds of all ages, demonstrating the art of gold panning and ensuring that they left with a few flakes of gold.

David Summers was introduced to geology at a young age by a retired professor and that early interest in the earth and love of the outdoors continued as a central theme throughout his life. After excursions into the farming and farm machinery business, David re-discovered geology and operated a gem and mineral business with his family in Tweed for 14 years. During that time, he was a frequent visitor to the Southern Ontario Resident Geologist's office, using the library to educate himself in the geology of the region, prospecting for mineral specimens, giving classroom presentations at local schools, and participating in the relocation of the Bancroft Drill Core Library inventory to Tweed. One of his proudest accomplishments was working for the Canadian International Development Agency (CIDA) in the Philippines, where he provided orientation and training in marble quarrying methods and assisted the local workers in establishing a stone-producing co-operative. At the age of 54, David returned to school and, after a spring work placement at the Southern Ontario Resident Geologist's office, graduated in June, 2011, as an Environmental Technician.

REFERENCES

A.S. Bayne & Company Consulting Engineers 1955. Diamond drill hole sections, Dupel Mines Limited, Hindon Township; unpublished report, Southern Ontario Resident Geologist's office, assessment file AFRI# 31E02SW0105, 9p.

Bending, D.A., Henry, A.L. and Parent, S.P. 1989. Assessment report of geophysical surveys, Barrie Township claims, Harlowe area; unpublished report for Homestake Mineral Development Company, Southern Ontario Resident Geologist's office, assessment file AFRO# 2.12433.

Breakwater Resources Ltd. 1989. Letter to County of Renfrew Planning Department; Southern Ontario Resident Geologist's office, unpublished material, Mineral Deposits Inventory file MDI31F07NE00063.

Buchan, C. 2010. A Blue Box for substrates; *Greenhouse Canada*, June 2010, www.greenhousecanada.com/content/view/2276/67/.

Carter, T.R. 1984. Metallogeny of the Grenville Province, southeastern Ontario; Ontario Geological Survey, Open File Report 5515, 422p.

Carter, T.R., Colvine, A.C. and Meyn, H.D. 1980. Geology of base metal, precious metal, iron and molybdenum deposits in the Pembroke–Renfrew area; Ontario Geological Survey, Mineral Deposits Circular 20, 186p. Accompanied by Preliminary Map P.2211, scale 1:126 000.

Diekmeyer, P. 2011. Cement, stone, and aggregates; commodity review *in* Canadian Institute of Mining, Metallurgy and Petroleum, CIM Magazine, December 2011 / January 2012, v.6, no.8, www.cim.org/bulletin/bulletinlive/articles.cfm?Issue_ID=999&row=9&Type=1&Segment_ID=94.

Easton, R.M. 1987. Geology of the Howland area, Haliburton, Peterborough and Victoria counties; Ontario Geological Survey, Open File Report 5639, 188p.

——— 1988. Geology of the Darling area, Lanark and Renfrew counties; Ontario Geological Survey, Open File Report 5693, 206p.

——— 1989. Regional alteration patterns and mineralization associated with the Deloro granite, Grenville Province, Madoc area; *in* Summary of Field Work and Other Activities, 1989, Ontario Geological Survey, Miscellaneous Paper 146, p.158-168.

——— 2001. Precambrian geology, Mazinaw Lake area; Ontario Geological Survey, Preliminary Map P.3439, scale 1:50 000.

Easton, R.M., Burnham, O.M., Berger, B.R., Beakhouse, G.P., Bajc, A.F., Parker, J.R., Kelly, R.I. and Debicki, E.J. eds. 2011. Summary of Field Work and Other Activities 2011; Ontario Geological Survey, Open File Report 6270, 378p.

Easton, R.M., Duguet, M. and Magnus, S.J. 2011. Geology and mineral potential of the northeastern Central Metasedimentary Belt, Grenville Province; *in* Summary of Field Work and Other Activities 2011, Ontario Geological Survey, Open File Report 6270, p.5-1 to 5-23.

Farrow, D.G., Alemany, R.M., Sangster, P.J., Debicki, R.L. and Wilson, A.C. 2012. Report of Activities 2011, Resident Geologist Program, Kirkland Lake Regional Resident Geologist Report: Sudbury District; Ontario Geological Survey, Open File Report 6276, 50p.

Gauthier, M. and Brown, A.C. 1986. Zinc and iron metallogeny in the Maniwaki–Gracefield district, southwestern Quebec; Economic Geology, v.81, p.89-112.

Gerson, H. 1984. Habitat management guidelines for bats of Ontario; Ministry of Natural Resources, Toronto, Ontario, Report #51602, 42p., www.ontla.on.ca/library/repository/mon/6000/10299740.pdf.

Glanfield, M.E. 2000. Report #1, Glanfield gold prospect SE-1 (Payrock property); unpublished report, Southern Ontario Resident Geologist's office, assessment file AFRO# 2.20031.

Gordon, J.B., Lovell, H.L., de Grijs, J.W. and Davie, R.F. 1979. Gold deposits of Ontario, part 2, part of District of Cochrane, districts of Muskoka, Nipissing, Parry Sound, Sudbury, Timiskaming, and counties of southern Ontario; Ontario Department of Mines, Mineral Deposit Circular 18, 253p.

Gordon, J.B., Rybak, U.C. and Robertson, J.A. 1981. Uranium and thorium deposits of southern Ontario; Ontario Geological Survey, Open File Report 5311, 665p.

Guillet, G.R. 1964. Fluorspar in Ontario; Ontario Department of Mines, Industrial Mineral Report 12, 68p.

——— 1994. Nepheline syenite; *in* Industrial minerals and rocks, 6th ed., Society for Mining Metallurgy and Exploration Inc., Littleton, Colorado, p.711-730.

Hanych, W. 1997. Report on the 1997 winter diamond drill program, McClintock nickel-copper-cobalt property, McClintock and Livingstone townships, Ontario, prepared for Orogrande Resources Inc.; unpublished report, Southern Ontario Resident Geologist's office, assessment file AFRO# 2.18144, AFRI# 31E07NW2001, 64p.

Hauck, S.A. 1990. Petrogenesis and tectonic setting of middle Proterozoic iron oxide-rich ore deposits: an ore deposit model for Olympic Dam-type mineralization; *in* The Midcontinent of the United States: permissive terrain for an Olympic Dam-type deposit?, United States Geological Survey, Bulletin 1931, p.4-39.

Hewitt, D.F. 1961. Nepheline syenite deposits of southern Ontario; Ontario Department of Mines, Annual Report 1960, v.69, pt.8, 194p.

——— 1963. Silica in Ontario; Ontario Department of Mines, Industrial Mineral Report 9, 36p.

——— 1967. Uranium and thorium deposits of southern Ontario; Ontario Department of Mines, Mineral Resources Circular 4, 76p.

Kettles, I.M. and Shilts, W.W. 1996. Geochemical and lithological composition of surficial sediments, southeastern Ontario; Geological Survey of Canada, Open File 3175, 33p.

Kingston, P.W., MacKinnon, A. and Caley, W.F. 1990. New industrial mineral opportunities in southeastern Ontario; CIM Bulletin, v.83, no.934, p.92-100.

Kingston, P.W. and Papertzian, V.C. 1997. Southeastern (Tweed) Resident Geologist's District—1996; *in* Report of Activities 1996, Resident Geologists, Ontario Geological Survey, Open File Report 5958, p.11-1 to 11-18.

Kingston, P.W., Papertzian, V.C. and Sangster, P.J. 1996. Southeastern (Tweed) Resident Geologist's District—1995; *in* Report of Activities 1995, Resident Geologists, Ontario Geological Survey, Open File Report 5943, p.332-346.

Kitching, J. and Greenwell, B. 2010. Ontario Mineral and Exploration Statistics – 2009; Ontario Geological Survey, Annual Statistical Report 8, 54p.

LeBaron, P.S. 1991. Exploration for gold in southeastern Ontario, 1980–1990; Ontario Geological Survey, Open File Report 5808, 147p.

LeBaron, P.S., Kingston, P.W., Papertzian, V.C., van Haaften, S., Meyn, H.D. and Caley, W.F. 1993. Southeastern Resident Geologist's District—1992; *in* Report of Activities 1992, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 161, p.371-392.

Lloyd, C.J. and Bending, D.A. 1989. Summary report, Harlowe area properties, Southern Ontario Mining Division, Ontario, Canada, for Homestake Mineral Development Company; unpublished report, Southern Ontario Resident Geologist's office, Ontario Mineral Incentive Program OM88-9-L-267.

Lumbers, S.B. 1976. Mattawa–Deep River area (eastern half), District of Nipissing and County of Renfrew; Ontario Division of Mines, Preliminary Map P.1197, scale 1:63 360.

MacKinnon, A. 1990. Wollastonite in Ontario; Ontario Geological Survey, Open File Report 5715, 289p.

MacKinnon, A. and LeBaron, P.S. 1992. Graphite occurrences of the Frontenac Axis, eastern Ontario; Ontario Geological Survey, Mineral Deposit Circular 33, 31p.

Macko, A. 2010. Greener pastures for cement plant; article, *St. Marys Journal Argus*, August 4, 2010, www.stmarys.com/news/article/91145.

Masson, S.L. and Gordon, J.B. 1981. Radioactive mineral deposits of the Pembroke–Renfrew area; Ontario Geological Survey, Mineral Deposit Circular 23, 155p.

McLemore, V.T. 2006. Nepheline syenite; *in* Industrial minerals and rocks, 7th ed., Society for Mining Metallurgy and Exploration Inc., Littleton, Colorado, p.653-670.

Meen, V.B. 1944. Geology of the Grimsthorpe–Barrie area; Ontario Department of Mines, Annual Report 1942, v.51, pt.4, p.1-50.

Menard, A.G. 1987. An inventory of the mineral resources in Peterborough County; Ontario Geological Survey, Open File Report 5635, 336p.

Moore, J.M., Jr. and Morton, R.L. 1986. Geology of the Marble Lake area, counties of Frontenac and Lennox and Addington; Ontario Geological Survey, Report 238, 63 p. Accompanied by Map 2499, scale 1:31 680.

Ontario Geological Survey 2006. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release—Data 126—Revised.

——— 2011. Mineral Deposit Inventory—2011; Ontario Geological Survey.

Rogers, M.C. 1996. Grade-tonnage deposit models of selected Ontario mineral deposit types; Ontario Geological Survey, Open File Report 5945, 105p.

Rowell, D.J. 2012a. Aggregate resources inventory of the County of Bruce, southern Ontario; Ontario Geological Survey, Aggregate Resources Inventory Paper 190, 94p.

——— 2012b. Aggregate resources inventory for the County of Bruce, southern Ontario; Ontario Geological Survey, Aggregate resources Inventory Paper 190, Map 2A–Bedrock resources, scale 1:100 000.

Russell, D.J. 1993. Role of the Sylvania Formation in sinkhole development, Essex County; Ontario Geological Survey, Open File Report 5861, 122p.

Sanford, B.V. 2007. Stratigraphic and structural framework of the Potsdam Group in eastern Ontario, western Quebec and northern New York State; unpublished PhD thesis, University of Ottawa, Ottawa, Ontario, 222p.

Sanford, B.V. and Arnott, R.W.C. 2010. Stratigraphic and structural framework of the Potsdam Group in eastern Ontario, western Quebec, and northern New York State; Geological Survey of Canada, Bulletin 597, 83p.

Sangster, P.J., Laidlaw, D.A., LeBaron, P.S., Carter, T.R., Fortner, L. and Lee, C.R. 2010. Report of Activities 2009, Resident Geologist Program, Southern Ontario Regional Resident Geologist Report: Southeastern and Southwestern Ontario Districts, Mines and Mineral Information Centre, and Petroleum Resources Centre; Ontario Geological Survey, Open File Report 6250, 55p.

Sangster, P.J., Laidlaw, D.A., LeBaron, P.S., Lee, C.R., Carter, T.R. and Fortner, L. 2009. Report of Activities 2008, Resident Geologist Program, Southern Ontario Regional Resident Geologist Report: Southeastern and Southwestern Ontario Districts, Mines and Mineral Information Centre, and Petroleum Resources Centre; Ontario Geological Survey, Open File Report 6238, 65p.

Sangster, P.J., Laidlaw, D.A., LeBaron, P.S., Steele, K.G., Lee, C.R., Carter, T.R. and Lazorek, M.R. 2008. Report of Activities 2007, Resident Geologist Program, Southern Ontario Regional Resident Geologist Report: Southeastern and Southwestern Ontario Districts, Mines and Minerals Information Centre, and Petroleum Resources Centre; Ontario Geological Survey, Open File Report 6222, 60p.

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, Mines and Petroleum Resources Centre; Ontario Geological Survey, Open File Report 6267, 65p.

Sawyer Consultants Inc. 1987. Report on the 1987 Phase 1 drill program on the northeast area, Bannockburn property, Madoc Township, Ontario, for Mono Gold Mines Inc.; unpublished report, Southern Ontario Resident Geologist's office, assessment file AFRI# 31C12NE0032, 101p.

SGS Canada Inc. 2010. Technical report, preliminary economic assessment on the Bissett Creek graphite property of Industrial Minerals, Inc. and Northern Graphite Corporation; unpublished report, July 16, 2010, revised February 2, 2011, 123p., www.northerngraphite.com/wp-content/uploads/2010/08/BISSETTCREEK_PEA2010-final.pdf.

Shklanka, R. 1968. Iron deposits of Ontario; Ontario Department of Mines, Mineral Deposit Circular 11, 489p.

——— 1969. Copper, nickel, lead and zinc deposits of Ontario; Ontario Department of Mines, Mineral Deposit Circular 12, 394p.

Slocan Van Roi Mines Ltd. [no date] Location plan, diamond drill holes #1, 2, 3, 4, 5, 6, 8 and 9, McClintock Township option, Ontario; unpublished report, Southern Ontario Resident Geologist's office, assessment file AFRI# 31E07NW0013, 1p.

United States Geological Survey 2012. Mineral commodity summaries 2012, United States Geological Survey, 198p.

W.G. Wahl Limited 1981. An evaluation, Cordova Mine property, Lasir Gold Inc.; unpublished report, Southern Ontario Resident Geologist's office, Mineral Deposit Inventory file MDI31C12SW00005.

Ware, A., Cherry, J. and Ding, X. 2008. Geology of the Eagle project; *in* 54th Institute on Lake Superior Geology, Proceedings, Part 2 - Field Trip Guidebook, p.87-114.

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Ontario Geological Survey
Regional Resident Geologist Program

Petroleum Resources Centre—2011

by

L. Fortner and T.R. Carter

2012

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Petroleum Resources Centre—2011

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1. Successful oil and gas exploration wells in southern Ontario in 2011 3

TABLE

1. Successful oil and gas exploration wells in southern Ontario in 2011 3

Petroleum Resources Centre—2011

Oil and Gas Exploration and Development Activity in Ontario in 2011

L. Fortner[1] and T.R. Carter[2]

[1]Sedimentary Geologist, Petroleum Resources Centre, Ministry of Natural Resources, London, Ontario

[2]Chief Geologist, Petroleum Resources Centre, Ministry of Natural Resources, London, Ontario

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INTRODUCTION

Drilling activity in southern Ontario in 2011 decreased compared to 2010. Production volumes also continued to fall as they have for several years. The average price of oil sold in Ontario in January was $87 per barrel. It reached a monthly average peak of $108 in April, finishing the year at $102 for December. The average price for the year was just under $96, which was significantly higher than the average for 2010 of just under $81. The price of natural gas in Ontario averaged $4.87 per MMBtu in January 2011 and remained fairly consistent during the year, with an average December price of $4.65. High production volumes of recently exploited shale gas continue to suppress prices in the North American market.

Data compiled from annual production reports submitted to the Petroleum Operations Section indicate that annual oil production declined 5.7% to 78 987 m^3 in 2011 with an estimated value of $47.8 million, compared to 83 779 m^3 with an estimated value of $42.6 million in 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 oil production decreased substantially from 2008 to 2009 due to a dramatic drop in unit price, but increased in 2010 and again in 2011.

EXPLORATION ACTIVITY

A total of 25 licences to drill and operate new wells were issued by the Ministry of Natural Resources in 2011, compared to 15 in 2010. An additional 29 licences were issued for plugging of existing wells.

Drilling of 19 new wells and 1 deepening were reported in 2011, compared to 24 new wells in 2010. These consisted of 3 exploratory wells and 1 exploratory re-entry, 7 development wells and 9 stratigraphic tests. Two of the development wells were drilled as horizontal wells.

Successful development drilling in 2011 resulted in 2 wells reported to be active gas producers, 1 active oil and gas well, 2 suspended gas wells, 1 potential gas well and 1 active private gas wells. This was a greater commercial success rate than in 2010, which yielded only 1 well reported to be a potential oil producer, 1 suspended natural gas well, 1 capped well with gas show and 6 active private gas wells at the time of writing the 2010 report.

Exploratory drilling in 2011 resulted in 1 potential oil well (Table 1; Figure 1), 2 dry holes and 1 dry deeper pool test. In comparison, exploratory drilling results in 2010 were significantly more positive, with 1 well reported as an active gas producer, 1 active oil producer, 2 potential oil wells, 1 potential gas well and 1 dry hole at the time of writing the 2010 report.

Cambrian Play

One exploratory well was drilled in Kent County to test Cambrian targets for oil and gas in 2011. It was subsequently plugged and abandoned. There had also been only 1 Cambrian exploratory test in 2010.

There were no development wells drilled to Cambrian targets in 2011. One Cambrian development well had been drilled in 2010.

Ordovician Play

One deeper pool test was drilled to Ordovician targets in Essex County in 2011. It was reported as unsuccessful.

Two development wells were drilled in Essex County to test the Ordovician in 2011, resulting in 1 active oil and gas producer and 1 suspended gas well.

No exploration or development wells targeted the Ordovician in 2010.

Silurian Sandstone Play

One exploration well tested Silurian sandstone targets in 2011 in Elgin County and was abandoned as a dry hole. There were no exploration wells testing Silurian sandstone targets in 2010.

Two development wells were drilled for Silurian sandstones in 2011. One was reported as an active commercial gas producer on Lake Erie and the other as an active private gas well in Welland County. In 2010, 6 private gas wells and 2 commercial wells targeted this play.

Silurian Carbonate Play

No exploratory wells were drilled to test Silurian Guelph reef and/or Salina Group targets in 2011. Five exploratory wells were drilled for these targets in 2010, all in Lambton County.

Three development wells were drilled to these targets in 2011, resulting in 1 active gas producer in Kent County, 1 suspended gas well in Essex County and 1 potential gas well in Huron County. There were no development wells drilled for Silurian Guelph–Salina targets in 2010.

Devonian Play

One exploration well tested Devonian targets in 2011 and was reported as a potential oil well in Elgin County. No exploration wells were drilled for the Devonian play in 2010.

As in 2010, no development wells were drilled to test Devonian targets in 2011.

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 through 2010 and 2011. Exploration activity focussing on oil has not increased in spite of oil prices that have been consistently robust for more than 2 years.

Activity in Ontario has been reduced to a minimum by the constraints of commodity prices. Low natural gas prices have a dramatic impact on exploration and development activity in the province. Ironically, sustained higher oil prices may 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.

There is considerable remaining untested potential for natural gas in the Ordovician play beneath the eastern basin of Lake Erie and onshore east and north from Kent County to the Niagara Escarpment. A 2005 re-assessment 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. Potential exists for trapping of natural gas in sandy facies of the Ordovician Shadow Lake Formation over the crest of the Algonquin Arch.

Gas or oil accumulations are also possible in stratigraphic traps along the pinch-out edge of the Cambrian sandstone, or in Cambrian reservoirs within fault-controlled structures. There may also 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 2011 (*see* Figure 1 for well locations).

Well #	Well Name	Results	Target	TD	Latitude	Longitude	TD Date
1	Clearbeach et al. #40, Dunwich 1-4-24-A	OS - POT	DEV	108.0	42.71165944	-81.44440306	29/07/2011

Abbreviations: DEV = Devonian; OS = oil show; POT = potential; TD = total depth (in metres).

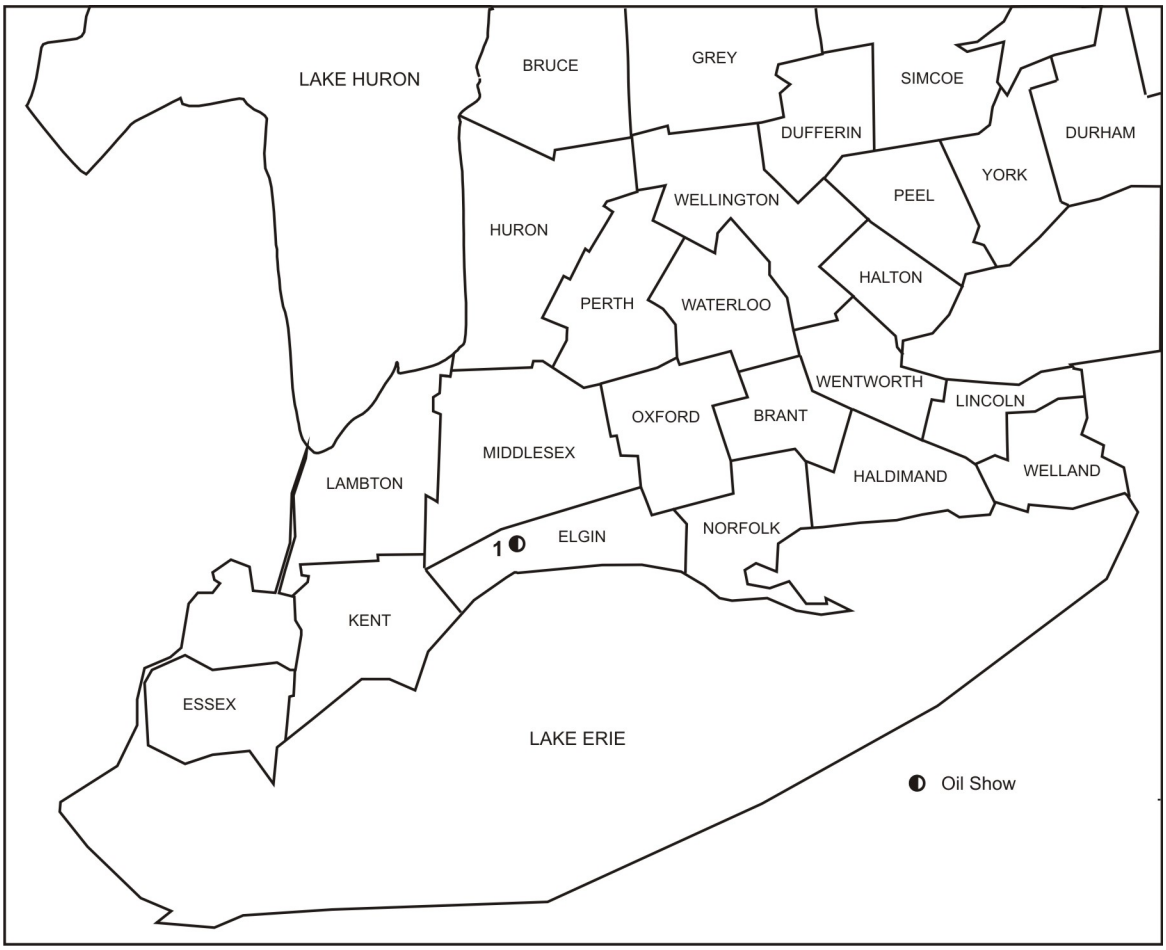

Figure 1. Successful oil and gas exploration wells in southern Ontario in 2011.

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 9**	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 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.*

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