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**Ontario Geological Survey
Open File Report 6296**

**Report of Activities, 2013
Resident Geologist Program**

**Southern Ontario Regional Resident
Geologist Report:
Southeastern Ontario and
Southwestern Ontario Districts and
Petroleum Operations**

2014



ONTARIO GEOLOGICAL SURVEY

Open File Report 6296

Report of Activities, 2013
Resident Geologist Program

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

by

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

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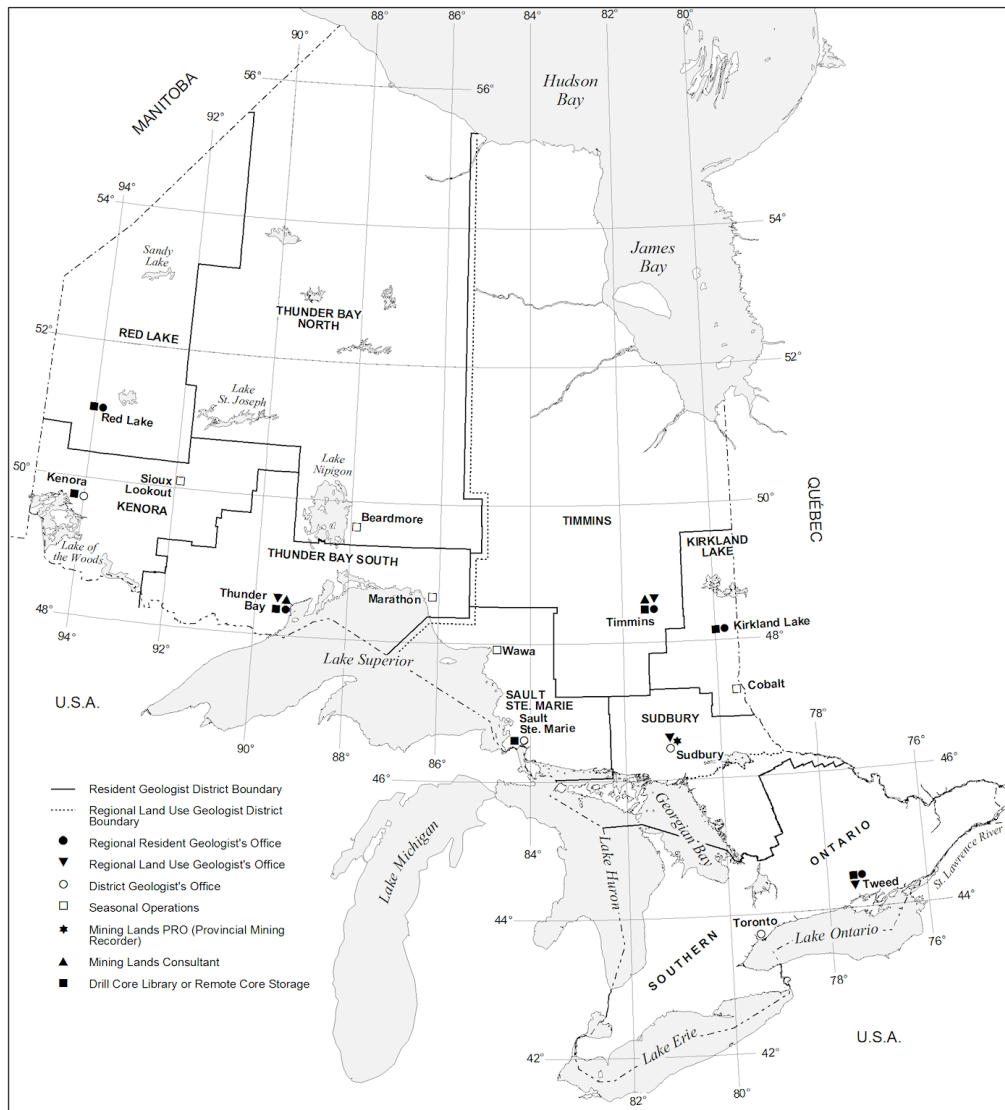
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**Ontario Geological Survey
Resident Geologist Program
Report of Activities—2013**

**SOUTHERN ONTARIO
REGIONAL RESIDENT GEOLOGIST REPORT**

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1. Southeastern Ontario District
Southwestern Ontario District
2. Petroleum Operations



Ontario Geological Survey Regional Resident Geologist Program

**Southern Ontario Regional Resident Geologist
(Southeastern Ontario and Southwestern Ontario Districts)—2013**

by

**P.J. Sangster, P.S. LeBaron, S.J. Charbonneau, D.A. Laidlaw,
R.L. Debicki, A.C. Wilson and S.E. Halet**

2014

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Southern Ontario Regional Resident Geologist (Southeastern Ontario and Southwestern Ontario Districts)—2013

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INTRODUCTION

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

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 whose development of is designated under the *Aggregate Resources Act* administered by the Ministry of Natural Resources.

In 2013, the Canadian Wollastonite, St. Lawrence deposit was brought into production as the first and only producing wollastonite mine in Canada.

On May 31, 2012, the surface and mining rights for 3000 km² of Crown lands in southeastern Ontario were withdrawn from staking on a temporary basis while the Ministry of Aboriginal Affairs and the Ministry of Natural Resources considered the status of certain lands that may have potential for future disposition as part of a settlement of the Algonquin land claim. In November 2012, approximately 2260 km² were re-opened for staking. If any of the withdrawn lands within this area cease to be required for the purposes of settlement, they will be re-opened for claim staking. As of January 2014, approximately, 740 km² remain withdrawn. Any alienated lands, including existing mining claims and mining leases, lying within the limits of the withdrawn area that subsequently revert to the Crown will automatically be considered to be withdrawn.

In 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. These lands were re-opened 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.

Southern Ontario prospectors and developers appear to have adapted well to the map-staking system introduced in 2011. In 2013, a total of 130 claims, comprising 537 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 11 through 19 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 compliant with National Instrument (NI) 43-101.

The authors note that, for ease of reading, all Web addresses were accessed March 18, 2013, unless otherwise noted.

In addition, Universal Transverse Mercator (UTM) co-ordinates are provided in Zone 18 using North American Datum 1983 (NAD83), unless otherwise noted.

MINING ACTIVITY

During 2013, there were over 100 mineral extraction operations in southern Ontario, including 15 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 2013, Ontario non-metallic mineral production was valued at \$3 billion—representing 30% of the total value of mineral production in the province. Five of the top 10 commodities produced in 2013 were industrial minerals. Most of this production came from southern Ontario mines and quarries.

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. In December 2012, the Closure Plan was accepted by the Ministry of Northern Development and Mines and Canadian Wollastonite began to bring the deposit into production (Photo 1).

In 2013, the company crushed and shipped over 6500 t of wollastonite clear stone and sand products into metallurgical and agricultural markets. The company also won approval for use of its primary ancillary ore—orthogneiss—as a Superpave aggregate in highway road construction. The deposit is the southernmost approved source of Superpave aggregates in the Province of Ontario and is well situated to supply the eastern Ontario market.

In 2014, the company plans to introduce wollastonite (calcium silicate) and diopside (calcium magnesium silicate) products into the local Ontario horticultural market as well as the northeastern United States. Wollastonite and diopside are both non-carbon dioxide-producing sources of calcium, magnesium and silica, which are all important elements in plant health and disease resistance. Plans for construction of a high-aspect-ratio (HAR) flotation plant have been postponed until 2015 while the company explores strategic joint venture opportunities for its construction. (B. Vasily, Canadian Wollastonite, personal communication, February 2014.)

Salt

Salt has been produced in Ontario since 1866. There are extensive beds of rock salt found in the Silurian Salina Group (formerly Formation) 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 Ministry of Transportation of Ontario reports that the Ministry's salt usage is highly dependent upon weather conditions, varying from 500 000 to 600 000 tonnes of salt annually.

A recent newspaper article (Patch 2014) from Toledo, Ohio, highlighted this year's demand for rock salt and provided background on its sources; paraphrasing, it stated: The demand for rock salt, mined at 7 locations in New York, Ohio, Michigan and Ontario varies from year to year, depending on winter weather. The winter of 2013–2014 saw the worst weather in at least 2 decades in the Great Lakes Region with snowfall approaching all-time records.

In an interview for the same article, J. Vincent, vice president of operations for Morton Salt indicated that all of the Morton Salt assets in the United States have been at maximum output, maximum capacity and, between October 2013 and January 2014, Morton shipped three times as much salt as it did during that part of the previous season. To meet the demand, in addition to salt from mines in Fairport, Ohio, and Windsor, Ontario, Morton shipped barge loads of Louisiana salt up the Mississippi River to fill orders for the Midwestern United States (Patch 2014).

In 2013, Ontario produced 8 million tonnes of salt valued at \$443 million. Salt remains one of the top 10 minerals in the province by value of production.

Sifto Canada Corporation 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.



Photo 1. First stockpiles of wollastonite and orthogneiss at the Canadian Wollastonite, St. Lawrence deposit.

MINING AND QUARRYING ACTIVITY
SOUTHEASTERN ONTARIO RESIDENT GEOLOGIST'S DISTRICT

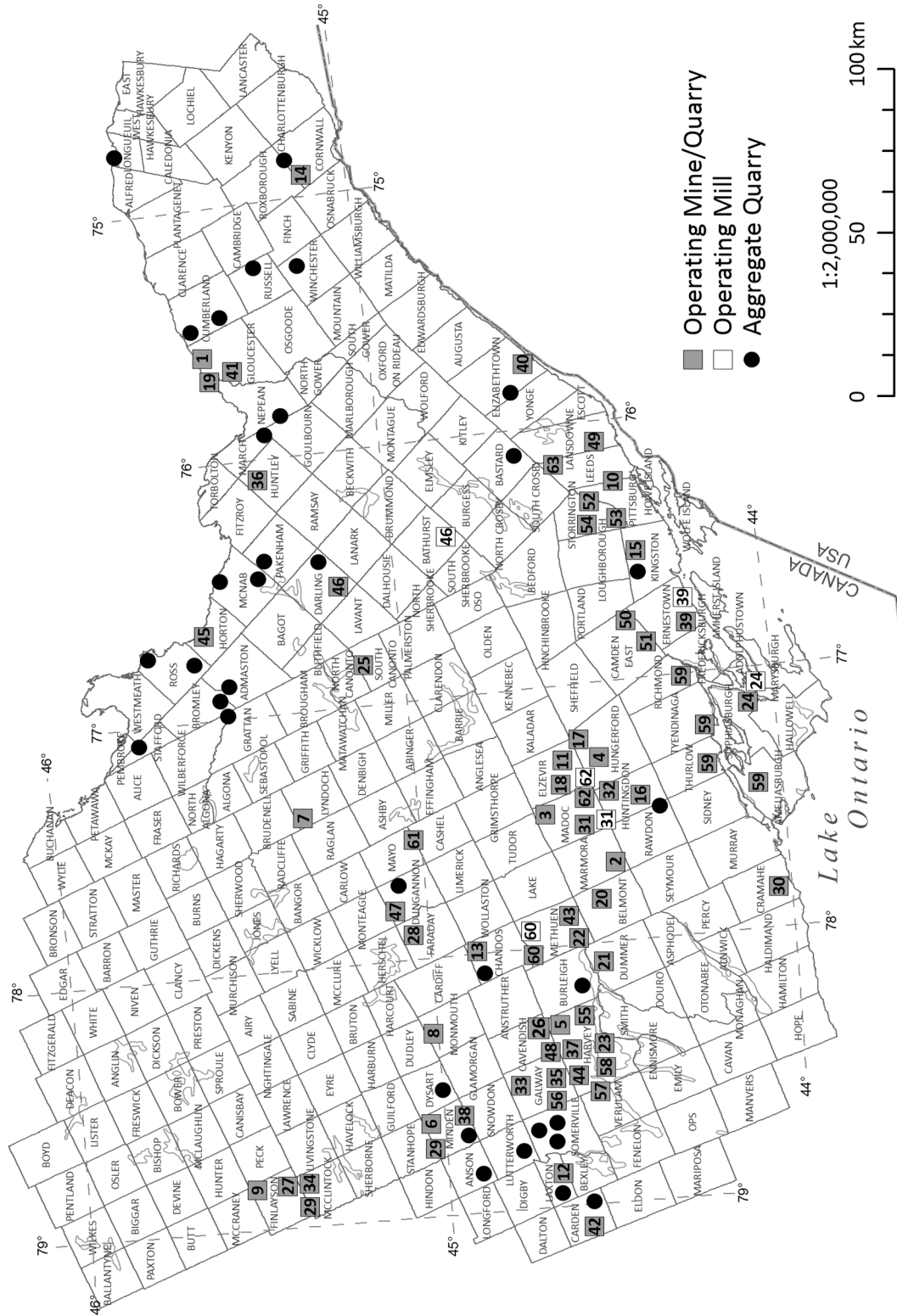


Figure 1. Mining activity in the Southeastern Ontario District in 2013 (keyed to Table 1).

Table 1. Mining activity in the Southeastern Ontario District in 2013 (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	Aecon Construction and Materials Ltd.	Marmorata (Limestone)	Limestone is quarried from former Marmoraton mine site for aggregate.
3	Allan Franks Construction Ltd.	Madoc (Limestone)	Limestone has been quarried and crushed on a seasonal basis since 1991 for road aggregate.
4	A. Marmoro and Terrazzo Olympic, LLC (Tweed Marble Quarry)	Hungerford (Marble)	Quarry was purchased in 2013.
5	Amsen Quarries Ltd.	Harvey (Limestone)	Limestone landscaping stone products.
6	Attia Quarries	Minden (Granite)	Stone is quarried for use as landscaping, dimension, flag and masonry stone.
7	Aqua Rose Gems and Minerals (Beryl Pit / Rose Quartz Pit)	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.
8	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 2013, a total of 158 people attended the field trips, with an estimated 6300 attending the Bancroft GemBoree.
9	Boothby Quarry	Finlayson (Granite)	Granite gneiss is quarried for flagstone and landscape stone.
10	Canadian Wollastonite (St. Lawrence Mine)	Pittsburgh, Leeds & Lansdowne (Wollastonite)	In 2013, the company crushed and shipped over 6500 t of wollastonite clear stone and sand products into metallurgical and agricultural markets.
11	Carbroc Quarry	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.
12	Central Ontario Natural Stone (Batty Quarry)	Laxton (Limestone)	Grey, buff and black limestone is produced as flagstone.
13	Colonial Brick & Stone (Elite Blue)	Chandos (Marble)	A blue grey metasedimentary rock is extracted for a variety of uses including armour stone, landscaping stone and dimension stone.
14	Cornwall Gravel Company Ltd. (Cornwall Quarry)	Cornwall (Limestone)	Limestone for aggregate is quarried from this quarry north of Cornwall.
15	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.
16	Danford Construction Ltd. (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.
17	Danford Construction Ltd. (Tweed Quarry)	Elzevir, Hungerford (Granite-gneiss)	Granite-gneiss is extracted, crushed and approved for use in "Superpave" aggregates.
18	Danford Granite Ltd. (Bridgewater Trap Rock Mine)	Elzevir (Trap rock)	Aggregate is quarried for use as railway ballast.
19	Dibblee Paving & Materials Ltd.	Gloucester (Dolomitic sandstone)	Dolomitic sandstone from the Boyce Quarry is removed from the lower member of the March Formation.
20	Drain Bros. Excavating Inc.	Belmont (Gabbro)	Gabbro is extracted for use as trap rock.
21	Drain Bros. Excavating Inc.	Dummer (Limestone)	Limestone for use as road aggregate.

SOUTHEASTERN ONTARIO AND SOUTHWESTERN ONTARIO DISTRICTS—2013

No.	Company/Individual (Mine Name)	Township(s) (Commodity)	Mining Activity
22	Drain Bros. Excavating Inc.	Methuen (Granite)	Crushed stone for aggregate.
23	Dufferin Aggregates	Harvey (Limestone)	Grey limestone is extracted for use as armour stone, landscaping stone and crushed stone.
24	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.
25	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.
26	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.
27	Fraser Quarry	Finlayson (Gneiss)	Predominately pink gneiss is extracted for landscaping and other decorative applications.
28	Graf Quarry (Senator Stone)	Faraday (Marble)	A variety of landscape and dimension stone is extracted from a quarry of calcitic marble breccia formerly held by Senator Stone and marketed as "Temagami Pink".
29	Haliburton Stone Works	McClintock, Minden (Granite, dolomite, limestone)	A variety of granite and limestone dimensional and landscape stones produced from 2 quarries.
30	Holcim (Canada) 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.
31	I.K.O. Industries Ltd. (I.K.O. Quarry)	Madoc (Trap rock)	I.K.O. Industries Ltd. has operated a trap rock quarry east of Madoc on the south side of Hwy 7 since 1991. 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. The quarry is licensed to produce up to 1 Mt per year.
32	JC Rock (Crookston Quarry)	Huntingdon (Limestone)	Historic producer; in 2010, saw dimension stone removed for restoration project, Belleville.
33	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.
34	John Bacher Construction Limited	McClintock (Granite, gneiss)	Building stone, flagging stone, and landscaping stone.
35	Johnston Quarry	Galway (Limestone)	Gull River Formation limestone is removed for use as landscaping stone, flagstone and building stone.
36	Karson Kartage & Konstruction Ltd. (Clarke Quarry)	Huntley (Limestone)	The quarry produces limestone for use as road aggregate.
37	Kawartha Rock Quarry Inc.	Harvey (Limestone)	Limestone is quarried to produce armour stone and flagstone.
38	Keystone Granite	Minden (Granite)	Granite is quarried for use as armour, flags, steps and dimension stone.
39	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.
40	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.
41	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.

No.	Company/Individual (Mine Name)	Township(s) (Commodity)	Mining Activity
42	Miller Paving Ltd.	Carden (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.
43	MRT Aggregates Inc. (MRT Traprock)	Methuen (Trap rock)	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.
44	Nelson Windover Quarries (Windover, Buckhorn Quarry)	Harvey (Limestone)	Grey limestone is quarried as a seasonal operation for the production of flagstone.
45	Nesbitt Aggregates	Horton (Granite)	Granite riverstone is quarried, sorted and split for use as flagstone, fieldstone, landscaping and masonry stone. The majority of production is exported to the United States.
46	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.
47	Princess Sodalite Mine	Dungannon (Sodalite)	Decorative stone, landscaping stone, mineral specimens including fee for collecting.
48	Redstone Quarries	Galway, Harvey, Cavendish (Limestone, sandstone)	Beige limestone and red sandstone are quarried for weathered landscaping stone and armour stone blocks.
49	Rideauview Contracts Ltd. (Ellisville Quarry)	Rear Leeds & Lansdowne (Sandstone)	Sandstone produced for flagstone, granite blocks and masonry stone.
50	Rideauview Contracts Ltd. (Pettworth)	Camden East (Limestone)	Limestone was quarried for building restoration in Kingston.
51	Rideauview Contracts Ltd. (Renaud Quarry)	Camden East (Limestone)	Limestone was quarried for building restoration in Kingston.
52	Rideauview Contracts Ltd. (Rideauview Quarry)	Storrington (Sandstone)	Red sandstone is produced for ashlar and flagstone.
53	Rideauview Contracts Ltd. (Sloan Quarry)	Storrington (Sandstone)	Cream and red sandstone are quarried for the production of ashlar, flagstone and landscaping stone at the Sloan Quarry.
54	Rideauview Contracts Ltd. (Battersea Quarry)	Storrington (Granite)	Red granite is quarried at the Battersea Quarry.
55	Rigbe's Quarry	Harvey (Limestone)	Buff limestone is removed for use as weathered armoury and rockery, crushed aggregates and landscape stone.
56	Royel Paving	Galway (Granite)	Granite is quarried and crushed on site for road aggregate.
57	Stone Cottage Inn Ltd. (Attia Quarries)	Harvey (Limestone)	Grey limestone is quarried for dimension stone.
58	Stonescape Quarry	Harvey (Limestone)	Limestone flagstone and ledgerock are quarried north of Buckhorn.
59	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.
60	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.
61	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.
62	Upper Canada Stone Co. Ltd.	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.
63	Upper Canada Stone Co. Ltd. (Kingston Red Granite Quarry)	Rear of Leeds & Lansdowne (Granite)	Red granite is produced for precast concrete panels, pavers, split block, spun concrete poles and landscaping.

MINING AND QUARRYING ACTIVITY SOUTHWESTERN ONTARIO RESIDENT GEOLOGIST'S DISTRICT

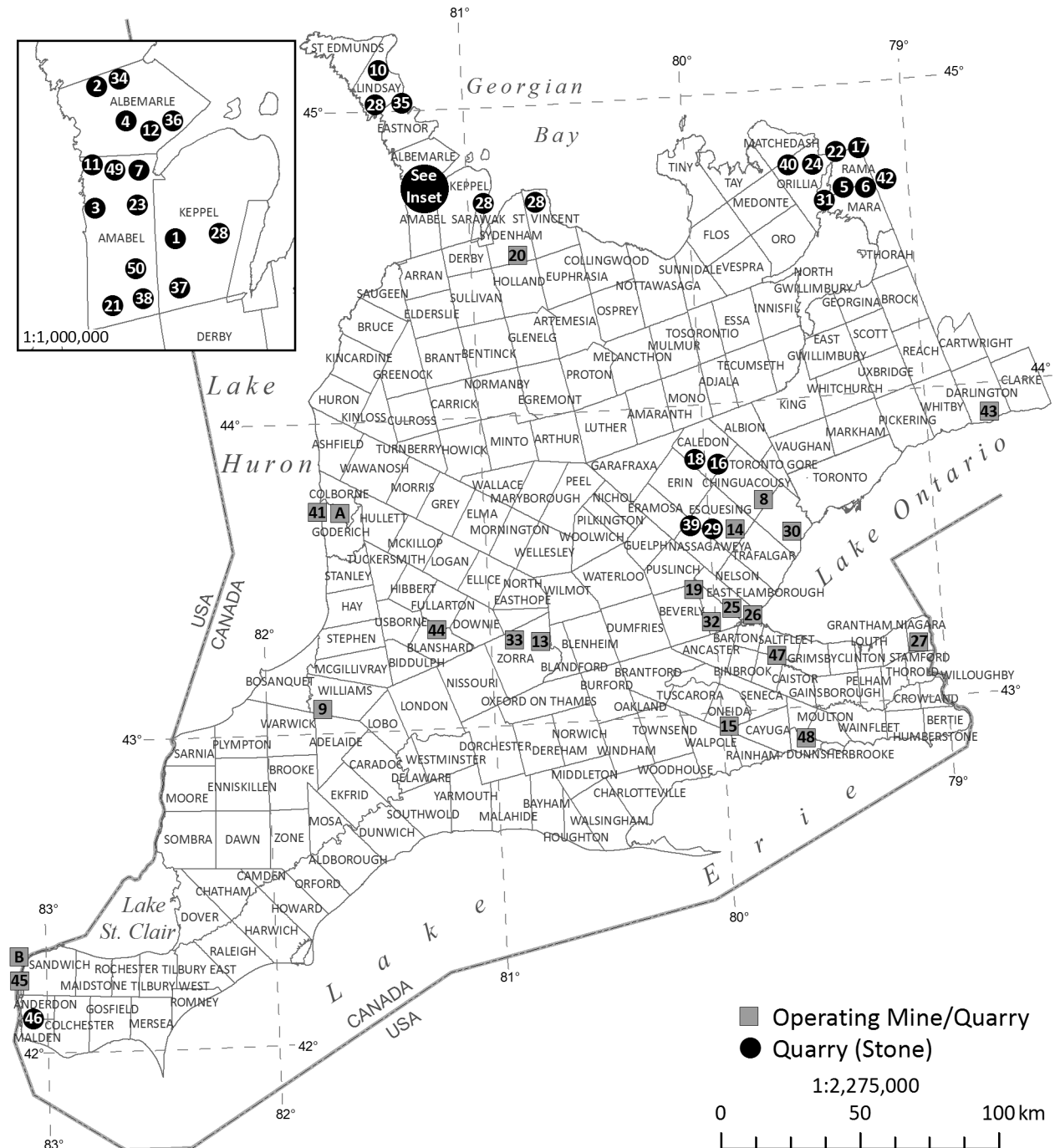


Figure 2. Producing mines and quarries in the Southwestern Ontario District in 2013 (keyed to Table 2).

Table 2. Producing mines and quarries in the Southwestern Ontario District* in 2013 (keyed to Figure 2).

No.	Company/Individual (Mine or Quarry Name)	Township(s) (Commodity)	Mining Activity
1	A & A Natural Stone Ltd. (A & A Quarry)	Keppel (Dolostone)	Grey dolostone is produced for use as flagstone, landscape stone and specialty aggregate.
2	Amsen Quarries Ltd. (Mar Quarry)	Albemarle (Dolostone)	Light and dark brown dolostone is produced for use as flagstone and building stone.
3	Amsen Quarries Ltd. (Warton Quarry)	Amabel (Dolostone)	Light and dark brown dolostone is produced for use as flagstone and building stone.
4	Arriscraft International Inc. (Adair Marble Quarries)	Albemarle (Dolostone)	Dolostone is produced for use as architectural stone.
5	Attia Quarries (Rama Quarry)	Rama (Dolostone)	Stone is quarried for use as landscaping, dimension, flag and masonry stone.
6	Attia Quarries (Seabright Quarry)	Rama (Dolostone)	Stone is quarried for use as landscaping, dimension, flag and masonry stone.
7	Block and Stone Resource Group Inc.	Amabel (Dolostone)	Dolostone is quarried for use as dimension stone.
8	Brampton Brick Ltd. (Cheltenham Quarry)	Chinguacousy (Shale)	Queenston Formation shale is extracted for use in the company's brick plant.
9	Brampton Brick Ltd. (Hungry Hollow North Quarry)	Williams (Shale)	Shale is extracted for use in the company's brick plant.
10	Bruce Peninsula Stone Ltd. (Lindsey Quarry)	Lindsay (Dolostone)	Dolostone is produced for landscaping and building stone products.
11	Bruce Peninsula Stone Ltd. (Warton Quarry)	Amabel (Dolostone)	Dolostone is produced for landscaping and building stone products.
12	Bruce Peninsula Stone Ltd. (Mar Quarry)	Albemarle (Dolostone)	Dolostone is quarried for use as dimension stone.
13	Carmeuse Lime Canada Ltd. (Beachville Quarry)	Zorra (Limestone)	Limestone is extracted, crushed and processed in on-site lime plant.
14	Century Brick (Georgetown Quarry)	Esquesing (Shale)	Queenston Formation shale is extracted for use in the company's brick plant.
15	CGC Inc. (Hagersville Mine)	Oneida (Gypsum)	An on-site wallboard plant utilizes gypsum from the mine.
16	Credit Valley Quarries Co. Ltd.	Caledon, Chinguacousy (Sandstone, limestone)	Sandstone is extracted for construction and landscaping applications. The stone has been used in many notable buildings including Toronto's Old City Hall and Ontario Legislature.
17	Cut Above Natural Stone (Cut Above Natural Stone Quarry)	Rama (Limestone)	Buff brown, white, light to dark grey limestone is quarried for use as armour stone, wallstone, flagstone and random slabs.
18	Deforest Brothers Quarry Ltd. (Deforest Brothers Quarry)	Caledon (Sandstone)	Red, grey, buff, piebald-textured sandstone is produced for use as steps, coping, wallstone, ledgerrock and landscaping stone.
19	Dufferin Aggregates (Flamborough Quarry)	West Flamborough (Dolostone)	Dolostone is produced for armour, landscaping and crushed stone.
20	E.C. King Contracting Ltd. (Sydenham Quarry)	Sydenham (Dolostone)	High-purity dolostone is crushed for aggregate.
21	Ebel Quarries Inc. (Ebel and Arnold Property quarries)	Amabel (Dolostone)	Light and dark brown and black dolostone is produced for use as flagstone, landscaping stone, slabs, steps and wallstone.
22	Fowler Construction Company Limited (Fleming Quarry)	Rama (Gneiss)	Granitic gneiss is quarried for use as flagstone, building, landscaping, masonry and crushed stone.
23	Georgian Bay Marble and Stone (Cook Quarry)	Amabel (Dolostone)	Dolostone is produced for use as landscaping stone, steps and building stone.
24	Gott Natural Stone (Hewitt Quarry)	Orillia (Limestone)	Limestone is quarried for use as aggregate, thin veneer and dimension stone from several quarries in the area.
25	Hanson Brick Ltd. (Aldershot Quarry)	East Flamborough (Shale)	Queenston Formation shale is extracted for use in the company's brick plant.
26	Hanson Brick Ltd. (Burlington Quarry)	East Flamborough (Shale)	Queenston Formation shale is extracted for use in the company's brick plant.
27	Hanson Brick Ltd. (Niagara-on-the-Lake Quarry)	Niagara (Shale)	Queenston Formation shale is extracted for use in the company's brick plant.

SOUTHEASTERN ONTARIO AND SOUTHWESTERN ONTARIO DISTRICTS—2013

No.	Company/Individual (Mine or Quarry Name)	Township(s) (Commodity)	Mining Activity
28	Harold Sutherland Construction (Lindsay, Keppel, Sarawak and Meaford Quarries)	Lindsay, Keppel, Sarawak, Meaford (Dolostone)	Dolostone is extracted and crushed for use as aggregate.
29	Hilltop Stone and Supply Inc. (Hilltop Quarry)	Esquesing (Sandstone)	Grey and buff sandstone is quarried for use as flagstone, masonry stone and dimension stone.
30	Holcim (Canada) Inc. (Mississauga Quarry)	Toronto (Shale)	Holcim (Canada) Inc. operates a cement plant and adjacent shale quarry. Limestone is shipped to the plant from Ogden Point quarry on Lake Ontario at Colborne.
31	James Lamb	Rama (Dolostone)	Crushed stone aggregate is produced.
32	Lafarge Canada Inc. (Dundas Quarry)	West Flamborough (Dolostone)	Dolostone is crushed for use as high-quality aggregate.
33	Lafarge Canada Inc. (Woodstock Quarry)	Zorra (Limestone)	Limestone is extracted and crushed for aggregate from quarry near site of former cement plant.
34	Limberlost Stone Inc. (Limberlost Quarry)	Albemarle (Dolostone)	Light and dark brown and grey dolostone is quarried for use as flagstone, landscaping stone, steps, slabs, coping and coursing.
35	Lions Head Stone Quarry	Lindsay (Limestone)	Limestone is produced for use as splitface, landscape and armour stone and flagstone.
36	Owen Sound Ledgerock Ltd. (Hope Bay Quarry)	Albemarle (Dolostone)	Dolostone is produced for use as custom cut and architectural cut stone, masonry, ledgerock wallstone, marble tiles and slabs and landscape stone.
37	Owen Sound Ledgerock Ltd. (Owen Sound Quarry)	Keppel (Dolostone)	Dolostone is produced for use as custom cut and architectural cut stone, masonry, ledgerock wallstone, marble tiles and slabs and landscape stone.
38	Owen Sound Ledgerock Ltd. (Senesun and Warton quarries)	Amabel (Dolostone)	Dolostone is produced for use as custom cut and architectural cut stone, masonry, ledgerock wallstone, marble tiles and slabs and landscape stone.
39	Rice and McHarg Ltd. (Rice and McHarg Quarry)	Esquesing (Sandstone)	Grey and buff sandstone is produced for use as flagstone, masonry and landscaping stone.
40	Rockleith Quarry Ltd. (Rockleith Quarry)	Orillia (Limestone)	Beige, tan and blue-gold limestone and dolomitic limestone is produced for use as dimensional building stone.
41	Sifto Canada Inc. (Goderich Mine and brinefields)	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 2013, the mine continued a major expansion program.
42	Speiran Quarries Ltd. (Speiran Quarry)	Rama (Limestone)	The quarry is operated by Gott Natural Stone '99 Inc. White limestone is produced for use as flagstone, landscaping stone, waterfall slabs, retaining wall blocks and steps.
43	St. Marys Cement Inc. (Bowmanville Quarry)	Darlington (Limestone)	Limestone quarry and cement plant at Bowmanville.
44	St. Marys Cement Inc. (St. Marys Quarry)	Blanshard (Limestone)	Limestone quarry and cement plant complex at St. Marys.
45	The Canadian Salt Company Ltd. (Ojibway Mine and brinefields)	Sandwich (Salt, salt in brine)	Underground workings are adjacent to international border. The company also produces salt from an adjacent brine field (B) operation.
46	Walker Industries Holdings	Anderdon, Malden (Limestone)	Limestone is produced for landscaping and building stone products.
47	Waterford Sand and Gravel (Vinemount Quarry)	Saltfleet (Limestone)	Limestone is extracted to produce a range of granular and premium clear products.
48	Waterford Sand and Gravel (Dunnville Quarry)	Dunn (Limestone)	Limestone is extracted and crushed for aggregate.
49	Warton Buckskin Quarry Co. Ltd.	Amabel (Dolostone)	Dolostone is extracted and processed for use as flagstone, steps, slabs and curbing stone.
50	Warton Stone Quarry Inc. (Warton Stone Quarry)	Amabel (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 2013, please refer to the report of the Petroleum Operations Branch (this volume).*

Sifto Canada (www.siftocanada.com) employs 490 people in the Goderich facilities. 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

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 permits shipping by lake vessel, rail and road transportation. Windsor Salt employs over 300 people at the Ojibway Mine and adjacent brine well field.

Brick and Shale

In 2013, there were 4 companies operating clay brick or tile plants in southwestern Ontario, all of which extract Queenston Formation shale as raw material. Total value of production in 2013 was \$104 million.

Hanson Brick Ltd. (www.hansonbrick.com) operates 3 brick plants in Burlington and 1 plant 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 2013, the company reported that brick sales achieved slight growth above the same period in 2012 due to increased residential construction, a trend that the company expects will continue into 2014 (Heidelberg Cement, "Interim Financial Report, January to September 2013", www.heidelbergcement.com, under Investor Relations | Financial Reports | 2013 [accessed January 7, 2014]). The company employs 130 people at its Ontario facilities.

Brampton Brick Ltd. (www.bramptonbrick.com) 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. During the first 9 months of 2013, revenues from the masonry products line increased by about 1% over the same period in 2012, due to higher shipments of concrete masonry products but lower clay brick production volumes (Brampton Brick Ltd., news release, November 5, 2013). In January, 2014, the company announced the acquisition of the facilities and inventory of Atlas Block Co. for \$13.4 million. Atlas Block is a Hillsdale, Ontario, company that manufactures concrete brick and block for buildings and landscaping (Brampton Brick Ltd., news release, January 7, 2014).

In December 2008, Brampton Brick submitted a proposal to open a shale quarry at Norval, about 10 km west of Brampton. The proposed extraction rate was 200 000 tonnes per year and total yield was 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 shale would be blended to produce a new product line of buff-burning bricks. The quarry proposal followed a 2006 amendment to the Official Plan, reducing the protected area of the shale resource from 1370 ha to 1200 ha.

The company's rezoning application was appealed to the Ontario Municipal Board in January 2011. In 2013, the company presented additional information and responses to the City of Brampton, which will assess the new information and provide a recommendation report in the first quarter of 2014. (City of Brampton, www.brampton.ca/EN/Business/planning-development/projects-studies/Pages/Norval-Quarry-Re-Zoning.aspx, see "Stakeholder Update #21" [accessed January 7, 2014]).

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. Shale for the brick operations is quarried by Limehouse Clay Products Ltd. at the Halton Hills quarry near Georgetown.

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 2013 show cement production in Ontario was valued at more than \$582 million (“Ontario Mineral Production 2013”, from MNDM Mineral Sector Analysis and Promotion staff, written communication, March, 2014).

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 7.5 million tonnes per year.

In 2012, the Cement Association of Canada released its fourth biennial report that documents environmental improvements by cement producers (Cement Association of Canada, www.cement.ca, under Publications, “2012 Environmental Performance Report”). From 2002 to 2010, energy efficiency in Canadian cement manufacturing has improved by 11% and carbon dioxide emission intensity has decreased steadily since 2002. Canadian cement and concrete sales are valued at over \$3.2 billion annually and provide over 27 000 direct and indirect jobs.

St. Marys Cement (Canada) Inc., a subsidiary of Votorantim Cimentos, operates limestone quarry and cement plant complexes at Bowmanville and St. Marys. St. Marys Cement employs a total of 245 people at its Ontario facilities.

In March, 2013, St. Marys reached a settlement with the Province of Ontario, under which the company agreed to withdraw all applications to operate a quarry in the Flamborough area. The province agreed to pay St. Marys \$15 million toward the \$22 million cost the company had spent on the project since purchasing the land in 2006 for the purpose of developing an aggregate quarry (St. Marys Cement, www.flamboroughquarry.ca/, “Update”, March 8, 2013 [accessed January 8, 2014]).

Lafarge Canada Inc., a subsidiary of Lafarge North America, operates a limestone quarry and cement plant at Bath near Kingston. In 2013, Lafarge Canada, Natural Resources Canada, the Queen’s Institute for Energy and Environmental Policy and Carbon Management Canada announced that they are investing more than \$8 million to develop the use of alternative fuels at the Bath plant. “This multi-partner initiative intends to produce low emission, low carbon fuels from local supplies such as construction and demolition site debris (wood based), railway ties, and other energy containing materials that aren’t presently recycled” (Lafarge Canada Inc., news release, May 3, 2013, www.lafarge-na.com/wps/portal/na/en/1_8_2-Archive_News [accessed April 4, 2014]). The company employs 105 people at the Bath site.

Holcim (Canada) 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. In the first 9 months of 2013, Holcim reported North American cement sales of 8.7 million tonnes, which was a decrease of 1.9% from the same period in 2012. Sales in Canada were not able to recover from weather-related setbacks in the first half of the year (Holcim Ltd., www.holcim.com, under Investor Relations, “Third Quarter 2013”).

ESSROC Canada Inc., a subsidiary of Italcementi Group, operates a quarry and cement plant at Picton with production capacity of about 1.2 million tonnes of clinker. The company employs 136 people at the Picton site. Italcementi reported a slight decrease in revenues on cement sales in North America for the first 9 months of 2013, down 0.3% from the same period in 2012, due to severe weather conditions in the first half of the year and a decline in the Canadian market (Italcementi Group, www.italcementigroup.com, under Investor Relations, “Q3 2013 Results”).

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.

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 2013, 22 quarries were licensed under the *Aggregate Resources Act* to extract dimension stone for building, landscaping and flagstone markets in the County of Bruce. An additional 15 quarries are licensed to extract stone in the neighbouring County of Grey. There are several additional sites in the Wiarton area that are currently in preparation for licensing under the *Aggregate Resources Act*. Rowell (2012) 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 on development, including the Niagara Escarpment Plan, which 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, Nepean Formation (Cambrian age) sandstone 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). Nepean Formation sandstone is also a popular landscaping stone. For more information on the Rideauview Contracts sandstone quarries, see "Property Examinations".

ORILLIA AREA QUARRIES

Five companies operate a total of 7 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. Dolostone from the Gull River Formation is extracted for use as landscape and dimension stone (Ontario Prospectors Association 2014; E. Attia, Attia Quarries, personal communication, August 2013). All of these quarries are situated on lands where both mining and surface rights are privately owned.

PETERBOROUGH AREA QUARRIES

There has been a long history of dimension production in the Peterborough area. In 2013, 6 companies operated 6 dimension-stone quarries in the Peterborough area. Stone from these quarries is produced for export as well as for local markets.

In 4 of the quarries, 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. The Parnell quarry in Galway Township is located on a contact between the Paleozoic sedimentary rock and Proterozoic metamorphic rock of the Canadian Shield. In addition to Gull River Formation dolostone, wine-coloured granite has been quarried at this site. At the Plourde quarry in Chandos Township, a blue-grey interbedded marble and amphibolite unit is quarried to produce "Elite Blue" dimension stone. Four of these quarries are situated on lands where both mining and surface rights are privately owned. The remaining 2 quarries are located on Crown land (Ontario Prospectors Association 2014).

ADVANCED EXPLORATION AND DEVELOPMENT

Gold

CALIFORNIA GOLD MINING INC. – 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. The company calculated probable and possible reserves (NI 43-101–non-compliant) of 8.5 million tons grading 0.043 ounces of gold per ton. 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–compliant mineral resource estimate report was completed (Roscoe 2011); key information from that report was announced by Upper Canada Gold Corporation (Upper Canada Gold Corporation, news release, February 8, 2011) and is summarized as follows:

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 Au (361 000 ounces contained gold).
- Inferred mineral resources of 1.7 million tonnes averaging 0.73 g/t Au (40 000 ounces contained gold).

In addition to the mineral resources defined within the open pit design area, the report estimates an additional exploration target on the Dingman property of 8 million to 14 million tonnes at an average grade of 0.8 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.

The report concluded that the proposal to mine 10.64 Mt of ore at a grade of 0.92 g/t Au for a total production of 290 000 ounces gold is not feasible at a base gold price of \$1500 per ounce and that the project should be re-evaluated if gold prices stabilize at greater than \$1800 per ounce.

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). In 2012, the company continued the environmental survey while exploration work was on hold, pending the resolution of an access and land disturbance compensation agreement with the surface rights owners.

In April 2013, the company name was changed from Upper Canada Gold Corp to California Gold Mining Inc. and an NI-43-101–compliant Economic Feasibility Study on the Dingman gold prospect was released (Cox and Roscoe 2013).

Graphite

Demand for graphite began to increase in 2009 and continued to increase into 2012. In 2013, China, the world's leading supplier of graphite, announced cutbacks in production. A decrease in China's exports combined with higher demand for the use of graphite in batteries is expected to lead to a higher price and greater opportunities for development of graphite deposits in Canada (Resource Investing News (<http://resourceinvestingnews.com/>), "2014 Graphite Outlook, Price Rebound, Supply Shift and New End Uses", January 14, 2014 [accessed January 16, 2014]).

The United States Geological Survey (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, which 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 ground-breaking 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 one relatively new prospect, the Bobcaygeon property of Valterra Resource Corp., which reported encouraging results in 2013.

In 2013, 2 companies continued to work toward the development of advanced-stage graphite projects in eastern Ontario: Northern Graphite's Bissett Creek deposit, Maria Township; and Ontario Graphite's Kearney deposit, Butt Township. Sabre Graphite Inc. acquired the Bedford Township and Burgess Township deposits of Mega Graphite Inc. and conducted a geophysical survey, in addition to completing an NI 43-101 technical report based on the results of previous exploration work on the properties.

ONTARIO GRAPHITE LTD. – KEARNEY MINE

Ontario Graphite Ltd. (www.ontariographite.com) is re-commissioning the Kearney Mine in Butt Township, near Huntsville (Photo 2). The company reports that, when reactivated, the mine will process an estimated 1 million tonnes of ore per year to produce 20 000 tonnes of natural, large flake, high-carbon graphite concentrate.

The deposit was first brought into production in 1989 and remained operational through 1994, during which time it achieved a peak production rate of 10 000 tonnes per year of flake graphite product. The mine has been under new ownership and management since 2007. An NI 43-101 report, completed in January 2010, confirmed 43.5 million tonnes of Measured and Indicated Resources (2.34% Cg⁸ average) and 12.3 million tonnes of Inferred Resources (2.42% Cg average).

A Closure Plan was submitted and accepted by Ministry of Northern Development and Mines (MNDM) in March, 2012. On May 13, 2013, Ontario Graphite Ltd. announced that all final operating permits for the re-commissioning of the Kearney Graphite Mine have been approved by the Ministry of the Environment and that the "company is now fully permitted and has all required approvals from the Ontario government to begin operation". The re-commissioning of the mine is expected to provide approximately 80 direct full-time jobs and potentially up to three times that number in spin-off positions (Ontario Graphite Ltd., news release, May 13, 2013).

⁸ "Cg" is a calculated value: graphite as carbon = total carbon less the amount of carbon present as CO₂.

In September 2013, Ontario Graphite announced a new “NI 43-101 compliant Mineral Resource Estimate, conducted in August 2013, reporting higher Indicated and Inferred Mineral Resources at the Kearney Graphite Mine, nearly doubling the previously estimated Indicated Resources. The revised estimate indicates a mineral inventory ... of 51.5 million tonnes of Indicated Mineral Resources at an average grade of 2.14 per cent carbon graphite (Cg), plus an additional 46.8 million tonnes of Inferred Mineral Resources at an average grade of 2.0 per cent Cg” (Ontario Graphite Ltd., news release, September 19, 2013).



Photo 2. Kearney mine site, Ontario Graphite Ltd., Butt Township. (Photo courtesy of Ontario Graphite Ltd.)

NORTHERN GRAPHITE CORPORATION – BISSETT CREEK DEPOSIT

Northern Graphite Corporation (www.northerngraphite.com) continued the evaluation of the Bissett Creek graphite deposit in Maria Township. The property is located in northern Renfrew County, in the Southern Ontario Mining Division, but is approximately 2 km north of the boundary of the Southern Ontario Resident Geologist Region. In January 2012, the company, a subsidiary of Industrial Minerals Inc., reported positive results from pilot plant tests on a 130 tonne bulk sample of graphitic ore taken in 2011 (Northern Graphite Corporation, news release, January 11, 2012): final concentrates of flake graphite averaged almost 80% +80 mesh, of which 50% averaged +48 mesh at 97.7% Cg). The following information is summarized from Northern Graphite Corporation news releases (www.northerngraphite.com, *under Media | News Releases* [accessed January 16, 2014]).

In July 2012, the company reported a positive bankable feasibility study, proposing development of an open pit mine and a 2300 tonnes per day flotation processing plant. The report lists NI 43-101-compliant probable reserves of 11.98 million tonnes averaging 1.89% Cg (Northern Graphite Corporation, news release, July 9, 2012).

In October 2012, the company began a 3000 m diamond-drilling program intended to upgrade inferred resources to the indicated category in the area of the proposed open pit shell (Northern Graphite Corporation, news release, October 1, 2012).

In January 2013, the company awarded a \$3.5 million contract for the detailed design of a 2500 tonnes per day processing facility and related infrastructure. The plant, designed to produce 20 000 tonnes of large flake, high-purity graphite per year, is scheduled to begin production in late 2014 (Northern Graphite Corporation, news release, January 18, 2013).

In March, the company released results of the late 2012 diamond-drilling program consisting of 61 holes, totalling 3425 m. The company reports that all holes returned graphite assays equal to or better than those used in the 2012 bankable feasibility study and a new resource estimate is in progress (Northern Graphite Corporation, new release, March 7, 2013).

In August, Northern Graphite announced that, having received government approval for the Closure Plan for the Bissett Creek deposit, the company, subject to the availability of financing, could advance to the next phase of the project. Aspects of the operating plan and the bankable feasibility study were being revised to incorporate a new, larger resource and lower graphite prices, as well as a number of modifications to the original capital and operating cost assumptions. Northern Graphite stated it would replace contract mining with an owner mining structure, which would reduce operating costs by over \$100/t of concentrate, while injecting an additional \$7-million in capital for mining equipment, which would be offset as detailed engineering, modifications to the semi-autogenous grinding mill drive and discharge, the use of a mobile crusher and the removal of a redundant mill circuit, reduced or eliminated costs (Northern Graphite Corporation, news release, August 26, 2013).

In September, Northern Graphite announced the development of a proprietary process for purifying concentrates that has consistently achieved 99.95%+ C purity levels in laboratory- and bench-scale testing. The company “has completed bulk sample and pilot plant testing which provided a representative sample of the concentrates that will be produced from the commercial process. ... [L]aboratory scale testing on these concentrates resulted in a process that ... purified micronized, spherical and flake graphite to 99.95%+C levels. This process has subsequently been tested in bench scale models of commercial equipment and spherical graphite with 99.95%+C purity has been consistently produced. Flake graphite purities as high as 99.9%+C have been achieved at the bench scale and further optimization work is ongoing” (Northern Graphite Corporation, news release, September 30, 2013).

In October, Northern Graphite announced the completion of a Preliminary Economic Assessment on future expansion of production. Specifically, the report estimates the economics of doubling plant throughput after 3 years of production (Northern Graphite Corporation, news release, October 23, 2013).

SABRE GRAPHITE CORP. – BEDFORD PROJECT AND BURGESS PROJECT

In May 2013, Paramax Resources Ltd. acquired the Bedford and Burgess graphite prospects previously held by Mega Graphite Inc. and in June, the company name was changed to Sabre Graphite 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 Burrige (Graphite Mountain) property. Diamond drilling of the Meadow zone in 1999–2000, consisting of 18 holes totalling 900 m, indicated 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 grading 7% Cg was reported (NI 43-101 non-compliant). Processing and separation tests were also conducted at that time (McKinnon and LeBaron 1992).

Airborne geophysical surveys were completed over the entire property in 2009 by Cardinal Explorations Inc. and an NI 43-101 report was completed for Mega Graphite Inc. in 2011 (Winter 2011).

Between February 4 and February 11, 2013, a gradient induced polarization survey, comprising 4.5 line-kilometres, was carried out over the southern part of the Meadow zone of the Bedford property. The objective of the work was to determine if some of the zones of flake graphite mineralization could be better defined.

In March, 2013, an NI 43-101 technical report on the Bedford and Burgess properties was completed for Mega Graphite by L.D.S. Winter (but appears to be unpublished); however, the results of the report are summarized in an information circular released jointly by Paramax Resources Ltd. and Mega Graphite Inc. (Paramax Resources Ltd.–Mega Graphite Inc. 2013). Sabre Graphite Inc. intends to follow the recommendations for exploration that are provided in the report, which include geological mapping, trenching, stripping and IP geophysical surveys in Phase 1, followed by diamond drilling, totalling 2500 m, in Phase 2.

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 2013.

Abbreviations						
AEM	.....	Airborne electromagnetic survey	IP	.....	Induced polarization survey	
AM	.....	Airborne magnetic survey	Lc	.....	Line cutting	
ARA	.....	Airborne radiometric survey	Met	.....	Metallurgical testing	
Beep	.....	Beep Mat survey	OD	.....	Overburden drilling	
Bulk	.....	Bulk sampling	ODH	.....	Overburden drill hole(s)	
DD	.....	Diamond drilling	PEM	.....	Pulse electromagnetic survey	
DDH	.....	Diamond-drill hole(s)	PGM	.....	Platinum group metals	
Enviro	.....	Environmental base line survey	Pr	.....	Prospecting	
GC	.....	Geochemical survey	RES	.....	Resistivity survey	
GEM	.....	Ground electromagnetic survey	Samp	.....	Sampling (other than bulk)	
GL	.....	Geological survey	Seismic	.....	Seismic survey	
GM	.....	Ground magnetic survey	SP	.....	Self-potential survey	
GRA	.....	Ground radiometric survey	Str	.....	Stripping	
Grav	.....	Gravity survey	Tr	.....	Trenching	
HLEM	.....	Horizontal loop electromagnetic survey	UG	.....	Underground exploration/development	
HM	.....	Heavy mineral sampling	VLEM	.....	Vertical loop electromagnetic survey	
IM	.....	Industrial mineral testing and marketing	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	Barrie (Au, Ag)	Willwin International Inc.	2011	Assay, DD	2.53383	115
2	Bedford (Graphite)	Mega Graphite Inc.	2013	IP	2.53583	49
3	Belmont (Cu, Ni, PGM)	First Nickel Inc.	2012	Assay, GL, Pr	2.53184	29
4	Butt (Graphite)	Dan Patrie Exploration Ltd.	2012, 2013	Assay, Pr	2.53520	66
5	Butt (Graphite)	Sheehan, V.E.	2012	Pr	2.53231	65
6	Butt (Graphite)	Sheehan, V.E.	2013	Lc	2.54542	68
7	Cardiff (Mineral specimens)	The Corporation of the Municipality of Highlands East	2011–2013	Pr	2.54017	250
8	Cardiff (Mineral specimens)	The Corporation of the Municipality of Highlands East	2012, 2013	Pr	2.54016	249
9	Cardiff (U, Th, REE)	Skead Holdings Ltd.	2013	Spectrometer	2.54238	251
10	Cardiff (U, Th, REE)	Skead Holdings Ltd.	2013	Spectrometer	2.54332	253
11	Cardiff, Monmouth (U, REE)	CJP Exploration Inc.	2011–2013	Assay	2.54144	248, 172
12	Cardiff, Monmouth (U, Th, REE)	Skead Holdings Ltd.	2012, 2013	Assay, Pr	2.54244	252, 174
13	Dungannon (Mineral Specimens)	Bancroft Gem and Mineral Club	2013	Pr	2.54165	52
14	Effingham (PGM, Au, diamond)	Lawrence, R.D.	2013	Pr	2.54064	15
15	Elzevir, Hungerford (Granite)	Danford Granite Ltd.	2012	DD	2.53132	35, 10
16	Galway (Syenite trap rock)	1447136 Ontario Inc., Earth Resources Ltd.	2012, 2013	Assay, Enviro, GL, Lc, DD	2.54241	71
17	Glamorgan (Mineral specimens)	The Corporation of the Municipality of Highlands East	2012, 2013	Pr	2.54020	33
18	Grimsthorpe (Gold)	Chard, J., Dillman, R.	2013	Microscope, Pr	2.53557	93
19	Grimsthorpe (Gold)	Chard, J., Dillman, R.	2013	Assay	2.53702	92
20	Lake (Cu, Ni, PGM)	First Nickel Inc.	2012, 2013	Assay, Pr	2.53933	34
21	Madoc (Basalt)	Reed, A.A.	2013	Bulk, Str	2.54131	164

No.	Township or Area (Commodity)	Company Name	Year	Type of Work	AFRO Number	Resident Geologist Office File Designation
22	Marmorata (Gold)	Neczkar, E.	2010–2012	Assay, GC	2.53399	115
23	Methuen (Base metals)	Trigan Resources Inc.	2012	Assay, GC	2.53221	58
24	Monmouth (Mineral specimens)	The Corporation of the Municipality of Highlands East	2011–2013	Pr	2.54018	173
25	North Burgess (Graphite)	Mega Graphite Inc.	2013	GL	2.54006	30
26	Tudor (Gold)	Chard, J., Dillman, R.	2011, 2012	Assay, DD	2.53608	130

Table 4. Exploration activity in the Southeastern Ontario District in 2013 (keyed to Figure 3).

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

No.	Company/Individual	Township/Area (Commodity)	Exploration Activity
1	1447136 Ontario Inc., Earth Resources Ltd.	Galway (Syenite trap rock)	Assay, Enviro, GL, Lc, DD
2	Reed, A.A.	Madoc (Basalt)	Bulk, Str
3	Bancroft Gem and Mineral Club	Dungannon (Mineral specimens)	Pr
4	Brunette, B.	Maria, Clara (Garnet)	GL, Samp, IM
5	California Gold Mining Inc.	Madoc, Marmorata (Au)	NI 43-101 Report
6	Chard, J., Dillman, R.	Grimsthorpe (Gold)	Microscope, Pr
7	Chard, J., Dillman, R.	Grimsthorpe (Gold)	Assay
8	CJP Exploration Inc.	Cardiff, Monmouth (U, REE)	Assay
9	Colonial Brick and Stone	Chandos (Stone)	Pr
10	Corporation of the Municipality of Highlands East	Cardiff (Mineral specimens)	Pr
11	Corporation of the Municipality of Highlands East	Cardiff (Mineral specimens)	Pr
12	Corporation of the Municipality of Highlands East	Monmouth (Mineral specimens)	Pr
13	Corporation of the Municipality of Highlands East	Glamorgan (Mineral specimens)	Pr
14	Crown William Mining Corp.	Tudor, Grimsthorpe, Anglesea (Au)	Drill core re-log, Sample assay
15	Dan Patrie Exploration Ltd.	Butt (Graphite)	Assay, Pr
16	Dubblestein, A.	Lyndoch (Graphite, marble, diopside)	Assay, Pr
17	First Nickel Inc.	Lake (Cu, Ni, PGM)	Assay, Pr
18	Glanfield, M.	Barrie (Au)	GC, Assay, Pr
19	Graf, W.	Faraday (Marble)	IM
20	J.D. Exploration Inc.	Hindon (Cu)	Pr
21	Lawrence, R.D.	Effingham (PGM, Au, diamond)	Pr

No.	Company/Individual	Township/Area (Commodity)	Exploration Activity
22	Ontario Graphite	Butt (Graphite)	NI 43-101 Report, Closure Plan completed
23	Sabre Graphite Inc.	North Burgess (Graphite)	NI 43-101 Report
24	Sabre Graphite Inc.	Bedford (Graphite)	IP, NI 43-101 Report
25	Sheehan, V.E.	Butt (Graphite)	Lc
26	Skead Holdings Ltd.	Cardiff (U, Th, REE)	GRA
27	Skead Holdings Ltd.	Cardiff (U, Th, REE)	GRA
28	Skead Holdings Ltd.	Cardiff, Monmouth (U, Th, REE)	Assay, Pr
29	Union Glory Gold Ltd.	Kaladar (Au)	Drill core re-log, Samp, Assay, GL
30	Union Glory Gold Ltd.	Tudor (Au)	Exploration permit acquired
31	Valterra Resources Corp.	Cavendish (Graphite)	GL, Pr, Tr, GM, GEM, IP
32	Wilson, M.	Sheffield (Marble, Mo)	GL, Samp, Assay, Beep
33	Laidlaw, J.	Cashel (Talc)	Pr
34	Laidlaw, J.	Grimsthorpe (REE, Au)	Drill core re-log, Magnetic susceptibility
35	Forget, M.	Barrie (Au)	Pr

Gold

UNION GLORY GOLD LIMITED – TUDOR TOWNSHIP

The Tudor gold property consists of a group of unpatented mining claims covering 1000 ha extending from northeastern Tudor Township into Grimsthorpe and Anglesea townships. In 2011, Union Glory Gold Ltd. optioned the property from R. Dillman and J. Chard and completed a diamond-drill program consisting of 10 holes, totalling 1675 m. The following results of the program are summarized from an assessment report submitted in 2013 (McBride 2012).

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 intersected gold mineralization. The Main zone consists of a unit of felsic, lapilli tuff containing a zone of fine-grained, pink, siliceous tuff, previously termed “felsite”, which hosts arsenopyrite mineralization and quartz stringers. Gold mineralization occurs near the eastern margin of the felsite unit and has been delineated by stripping and diamond drilling over a strike length of greater than 5 km. Assays from previous drilling programs returned gold values ranging from 0.20 to 10.82 g/t Au and included 1 notable 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 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”, “Opatatika Mining Corporation – Tudor Gold Property”).

The 2011 program was designed to test the Main zone at a vertical depth of about 100 m over a strike length of 500 m. All holes intersected gold mineralization within a unit of felsic tuff (felsite). Best intersections range from 0.89 g/t Au over a core length of 20 m to 1.24 g/t Au over 18.05 m and 2.53 g/t Au over 9.0 m. A follow-up diamond-drilling program, totalling 4000 m in depth, was recommended to test the zone at a vertical depth of 50 m below the level of the 2011 program. In December 2013, the company obtained a work permit to conduct diamond drilling on the Tudor property, which is expected to begin early in 2014.

EXPLORATION ACTIVITY AND CLAIM STAKING ACTIVITY SOUTHEASTERN ONTARIO RESIDENT GEOLOGIST'S DISTRICT

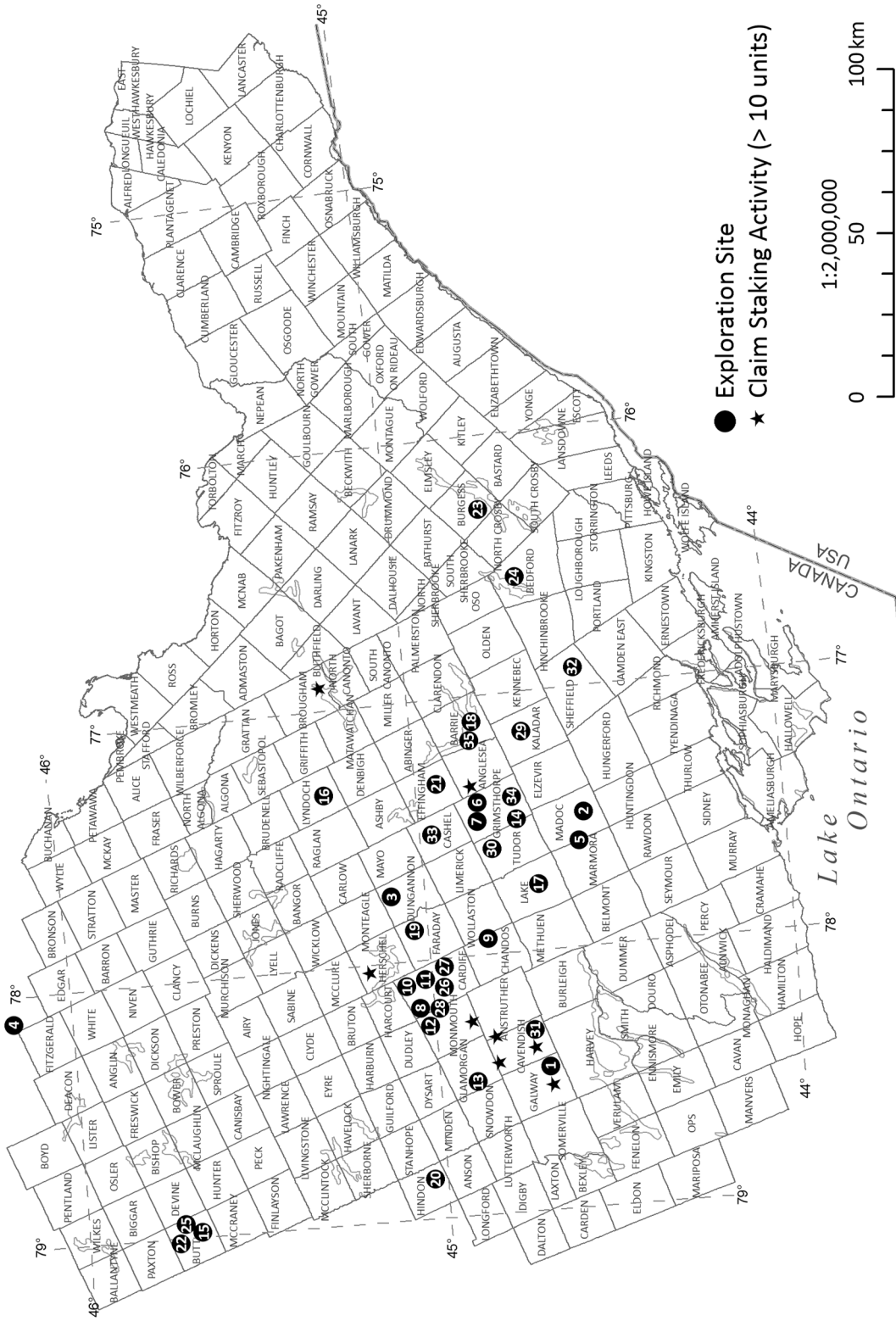


Figure 3. Exploration activity in the Southeastern Ontario District in 2013 (keyed to Table 4).

UNION GLORY GOLD LIMITED – ADDINGTON GOLD MINE, KALADAR TOWNSHIP

Union Glory Gold Limited has entered an option agreement to conduct exploration on the Addington gold mine property of Imperial Metals Corporation in Kaladar Township. In 2013, the company re-logged and sampled archived diamond-drill core from the property, stored at the MNM Drill Core Library, Tweed.

A total of 206 samples were taken from 15 diamond-drill holes completed in 1988 by Michele Gold Mines Limited. A technical report based upon results of previous work on the property and including results of the 2013 sampling program was completed, but has not yet been released by the company (C. Chan, Union Glory Gold Ltd., personal communication, January 2014).

The Addington mine produced about 480 ounces of gold prior to 1921 from a quartz-tourmaline vein zone at the contact between Flinton Group metasedimentary rocks and Tudor Formation mafic metavolcanic and metasedimentary rocks. Previous resource estimates range from 256 000 tons grading 0.16 ounces of gold per ton by Addington Mines Limited in 1939 to 318 000 tons grading 0.13 ounces of gold per ton by Michele Gold Mines in 1988 (LeBaron 1991).

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 km² in the townships of Tudor, Grimsthorpe, Cashel and Effingham in southern Ontario. During 2011, 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 2011, the company acquired the Bannockburn project, formerly known as 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, which resulted in an NI 43-101–non-compliant historical indicated and inferred resource estimate of 372 154 tons grading 0.395 ounces of gold per ton (Sawyer Consultants Inc. 1987).

In 2013, Crown William Mining contracted Fladgate Exploration Consulting Corporation of Thunder Bay to conduct a program of logging and sampling archived drill core from the property, now stored at the MNM Drill Core Library in Tweed. A total of 446 samples were taken from 25 drill holes completed between 1985 and 1996. The company was in the process of obtaining permits to conduct additional diamond drilling and to dewater the workings for an underground exploration program in 2014 (A. Schweitzer, Crown William Mining Corp., personal communication 2013).

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, currently under option to Union Glory Gold Ltd. Gold mineralization is associated with quartz veins and carbonate alteration in mafic metavolcanic rocks and with quartz vein and/or arsenopyrite zones in silicified and sericite-altered felsite within the volcanic sequence.

Graphite

Of the 5 grass-root, graphite exploration projects in southeastern Ontario that were active in 2011–2012 (described by Sangster et al. 2013), only one, Valterra Resource Corporation (described below), conducted an active field program in 2013.

Standard Graphite Corp. and Olympic Resources Ltd. were not active in southeastern Ontario in 2013. Terra Firma Resources Inc., which had acquired the Beidelman–Lyll graphite prospect in Lyndoch Township from Standard Graphite Corp. in 2012, reported no exploration work and terminated the option in 2013.

Big North Graphite Corp., which had optioned properties in Griffith and Brougham townships from Standard Graphite Corp. in 2012, released a revised NI 43-101 technical report on the project in March of 2013 (Harron 2013). The report recommended additional prospecting, trenching and stripping, but no work was done on the property in 2013.

VALTERRA RESOURCE CORPORATION – BOBCAYGEON GRAPHITE PROPERTY

In June 2012, Valterra Resource Corporation optioned the Bobcaygeon graphite property, consisting of over 5500 ha in Cavendish Township. Graphite was discovered on the property in 2003 during trenching completed as part of a vermiculite exploration program. The graphite occurs as veins within calcitic marbles on the west margin of a syenitic amphibolite unit and the contact is traceable for up to 10–12 km. The following information is summarized from Valterra Resource Corporation news releases (www.valterraresource.com, see News | 2012 Archive, and News | 2013 Archive [accessed January 22, 2014]).

In October 2012, the company reported that a 20 kg sample of graphitic marble returned an assay of 34% graphitic carbon, primarily in the form of flakes up to 3 mm in length (Valterra Resource Corporation, news release, October 17, 2012).

The company began a ground exploration program on the property in November 2012. Magnetic, electromagnetic and induced polarization surveys were done on an 11 line-kilometres grid over the main occurrence and flanking stratigraphy (Valterra Resource Corporation, news release, November 5, 2012).

In December 2012, trenching was done on, and stepping out from, the initial discovery. The trenching “identified a 20m lateral exposure of high grade graphite with trenching bottoming in graphite suggesting a minimum thickness of this lens at 1.5m.” The trenching yielded assay results from 7.76 to 36.8% Cg over 1.5 m (Valterra Resource Corporation, news release, January 15, 2013).

In March 2013, 5 holes, totalling 145.75 m, were drilled to test the area of the discovery trench at shallow depth. Best intersections were 2.4% Cg over 2.68 m and 6.36% Cg over 3.38 m, both of which include high-grade intervals from 0.5 to 0.6 m wide (Valterra Resource Corporation, news release, April 19, 2013).

In May 2013, the company reported the discovery of a new zone of graphite mineralization about 1.5 km north of the discovery area and at least 1 km long (Valterra Resource Corporation, news release, May 2, 2013). Valterra also reported that continued testing of a bulk sample from the discovery trench produced an ultra-high-purity, fine flake graphite concentrate of 99.97% C (Valterra Resource Corporation, news release, May 13, 2013).

In June 2013, the company reported “grab and chip sampling results of up to 28.1% Cg from ... regional prospecting which identified three new graphite prospects located up to 23km on-strike from the Bobcaygeon Discovery Zone”. Of 27 surface grab or chip samples collected, 41% of the samples returned values greater than 1% Cg. Sample highlights at the newly defined Salerno zone included “28.1% Cg from a 10cm wide graphite seam and 15.7% Cg over 1.5m in a marble host unit. Preliminary mapping at the zone identified three graphite seams up to 1.5m thick hosted in a 25m wide favourable marble horizon” (Valterra Resource Corporation, news release, June 5, 2013).

On December 5, 2013, Valterra Resource Corporation reported “channel sample results of up to 1.7 metres grading 5.7% Cg from recent regional prospecting and mapping on the Bobcaygeon Project”. The highest grade results were obtained 24 km from the Discovery zone at the Salerno zone, defined by historic drill records and mapping. Valterra budgeted \$500 000 to \$750 000 for the next phase of exploration work in the Discovery zone area and regionally within the 190 km² property. Preliminary plans include diamond drilling of between 2000 to 2500m (Valterra Resource Corporation, news release, December 5, 2013).

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.

From 2009 to 2012, First Nickel Inc. (www.firstnickel.com) explored 3 nickel-copper-platinum group element (PGE) prospects in southeastern Ontario. The project exploration model is the Voisey's Bay-type nickel-copper mineralization and low-sulphide PGEs associated with mafic and ultramafic intrusions.

In 2009, the company was successful in identifying a new zone of PGE mineralization associated with the Moccasin Lake mafic intrusion in Raglan Township. The results of the 2009 diamond-drill program, which include assays of 1.98 g/t Pt + Pd over a width of 5.05 m, are summarized by Sangster et al. (2010). A detailed description of property geology, mineralization and exploration activities from 2008 to 2012 is provided by Sangster et al. (2012, 2013).

The First Nickel Inc. financial report for 2012 was released in April 2013, in which it is reported that the company has no plans for additional exploration work on the Belmont and Raglan projects (First Nickel Inc., news release, April 2, 2013, www.firstnickel.com, *under* Investor | Press Releases | 2013, "First Nickel Reports 2012 Financial and Operating Results" [accessed January 23, 2014]).

Ontario Exploration Corporation Projects

The Ontario Exploration Corporation (OEC) was established to assist and encourage prospecting in Ontario. Founded in 2002 and owned by the Ontario Prospectors Association (OPA), the OEC's grant program replaced the provincial government's Ontario Prospectors Assistance Program (OPAP). The first phase of the program is for a maximum of \$10 000, half of which is provided upon approval of the funding. The other \$5000 is awarded after the prospector files an assessment report with the Ministry of Northern Development and Mines. The OEC takes a 1% NSR on this initial \$10 000. If a claim proves to have no economic potential, the prospector is under no obligation to repay the funds. If the results of phase 1 exploration justify additional work, prospectors can apply for phase 2 funding of \$25 000, and another \$50 000 for phase 3 of the program. There were 2 OEC-funded projects in progress in southeastern Ontario in 2013.

M. WILSON, SHEFFIELD TOWNSHIP

A marble and molybdenite exploration proposal submitted by M. Wilson was approved for OEC funding in 2013. The property, in Sheffield Township, consists of an 8-unit mining claim covering the southern half of a lens-shaped area of marble, approximately 2 by 4 km, bordered by metavolcanic rocks to the west and granitic rock to the east.

Several occurrences of molybdenite are located within granitic intrusions to the north and east of the claim. Small amounts (<1000 tons) of pegmatitic quartz-pyroxenite containing 1% to 2% coarse flakes of molybdenite were mined from 1915 to 1917. One larger deposit, the Chisholm Mine, in Concession XIV, Lot 5, Sheffield Township (about 3.5 km east of Herring Lake), produced about 8000 pounds of molybdenite from 10 000 tons of ore from a sulphide-bearing skarn at the contact between marble and granite (Malczak, Carter and Springer 1985).

The exploration program, conducted by M. Wilson with assistance from local prospector, M. Forget, was designed to evaluate both the potential for economic molybdenite mineralization and the potential of the marble for dimension stone and/or aggregate. Molybdenite potential was investigated by geological mapping, sampling, and a beep mat survey. Outcrop areas of white to pale grey marble exhibiting very wide joint spacing, with potential use as dimension stone, landscaping stone and decorative aggregate, were evaluated by mapping, sampling and testing for abrasion resistance, compressive strength and modulus of rupture. A report on the exploration program has been submitted to the OEC, but has not yet been filed for assessment work (M. Forget, Prospector, personal communication, December 2013).

For additional details on the geology and mineral potential of the Wilson property, *see* "Property Examinations" "M. Wilson Property, Sheffield Township" in this report.

M. GLANFIELD, BARRIE TOWNSHIP

M. Glanfield began an OEC-funded project on his claims in Barrie Township in 2013. The property consists of 2 single-unit claims, covering a historic gold prospect known as the Pay Rock occurrence. The property is described in detail by Sangster et al. (2012, p.31-33, under “Property Examinations”).

The known gold mineralization occurs within a zone of rusty-weathering, silicified, dolomitic marble near the unconformable contact with overlying Flinton Group metaconglomerates. The exploration program is designed to evaluate the gold potential of the original Pay Rock occurrence and to investigate the possibility for similar mineralization along the favourable marble-conglomerate unconformity.

Assisted by J. Laidlaw, the owner conducted a program of prospecting, rock sampling and soil geochemical sampling, to be followed up in 2014 by cleaning and resampling the original trenches, and new trenching in the area of any anomalous gold concentrations indicated by the 2013 soil sampling program. A complete report on the results will be submitted to the OEC in 2014 upon completion of the program (M. Glanfield, personal communication, December 2013).

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, District Geological Assistant. A.C. Wilson, *P.Geo.* Mineral Deposit Compilation Geologist—Northeastern Ontario, 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 and is included in this report.

Additional support was provided by S. Peelow, Administrative Assistant to the Senior Manager, Resident Geologist Program, Sudbury. J. Bremner provided on-call contract administrative assistance. Summer Experience Program student J. VanExan provided field season support.

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.

The Southern Ontario Regional Resident Geologist’s office in Tweed offers public access to a complete library of Ontario Geological Survey publications for southern Ontario and a technical library of related publications. Diamond-drill core from industry and government projects across southern Ontario is available for examination with prior appointment.

In 2013, the project to convert all office files to a high-density system continued. To date, mineral deposit inventory files, assessment files, drill-core library, maps and technical papers have been incorporated. A library of industrial mineral references, formerly stored with the MNDM Mineral Development and Lands Branch in Sudbury is being indexed and filed for public access, as time permits.

Special Projects

In 2013, the Resident Geologist collaborated with D.J. Rowell, Geologist, Earth Resources and Geoscience Mapping Section, Ontario Geological Survey, in a scoping study designed to sample selected exposures of Nepean Formation sandstone in southeastern Ontario as potential resources for industrial sand applications. A detailed description of the project and results was published (Sangster and Rowell 2013).

There are over 6000 mineral occurrences in southern Ontario documented in the Ontario Mineral Deposit Inventory (MDI) database. Staff of the Southern Ontario Regional Resident Geologist's office work with A.C. Wilson, Mineral Deposit Compilation Geologist—Northeastern Ontario, on an ongoing basis to ensure the integrity of the database. Site investigations to confirm the presence and accurate location of MDI data points are an essential part of the process. During the 2013 field season, visits were made to MDI locations in Bastard, Bathurst, Belmont, Burgess, Clarendon, Darling, Elmsley and Leeds townships. In general, MDI records were validated; however, several locations were corrected based on new GPS readings. An occurrence of “green jasper” in Clarendon Township was found to be epidote.

First Nations Interactions

During 2013, activities co-ordinated by the Aboriginal Relations Branch included introductory meetings with the Regional Resident and District geologists, Mineral Development and Lands Branch staff and First Nation representatives. Meetings were held with Alderville, Curve Lake and Sarnia First Nations.

In addition, the Resident Geologist and/or District Geologist provided introductory mineral exploration and geology talks and/or geology field trips with MNDM First Nations Mineral Information Officer, S.E. Halet, to classes at Curve Lake, Pembroke and the Canadian Ecology Centre in Mattawa. In August, the Bancroft First Nation invited the Resident Geologist office to present an information booth at the Algonquin Nation Gathering in Bancroft.

Presentations

Staff assisted in the development and presentation of the Ontario booth at the Prospectors and Developers Association of Canada annual convention. Contributions were made to the Resident Geologist Program poster for the Ontario Exploration and Geoscience Symposium in Sudbury where the Resident Geologist presented a talk on “Critical Minerals in Southern Ontario”. A meeting was organized for a client group including the Southern Ontario Prospectors Association in April, featuring updates on Mining Act Modernization presented by J. Fairchild, MNDM Mineral Development and Lands Branch.

Mineral Shows, Outreach and Field Trips

Staff presented a poster and mineral display at the Bancroft GemBoree, highlighting historic and current mineral collecting sites within 100 km of Bancroft. The District Geologist gave a presentation on “Gold – History, Geology and Southern Ontario Exploration”. The four-day event traditionally hosts 8000 to 10 000 attendees with the opening of the new Bancroft Mineral Museum being a focus for the 2013 celebration.

In October, as part of the Ancaster Gem and Mineral Show, the Resident Geologist gave a series of talks to 300 elementary school students and, with the District Geological Assistant, provided a weekend-long poster and sample display.

Mineral samples, maps, reports, field notebooks and MNDM photo-scale cards were provided to the organizers of the Picton Gem and Mineral Show for the annual show in July.

Self-guided geology tours were prepared for County Road 46 and for Highway 7 from Peterborough to Havelock. In conjunction with the annual MRT Aggregates open house, the District Geologist led a field trip in the Kasshabog Lake area.

The District Geologist led a field trip to several dimension-stone quarries and ornamental stone sites for a group of stone sculptors in October.

The Resident Geologist provided a “Geology of the Pembroke Area” tour for a First Nation prospecting class.

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 2013.

Table 5. Program activity statistics (five-year summary) for the Southern Ontario Regional Resident Geologist’s office.

Activity	2009	2010	2011	2012	2013
Field Investigations / Property Visits	32	41	42	45	45
Field Trips Given / Field Guides Written	3	3	3	2	3
MDI Records Revised	61	125	875	265	173
Presentations to Ministry of Municipal Affairs and Housing, Ministry of Natural Resources, Ministry of Aboriginal Affairs	1	5	19	15	14
Clients Visits to RGP–Tweed Office	343	449	430	330	394
Drill Core Library Users	55	275	40	12	114
Client Communications / Interactions (Presentations/Poster Sessions)	>3000	>3000	>3000	>3000	>3000

Diamond-Drill Core Collection

The Resident Geologist’s Office (RGO) maintains an off-site diamond-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 pallets. A smaller collection of core that is less likely to survive outdoor storage is housed at the RGO facility in Tweed. In 2013, industry clients made 114 visits to the examine drill core in the RGO collection.

In 2013, two companies, Union Glory Gold Limited and Crown William Mining Corp., conducted major re-logging and sampling programs on archived diamond-drill core stored at the Tweed Drill Core Library.

Union Glory Gold Limited contracted D. McBride, consulting geologist, to re-log and sample diamond-drill core from the Addington gold mine property in Kaladar Township as part of an initial exploration program designed to confirm previously reported gold mineralization and to provide guidance for follow-up surface exploration and diamond drilling on the property. A total of 206 samples were taken from the cores of 15 holes drilled in 1988 by Michele Gold Mines Ltd. As of January 24, 2014, the company had yet to release a report on the project.

Crown William Mining Corp. contracted Fladgate Exploration Consulting Corporation to conduct a program of logging and sampling of archived drill core from the Mono Gold (Bannockburn) prospect in Madoc Township. A total of 446 samples were taken from the cores of 25 drill holes completed between 1985 and 1996. As of January 24, 2014, no results have been released.

Table 6. Library acquisitions in 2013 by the Southern Ontario District (publications of particular interest to the Southern Ontario District are shown in bold).

Title	Author	Type and Year of Publication
Ontario Precambrian Bedrock Magnetic Susceptibility Geodatabase for 2001 to 2012	T.L. Muir	Ontario Geological Survey, Miscellaneous Release—Data 273 – Revised, 2013
Aggregate Resources Inventory of the City of Ottawa, Southern Ontario	V.L. Lee	Ontario Geological Survey, Aggregate Resources Inventory Paper 191, 2013
Geographic Index to Published Reports, Maps and Digital Data, 2011–2012	Ontario Geological Survey	Ontario Geological Survey, Miscellaneous Paper 178 (Supplement 2011–2012), 46p., 2013
Index to Published Reports, Maps and Digital Data, 2011–2012	Ontario Geological Survey	Ontario Geological Survey, Miscellaneous Paper 177 (Supplement 2011–2012), 45p., 2013
Index to Maps, Surficial Geology 1991–2012, Southern Sheet	Ontario Geological Survey	Ontario Geological Survey, scale 1:1 000 000, 2013
Index to Maps, Bedrock Geology 1991–2012, Southern Sheet	Ontario Geological Survey	Ontario Geological Survey, scale 1:1 000 000, 2013
Report of Activities 2012, Resident Geologist Program, Red Lake Regional Resident Geologist Report: Red Lake and Kenora Districts	A.F. Lichtblau, C. Ravnaas, C.C. Storey, R.L. Debicki, H.C. Lockwood, R.D. Tuomi, S.E. Zurevinski, P. Moses and J. Bongfeldt	Ontario Geological Survey, Open File Report 6283, 132p., 2013
Report of Activities 2012, Resident Geologist Program, Thunder Bay North Regional Resident Geologist Report: Thunder Bay North District	G.D. White, R.M. Cundari, H.C. Lockwood, R.D. Tuomi, R.L. Debicki, P. Moses and S.E. Zurevinski	Ontario Geological Survey, Open File Report 6284, 62p., 2013
Report of Activities 2012, Resident Geologist Program, Thunder Bay South Regional Resident Geologist Report: Thunder Bay South District	M.A. Puumala, D.A. Campbell, R.M. Cundari, S.E. Zurevinski, R.D. Tuomi, H.C. Lockwood, R.L. Debicki, P. Moses, M.R. Brunelle and R. Pelaia	Ontario Geological Survey, Open File Report 6285, 67p., 2013
Report of Activities 2012, Resident Geologist Program, Timmins Regional Resident Geologist Report: Timmins and Sault Ste. Marie Districts	B.T. Atkinson, P. Bousquet, A. Pace, R.L. Debicki, G.P.B. Grabowski, H.C. Lockwood, A.C. Wilson, S.E. Halet, C. Larche, R. McMillan and D.M. Draper	Ontario Geological Survey, Open File Report 6286, 126p., 2013
Report of Activities 2012, Resident Geologist Program, Kirkland Lake Regional Resident Geologist Report: Kirkland Lake and Sudbury Districts	D.L. Guindon, D.G. Farrow, G.P.B. Grabowski, R.L. Debicki, H.C. Lockwood, A.C. Wilson, S.E. Halet, L.A. Bardeggia and N. Sabiri	Ontario Geological Survey, Open File Report 6287, 117p., 2013
Report of Activities 2012, Resident Geologist Program, Southern Ontario Regional Resident Geologist Report: Southeastern Ontario and Southwestern Ontario Districts, and Petroleum Operations	P.J. Sangster, P.S. LeBaron, S.J. Charbonneau, D.A. Laidlaw, A.C. Wilson, T.R. Carter and L. Fortner	Ontario Geological Survey, Open File Report 6288, 78p., 2013
Precambrian Geology of Albnel Township, Southern and Superior Provinces	D. Lewis	Ontario Geological Survey, Preliminary Map P.3773, scale 1:20 000, 2013
Precambrian Geology, Pecors–Whiskey Area	R.M. Easton	Ontario Geological Survey, Preliminary Map P.3775, scale 1:20 000, 2013
Geological, Geochemical and Geophysical Data from the Elliot Lake Area, Southern and Superior Provinces, Ontario	R.M. Easton	Ontario Geological Survey, Miscellaneous Release—Data 305, 2013
Aggregate Resources Inventory of the County of Simcoe, Southern Ontario	D.J. Rowell	Ontario Geological Survey, Aggregate Resources Inventory Paper 188, 2013
Results of the 2008, 2009 and 2010 Drilling Programs in the Orangeville–Fergus Area of Southwestern Ontario	A.K. Burt and J.L. Webb	Ontario Geological Survey, Miscellaneous Release—Data 303, 2013

Title	Author	Type and Year of Publication
Ground Gravity Survey, Residual of the Bouguer Anomaly, Orangeville Area	Ontario Geological Survey	Ontario Geological Survey, Maps 82 588 and 82 589 , scale 1:50 000, 2013
Ontario Geophysical Surveys, Ground Gravity Data, Grid and Point Data (ASCII and Geosoft® Formats) and Vector Data, Orangeville Area	Ontario Geological Survey	Ontario Geological Survey, Geophysical Data Set 1072 , 2013
Aggregate Resources Inventory of the County of Lanark, Southern Ontario	V.L. Lee	Ontario Geological Survey, Aggregate Resources Inventory Paper 189 , 2013
Precambrian Geology, Raglan Hills Metagabbro and Environs, Grenville Province	S.J. Magnus	Ontario Geological Survey, Preliminary Map P.3774 , scale 1:20 000, 2013
Geological, Geochemical, Geophysical and Petrographic Data from the Raglan Hills Area, Central Metasedimentary Belt, Grenville Province	S.J. Magnus	Ontario Geological Survey, Miscellaneous Release—Data 309 , 2013
Aggregate Resources Inventory of the County of Perth, Southern Ontario	D.J. Rowell	Ontario Geological Survey, Aggregate Resources Inventory Paper 175 , 2013
Gas Assessment of the Devonian Kettle Point Formation	C. Béland Otis	Ontario Geological Survey, Open File Report 6279 , 63p., 2013
Geological, Geochemical and Geophysical Data from the Kettle Point Formation Drilling Program, Southern Ontario	C. Béland Otis	Ontario Geological Survey, Miscellaneous Release—Data 304 , 2013
Summary of Field Work and Other Activities, 2013	Ontario Geological Survey	Ontario Geological Survey, Open File Report 6290 , 584p., 2013
Fault Locating with an Engineering Seismograph	L.G.D. Thompson	Ontario Ministry of Natural Resources, 1985
Flotation Study on Three Types of Talc Containing Ore	I.M.D. Laboratories Ltd.	I.M.D. Laboratories Ltd., 1988
Geophysical Methods as Mapping Tools in Strata-Bound Gold Deposit: Haile Mine, South Carolina Slate Belt	J.C. Wynn, R.W. Luce	Economic Geology, v.79, p.382-388, 1984
Journal of Petrology, v.1, no.1	Various	Oxford University Press, 1960
Metallogeny of Archaean Granitoid Rocks of the English River Subprovince, Superior Province, Ontario, Canada: A Review	F.W. Breaks, M.E. Cherry, D.A. Janes	<i>High Heat Production (HHP) Granites, Hydrothermal Circulation and Ore Genesis</i> , Institute of Mining and Metallurgy, 1985
Wollastonite Occurrences in British Columbia	G.V. White	British Columbia Ministry of Energy, Mines and Petroleum Resources, 1989
Industrial Minerals and Rocks	M. Kuzvart	Elsevier, <i>Developments in Economic Geology</i> , v.18, 1984
Komatiites in Munro Township, Ontario	N.T. Arndt, A.J. Naldrett	<i>Decade of North American Geology, Centennial Field Guide</i> , v.5, Geological Society of America, 1987
Stress and Strain: Basic Concepts of Continuum Mechanics for Geologists	W.D. Means	Springer-Verlag, 1976
Geology, Silver and Gold Deposits: Cobalt and Kirkland Lake, Field Trip 4	L. Owsiaci, H.L. Lovell	Geological Association of Canada, 1984
Ultraviolet Guide to Minerals: A Complete Working Manual for the Use of Ultraviolet Light in Locating and Recognizing Minerals	S. Gleason	D. Van Nostrand Company Inc., 1960
Identification Tables for Minerals in Thin Sections	E.P. Saggerson	Longman, 1975
Canada Rocks: The Geologic Journey	N. Eyles, A.D. Miall	Fitzhenry & Whiteside, 2007
Ontario Rocks: Three Billion Years of Environmental Change	N. Eyles	Fitzhenry & Whiteside, 2002
Mapmaker, Memoirs of a Modern Day Explorer	K.D. Card	General Store Publishing House, 2012
Road Rocks: Ontario: Over 250 Geological Wonders to Discover	N. Eyles	Fitzhenry & Whiteside, 2013

PROPERTY EXAMINATIONS

In 2013, a total of 43 properties in the Southern Ontario Region were visited by Resident Geologist Program staff. An additional 2 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 2013 (keyed to Figures 4 and 5).

Number	Property / Operation	Commodity
Southeastern and Southwestern Ontario		
1	Ackerman Mine, Marmora Township	Gold
2	Arriscraft Green Marble Quarry, Darling Township	Dimension stone
3	Arriscraft White Sandstone Quarry, Bastard Township	Sandstone
4	Attia Rama Quarry, Rama Township	Ledgerock
5	Attia Seabright Quarry, Rama Township	Ledgerock
6	Canadian Silica, Bathurst Township	Sandstone
7	Canadian Wollastonite, Pittsburgh and Leeds Townships	Wollastonite
8	Coloured Aggregates, Marmoraton Mill Site, Marmora Township	Aggregate, fine grinding plant
9	Cooper (Gateford) occurrence, Madoc Township	Gold (mine hazard investigation)
10	County Road 46 field trip, Methuen Township	Scientific interest
11	Dwyer brucite occurrence, Hinchinbrooke Township	Brucite
12	Forfar Quarry, Bastard Township	Sandstone
13	Freeman Corners basalt, Belmont Township	Scientific interest
14	Gibson Quarry, Bathurst Township	Sandstone
15	Hartsgravel Road outcrop, Bastard Township	Sandstone, scientific interest
16	Hughes Quarry, Elmsley Township	Sandstone
17	Hungerford pyrite mine, Hungerford Township	Pyrite (mine hazard investigation)
18	Hwy 46 “Fossil Hill”, Methuen Township	Scientific interest
19	James Joseph occurrence, Elzevir Township	Gold
20	Little–Bryan graphite prospect (A. Dubblestein), Lyndoch Township	Graphite, marble
21	M. Wilson marble prospect, Sheffield Township	Dimension stone
22	M. Wilson soapstone, Camden East Township	Soapstone
23	MacDonald feldspar mine site, Monteagle Township	Feldspar (mine hazard investigation)
24	Moss Marsh iron occurrence, Marmora Township	Magnetite (mine hazard investigation)
25	Mountain Grove “unakite” occurrence, Olden Township	Mineral/rock specimens
26	MRT Aggregates Quarry, Methuen Township	Trap rock, ilmenite
27	Ojibway Mine, Windsor Salt, Sandwich Township	Salt
28	Omega Marble Quarry, Darling Township	Dimension stone
29	OMYA Tatlock Marble Quarry, Darling Township	Calcium carbonate
30	P. Widmeyer property, Grimsthorpe Township	Quartz veins
31	Pembroke geology field trip	Scientific interest
32	Perth Feldspar Quarry, Bathurst Township	Mineral specimens
33	Rideauview Contracts Sunbury Quarry, Storrington Township	Sandstone dimension stone
34	Rideauview Contracts Ellisville Quarry and Plant, Leeds Township	Sandstone dimension stone
35	S. Wanner property, Elzevir Township	Gold, silver
36	Sifto Salt (surface), Goderich Township	Salt
37	Stocklosar Green Marble Quarry, Marmora Township	Marble (mine hazard investigation)
38	Trigan Resources ilmenite prospect, Methuen Township	Titanium (ilmenite)
39	Tweed Marble Quarry, Hungerford Township	Dimension stone
40	Unimin Canada, Blue Mountain Operations, Methuen Township	Nepheline syenite
41	Upper Canada Stone White Marble Quarry, Marmora Township	Brucitic marble
42	W. Bowers (Chrysler Lead) property, Limerick Township	Galena (mine hazard investigation)
43	Wilson Quarry, Bathurst Township	Sandstone
Outside Southeastern Ontario and Southwestern Ontario Districts		
44	Douglas–Taylor prospect, Kipling Township	Silica/kaolin
45	Mattawa eclogite field trip, Mattawan Township	Mineral collection

PROPERTY VISITS AND CLAIM STAKING ACTIVITY SOUTHEASTERN ONTARIO RESIDENT GEOLOGIST'S DISTRICT

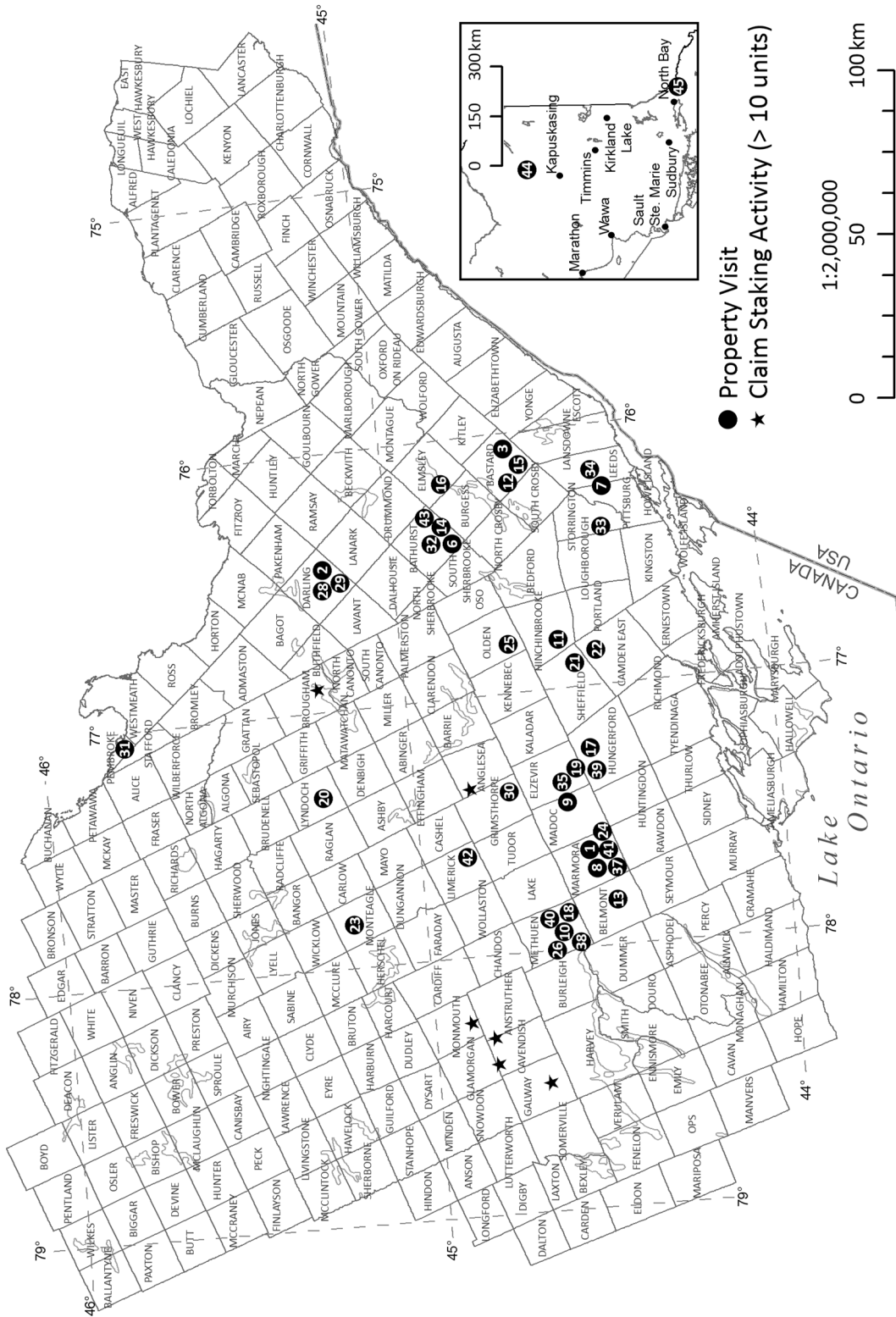


Figure 4. Property visits (keyed to Table 7) and claim staking activity in the Southeastern Ontario District in 2013.

PROPERTY VISITS
SOUTHWESTERN ONTARIO RESIDENT GEOLOGIST'S DISTRICT

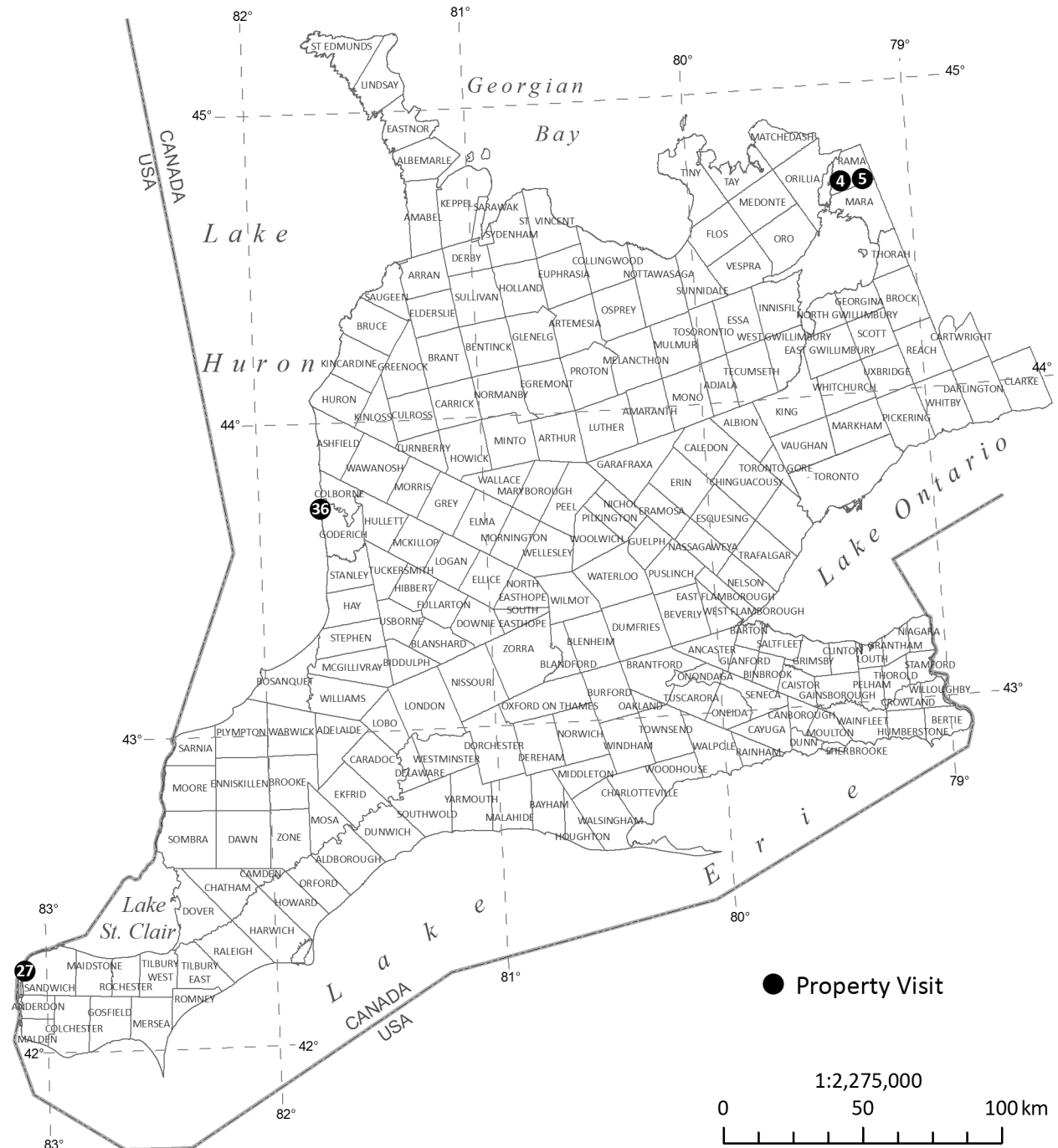


Figure 5. Property visits (keyed to Table 7) in the Southwestern Ontario District in 2013.

A. Dubblestein Graphite Property, Lyndoch Township

On September 26, 2013, the District Geologist and the District Geological Assistant accompanied A. Dubblestein on an examination of his graphite prospect in Lyndoch Township. A series of trenches exposes a graphitic, sulphide-bearing gossan zone known as the Little–Bryan graphite occurrence, which is located in concessions VI and VII, lots 14 to 17 (Figure 6).

LOCATION AND ACCESS

The property consists of 7 mining claims, totalling 10 claim units, in the southeastern quadrant of Lyndoch Township. The old workings are covered by claims 1500708-09 and 1500671-74, staked in July and August, 2013. One 4-unit claim, no. 1500228, was staked in November, 2011 (*see* Figure 6).

Access is by Highway 28 east from Bancroft to Schutt Road; north to Road 515, east to Quadeville; 6 km south on Addington Road to Hyland Creek Road, which is a logging road that runs east past McLaughlin Lake and branches south to the Dubblestein property.

EXPLORATION HISTORY

The area has been explored sporadically since the late 1800s. Hewitt (1953a, 1953b) documents occurrences of beryl, copper, corundum, feldspar, gold, graphite, iron, molybdenum, rare earth elements and radioactive minerals in the Brudenell–Raglan area, including Lyndoch Township.

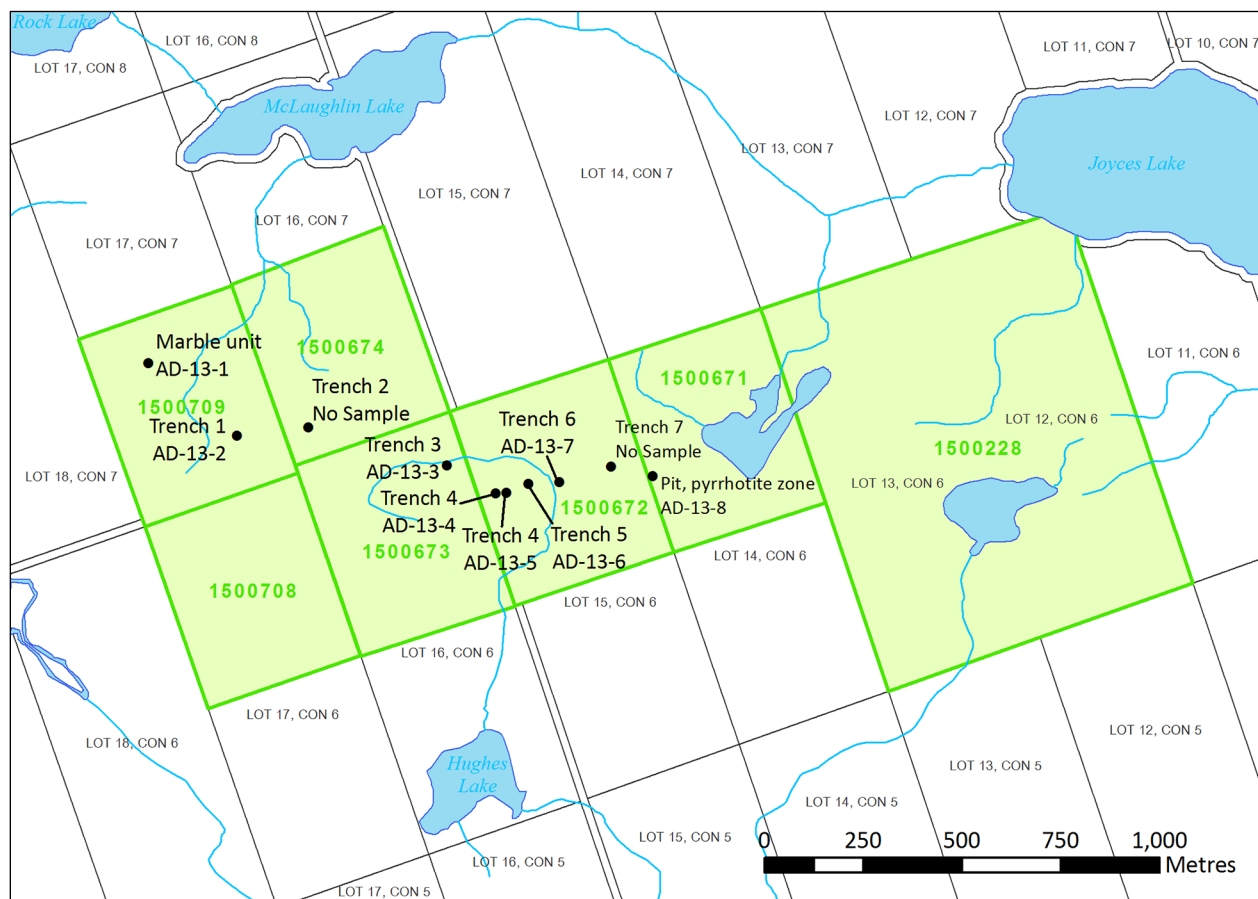


Figure 6. Location of the Dubblestein claims, Lyndoch Township graphite prospect, showing locations of trenches and samples.

The most significant base metal occurrence in the area, the Simon copper prospect, is located about 7 km south of the Dubblestein property. It contains 250 000 tonnes grading 1.1% Cu, hosted by metasedimentary rocks in contact with metavolcanic rocks and has been interpreted as either a sedimentary exhalative (SEDEX) or volcanogenic sulphide deposit (Taner 2008).

H. Moriarty of Quadeville prospected the Dubblestein property for copper in 1962. In the 1970s, M. Little and J. Bryan discovered graphite on the property and conducted geological mapping, electromagnetic (EM) surveys, trenching and diamond drilling of 2 holes (Q-1 and Q-2), totalling 538 feet (164 m).

In 1989, Harrington Sound Resources, through an option agreement with A. Dubblestein, contracted Derry, Michener, Booth and Wahl to conduct an exploration program consisting of geological mapping, trenching and channel sampling (Evoy et al. 1989) and very low frequency EM (VLF-EM) and magnetic surveys (Woolham 1989).

In 1998, R. Stewart conducted geological mapping and sampling as part of an Ontario Prospector's Assistance Program (OPAP) grant (Stewart 1998).

In 2011, Standard Graphite Corp. (formerly Orocan Resources Corp.) acquired the Little-Bryan property, consisting of the Dubblestein claim group and adjacent claims to the north and west, through option agreements. In February, 2012, the company completed a time-domain EM (TDEM) survey of the Little-Bryan property. The survey identified a conductor coinciding with the Little-Bryan graphite zone and extending several kilometres to the west of the trenches on the Dubblestein property. It also outlined a second near-surface conductive trend lying approximately 1 km to the north, extending for over 5 km along strike in association with calc-silicate and marble rocks (Standard Graphite Corp., news release, February 21, 2012, www.standardgraphite.com, under News | 2012, "Standard Graphite Completes TDEM Survey on Little Bryan" [accessed January 23, 2014]). Figure 7 shows the TDEM survey results and the location of the Dubblestein claims.

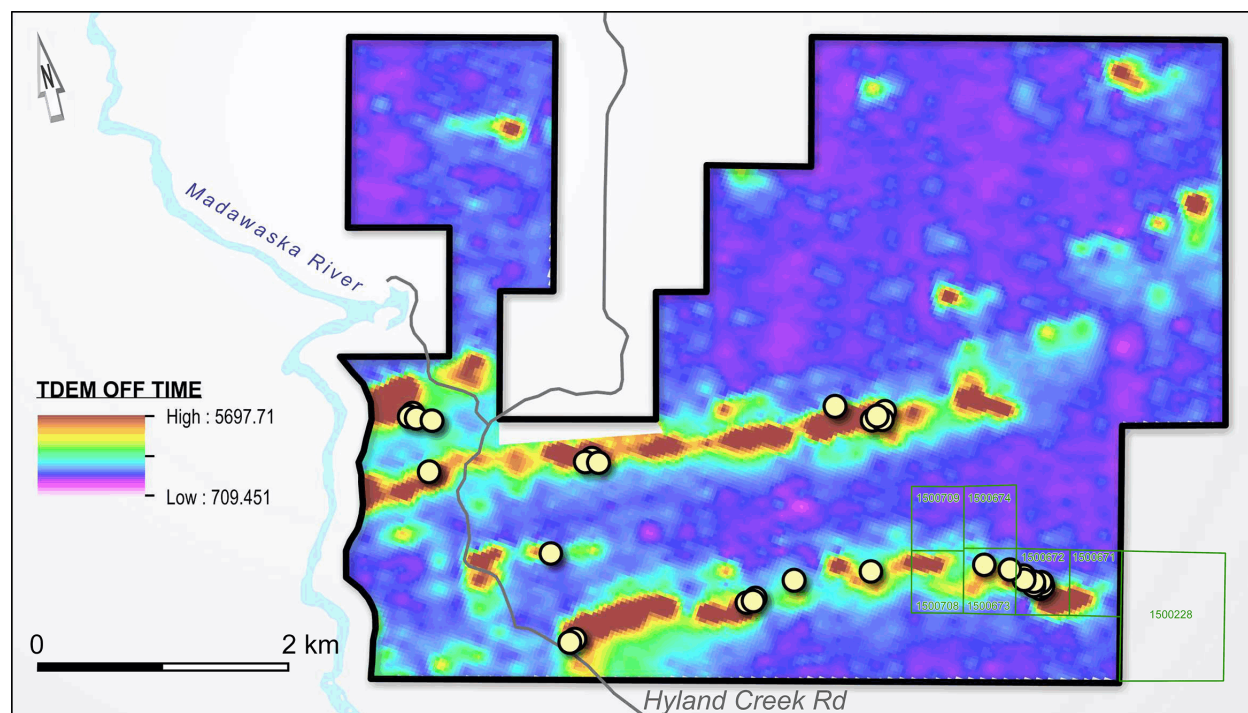


Figure 7. Standard Graphite airborne TDEM survey results for the Little-Bryan property, showing linear conductive zones, graphite-bearing sample locations (yellow circles outlined in black) and the location of the Dubblestein claims (numbered green rectangles) (modified from Standard Graphite Corp., news release, February 21, 2012).

REGIONAL GEOLOGY

The property lies within the Bancroft terrane of the Central Metasedimentary Belt, an area dominated by calcitic and dolomitic marbles and quartzofeldspathic gneisses derived from siliceous, clastic sedimentary rocks. Plutonic rocks consist of tonalite-granodiorite and gabbro-diorite-syenite-granite complexes. Syenitic and nepheline syenitic gneisses are widespread, as are skarns and pegmatites associated with a late suite of carbonatitic rocks and fenites.

The geology in the area of Lyndoch Township, as mapped by Lumbers (1982), consists of a northeasterly trending belt of calcareous metasedimentary rocks flanked by alkalic granitic and syenitic intrusive rocks to the north and by an older biotite diorite suite of intrusive rocks (gabbro, diorite, syenite and granite of the Slate Falls Complex) to the south (Figure 8).

Mineral occurrences in the area include molybdenite, associated with skarns and pyritic zones at contacts between marble and diorite, syenite and pegmatite intrusions; magnetite skarns at the margins of gabbro, diorite and syenite intrusions; base metals, associated with dolomitic marbles and siliceous metasedimentary rocks, as at the Renprior zinc prospect (sphalerite) in Admaston Township or near metasedimentary–metavolcanic contacts as at the Simon copper prospect (chalcopyrite, sphalerite); and graphite, associated with both marbles and siliceous, rusty schists.

PROPERTY GEOLOGY

From north to south, rock types observed on the property are white, siliceous, dolomitic marble; mafic to felsic siliciclastic metasedimentary rocks; and rusty, graphite-sulphide-bearing schist, containing disseminated to semi-massive pyrrhotite. Strikes are generally east-northeast and dips are from 60 to 80° southward.

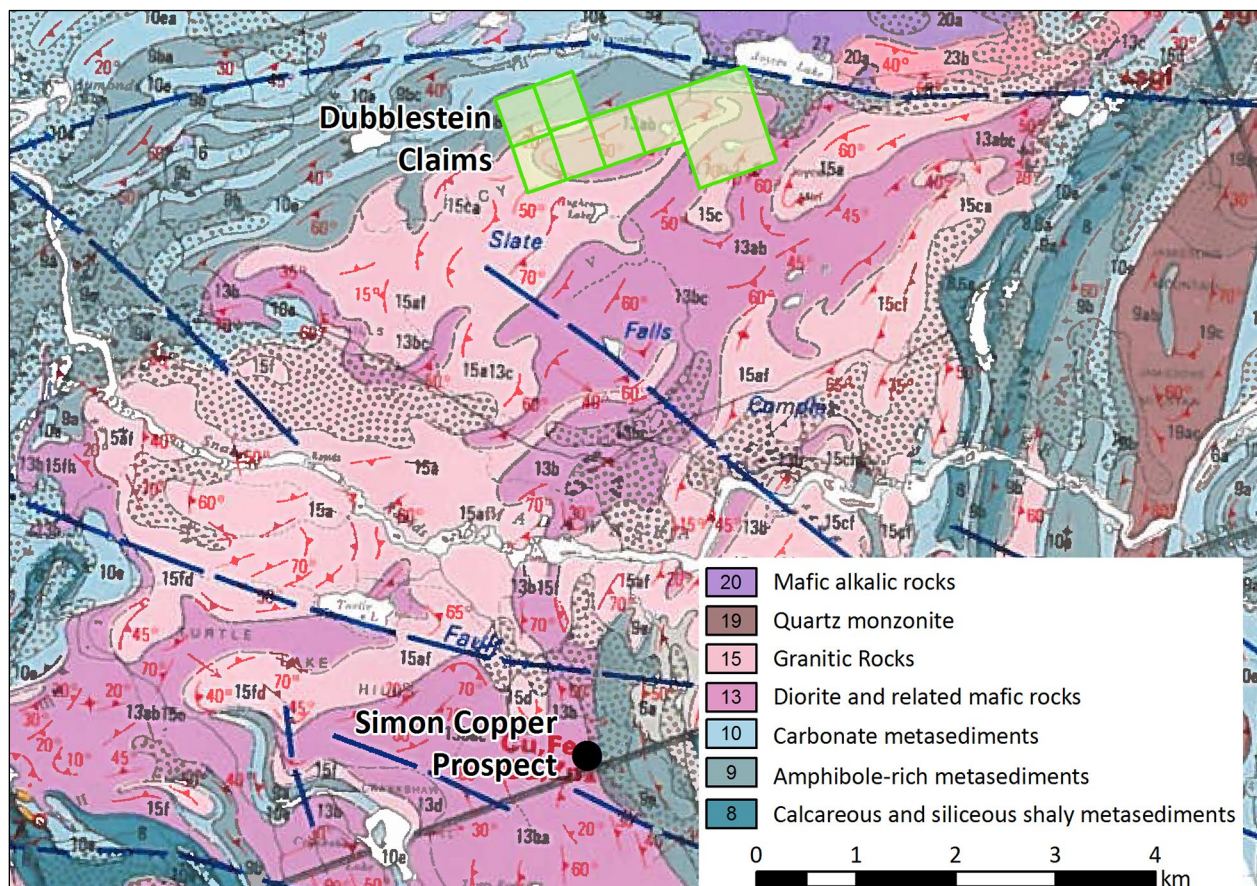


Figure 8. Geology in the area of the Dubblestein graphite property and the Simon copper prospect, Lyndoch Township (geology from Lumbers 1982).

A ridge of white, dolomitic marble trends eastward across the northern part of the claim group. The unit is shown by Evoy et al. (1989) as a marble band from 60 to 100m wide along the north side of the ATV access road. The outcrop area examined (UTM location: 317766E 5015361N) is a siliceous, very white, brown-grey-weathering, medium-grained dolomitic marble containing approximately equal amounts of dolomite and white diopside, with trace amounts of phlogopite, serpentine and talc. The marble is only weakly effervescent in dilute hydrochloric acid. A narrow band of white, dolomitic marble was also observed in the rusty schist zone near the southern end of trench #2. Narrow bands (<1 m) of “talcose marble” and “diopside marble” occur within the graphitic zone, as noted in drill logs for holes Q-1 and Q-2 (Bryan 1974).

The dominant lithologies on the property are a sequence of hornblende-quartz-feldspar-biotite paragneisses. These range from black, amphibole-rich to leucocratic, quartz-feldspar-rich bands. They were observed between the marble unit and the graphitic, rusty schist; interlayered with the rusty schist; and were not observed, but were mapped by Evoy et al. (1989) south of the rusty schist zone.

The graphite-sulphide-bearing zone is a rusty, gneissic to schistose, quartz-feldspar-biotite-hornblende metasedimentary unit up to 30 m wide, exposed in outcrop and trenches over a strike length of over 900 m. Common accessory minerals are phlogopite and tremolite. The average content of graphite, occurring as disseminated, medium-grained graphite flakes, appears to be from 3 to 7%, with higher concentrations over narrow widths. Evoy et al. (1989) reported grab samples containing up to 34% Cg.

A series of 7 trenches exposes the graphitic zone over a strike length of about 900 m. The results of channel sampling reported by Evoy et al. (1989) are as follows:

- trench 1: 3.79% Cg over 11 m, including 5.15% over 6 m
- trench 4: 3.72% Cg over 22 m
- trench 5: 4.74% Cg over 11 m
- trench 6: 4.93% Cg over 10 m
- results for trenches 2, 3 and 7 averaged less than 1% Cg

Pyrrhotite mineralization was observed in all trenches, with the exception of trenches 2 and 3 during the property examination. Traces of pyrite and chalcopyrite were observed, but much of what appears to be chalcopyrite is tarnished pyrrhotite. The samples are weakly to moderately magnetic and at least 3 distinct linear magnetic anomalies with associated VLF–EM anomalies are indicated by the geophysical surveys (Woolham 1989) within a 350 m wide zone that hosts the known gossan zones. A possible fourth magnetic or VLF–EM anomaly is coincident with a pyrrhotite-rich zone exposed in a pit near the top of a 30 m high ridge near the southern boundary of the claim group and about 100 m east of trench 7. This zone contains semi-massive pyrrhotite and disseminated graphite. The pit predates the exploration work contracted by Harrington Sound Resources in 1989 and was probably excavated during previous exploration for copper.

RESULTS OF SAMPLING

Grab samples were taken from all trenches with the exception of trenches 2 and 7, in which very little bedrock remains exposed. Samples of semi-massive pyrrhotite from the older pit near the southern boundary of claim number 1500671 and of the white marble in claim 1500709 were also taken and submitted to Activation Laboratories Ltd., Ancaster, Ontario, for analysis. Sample locations and analytical results are shown in Table 8.

The results of whole-rock, major element oxide analyses for marble sample AD-13-1 are provided in Table 9. The high silica content was unexpected and subsequent mineralogical determination by X-ray diffraction (XRD) analysis indicated a composition of 52% white diopside, 44% dolomite, 3% calcite and 1% talc.

Table 8. Locations and analytical results for samples collected during the visit to claim numbers 1500671 and 1500709.

Sample No.	Sample Collection Site	Location (UTM, Zone 18, NAD83)		Graphite (% Cg)	Cu (ppm)	Zn (ppm)	Au (ppb)	Ag (ppm)
		Easting	Northing					
AD-13-2	Trench 1	317990	5015178	0.68	772	79	<10	0.7
AD-13-3	Trench 3	318521	5015103		75.8	47	<10	0.3
AD-13-4	Trench 4	318644	5015032	1.80				
AD-13-6	Trench 5	318727	5015056	0.15	216	66	<10	0.3
AD-13-7	Trench 6	318806	5015061	2.37	117	101	<10	0.2
AD-13-8	Pit, pyrrhotite zone	319041	5015075	3.45	336	30	<10	1.0

Table 9. Whole-rock, major element oxide analyses by X-ray fluorescence (XRF) for marble sample AD-13-1.

SiO ₂ (wt %)	Al ₂ O ₃ (wt %)	Fe ₂ O _{3(T)} (wt %)	MnO (wt %)	MgO (wt %)	CaO (wt %)	Na ₂ O (wt %)	K ₂ O (wt %)	TiO ₂ (wt %)	LOI (wt %)
41.51	0.22	0.21	0.024	19.45	27.16	0.03	<0.01	<0.01	11.99

DISCUSSION

Graphitic Zones

The graphite content of composite grab samples taken during this property examination confirms the presence of graphite in grades comparable to those reported in channel samples by Evoy et al. (1989).

The geophysical surveys indicate that there are at least 3 linear magnetic features with associated VLF–EM anomalies (Woolham 1989). An overlay of the magnetic survey contour map with the geological map shows that trenches 1 and 2 are on the most northerly trend; trench 3 is on the central anomaly; and trenches 4 to 6 and drill-holes Q-1 and Q-2 are on the southern trend. Trench 7 appears to lie between the southern, linear magnetic high and a short magnetic anomaly that coincides with the older pit in semi-massive pyrrhotite mineralization near the southern boundary of claim 1500671.

The western extensions of the northern and southern magnetic anomalies, which host the highest graphite concentrations (trenches 1, 4, 5 and 6), have not been tested. Detailed mapping and re-examination of the Woolham (1989) magnetic survey data (re-contouring at a smaller interval) may assist in determining whether these are separate zones or folded and/or faulted extensions of the same unit. Hinge zones of folds may be favourable target areas for increased thickness and grade of mineralization.

All of the zones on the Dubblestein property appear to lie within a broad conductive zone, identified by the 2012 airborne TDEM survey, which extends for at least 3 km west of the Dubblestein property (*see* Figure 8). A parallel zone of similar extent about 1 km north of the Little–Bryan zone, reported by Standard Graphite Corp. to host graphite mineralization in rusty gneiss, may represent the Little–Bryan zone repeated by folding.

Sulphides

The Simon copper prospect, hosted by amphibole-rich and quartz-feldspar-biotite-rich gneisses and considered to be of either sedimentary exhalative (SEDEX) or volcanogenic sulphide origin, and the Dubblestein graphite-sulphide zones occur in similar lithologies on opposite sides of the Slate Falls intrusive complex (*see* Figure 8). The stratiform nature of the Dubblestein sulphide mineralization and the presence of semi-massive pyrrhotite in one of the zones indicate that there may be potential for volcanogenic base metal mineralization in the area. Pyrrhotite is also the predominant sulphide in the Simon copper prospect, from which the best intersection in the 2008 diamond-drilling program by Adroit Resources Inc. was estimated to contain up to 27% pyrrhotite, 7% sphalerite, 4% chalcopyrite and 4% pyrite over 8.6 m (Taner 2008).

Strike extensions of the mineralized zones on the Dubblestein property should be investigated for variations in base metal content. Samples AD-13-2 (5–10% pyrrhotite) and AD-13-8 (40–50% pyrrhotite) are anomalous in copper content at 772 ppm Cu and 336 ppm Cu, respectively.

Marble

Previous exploration work on the property has focussed only on the graphite and base metal potential of the rusty, sulphide-bearing zones. However, the white, diopside-bearing dolomitic marble unit warrants further investigation, based upon its apparent composition as a two-mineral assemblage with very low free silica, alumina and iron oxide content. The CaO:MgO ratio is 1.40, typical of dolomite. However, the high silica content (41.51%) and low loss-on-ignition (11.99%) indicate that silica was present in the initial sediment or has been added during metamorphism. Progressive thermal metamorphism of siliceous dolomite first produces tremolite, followed by diopside. Considering the low iron and aluminum content of sample AD-13-1, the protolith of the diopside-dolomite assemblage may have been dolomite interlayered with relatively pure quartz sand or chert—possibly a stromatolitic dolomite formation.

A normative mineral calculation for sample AD-13-1, assuming that all loss-on-ignition is in the form of carbon dioxide and that there are only trace amounts of calcite and talc as accessory minerals (determined from the XRD analysis), indicates a composition of 73 weight % diopside and 27 weight % dolomite.

Diopside has been used in combination with up to 20% dolomite to produce mineral fibre for reinforced concrete (Rogers and Haslam 1985). The use of diopside as a raw material in ceramics can decrease water absorption, reduce thermal shrinkage and increase mechanical strength. Addition of dolomite with diopside in ceramics helps increase the fluidity and reduces opacity of the product. White diopside, rather than the more common green diopside, is preferred for use in glass and ceramics applications. The white diopside-dolomite assemblage observed on the property may have potential as an industrial mineral product with or without separation of the 2 primary minerals.

S. Wanner Property, Elzevir Township

On May 22, 2013, the District Geologist accompanied S. Wanner on an examination of prospect pits located on his property on Concession XI, Lot 4, Elzevir Township, which is a patented lot.

LOCATION AND ACCESS

The property is located at the northern end of Peterson Road, which leads north from Highway 7 about 10 km northwest of Tweed. The most westerly of the trenches (No. 1) is located at UTM location 310187E 4934962N. A trail leads northward from the house about 300 m and branches eastward for another 150 m to pit 1.

EXPLORATION HISTORY

Gold was first discovered in the Madoc area in 1866, at the Richardson Mine in Eldorado. A subsequent increase in the amount of prospecting activity resulted in the discovery of several other small mines and occurrences of gold. In 1869, a discovery of native gold was reported at the Barry occurrence on Concession II, Lot 5, Elzevir Township, about 2.5 km east-northeast of the Wanner property (Kindle 1936). About 1.1 km north of Highway 7 on the Queensborough Road, 3 shallow shafts are located 80 to 120 m west of the road and one shaft about 20 m east of the road. No gold production was recorded.

The Sophia, or Diamond, gold mine was discovered in 1896 on Concession X, Lot 4, Madoc Township, about 1 km west of Queensborough and 6.2 km northwest of the Wanner property. The total production from operations in 1900 and 1941 was 110 ounces of gold from 1800 tons of ore, for an average grade of 0.06 ounces of gold per ton or 2.0 g/t Au (Gordon et al. 1979).

A resurgence of gold exploration in the area in the 1980s resulted in the confirmation of gold mineralization at many locations, including the Barry and Sophia occurrences, and in the discovery of a new gold deposit near Bannockburn—the Mono prospect. Details of the exploration programs are provided in LeBaron (1991).

There are no records of exploration or mining work on the Wanner property. However, Holmes (1984), in a locally published book on the history of Elzevir Township, quotes a report from the early 1900s, stating that “gold is being found in large quantities near the western boundary of Elzevir, near the Berry [Barry] property [by Mr. Cowan and Mr. Feeny (no reference given)]”. The workings on the Wanner property may be evidence of this work.

REGIONAL GEOLOGY

The property is located in the Grimsthorpe domain of the Central Metasedimentary Belt, Grenville Province, dominated by mafic metavolcanic and clastic metasedimentary rocks older than 1270 Ma (Easton 2008). In the Elzevir–Grimsthorpe–Madoc townships area, mafic metavolcanic and intercalated metasedimentary rocks of the Tudor Formation form a relatively narrow (3–5 km wide), northerly trending belt between carbonate-dominated metasedimentary rocks of the Belmont domain to the west and tonalite-granodiorite of the Elzevir pluton to the east. Metamorphic grade is lower to middle greenschist.

Several gold occurrences, including the Barry, Sophia and Mono sites, are located within this belt and are spatially associated with metavolcanic rocks near the contact with clastic metasedimentary rocks (Figure 9). All consist of quartz and quartz-carbonate (ankerite) veins containing various assemblages of pyrite, pyrrhotite, arsenopyrite and traces of native gold. All are structurally controlled, occurring within or adjacent to zones of shearing that exhibit pervasive iron carbonate and/or biotite alteration and/or pyrite mineralization.

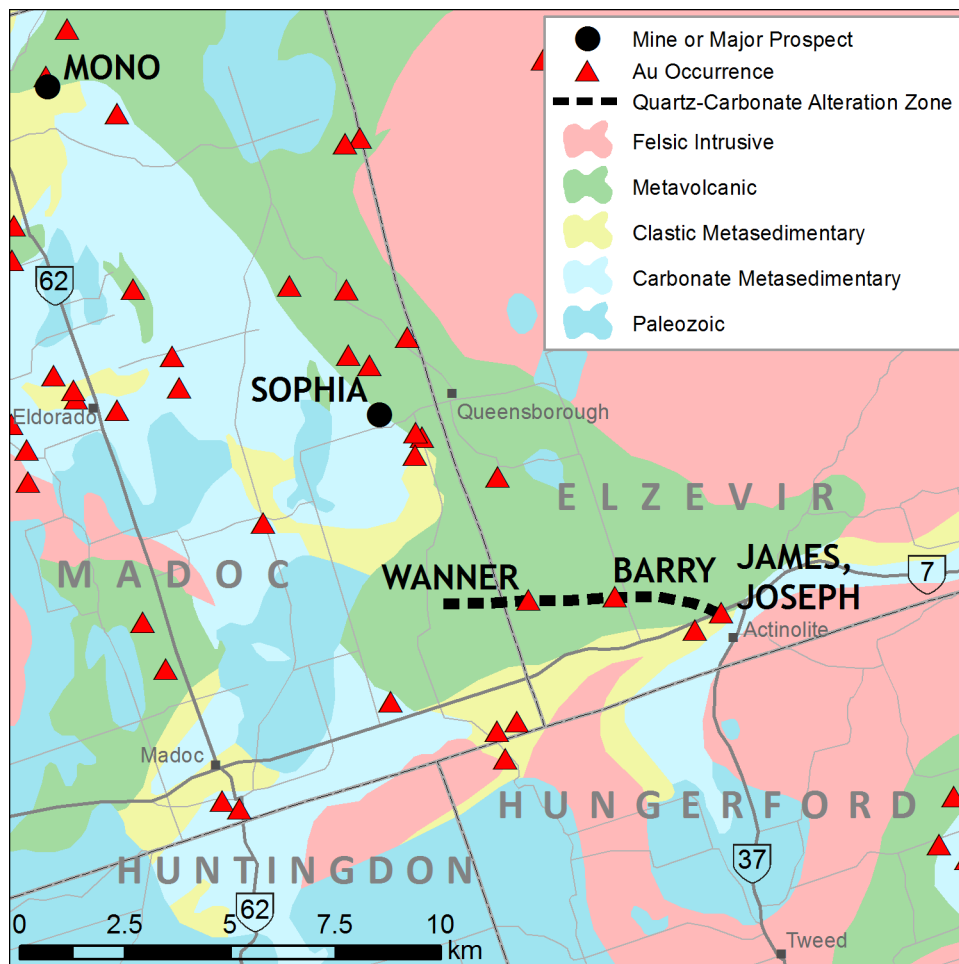


Figure 9. Geology and gold occurrences in the Madoc area, Madoc and Elzevir townships. Geology from Ontario Geological Survey (2006).

PROPERTY GEOLOGY

The bedrock geology of the property consists predominantly of mafic metavolcanic, metasedimentary and associated gabbroic intrusive rocks (Di Prisco, Hammer and Easton 2001). Rocks observed during the property examination include black, fine- to medium-grained, amphibolitic metavolcanic rocks (Tudor Formation basalt) and dark grey, quartz-feldspar-biotite metagreywacke, weakly foliated with an orientation of 100/80S.

Three prospect pits were examined.

Pit #1 (UTM location: 310187E 4934962N) is a vertical shaft approximately 3 by 3 by 3 m (depth to water level; total depth is unknown). It appears that a crosscut runs north from the north wall at water level. A few metres south of the shaft are large blocks of massive white quartz vein material in dark green to black amphibolitic metavolcanic rock, possibly in place. The veins are 1 to 1.5 m wide with an orientation of 100/70S, and contain minor tourmaline and smoky quartz at the vein margins. Traces of pyrite and chalcopyrite occur in the black host rock and in hematitic fractures in the quartz.

Pit #2 (UTM location: 310252E 4934969N) is 3 by 3 by 3 m deep, with sloped sides and dry. The pit was excavated on a quartz-ankerite vein zone in a biotite-rich (biotite-quartz-feldspar) metasedimentary rock foliated at 110/80S. Quartz vein material in the rock dump is not as obvious as at pit #1 due to brown weathering of the ankerite. Veins are 1 to 5 cm wide and contain angular fragments of wall rock showing pervasive biotite and iron carbonate alteration and trace pyrite or chalcopyrite mineralization. Minor tourmaline occurs at the vein margins; sulphides were not observed in the quartz-ankerite veins.

Pit #3 (UTM location: 310259E 4935001N) is a shallow pit, about 2 m in diameter and 1 m deep. No bedrock is exposed in the pit, but there is abundant white quartz vein material in the rock dump. Massive, white quartz veins up to 25 cm wide are in black, brown-weathering (ankerite alteration), moderately foliated amphibolitic metavolcanic rock. Rusty quartz material locally contains black, smoky quartz, minor ilmenite, fine tourmaline needles and traces of pyrite or chalcopyrite.

The host rock, alteration and mineralization, particularly in pit #2, are similar to those of the Barry occurrence, which is described by LeBaron (1991, p.56):

Gold mineralization at the Barry occurrence is hosted by a strongly silicified and carbonatized zone 15 to 100 ft wide containing cross-cutting veinlets and clasts of altered amphibolite and metasediments. It is best exposed in a road cut on Hastings County Road 20, 1.1 km north of Hwy. 7, as an 80 ft wide zone of massive, rusty weathering ankerite which contains clasts of siliceous, altered country rock and is cut by quartz veinlets. The zone strikes 110° and dips 85° to the south. Mineralization consists of pods of pyrite and arsenopyrite totalling less than 3% of the rock by volume.

Diamond drilling of the Barry zone in 1988 by Corona Corporation indicated that gold mineralization is low grade and erratic, with best assays of 0.49 ounces of gold per ton over 3 feet and 0.32 ounces of gold per ton over 1 foot. Only 2 of 5 holes returned assays greater than 0.03 ounces of gold per ton.

Di Prisco (1989) interpreted the Barry zone as part of an east-southeast-trending fault that extends eastward to the James Joseph gold occurrence near the intersection of the French Settlement Road and Highway 7 on concessions III and IV, Lot 3, Elzevir Township. Bishop (1988) reported that the zone is traceable by geological mapping, soil geochemistry (anomalous arsenic content) and VLF-EM for a distance of at least 2.4 km. The quartz-ankerite zone on the Wanner property may be the western extension of the same structural feature showing strong quartz vein development, carbonate alteration and minor sulphide mineralization.

RESULTS OF SAMPLING

A sample of quartz vein material brought to the Resident Geologist Office in 2012 by Mr. Wanner was sent to the Ontario Geological Survey Geoscience Laboratories (Geo Labs) and returned an assay value of 2.0 ounces of silver per ton, less than 0.01 ounce of gold per ton and over 2.5% Cu. The sample contained more chalcopyrite than was observed during this property visit.

Four samples, collected during this property examination, from rock dumps of the 3 pits were submitted to OGS Geo Labs for fire assay analysis. Samples SW-13-1 (pit #2), SW-13-2 (pit #3), SW-13-3 (pit #1) and SW-13-4 (pit #1) all consisted of quartz-ankerite vein material containing trace amounts of pyrite ± chalcopyrite and all gave results below the detection limit for gold (<0.01 ounce per ton) and silver (<0.1 ounce per ton).

CONCLUSIONS AND RECOMMENDATIONS

Although no anomalous gold or silver assays were obtained from samples taken during this property examination, the presence of silver (2.0 ounces per ton) in a sample provided by the property owner, combined with the similarity of host rock, alteration and mineralization to nearby gold occurrences suggests that erratic gold-silver mineralization may be present in the quartz vein zone on the Wanner property.

The zone may be an extension of an easterly trending, fault- or shear-related zone of quartz veining and ankerite alteration that hosts anomalous gold mineralization at the Barry and James Joseph occurrences to the east.

Detailed prospecting, geological mapping and soil geochemical surveys may be useful in tracing the zone and in detecting anomalous levels of gold, silver, arsenic or copper that may reflect local concentrations of gold mineralization within the zone.

M. Wilson Property, Sheffield Township

On August 21, 2013, the District Geologist accompanied M. Wilson on a geological examination of his mining claim in Sheffield Township near the village of Tamworth.

LOCATION AND ACCESS

The property consists of a single, 8-unit mining claim (No. SO 1500237), comprising Concession XII, lots 7 and 8, Sheffield Township. The claim was recorded on December 30, 2011, and has a total area of about 160 ha.

Access is via Highway 41, 30 km north of Napanee, to Road 4; east 4 km to Tamworth; continue east from Tamworth on Mountain Road a distance of 7.5 km to the southwestern corner of the claim (at a sharp northerly turn in the road). Marble outcrops are exposed along the roadside over the next 1.2 km, to the northern boundary of the claim.

EXPLORATION HISTORY

There are documented mineral occurrences on the property. However, it is thought that the area was prospected at several times dating back to the early 1900s when occurrences of both zinc (in marble) and molybdenite (in pegmatites in granite and in skarns at granite-marble contacts) were discovered in the eastern part of the township. A hematite iron prospect at the Paleozoic-Precambrian unconformity was explored to the west of the claims in the 1950s and exploration for zinc was revived in the 1980s.

GEOLOGY

The property lies within an area of metavolcanic rocks, siliceous metasedimentary rocks and marble of the Sharbot Lake domain, a subdivision of the Elzevir Terrane in the Central Metasedimentary Belt. Metamorphic grade is middle to upper amphibolite. The geology of the area is described by Easton (2001a, 2001b).

The claim covers the southern half of a lens-shaped area (~2 by 4 km) of marble bordered by metavolcanic rocks to the west and granitic rock to the east (monzogranite, Methuen Suite, 1240–1250 Ma). A small granitic intrusion to the north, the Cranberry Lake granite, may extend onto the northern part of the claim. The western half of the claim is underlain by marble and the eastern half (east of Herring Lake) by granite as indicated by Easton (2001b).

Several occurrences of molybdenite are located within granitic intrusions to the north and east of the claim. Small amounts (<1000 tons) of pegmatitic quartz-pyroxenite containing 1 to 2% coarse flakes of molybdenite were mined from 1915 to 1917. One larger deposit, the Chisholm Mine (Concession XIV, Lot 5, Sheffield Township; about 3.5 km east of Herring Lake), produced about 8000 pounds of molybdenite from 10 000 tons of ore from a sulphide-bearing skarn at the contact between marble and granite (Malczak, Carter and Springer 1985).

Zinc mineralization occurs within 2 areas of marble within a belt of metavolcanic and metasedimentary rocks bounded to the west by the Robertson Lake mylonite zone and to the east by the Hinchinbrooke gneiss. One area, in Olden Township to the west of the Mountain Grove pluton, hosts the past-producing Long Lake zinc mine from which almost 100 000 tons of ore averaging 11.6% Zn were mined between 1970 and 1974 (Malczak, Carter and

Springer 1985). The other area is in the area of the Fifth Depot Lake and Chippewa plutons, where several zinc occurrences are present within marble around and within the granitic intrusive rocks. The largest of these is the Slave Lake zinc occurrence, where 6 mineralized zones have been explored by pits and shafts. The zones (up to 2 m wide and 100 m long) consist of disseminated to nearly massive sphalerite in white, medium- to coarse-grained calcitic marble.

MINERAL POTENTIAL

The marble exposed along the sides of the road is predominantly white to very pale grey, medium-grained, calcitic marble, varying from massive, uniform texture in the south part of the claim to banded dark grey–pale grey in the northern part. The grey colour appears to be due to the presence of very fine-grained graphite. The strike of the foliation in the banded marble is approximately north, with a dip of approximately 40° west. East of the road, about 500 m north of the southern claim boundary (UTM location: 347056E 4932792N), a flat-lying outcrop area (~20 by 10 m) consists of massive, joint-free, white to pale grey, calcitic marble (Photo 3). There is moderate karst development, resulting in minor collapse of large blocks at the roadcut. Karst features were also observed in outcrops west of the road.

Within the more banded marbles along the road in the northern part of the claim are some dolomitic bands interlayered with calcitic marble. Minor granitic pegmatite with pyrite and tremolite-actinolite-diopside-phlogopite alteration along the margins was observed near the northern claim boundary, possibly associated with the Cranberry Lake granite which crops out to the north. Other than this local alteration, no sulphide mineralization or silicate minerals were observed in the marble.

The marble is an attractive, white to slightly blue-grey stone that is free of deleterious minerals (sulphides, mica) and exhibits very wide joint spacing; therefore, it appears to have potential for development for the production of dimension stone, landscaping stone and decorative aggregate. Outcrop areas to the east and west of the road show very little overburden and could easily be stripped in order to evaluate jointing and variations in composition and fabric of the marble.

This evaluation is based on a very preliminary and spatially limited examination. Additional mapping and sampling in the remainder of the claim area is recommended to determine the extent of, and variations within, the marble unit. The geological contacts shown by Easton (2001b) may not be an accurate representation of the extent of the marble area. For example, outcrops along a bush road leading eastward from the paved road into Herring Lake indicate that the granite–marble contact, shown to be east of Herring Lake, is actually located at least 200 m west of the lake.



Photo 3. Marble outcrop area (UTM location: 347056E 4932792N), east of road, showing lack of jointing, M. Wilson property, Sheffield Township.

Coloured Aggregates, Marmora Plant

On November 22, 2013, the District Geologist and District Geological Assistant toured the new processing plant and product warehouse of Coloured Aggregates in Marmora with Jamie Fairchild, MNDM Mineral Exploration and Development Consultant, and Jeff Oravec, the company's Vice President of Financing and Marketing.

The company purchased the facilities at the former Marmoraton iron mine from Sheritt International Corp., which previously operated a talc and dolomite crushing-grinding operation at the site to process ore from the Canada Talc Mine at Madoc.

Over the past 2 years, the company has cleaned up the site, removed old asbestos-bearing wall board and insulation, replaced roofing and flooring, created a new warehouse and laboratory, renovated office space, installed a new crusher and refurbished old equipment. Upgrading of the facilities is ongoing, but the plant is operational and a variety of aggregate products are being shipped from the site.

PLANT

The main plant is 63 000 square feet in area, including office space, laboratory, maintenance room, crushing-grinding-bagging facility and warehouse (Photos 4 and 5). Currently, it is used only for processing white marble; bagged products are stored on pallets in the production area. A new warehouse has been constructed and is near completion, where separate areas have been designated for dolomitic and calcitic products. A separate building, which has been renovated, is expected to house another crushing circuit for coloured stone and will bring the total plant building area to 70 000 square feet.

Several Raymond mills remain from the previous operation and may eventually be used for micronizing. Air classifiers, currently located outside the building, may be moved inside and used in the sizing of fine-grind material.

An overhead conveyor moves marble from an outdoor stockpile to the crusher. The new crusher system includes a series of 4 magnetic separators that extract fine magnetite from the crushed product before it passes through a dryer and into the bagging hopper. New doors have been constructed directly adjacent to the bagging station to reduce the amount of forklift time required for moving the bagged material to the warehouse.



Photo 4. Coloured Aggregates plant entrance and office area, Marmora, Ontario.

PRODUCTS

Coloured Aggregates currently produces crushed calcitic and dolomitic marble at the Marmora plant. The stone is sourced from various quarries throughout Canada and the United States. A range of aggregate sizes is produced for use in terrazzo, stucco and concrete.

The company is in the process of obtaining an aggregate licence on a dolomitic marble property in southeastern Ontario. The high-purity, white marble will be trucked to the Marmora plant for crushing to provide a variety of sizes of dolomitic aggregate similar to the calcitic marble product line.

Crushed, recycled glass is shipped to the Marmora plant from a source in eastern Canada for bagging and distribution from Marmora.

High-grade magnetite from the Tomclid Mine in southeastern Ontario, operated by Ferromin, a subsidiary of Coloured Aggregates, is crushed and trucked to the Marmora plant for distribution to various manufacturers for use in high-density concrete or as loose ballast.

The company quarries trap rock from the River Valley anorthosite in Dana Township near Sudbury. The stone is not processed or shipped from the Marmora plant at this time.

Coloured Aggregates plans to continue to renovate and expand the Marmora plant for the production of a wide range of specialty aggregates and industrial minerals, possibly to eventually include silica and/or sandstone and mineral fillers such as muscovite. The company is investigating the potential to utilize waste rock from other quarrying operations such as dimension-stone quarries (granite, sandstone, limestone and marble) to produce marketable aggregates.



Photo 5. Coloured Aggregates, Marmora, Ontario, production area: crusher, hoppers and bagging at far end of room; bagged products are stored temporarily in production area.

RECOMMENDATIONS FOR EXPLORATION

Critical Minerals: A Southern Ontario Perspective

BACKGROUND

Existing and emerging technologies are generating unprecedented demand for lesser known minerals bearing elements such as lithium (Li), indium (In), tellurium (Te), gallium (Ga), antimony (Sb), beryllium (Be), rare earth elements (REE) and high-purity silica. Many jurisdictions including the United States, the European Union, India and Japan have each developed a listing of minerals they consider to be “Critical”.

To determine which minerals are critical to a specific jurisdiction, the importance of that mineral to a given economy is considered relative to the risk that the supply of that mineral will be disrupted. Of particular concern are those commodities for which a jurisdiction has no domestic supply, particularly if the supply is from a single offshore source.

Some of the commodities identified include antimony, beryllium, cobalt, fluorspar, gallium, germanium, graphite, indium, lithium, magnesium, niobium, platinum group metals, rare earth elements, rhenium, tantalum, tellurium and tungsten.

Historically, there has been limited exploration for sources of minerals bearing these elements. In recent years, exploration has focussed largely on gold. For example, in 2011, \$1 billion was spent on exploration and deposit appraisal in Ontario. This was the highest level of expenditure ever achieved in the province. Over 80% of the investment was in exploration and development of gold. Until the burgeoning development of new technologies and analytical methods, many elements had limited applications or were seen as scientific curiosities. There are resulting gaps in our knowledge of the occurrence, resource inventory, methods of extraction, and environmental behavior and management of these elements.

Ontario potential for new discoveries of many of these critical minerals is documented in Ontario Geological Survey publications, in the Mineral Deposit Inventory database and in donated and unique information available through the Resident Geologist Office.

Ontario Potential – Rare Earth Elements, Magnesium and Cobalt

Carbonatite and alkaline intrusive complexes have the highest potential for hosting many of these critical elements including rare earth elements. From 1982 to 1987, the Ontario Geological Survey mapped, researched and published 25 reports on these occurrences across the province (Figure 10). In the intervening decades since these studies were completed, there have been new discoveries made and new analytical methods developed that have resulted in a better understanding of this type of deposit. There are new demands and markets for the minerals they potentially contain. Further examination of Ontario carbonatite and alkaline intrusive complexes as potential sources of rare earth elements and other critical minerals is recommended.

A source of cobalt has been identified as a critical mineral resources by the European Union. Potential remaining cobalt resources remain undefined in the historic Cobalt camp, but historic documents indicate significant resources may be present (G.P.B. Grabowski, District Geologist, Kirkland Lake, personal communication, October, 2013). In southeastern Ontario, a greenfields target for exploration is the Lavant Lake gabbro complex where large areas remain unexplored (Sangster et al. 2013). Historic reports of the Geological Survey of Canada (e.g., Dawson 1896, p.38) indicate nickel and cobalt values.

Finding new sources of magnesium has also been identified as critical. A detailed recommendation for exploration for brucite as a source of magnesium is provided below.

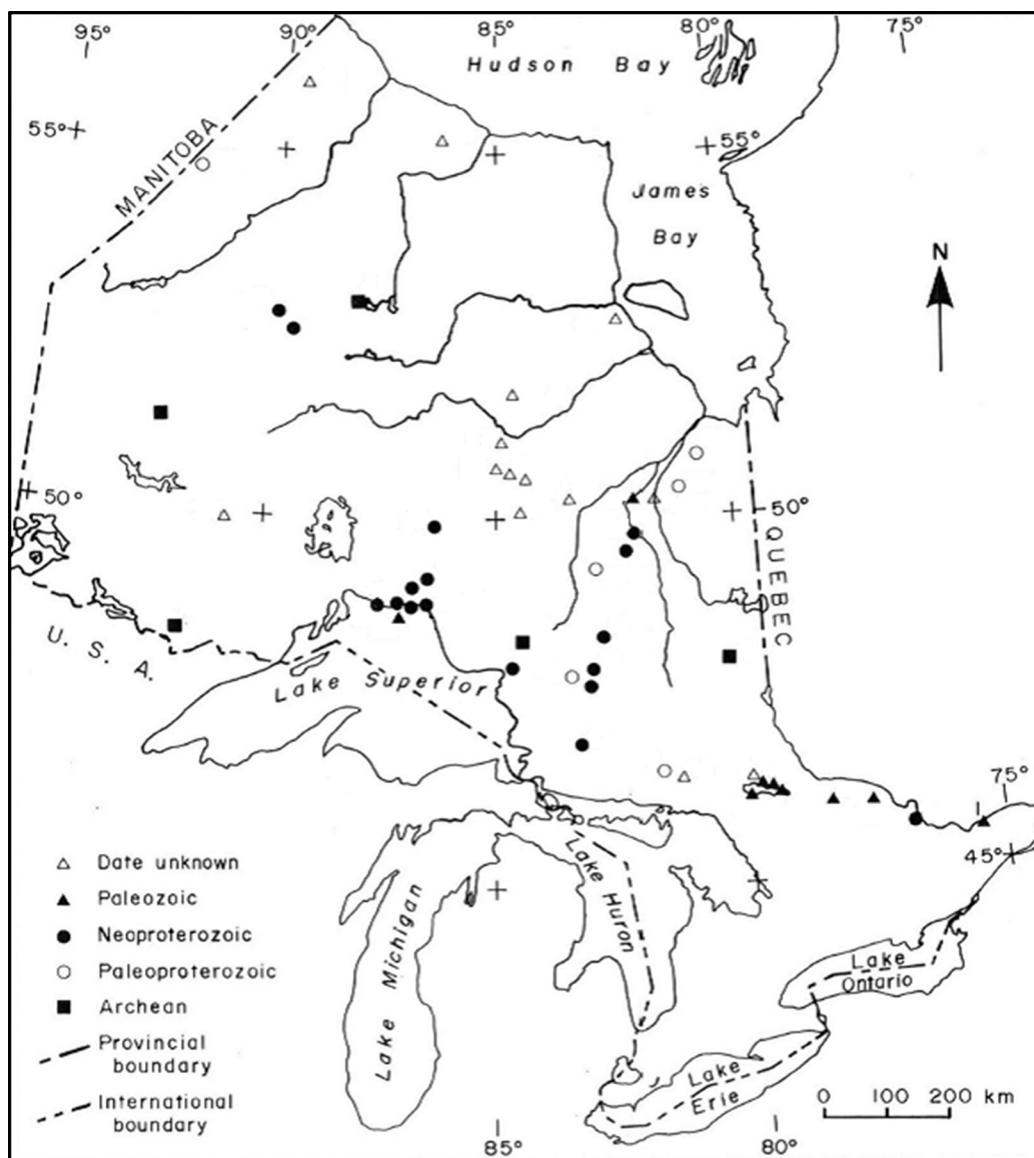


Figure 10. Carbonatite-alkalic complexes in Ontario and mafic complexes in the James Bay Lowland (modified from Sage 1987).

Minerals for Infrastructure

Although not generally considered as “Critical Minerals”, a domestic supply of a wide range of structural commodities including sand, gravel, crushed stone aggregate, cement, clay and lime is essential. By their nature, these high volume–low value raw materials cannot economically be transported over long distances or from offshore sources. In 2013, Ontario production of these commodities was valued at over \$1.8 billion.

Roads, bridges, water and waste-water systems are assets owned by the public and require constant attention and reinvestment. Federal, provincial and municipal governments are the largest consumers of these commodities.

For example, in April 2013, Toronto announced that the city would spend \$155 million on roads and bridges, as part of \$2.9 billion program over the next 10 years. In addition, the City could invest another \$17 million on repairing the Gardiner Expressway. To complete these and other projects, a reliable supply of raw materials is required. The supply of aggregate for the Greater Toronto Area is at capacity. Further exploration of new Ontario sources of these minerals for infrastructure is recommended.

Brucite in Southeastern Ontario: Industrial Mineral and Magnesium Ore

BRUCITE USES AND CONSUMPTION

Brucite, $\text{Mg}(\text{OH})_2$, has a much higher content of MgO (69.1 weight %) or Mg (41.6 weight %) than any other naturally occurring magnesium compound, except the high-temperature metamorphic mineral periclase (MgO), which is rare in nature as it retrogrades to brucite in the presence of water. In comparison, the main currently exploited magnesium-bearing minerals—magnesite and dolomite—contain 28.8 and 12.6 weight % Mg , respectively. Brucite has the additional advantage, in both energy consumption and environmental considerations, of producing no CO_2 during the calcining process and, therefore, is a mineral of considerable interest as an alternative raw material for production of MgO and elemental magnesium.

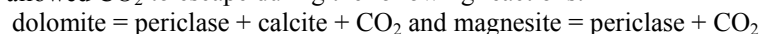
Most current producers of magnesium metal use the energy-intensive Pidgeon process, combining calcined dolomite ore and ferrosilicon and using about 11 t of raw materials for every tonne of magnesium produced. In electrochemical extraction processes, dolomite or magnesite ore is crushed, roasted and mixed with seawater, producing magnesium hydroxide. The $\text{Mg}(\text{OH})_2$ is heated and reacted with chlorine to produce molten magnesium chloride, which is electrolyzed to release magnesium.

Global consumption of magnesium metal reached a new high in 2012 at 1.2 Mt, with demand growing 5.5% a year over the past decade. Increases in auto sales, particularly in China, and the trend toward producing lightweight vehicles has led Roskill Information Services to predict an annual 5% growth in magnesium metal consumption through 2017 (Topf 2013). Since the closure of the Timminco Metals dolomite-based magnesium plant (Haley Station, southeastern Ontario) in 2007, there has been no production of magnesium metal in Canada.

As an industrial mineral, brucite can be used for magnesia production, in flame retardants, electric wire insulation, carpet backing, agricultural feed, specialty cements and as a functional filler in plastic compounds (Simandl, Paradis and Irvine 2007).

GEOLOGY OF SOUTHERN ONTARIO BRUCITE OCCURRENCES

Most brucite deposits of economic interest are associated with shallow-level, low-quartz, igneous intrusions into high-purity dolomite or magnesite-bearing sedimentary rocks. Addition of silica from the intrusion or from impurities within the carbonate rocks will produce a calc-silicate assemblage. In most cases, the brucite-bearing zone is located closest to the intrusion and is best developed where fracturing and/or faulting has increased permeability and allowed CO_2 to escape during the following reactions:



Brucite then forms by retrograde metamorphism of periclase (Simandl, Paradis and Irvine 2007) by the reaction

$$\text{brucite} = \text{periclase} + \text{H}_2\text{O}.$$

In the 1940s, Alcan quarried brucite for the production of MgO from Grenville Province dolomitic marble-hosted deposits near Wakefield, Quebec. In southeastern Ontario, brucite occurrences have been documented within high-purity dolomitic marble adjacent to syenitic intrusive rocks in Hinchinbrooke and Marmora townships (Figure 11).

The Hinchinbrooke occurrences, described by Harding (1951), are hosted by a series of narrow marble units surrounded by granite and syenite. All consist of up to 20% brucite disseminated within white, calcitic marble. The occurrences were discovered about 1940 by the Consolidated Mining and Smelting Company during exploration of the marble belt for lead-zinc mineralization. The company did minor surface exploration, including trenching, but considered the brucite zones to be too small and low grade for development. Easton (2001a, 2001b) has classified the intrusive rocks as monzonite of the Chippewa pluton, containing abundant inclusions and screens of marble.

The Marmora occurrence consists of brucitic marble that is currently being quarried for decorative aggregate by Upper Canada Stone Company Ltd. The quarry exposes a 150 by 250 m zone in white, dolomitic marble containing pervasive brucite mineralization, which, on the weathered surface, has been altered to white, chalky hydromagnesite. Brucite content appears to be between 20 and 30%. Detailed geological mapping by MacKinnon (1990) indicates that the zone extends along strike to the north and south of the quarry for a total length of about 1 km. The marble is adjacent to both a marginal, syenitic phase of the Deloro granite and the Moira River fault zone—ideal conditions for the development of brucite in the thermal metamorphic aureole of the intrusion.

A sample from the Marmora quarry, collected by the District Geologist in 2013 and analyzed by X-ray diffraction for mineral identification and semi-quantitative analysis by Activation Laboratories Ltd., was estimated to contain 57% calcite, 12% dolomite and 27% brucite by weight (Fernandes 2014).

Brucite has not been the focus of any significant exploration in southeastern Ontario and may have been overlooked during previous mapping and sampling of the marble belts. Dolomitic marble near the margins of syenitic, dioritic and gabbroic intrusive rocks may host additional deposits of brucite. The presence of wollastonite-bearing skarns associated with calcitic marble adjacent to intrusive rocks may indicate favourable conditions for the formation of brucite if dolomitic marble is also present. Both periclase and wollastonite can form in relatively high-temperature, low-pressure, inner-contact metamorphic zones of high-level intrusions. The Marmora brucite occurrence is located less than 5 km north of the Platinova–Cominco wollastonite deposit (about 1 Mt averaging over 40% wollastonite), also located adjacent to the Deloro granite (MacKinnon 1990).

The geology and geochemistry of Grenville marble belts and specific prospects are documented in the following Ontario Geological Survey reports:

- *Geochemistry of Grenville Marble in Southeastern Ontario* (Grant, Papertzian and Kingston 1989)
- *Precambrian Dolomite Resources in Southeastern Ontario* (LeBaron and MacKinnon 1990)
- *High-Purity Calcite and Dolomite Resources of Ontario* (Kelly 1996)

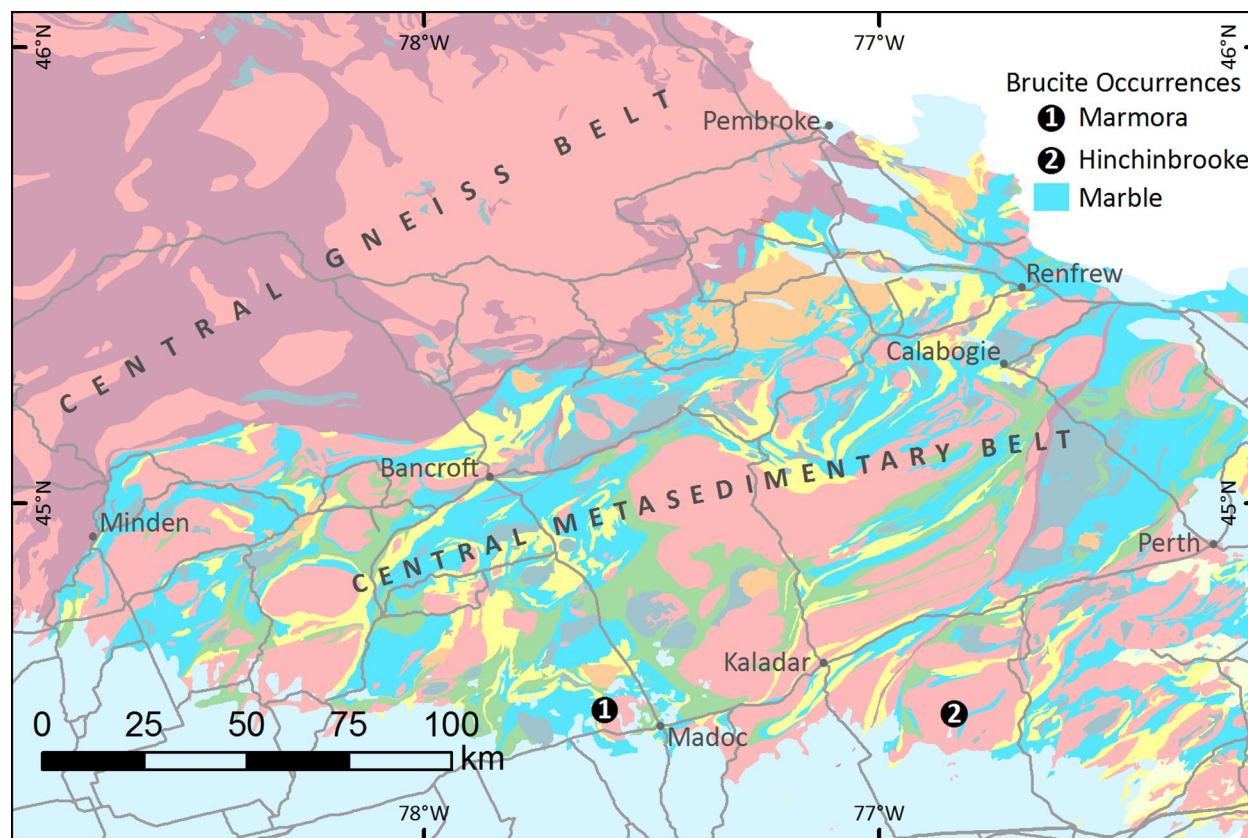


Figure 11. Brucite occurrences and marble belts, southeastern Ontario. Geology from Ontario Geological Survey (2006).

Gold in Southeastern Ontario: Summary of Exploration Activity, 1986–2014

INTRODUCTION

Exploration for gold in southeastern Ontario began with the discovery of Ontario's first gold mine, the Richardson Mine at Eldorado, about 45 km south of Bancroft, in August of 1866. The discovery was made by Marcus Powell, who had been prospecting for copper in the Madoc area since 1863. Iron had been mined and smelted in the Marmora area since 1821.

The Richardson Mine was a small deposit, producing about 100 ounces of gold. However, the increase in prospecting activity in the area resulted in new discoveries in the following years. Between 1895 and 1908, 12 gold mines were operating, the most important of which were the Deloro Mine, which produced about 10 000 ounces of gold from 40 000 tons of ore, and the Cordova Mine, with production of 23 000 ounces of gold from 120 000 tons of ore. A Provincial Assay Office was opened in the city of Belleville in 1898 to service the new mining area. The total past production of all southern Ontario gold mines is about 40 000 ounces.

With the discovery of rich deposits of gold and silver in northern Ontario in the early 1900s, the focus of exploration shifted away from southern Ontario. As the price of gold increased to over \$800 per ounce in 1980, interest in the old gold mines of southern Ontario was renewed and a significant amount of exploration was done throughout the 1980s. That work resulted in 2 new discoveries in 1985: the Mono Gold Mines property near Bannockburn in Madoc Township and the Dingman deposit near Malone in Marmora Township. Based on diamond drilling to date (January 2014), the Mono deposit contains about 135 000 ounces of gold and the Dingman deposit contains about 360 000 ounces. Both properties have changed hands several times and continue to be active projects.

The gold exploration programs of the 1980s on 23 properties are documented in LeBaron (1991). Since that time, significant exploration has been done on only a few of the prospects, as described below. Figure 12 shows the geology and gold occurrences of the Marmora–Madoc–Harlowe area and the general location of the favourable metavolcanic–metasedimentary rocks contact that hosts or is proximal to many of the occurrences.

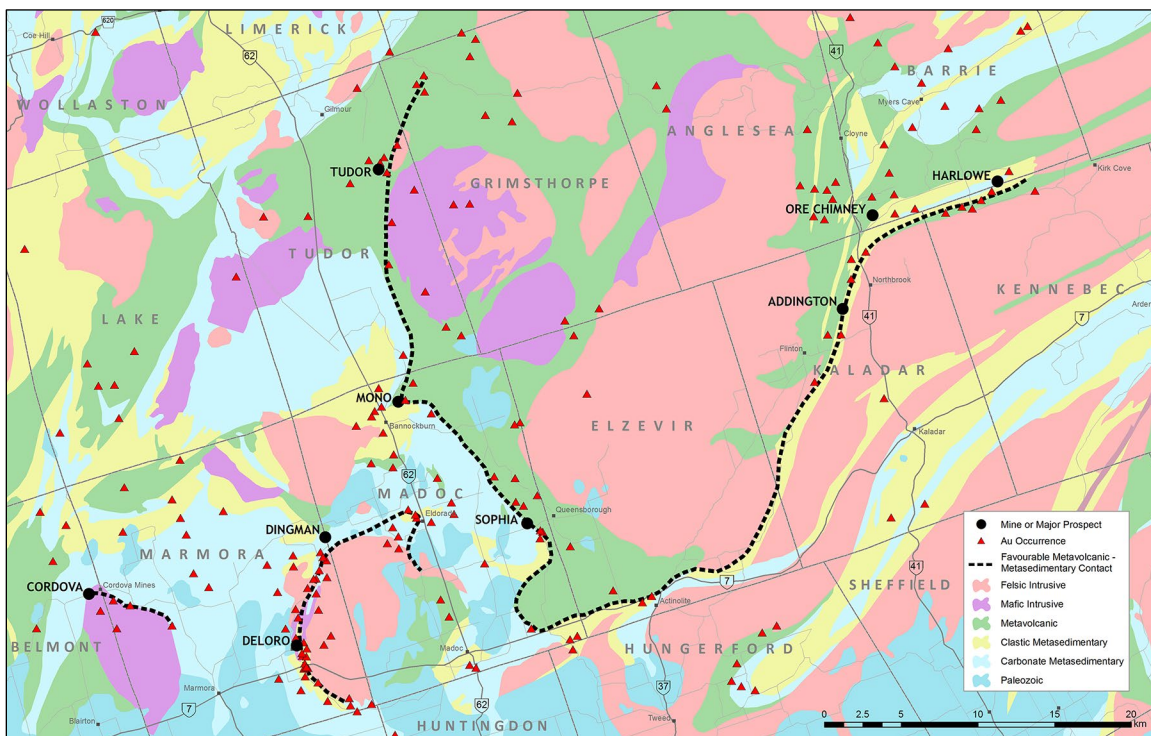


Figure 12. Geology and gold occurrences in the Marmora–Madoc–Harlowe area, southeastern Ontario. Geology from Ontario Geological Survey (2006).

BANNOCKBURN (MONO GOLD MINES) PROSPECT

(summarized from Schorn 1998)

By the end of 1986, Mono Gold Mines had completed over 100 diamond-drill holes, totalling over 30 000 feet, outlining a deposit of about 250 000 tons of ore grading 0.45 ounces of gold per ton. Additional drilling in 1987 led to a revised tonnage and grade estimate of 372 000 tons averaging 0.39 ounces of gold per ton.

In 1988, Mono entered an agreement with Micham Exploration Inc. to conduct underground exploration work. A ramp was driven to the 25 m level, at which depth a drift was continued along the quartz vein zone for about 100 m. With a declining price of gold in 1989, the project was stopped.

In 1993, with the price of gold rising above \$400 per ounce for the first time in 30 months, Mono contracted a mining company to dewater the workings and continue underground exploration. The results of this work were not sufficiently encouraging to warrant additional investment, and Mono abandoned the property.

In 1996, Madoc Mining Company Limited applied for a permit to extract a bulk sample of up to 10 000 tons from the underground workings. Work continued sporadically over the following year, as funds to pay the mining contractor were difficult to raise. However, the contractor agreed to continue working in exchange for a 50% interest in any gold that was recovered from the bulk sample. By the end of September 1997, 1300 tons of ore were shipped to a custom mill operated by St. Andrew Goldfields near Timmins. By this time, the price of gold had dropped to below \$300 per ounce and the project was abandoned in October 1997. Results of the bulk sample test are unknown.

The portal to the underground workings was sealed once again, and the property has remained dormant since that time. In late 2011, Crown William Mining Corporation acquired the mineral rights to the property and began a re-evaluation of the deposit. Beginning with a review of past exploration work, the company followed up in 2013 with re-examination and sampling of diamond-drill core from the property, stored at the MNDM Drill Core Library in Tweed. The company has reported that they intend to do additional sampling of archived drill core and are looking into obtaining a permit to dewater the workings and conduct additional underground sampling in 2014 (A. Schweitzer, Crown William Mining Corporation, personal communication, 2013)

DINGMAN PROSPECT, MARMORA TOWNSHIP

(summarized from Cox and Roscoe 2013)

In 1985, gold was discovered in a small granitic body located several kilometres north of the historic Deloro area mines, which produced about 14 000 ounces of gold prior to 1908.

Noranda Exploration acquired the property in 1986 and conducted surface exploration followed by a diamond-drilling program in 1987 and 1988. Noranda estimated that the deposit contains 8.5 million tons grading 0.043 ounces of gold per ton – a large, low-grade deposit, unlike the smaller, higher grade deposits typical of the Deloro area.

In 1997, Deloro Minerals Ltd. purchased the property and drilled 14 holes, totalling 2053 m.

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

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

An additional 3926 m of diamond drilling in 16 holes were completed by Opawica on the property in February to April, 2009. Several deeper holes confirmed that the gold zone widens and remains open at depth and that the mineralization remains consistent at about 1.0 g/t Au. Hole DI-09-01, drilled to a vertical depth of about 575 m,

intersected 131 m of mineralized, altered granite containing a 95 m core length averaging 1.0 g/t Au. Hole DI-09-05 intersected 133 m averaging 1.0 g/t Au. The results of this program were not included in the NI 43-101 report released in March, 2009 (Palmer, Greenough and Laakso 2009b). The following revised resource estimate was released following receipt of drill core analyses: Indicated resources remain unchanged, at 8 801 000 tonnes grading 0.97 g/t Au and Inferred resources are increased to 11 301 000 tonnes at 0.98 g/t Au (Opawica Explorations Inc., news release, July 16, 2009).

In 2010, Upper Canada Gold Corporation acquired the mineral rights to the Dingman property and completed a diamond-drilling program consisting of 24 holes, totalling 6556 m, to test the Dingman gold zone at depth and to better define gold resources for the possibility of open-pit mining. The company revised the resource estimate to 11.6 million tonnes averaging 0.97 g/t (361 000 ounces contained gold).

The company changed its name to California Gold Mining Inc. in 2013. No new exploration work has been done since 2010. The company released an economic feasibility study in May, 2013, which concludes that the proposal to mine 10.64 Mt of ore at a grade of 0.92 g/t Au for a total production of 290 000 ounces gold, is not feasible at a base gold price of \$1500 per ounce and that the project should be re-evaluated if gold prices stabilize at greater than \$1800 per ounce (Cox and Roscoe 2013).

DILLMAN–CHARD (TUDOR GOLD) PROSPECT, TUDOR TOWNSHIP

In 1985, R. Dillman and J. Chard staked 4 claims covering the north half of a northerly trending felsite unit hosting minor gold occurrences in Tudor Township. Between 1985 and 1989, the owners conducted magnetometer and VLF–EM surveys, rock sampling, and soil geochemical surveys. The soil survey outlined a 1300 m long gold-arsenic anomaly coincident with the felsite unit. Rock sampling along the anomalous zone subsequently revealed several new occurrences of gold mineralization with values of up to 0.24 ounce per ton gold (8.2 g/t Au).

Homestake Minerals Inc. optioned the property in 1989 and, after geological mapping, soil geochemistry and induced polarization surveys and trenching, completed diamond drilling of 5 holes, totalling 335 m. Gold values were encountered in all holes drilled within the felsite unit, including an 8 m section that averaged 2.1 g/t Au.

In 1994, Romfield Building Corporation excavated 18 trenches across the width of the felsite unit (the “Main Zone”) at 50 to 100 m intervals along a 1300 m strike length. Channel sampling of the trenches gave average grades of 2.0 to 2.5 g/t Au and ranged up to 72.9 g/t Au in individual samples. The company also completed diamond drilling of 499 m in 7 holes. Significant gold intersections included 2.68 g/t Au over 1.8 m, 2.42 g/t Au over 22.6 m, 7.6 g/t Au over 2.3 m, and 6.47 g/t Au over 1.4 m.

Dillman and Chard continued exploration work from 1997 to 2007 through Ontario Prospectors Assistance Program grants and option agreements with Louvicourt Gold Mines Inc., Rincon Resources Inc. and Everock Inc. Additional claims were staked to the north and south along extensions of the felsite unit and a parallel carbonatized shear zone in mafic metavolcanic rock. New zones of gold mineralization, assaying 0.5 to 2.0 g/t Au were discovered along the latter structure.

In July 2007, the owners entered an option agreement with Opasatika Mining Corporation and, in July 2008, a 9-hole, 1010 m diamond-drill program was completed on the Main Zone, a 3.5 km long zone of felsite containing arsenopyrite mineralization, quartz stringers and silicification. Table 10 shows some of the more significant intersections from the 2008 drill program (R. Dillman, personal communication, February 2010).

Table 10. Significant intersections from the 2008 drill program on the Main zone, Dillman–Chard prospect.

Drill Hole No.	Gold (g/t Au)	Width (m)	Including (g/t Au / m)
MZ-08-03	3.67	1.6	7.81 / 0.7
	314.2	2.9	1012 / 0.9
	0.77	4.6	8.7 / 0.43
	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	68.9	1.43 / 8.85; 1.56 / 12.76; 10.82 / 0.5

In 2011, Union Glory Gold Ltd. entered an option agreement with the property owners and completed a diamond-drill program consisting of 10 holes, totalling 1675 m, designed to test a section of the Main Zone for gold mineralization at a vertical depth of about 100 m over a strike length of 500 m. The felsite unit, in which gold mineralization has been encountered over a strike length of 5 km, is considered by McBride (2012) to be a felsic tuff. Gold mineralization was encountered in all holes, with best intersections of 0.89 g/t Au over a core length of 20 m, 1.24 g/t Au over 18.05 m and 2.53 g/t Au over 9.0 m. A follow-up diamond-drilling program, totalling 4000 m in depth, was recommended to test the zone at a vertical depth of 50 m below the level of the 2011 program (McBride 2012).

In December 2013, the company obtained a work permit to conduct diamond drilling on the Tudor property, which is expected to begin early in 2014. To date, 37 diamond-drill holes have been completed on the property for a total of 4039 m.

HARLOWE AREA GOLD PROSPECTS, KENNEBEC AND BARRIE TOWNSHIPS

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.

In subsequent years, several additional gold occurrences were discovered 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 (conglomerates, quartzites and pelitic schists) along the northern margin of the granodioritic Northbrook pluton.

A spatial association of gold mineralization with the basal Flinton Group unconformity in Kaladar, Barrie and Kennebec townships has been recognized by Moore and Morton (1986) and others. The occurrences are hosted by either 1) mafic schist of the Ore Chimney Formation, interpreted as a paleoregolith which locally lies at the unconformity between underlying mafic metavolcanic rocks and overlying conglomerates and quartzites of the Flinton Group. Examples are the Ore Chimney and Addington deposits to the west of the Harlowe area in Barrie and Kaladar townships, respectively, 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).

From 1986 to 1989, Homestake Mineral Development Company explored several of the Harlowe area gold occurrences. Geological mapping, soil sampling and geophysical surveys (magnetic and VLF-EM) were completed and the results were summarized by Lloyd and Bending (1989).

In 1990, Rio Algom Exploration Ltd. acquired the Homestake properties and conducted surface exploration followed by diamond drilling of 27 holes for a total of 4078 m. Significant gold mineralization was encountered in quartz-tremolite veins hosted by dolomitic marble on the Shorts property (up to 32 g/t Au over 1 m) and in quartz-tourmaline veins within “pseudo granite conglomerate” (up to 8 g/t Au over 3 to 4 m widths). The latter host rock is described as “tectonized granite dikes within biotite mudstone” situated between quartzite pebble conglomerate and dolomitic marble (Knowles 1990). A summary of the Rio Algom exploration results is documented by LeBaron (1991).

The Gold Base occurrence on Concession V, Lot 30, Kennebec Township, hosts an auriferous quartz vein zone within interlayered carbonate and mafic metasedimentary rocks in an area of predominantly mafic metavolcanic rocks near the contact with the Northbrook pluton. The vein zone, up to 2 m wide and exposed in trenches over a length of 300 m, has yielded assays from grab samples of up to 1.44 ounces of gold per ton (49 g/t Au). Details of the history, geology and mineralization of the prospect are described by Sangster et al. (2007).

In October, Opawica Explorations Inc. optioned the property from owner H. Veley and drilled 6 holes on 3 sections spaced 75 m apart to test the vertical continuity of the vein zone. Two holes were drilled to depths of about 60 and 90 m on each section below zones of known mineralization. Although the company reported that each hole intersected 1 to 2 m of quartz and carbonate veining, no significant mineralization was encountered and the option was terminated (Opawica Explorations Inc., news release, November 6, 2007).

OUTLOOK AND RECOMMENDATIONS

Since the late 1980s, in addition to the work described above, sporadic exploration for gold in southeastern Ontario has continued by a few local prospectors. The current downturn in mineral exploration and difficulties in raising exploration funding by junior mining companies has resulted in a generally low level of gold exploration activity in southern Ontario in recent years. However, as the discoveries of the mid-1980s proved, despite over 150 years of prospecting, there is potential for the discovery of new gold deposits in southeastern Ontario. Favourable settings for gold mineralization are the following:

- **Intrusive margin**
The mines at Cordova and Deloro are quartz vein-type deposits that formed along the margins of the Cordova gabbro and the Deloro granite. Gold that was present in rocks near the metavolcanic–metasedimentary rocks contact may have been remobilized and deposited in fractures associated with shearing and faulting along the edges of the intrusions. The veins include other minerals typical of lode gold deposits such as pyrite, chalcopyrite, arsenopyrite, tourmaline and iron-bearing carbonates.
- **Volcanic-sedimentary contact**
The Sophia, Mono and Tudor gold deposits occur in both metavolcanic and metasedimentary rocks associated with fault- and/or fold-related shear zones. These probably represent a concentration of gold that occurred from a combination of hydrothermal activity and erosion of the volcanic pile during and subsequent to the final stages of volcanism, followed by remobilization and deposition into structural traps during Grenville deformation and metamorphism.
- **Flinton Group Unconformity**
The Addington and Ore Chimney mines and the Harlowe area occurrences represent concentrations of gold near the base of the Flinton Group—a thick sequence of sedimentary rocks that was deposited after the continental collision had begun. At the base of the sequence are conglomerates and quartzites that may have contained some placer gold enrichment, which was then remobilized during post-Flinton Group deformation and metamorphism. There is no direct evidence of placer mineralization, but the spatial association of the gold occurrences with the unconformity suggests that there may have been some enrichment in the conglomerates at the base of the sequence and/or in the pre-Flinton Group paleoregolith (the Ore Chimney Formation).

Tables 11 through 19 list currently inactive mineral deposits with identified resources and past-producing mineral occurrences.

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

Mine	Township	Operating	Tons Milled	Production
Kingdon	Fitzroy	1884–1885, 1914–1931	905 000	76 821 409 pounds Pb concentrate; 857 312 pounds Zn concentrate; 60 074 072 pounds Pb recovered
Long Lake	Olden	1897–1925, 1973–1974	3442, not available	\$41 550 ore value, 9467 tons Zn valued at \$1 227 000
Eldorado Copper	Madoc	1906	not available	234 000 pounds Cu matte containing 230 ounces Au, 182 ounces Ag, 109 000 pounds Cu
Hollandia Lead	Madoc	1903–1906	not available	2 653 365 pounds Pb

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

Mine	Township	Operating Years	Tons Milled	Ounces Produced	Grade (ounces/ton)
Big Dipper	Barrie	1907–1909	52	17	0.33
Cook	Marmorora	1901–1904	1483	289	0.26
Cordova	Belmont	1892	120 670	22 774	0.19
Craig	Tudor	1905–1906	1850	248	0.13
Deloro	Marmorora	1897–1902	39 143	10 360	0.26
Gatling 5 Acre	Marmorora	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	Marmorora	1893–1908	239	302	1.26
Richardson	Madoc	1866–1868	unknown	75 – 100	0.408
Sophia	Madoc	1900–1941	1800	110	0.06
Sovereign	Marmorora	1878 1892–1900	unknown 1962	970 370	unknown 0.19
Star of the East	Barrie	1905–1907	976	134	0.14
Total			174 894	38 592	

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

Mine	MDI Number	Township	Operating Years	Total Production (Tons)
Bailey	31C06NW00003	Madoc	1907, 1916, 1917, 1944–1950	25 000
Blakely	31C06NW00019	Huntingdon	1918–1920, 1928, 1941–1947	5026
Coe	31C06NW00008	Huntingdon	1941–1942	114
Dwyer	31E01SE00091	Cardiff	1918–1920, 1943, 1944	97
Herrington South	31C05NE00009	Huntingdon	1917	13
Howard, Fred Hill	31C06NW00014	Huntingdon	1918, 1920, 1929, 1940–1942, 1944	2500
Johnston	31C06NW00013	Huntingdon	1943, 1944–1947, 1949	187
Keene	31C06NW00004	Huntingdon	1918–1919, 1943, 1944, 1950	5000
Kilpatrick	31C06NW00005	Huntingdon	1944, 1953–1959	11 566
Lee Junior	31C05NE00008	Madoc	1917, 1940, 1943–1945	2000
Lee Senior	31C05NE00006	Madoc	1916–1918, 1942, 1943	1600
McIlroy	31C05NE00003	Madoc	1917–1918, 1923, 1944	540
Miller	31C05NE00005	Madoc	1917–1919	460
Noyes	31C06NW00011	Huntingdon	1917–1920, 1941–1943	25 000
Palmateer	31C06NW00016	Huntingdon	1942	44
Perry	31C06NW00009	Huntingdon	1915–1920, 1941–1943	8000
Perry Lake	31C06NW00007	Huntingdon	1910, 1913, 1915, 1917, 1952, 1960	4000
Ponton	31C05NE00004	Madoc	1929–1942	1500
Rogers	31C06NW00018	Huntingdon	1909–1914, 1943–1951	45 000
Rooks	31C12SE00003	Madoc	1916–1918	100
South Reynolds	31C06NW00010	Huntingdon	1917–1918, 1943	100
Wallbridge & Herrington	31C05NE00007	Madoc	1920–1922, 1941–1943	6600
William Reynolds	31C12SE00002	Madoc	1941–1942	88

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

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

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

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

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

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

Table 16. Uranium deposits not currently being mined in the Southeastern Ontario District in 2013.

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 ₃ O 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 ₃ O 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 ₃ O 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 ₃ O 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 ₃ O ₈ within 500 feet of shaft & to a depth of 600 feet; 56 720 tons at 0.120% U ₃ O 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 ₃ O 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 ₃ O 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 ₃ O ₈ (1957)	MRC 4, p.26
Farcroft Anstruther Tp.	MDI31D16SE-00059 (Developed Prospect w/o Reserves)	U	not known	
Garland Anstruther Tp.	MDI31D16SW-00093 (Prospect)	U, Th	not known	
Cavendish Cavendish Tp.	MDI31D16SW-00099 (Prospect)	U, Th	Estimated reserves: 435 624 tons grading 0.096% U ₃ O 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 ₃ O 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 ₃ O 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 ₃ O ₈ (1976)	MDC 23, p.60

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

Table 17. Mineral deposits not currently being mined in the Southeastern Ontario District in 2013. (Note: table does not include nepheline syenite, trap rock, REE and dimension-stone deposits.)

Abbreviations						
AF	Assessment Files	MDI	Mineral Deposit Inventory			
AR	Annual Report	MLS	Mining Lands, Sudbury			
CAMH.....	<i>Canadian and American Mines Handbook</i>	MP	Miscellaneous Paper			
CMH.....	<i>Canadian Mines Handbook</i>	NM.....	<i>The Northern Miner</i>			
GR	Geological Report	OFR	Open File Report			
MDC.....	Mineral Deposit Circular [No.15-]	PC	Personal Communication			
	[formerly Mineral Resources Circular, No.1-14]	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, p.138
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)	AE	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, p.104
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)	A	Au	225 000 tons grading 0.267 ounces per ton Au	MP 161, p.377
Cooper Spruce Ridge Resources Ltd. Elzevir Township	MDI31C11SW-00044 (SO 2679)	I	Au, talc	3 Mt @ 30–33% recoverable talc and 40 000 t @ 8.0 g/t Au	OFR 5945, p.92; OFR 5808, p.79
Dingman Deposit Marmora Township	MDI31C12SE-00040 (SO 3590)	AE	Au	7 Mt @ 1.8 g/t Au	OFR 5958, p.11-13

Deposit Township	MDI File Number	Status	Commodity	Reserves	Reserve Reference
Hawley Ram Petroleum Limited Olden Township	MDI31C10NW-00117 (SO 4057)	I	Wollastonite	2.5 Mt @ 32% wollastonite to a vertical depth of 75 m	OFR 5943, p.337
Marmora Gitennes Exploration Inc. Marmora Township	MDI31C12SE-00096 (SO 3729)	I	Wollastonite	450 000 t (open pit) @ 47% wollastonite, plus 680 000 t @ 39% wollastonite in a separate zone	OFR 5715, p.50
Trudeau C. Roger Young Hungerford Township	MDI31C11SW-00049 (SO 1192)	A	Calcite, dolomite	4 Mt high-purity dolomite; no reserve estimate available for the calcite zone	OFR 5958, p.11-11
Verona–Kirkham Stewart Lake Resources Inc. Bedford Township	MDI31C10SE-00023 (SO 1244)	A	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 ₃ O ₈ , 1 098 283 pounds U ₃ O ₈ ; indicated reserve of 450 988 short tons grading 0.158% U ₃ O ₈ , 1 427 195 pounds U ₃ O ₈ , total reserves of 836 181 short tons grading 0.151% U ₃ O ₈ , 2 525 478 pounds U ₃ O ₈	OFR 5515, p.393
Addington Mine Kaladar Township	MDI31C11NE-00010 (SO0882)	I	Gold	Total geological reserve of 758 000 tons grading 0.14 ounces per ton Au	OFR 5808, p.71
Dominion Magnesium (Timminco) Deposit Ross Township	MDI31F10SE-00002 (SO0068)	I	Dolomitic marble (magnesium metal)	Production rate was 1000 tons of dolomite weekly. No reserve estimate available. Production from purchased feedstock ceased in 2008.	OFR 6222, p.6

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

Table 18. Mineral deposits not currently being mined in the Southwestern Ontario District in 2013.

Abbreviations					
AF	Assessment Files	MDI	Mineral Deposit Inventory		
AR	Annual Report	MLS	Mining Lands, Sudbury		
CAMH.....	<i>Canadian and American Mines Handbook</i>	MR.....	Mining Recorder		
CMH.....	<i>Canadian Mines Handbook</i>	NM.....	<i>The Northern Miner</i>		
GR	Geological Report	OFR	Open File Report		
IMR	Industrial Mineral Report	PC	Personal Communication		
MDC.....	Mineral Deposit Circular [No.15-] [formerly Mineral Resources Circular, No.1-14]	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 ×10 ⁶ t @ 94% SiO ₂)	Amherst Quarries (1969) Ltd.	OFR 5861, p.32 IMR 9, p.29, 31	Inactive
Big Creek 1 (40J/03SE)	Silica	19.5 m thick @ 25 m (10 ×10 ⁶ t of sandstone)	N/A	IMR 9, p.29	Inactive
Big Creek 1 (40J/03SE)	Silica	14.6 m thick @ 34.4 m (10 ×10 ⁶ t of sandstone)	N/A	IMR 9, p.29	Inactive
Dow–Moore 2-20-12 (40J/16NW)	Salt	21 m thick @ 698 m 73 m thick @ 582 m 114 m thick @ 410 m	N/A	PRW Dow–Moore 2-20-XII	Inactive
Eastnor–Lindsay prospect (41H/03SW)	Dolomite	60 ×10 ⁶ t dolomite @ <0.10% impurities (SiO ₂ +Fe ₂ O ₃ +Al ₂ O 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 ×10 ⁶ t dolomite @ <0.10% impurities (SiO ₂ +Fe ₂ O ₃ +Al ₂ O ₃)	N/A	PRW OGS Lindsay 31-VIII W	Inactive
Patton Farm (40J/03SE)	Silica	5.4 m thick @ 10.1 m	N/A	IMR 9, p.29	Inactive
Sunburst GB #7 McGillivray 41-NB (40P/04NE)	Salt	88.7 m thick @ 363.6 m 5.8 m thick @ 339.5 m	N/A	PRW Sunburst GB #7	Inactive
Tobermory prospect (41H/04NE)	Dolomite	60 ×10 ⁶ t dolomite @ <0.10% impurities (SiO ₂ +Fe ₂ O ₃ +Al ₂ O 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 19. Titanium, tantalum and REE occurrences compiled from MDI 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
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 Tp., 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, W.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

SOUTHEASTERN ONTARIO AND SOUTHWESTERN ONTARIO DISTRICTS—2013

Name	Township	MDI File #	Commodity	Deposit Status
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: MDI 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

Multi-year mapping and related projects in southern Ontario by staff of the Earth Resources and Geoscience Mapping Section, Ontario Geological Survey, continued during the 2013 field season.

In the northeastern part of the Central Metasedimentary Belt, Grenville Province, mapping of the Brudenell area, begun in 2011, was completed and 1:50 000 scale mapping of the Cobden area was started. Details of work done in 2013 on OGS and collaborative projects in the Central Metasedimentary Belt are presented in the following articles, published in *Summary of Field Work and Other Activities 2013* (Ontario Geological Survey 2013).

- Geology and Mineral Potential of the Brudenell Area, Northeastern Central Metasedimentary Belt, Grenville Province, with an Emphasis on the Syenitic Rocks; by R.M. Easton
- Mineralogy of the Rare Earth Elements in Marbles from the Brudenell Area, Northeastern Central Metasedimentary Belt, Grenville Province; by R.M. Easton and S.A. Clarke
- Geology and Mineral Potential of the Late Syenite Suite (1090–1030 Ma) and Associated Rocks, Central Metasedimentary Belt Boundary Tectonic Zone, Grenville Province; by R.M. Easton
- Faulting History, Terrane Subdivision and Mineral Potential of the Cobden Area, Northeastern Central Metasedimentary Belt, Grenville Province; by R.M. Easton
- Geology and Mineral Potential of the Chenux Gabbro, Northeastern Central Metasedimentary Belt, Grenville Province; by B. Azar and R.M. Easton
- Geology and Mineral Potential of the Admaston–Horton and Mud Lake Map Areas, Northeastern Central Metasedimentary Belt, Grenville Province; by M. Duguet, V. Dubé-Bourgeois and S. Ma
- Rare Earth Element Mineralization in a Skarn Zone, Burnstown Outcrop, Mazinaw Domain, Grenville Province; by V. Dubé-Bourgeois, Q. Gall and M. Duguet
- Late Dextral Strike-Slip Event in the Northern Mazinaw Domain, Central Metasedimentary Belt, Grenville Province; by Z. Liu, S. Van de Kerckhove and R.A. Jamieson

A new geological map and data from the northeastern Central Metasedimentary Belt were published in 2013:

- Preliminary Map P.3774, *Precambrian Geology, Raglan Hills Metagabbro and Environs, Grenville Province*; by S.J. Magnus
- Miscellaneous Release—Data 309, *Geological, Geochemical, Geophysical and Petrographic Data from the Raglan Hills Area, Central Metasedimentary Belt, Grenville Province, Ontario*; by S.J. Magnus

Other OGS studies related to Paleozoic geology and energy studies, Quaternary geology, aggregate resources and groundwater resources in southern Ontario were in progress in 2013; detailed articles were published in *Summary of Field Work and Other Activities 2013* (Ontario Geological Survey 2013).

Aggregate Resources and Industrial Minerals

- Aggregate Resources Inventory of Middlesex County, Southwestern Ontario; by V.L. Lee
- Aggregate Resources Inventory for Oxford and Brant Counties; by D.J. Rowell
- Industrial Sand Pilot Project Results; by P.J. Sangster and D.J. Rowell
- Aggregate and Industrial Mineral Potential of the Guelph Formation: An Update; by D.J. Rowell

Surficial Mapping and Sampling

- Quaternary Geological Mapping of the Lindsay Area, Southern Ontario; by A.S. Marich

Surficial Geochemistry

- Characterization of Phosphorus in Stream Sediments and Waters in Selected Watersheds of Lake Erie; by H.E. Burke

Paleozoic Geology and Energy Studies

- Karst and Hazards Lands Mitigation: Some Guidelines for Geological and Geotechnical Investigations in Ontario Karst Terrains; by F.R. Brunton

Groundwater Studies

- The Niagara Peninsula Study: A New Three-Dimensional Quaternary Geology Mapping Project; by A.K. Burt
- Ambient Groundwater Geochemistry Project of the Kingston–Peterborough Area; by C.N. Freckelton and S.M. Hamilton
- Development of an Aquifer Mapping Tool, City of Clarence–Rockland, Ontario; by S.R. Morton, T. Di Iorio, S.M. Hamilton and M.J.L. Robin

Several publications were released in 2013 relating to aggregate and energy resources in southern Ontario:

- ARIP 175, *Aggregate Resources Inventory of the County of Perth, Southern Ontario*; by D.J. Rowell
- ARIP 189, *Aggregate Resources Inventory of the County of Lanark, Southern Ontario*; by V.L. Lee
- ARIP 191, *Aggregate Resources Inventory of the City of Ottawa, Southern Ontario*; by V.L. Lee
- Open File Report 6279, *Gas Assessment of the Devonian Kettle Point Formation*; by C. Béland Otis
- Miscellaneous Release—Data 304, *Geological, Geochemical and Geophysical Data from the Kettle Point Formation Drilling Program, Southern Ontario*; by C. Béland Otis

Geophysical surveys that were completed or were in progress in southern Ontario in 2013 are described in *Summary of Field Work and Other Activities 2013* (Ontario Geological Survey 2013).

- Summary of Geophysical Projects and Activities; by D.R.B. Rainsford

A ground gravity survey in the Orangeville area was released as Map 82 588 and Map 82 589 (1:50 000 scale) and Geophysical Data Set 1072. Projects that were in progress are a ground gravity survey in the Niagara Peninsula area and 2 airborne magnetic and radiometric surveys in the Renfrew and eastern Ontario areas.

University Research and Collaborations

The following research projects by faculty and graduate students of various accredited universities were in progress or were published in 2013.

Results of studies of Ordovician sedimentology and stratigraphy in eastern Ontario by Dr. G. Dix of Carleton University and others were released in the following publications in 2013:

- Dix, G.R., Nehza, O. and Okon, I. 2013. Tectonostratigraphy of the regional Chazyan (Middle–Upper Ordovician) carbonate platform, Quebec Embayment; *Journal of Sedimentary Research*, v.83, p.451-474.
- Gbadeyan, R. and Dix, G.R. 2013. The role of regional and local structure in a Late Ordovician (Edenian) foreland platform-to-basin succession inboard of the Taconic orogen, central Canada; *Geosciences*, v.3, no.2 (Special Issue: Sedimentary Basins and Orogens), p.216-239.
- Dix, G.R. 2013. The Sauk–Tipppecanoe megasequence boundary in an interior structural corridor (Ottawa Embayment) of the great American carbonate bank; *in The Great American Carbonate Bank*, American Association of Petroleum Geologists, Memoir 98, p.545-557.

Results of studies by Dr. W.M. Schwerdtner of the University of Toronto and others are in progress (W.M. Schwerdtner, University of Toronto, www.es.utoronto.ca, written communication, 2014):

- Dr. W.M. Schwerdtner, University of Toronto, and Dr. T. Rivers, Memorial University of Newfoundland, have been working on a field-based study of structural and petrological effects of postconvergent tectonism in the Central Gneiss Belt, Grenville Province of Ontario. This ongoing collaborative study was started in the fall of 2010 and included one graduate student (M. Ahmed, Memorial University of Newfoundland) and several undergraduate field assistants from the University of Toronto. In 2014–2015, they will continue the study, focussing on kilometre-scale cross-folds and major lenticular structures in the Georgian Bay, Muskoka and Algonquin Park regions.
- A major paper on gravitational collapse (Schwerdtner et al. 2014) has been published in the J. Tuzo Wilson special issue of *Canadian Journal of Earth Sciences*.

The following research projects by Doctoral candidates at Western University were in progress in 2013:

- Nikole Bingham-Koslowski, with supervisors Dr. Jisuo Jin and Dr. Cameron Tsujita of Western University, is working on a PhD thesis entitled, “High-Resolution Stratigraphy and Sedimentology of the Upper Devonian Kettle Point Formation, Southwestern Ontario, Canada”; a summary is provided (J. Jin, Western University, written communication, 2014):

The Kettle Point Formation is a succession of Upper Devonian black shale known from local outcrops along the southern shore of Lake Huron and found throughout the subsurface of southwestern Ontario. The formation was deposited in an epeiric sea during the Acadian Orogeny and is situated between the Appalachian and Michigan Basins, in the Chatham Sag, bounded by the Algonquin and Findlay arches. The formation contains carbonate concretions 40-150 cm in diameter, called kettles, after which the formation and location are named. Data for this project is primarily collected from macroscopic, thin section, and geochemical analyses of drill cores housed at the Oil, Gas and Salt Resources Library in London, Ontario, as few outcrops exist for this formation.

Despite the recent interest in black shales as alternative hydrocarbon reservoirs, the depositional environments of these rocks remain enigmatic because of a general lack of modern analogs. This study aims to help elucidate the mechanisms behind the deposition of black shales by using the Upper Devonian Kettle Point Formation of southwestern Ontario as a case study. The Kettle Point Formation can be subdivided into three lithofacies: interlaminated black shales interbedded with greyish green mudstones and separated by thick intervals of non-interlaminated black shales. Subsurface correlation of the Kettle Point, using gamma ray logs, has revealed thickness variations of these lithofacies that suggest the influence of local tectonic features on their depositional patterns. Major variations in lithology within the succession are attributed to changes in the intensity and vertical extent of anoxia in the marine water column that culminated in the deposition of the thick packages of non-interlaminated black shales during the peak of anoxia. Interbedded interlaminated black shales and greyish green mudstones record lower intensities of oxygen deficiency overall, but fluctuating at a finer level between anoxic and dysoxic conditions respectively. Geochemical analysis based on sulphur isotopes is currently being conducted to further resolve the redox conditions of the Chatham Sag. Integration of the lithological, stratigraphical, and geochemical data will result in the determination of the depositional environment of the Kettle Point Formation. This information can then be extrapolated and applied to other syndepositional black shales, contributing to the understanding of possible black shale depositional environments and aiding in the interpretation of ancient global climate change patterns.

- Colin Sproat, PhD candidate, and supervisor Dr. Jisuo Jin of Western University, are working on a project entitled, “The Trentonian (Early Katian, Late Ordovician) Brachiopod Fauna of Eastern Laurentia: Evolution, Paleocology, and Paleobiogeography of a Fauna during a Time of Rising Sea Level”; a summary is provided (J. Jin, Western University, written communication, 2014):

The Late Ordovician Trentonian brachiopod fauna of southern Ontario lived during the beginning of an inundation of the eastern margin of Laurentia and rapid worldwide biodiversification of the shelly benthos during the Great Ordovician Biodiversification Event (GOBE). This study will examine Trentonian brachiopod collections from the Manitoulin Island, Lake Simcoe, and Ottawa Valley regions.

Morphological changes are being investigated quantitatively using single-trait statistics and multivariate techniques to determine morphological trends and clusters in the fauna. Geographical information systems (GIS) will be used to study paleobiogeography, examining spatial distribution and biodiversity over the early Katian. The results of this study will be compared to other contemporaneous brachiopod faunas in the region including those of New York, Minnesota, and Cincinnati where the brachiopods lived in different paleoenvironmental settings to contrast the effects of differing ecological pressures.

The results of this study will provide key data on the response of the shelly benthos to a sea level rise during the GOBE. The paleobiogeographical shifts being investigated in this study may serve as ancient analogues to the effects of rising sea level on the shelly benthos in the modern marine ecosystem. The results will also indicate whether any latitudinal gradients are indicated in the fauna as have been described later in the Late Ordovician – a phenomenon well-documented in the modern marine ecosystem.

REGIONAL LAND USE GEOLOGIST ACTIVITIES—SOUTHERN REGION

Land Use Planning Activities

The southern Regional Land Use Geologist, based in Tweed, co-ordinates input into land use planning activities in the Southern Ontario Resident Geologist Districts (southeastern and southwestern) and the part of the Sudbury District south of the French River, including Manitoulin Island. The southern Regional Land Use Geologist position was staffed throughout 2013 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;
- raise awareness within the mineral sector of the implications of legislation and regulations other than the *Mining Act* on their activities; and
- promote awareness of how geoscience serves the public good, including by
 - establishing base-line environmental values;
 - identifying sources of minerals and energy to support sustainable economic activity; and
 - highlighting areas where natural geological hazards and mining-related hazards pose a threat to people and property.

The competing interests for land use vary across the province, but most have the potential to restrict the availability of land, access to it, and/or the activities on it. In 2013, the southern Regional Land Use Geologist dealt with a variety of land use planning issues throughout the Southern Region; the following sections summarize the work that was done.

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, proposed parks, and other initiatives related to Crown land use.

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.

Approved Forest Management Plans, with detailed information about annual operations including plans for creating new access routes or decommissioning existing routes, and maps showing forest access roads are posted on the MNR web site (www.efmp.lrc.gov.on.ca/efMP/home.do).

Due to the planning cycle for forest management planning, the southern Regional Land Use Geologist was not required to provide input into planning for any of the 5 forest management units in Southern Ontario in 2013.

Provincial Parks and Conservation Reserves

In 2013, the southern Regional Land Use Geologist responded to requests for comments on a proposed conservation reserve amendment, as well as a provincial park management plan. One was to facilitate a land exchange related to the Louck Lake Wetland Conservation Reserve. Another was to update the Balsam Lake Provincial Park Management Plan. The MNR posted all of these proposals on the Environmental Registry in 2013 for public comment, but no decision notices have been published.

Withdrawal Orders

The southern Regional Land Use Geologist normally reviews applications for withdrawal of lands from staking under Section 35 of the *Mining Act*. Applicants can request withdrawal of surface rights only, mining rights only, or for both surface and mining rights. These requests are made for a wide range of reasons, including

- developing waste disposal sites and sewage lagoons;
- selling Crown land for cottage lots;
- enabling land exchanges;
- supporting First Nation land claims and treaty entitlement negotiations;
- allowing hydroelectric and other infrastructure developments;
- facilitating Ministry of Transportation review of aggregate potential in support of highway maintenance; and
- assessing applications under Section 35.1 of the *Mining Act* for the withdrawal of Crown-owned mining rights in Northern Ontario, where the surface rights are privately held.

No requests for reviews were received in 2013, although an area of over 3000 km² of selected Crown lands in southeastern Ontario withdrawn in 2012 as being candidate lands for settling the Algonquin land claim was re-opened for prospecting, staking out, sale or lease. A key element of the proposed land claim settlement is the transfer of not less than 475.5 km² of provincial Crown land to Algonquin ownership. Any withdrawn lands not required as part of the proposed land transfer were re-opened to prospecting, staking out, sale or lease on November 30, 2012, after a preliminary draft Agreement in Principle was worked out. Approximately 740 km² remain withdrawn.

Forfeited Mining Lands

The southern Regional Land Use Geologist reviewed a list of 70 properties that were scheduled to be forfeited and re-opened for staking for non-payment of taxes from 2012. Comments relating to nearby abandoned mine hazards and potential First Nation concerns for these potential mining lands forfeitures were provided.

MUNICIPAL AND PRIVATE LANDS

The Ministry of Northern Development and Mines supports municipal and private land use planning across Ontario through the One-Window Planning Service led by the Ministry of Municipal Affairs and Housing (MMAH). Input from MNM includes

- providing data with regard to mineral potential, mining claims and leases, exploration and mining activity and mining-related hazards to planning authorities, planning consultants and MMAH in support of the new municipal Official Plans, Official Plan Amendments, zoning bylaws, and consents (lot severances);
- reviewing land use policies proposed in municipal planning documents and providing comments on those policies to MMAH's "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 (PPS), which guides planning in municipalities and on private land outside of municipalities in Ontario, is issued under the provisions of the *Planning Act*. The PPS was last modified in 2005.

A compulsory five-year review of the PPS 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 PPS review in 2013 included reviewing PPS draft policy options and providing input to the updated Inter-Ministry Protocol for Plan Input, Review and Appeals. This work is helping to guide the revision of the Provincial Policy Statement.

The revised PPS, released on February 24, 2014, includes enhanced provisions to help ensure the recognition of mining operations and areas with significant mineral potential in municipal Official Plans, so that they can be protected from incompatible land uses.

In 2013, the southern Regional Land Use Geologist also reviewed, commented on and/or supplied data and expertise for consent (severance) applications for 12 lower tier municipalities and 24 Official Plans and related planning initiatives, and for 13 new or updated draft Official Plans. The municipalities involved in these planning initiatives are listed in Table 20; their locations are shown in Figures 13 and 14.

Table 20. Municipal planning initiatives with MNDM input, southern Ontario, 2013.

Consent (Severance) Applications	Completed Official Plans and Related Initiatives	Official Plans and Related Initiatives Under Development
Barrie, Township of (2)	Addington Highlands, Township of	Chatham–Kent, Municipality of
Bathurst, Township of	Chatham–Kent, Municipality of	Dufferin, County of
Calvin, Township of (2)	East Ferris, Township of	Lennox and Addington, County of
Darling, Township of	Essex, County of	Loyalist, Township of
Goderich, Town of (10)	Haldimand, County of	McKellar, Township of
Lavant, Township of	Joly, Township of	McMurrich–Monteith, Township of
Madoc, Township of (2)	Manitoulin, District of	Northumberland, County of
Marmora, Township of	McDougall, Township of	Perth, County of
Mayo, Township of	Melancthon, Township of	Smiths Falls, Town of
Rideau Lakes, Township of	Prescott and Russell, United Counties of (2)	St. Mary's, Town of
Tay Valley, Township of (2)	Renfrew, County of	Stormont, Dundas and Glengarry, United Counties of
Wollaston, Township of	Seguin, Township of	Stratford, City of
	South Bruce Peninsula, Town of	The Archipelago, Township of
	South Frontenac, Township of	
	Stone Mills, Township of	
	Stormont, Dundas and Glengarry, United Counties of	
	Stratford, City of	
	Strong, Township of	
	Trent Hills, Municipality of	
	Wellington, County of (2)	
	Whitestone, Municipality of	
	Windsor, City of	

Exemptions from Mining Tax

As of January 1, 2011, Section 189 (1) of the *Mining Act* allows for owners of patented mining rights (private landowners) to apply for exemption from paying mining tax on the land. Key factors that are considered when applications are reviewed are whether or not the lands are being used for mining-related purposes, and whether or not there would be third-party interest in using the lands for mining-related purposes (e.g., the surrounding lands are staked and being explored or the sites in question have provincially significant mineral potential). The southern Regional Land Use Geologist reviewed and provided comments on 24 applications for exemption from Mining Tax in southern Ontario during the year.

Data Committee

The MNR and MMAH jointly host an interministerial committee that is intended to identify and implement ways of making relevant data more readily available to support land use planning in Ontario, especially in the context of municipal planning. The southern Regional Land Use Geologist continued to serve as MNDM's representative on the committee in 2013. In 2013, the committee updated and verified the accuracy of information in the draft data catalogue that will be used to develop a baseline inventory of data available for municipal planning.

PLANNING INITIATIVES WITH MNDM INPUT SOUTHWESTERN ONTARIO

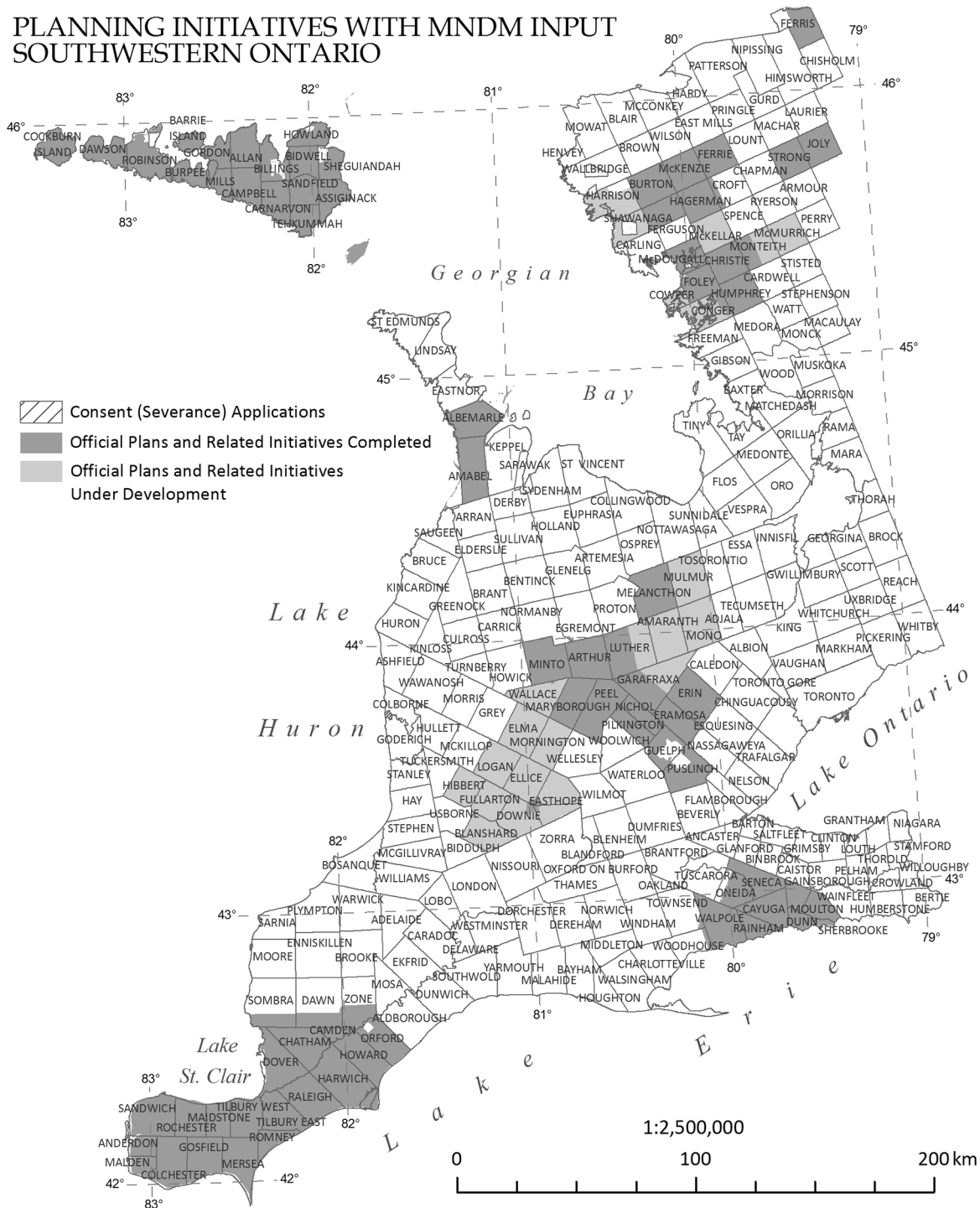


Figure 13. The locations of municipal planning initiatives with MNDM input, southwestern Ontario, 2013.

PLANNING INITIATIVES WITH MNDM INPUT
SOUTHEASTERN ONTARIO

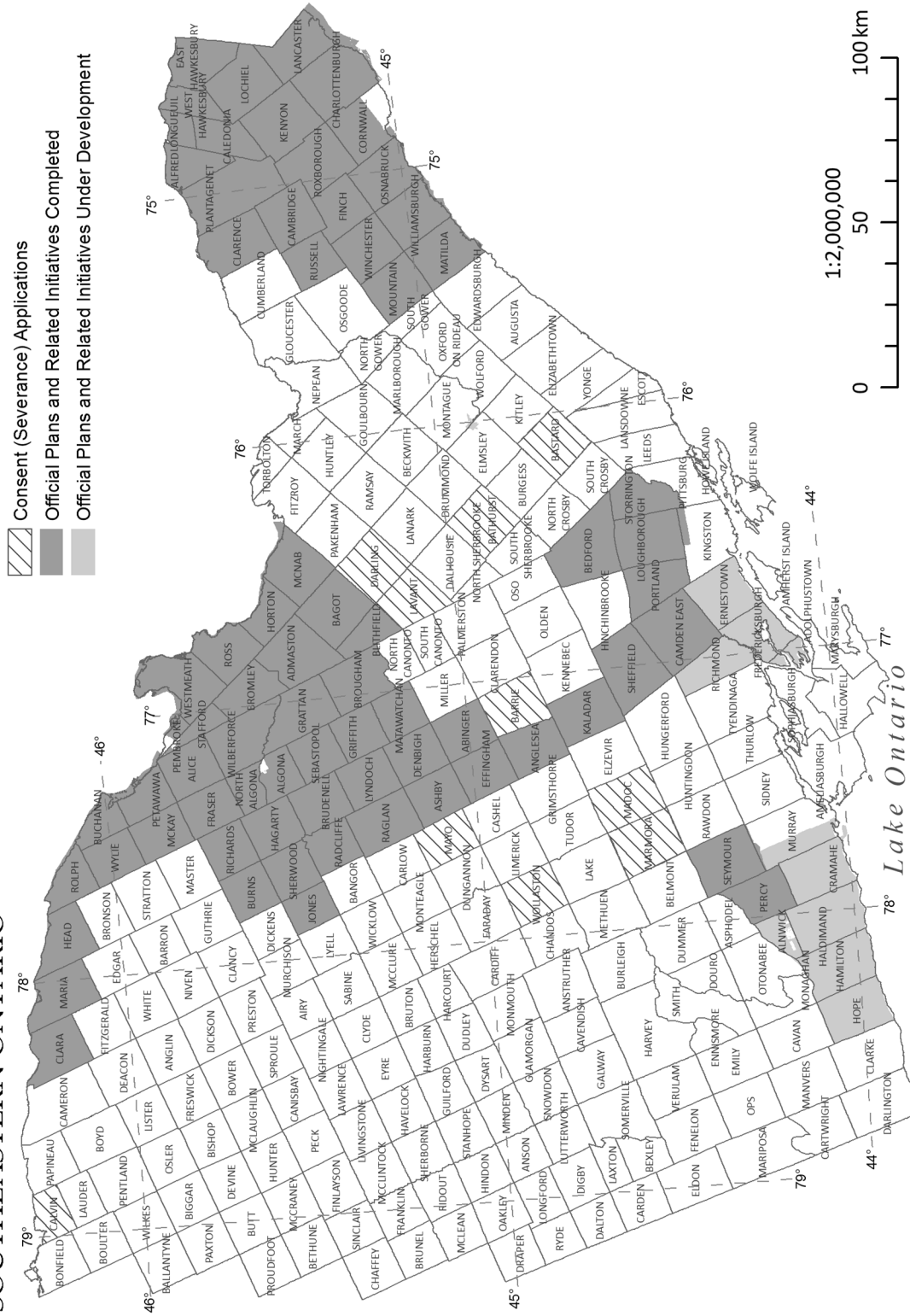


Figure 14. The locations of municipal planning initiatives with MNDM input, southeastern Ontario, 2013.

FIRST NATIONS

During 2013, the southern Regional Land Use Geologist assisted the Southern Ontario Regional Resident Geologist, who has been working with the Aboriginal Relations Unit, MNDM, as a technical expert in support of the Algonquin First Nation land claim discussions, by providing input to technical resource materials.

As a first step in negotiating the land claim settlement between the Algonquins of Ontario and the governments of Canada and Ontario, a preliminary draft Agreement-in-Principle (AIP) was made available for public review in December 2012. The preliminary draft AIP is being used to consult with the Algonquin First Nation and the general public on key elements of a final AIP. In 2013, public information sessions, community meetings and forums were held to obtain feedback from Algonquin voters, stakeholder groups, elected officials and the general public on the draft AIP. Once the final draft AIP is complete, it will be submitted to the Algonquin First Nation for a ratification vote.

Other Activities

The southern Regional Land Use Geologist also participated in a number of other initiatives in 2013, as outlined below.

CLASS ENVIRONMENTAL ASSESSMENTS

Class Environmental Assessments (“Class EAs”) are documents that set out streamlined environmental assessment processes. They apply to routine projects that have predictable and manageable environmental effects. There are currently 11 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.

Work related to Class Environmental Assessments in southern Ontario in 2013 included commenting on proposals by the City of Burlington and The Region of Halton to carry out road widening in Burlington, waterfront development in the Town of Deseronto; and a proposal to revise plans for a wind power project in Dufferin County. 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.

ONTARIO BIODIVERSITY STRATEGY

The Ontario Public Service (OPS) Biodiversity Network is an interministry forum where MNR’s Biodiversity Branch 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 represented MNDM on the OPS Biodiversity Network by attending teleconferences and providing input to biodiversity-related initiatives. 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 will support the achievement of the Ontario Biodiversity Strategy’s goals through the implementation of specific activities.

OTHER

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 shows including the Prospectors and Developers Association of Canada Annual Convention, the Northeastern Ontario Mines and Minerals Symposium 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 an opportunity to share information regarding the mineral sector with mineral collectors and the general public.

The southern Regional Land Use Geologist and Jamie Fairchild, Mineral Exploration and Development Consultant (MNDM) represented MNDM at the Ontario East Municipal Conference (OEMC) with a booth and poster

presentation. The OEMC is an annual land-use planning event organized by Ontario East Economic Development Commission and MMAH. The two-poster display highlighted MNDM geoscience data supporting land use planning across Ontario; and new rules and tools supporting recent amendments to Ontario’s *Mining Act*.

Throughout 2013, 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. She also assisted with hosting a Southern Ontario Prospectors Association (SOPA) day-long meeting in Actinolite. The meeting provided members of SOPA with information on topics related to exploration and mining and changes to government regulations.

Other land use planning work done 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.

FIRST NATIONS MINERALS INFORMATION OFFICER— NORTHEASTERN ONTARIO

S.E. Halet continued to serve as First Nations Minerals Information Officer for northeastern Ontario. The role of the First Nations Minerals Information Officer is to promote understanding and a co-operative working relationship between government, Aboriginal communities and mineral sector stakeholders in Ontario through the provision of outreach, information and training programs. Programs include technical information regarding the mining sequence, claim staking, basic prospecting, and mineral exploration practices and techniques, delivered through information sessions, field trips and presentations at schools, career fairs and trade shows; some of these activities are listed in Table 21.

Highlights of events attended in the Timmins District:

- In March 2013, an evening of mineral exploration information session to the community of Hearst at the Innovo Centre, home to the Hearst Economic Development Corporation, was attended with Timmins Regional Resident Geologist Brian Atkinson. S. Halet discussed the mining sequence and opportunities at various stages within the sequence. B. Atkinson discussed mineral exploration, mining and aggregate projects proximal to the community of Hearst.
- During the May 2013 visit to Chapleau Cree First Nation, participants had the opportunity to tour the Probe Mines Borden Gold project just east of Chapleau. Project Geologist Craig Yuill delivered a tour of the exploration property and showed the course participants some core from their drilling program.
- The Kapuskasing Aboriginal Youth Gathering in July was attended with Timmins Regional Resident Geologist B. Atkinson. The Youth Gathering was a three-day event for approximately 50 Aboriginal and Non-Aboriginal Youth to educate and learn more about each other. There were cross-cultural workshops; various training and education workshops and/or presentations on youth entrepreneurship, leadership and career, drug addiction and suicide prevention, Duty to Consult with First Nations, roles and responsibilities of Aboriginal governments (Individual, Tribal, Regional, Provincial, National), federal, provincial and municipal governments, “Ring of Fire” mining, exploration, careers, aspects of mining, energy, Ontario Power Generation, and current and future major projects.
- The Whish Ki Yak It “Restoring and Managing Our Lands After Mining” Conference in September was attended with Regional Land Use Planner C. Daniels (Timmins) and Mineral Exploration Development Consultant J. Postma (Timmins). The conference was highly integrative and focused heavily on the traditional knowledge perspective of mining land reclamation. There were numerous First Nation attendees, mostly from the Wabun and Mushkegowuk Tribal Councils, and this was an excellent opportunity for industry and government to interact with key environmental and land use personnel from the various FN communities.

Table 21. Northeastern Ontario First Nations Minerals Information Officer activities conducted in 2013.

Community	District	Date	Activity	Participants
Algonquins of Ontario	Southern Ontario	August 12–14	Prospecting Course	15
Algonquins of Ontario Nations Gathering	Southern Ontario	July 27–13	Booth	
Chapleau Cree First Nation	Timmins	May 13–15	Prospecting Course	10
Constance Lake First Nation	Timmins	February 13–14	Prospecting Course	8
Curve Lake First Nation	Southern Ontario	June 25–27	Prospecting Course	5
Garden River First Nation	Sault Ste. Marie	April 18–19	Prospecting Course	15
Kapuskasing First Nation Youth Gathering	Timmins	July 25–27	“The Earth Beneath Your Feet” interactive workshop	50
Matachewan First Nation	Timmins	March 25–27	Prospecting Course	*
Moose Cree First Nation	Timmins	April 8–12	Prospecting Course	4
North Shore Tribal Council (Garden River, Mississauga, Sagamok and Serpent River First Nations), Aboriginal Skills and Employment Training Strategy representatives	Sault Ste. Marie	February 28	Mining for Non Miners	7
Serpent River First Nation	Sault Ste. Marie	May 1	Prospecting Course	*
Serpent River First Nation	Sault Ste. Marie	May 3	Career Fair	100+
Temiskaming Native Women’s Association	Kirkland Lake	May 27–28	Prospecting Course	11
Taykwa Tagamou First Nation	Timmins	October 28–29	Prospecting Course	5
Wikwemikong First Nation	Sudbury	August 20	Youth Skills Tradeshow Booth	100+
Presentations	Location	Date	Activity	Participants
Cambrian College: students	Sudbury	March 15	Mining for Non Miners	10
Hearst Economic Development Corporation	Hearst	March 20	Mining for Non Miners	10
Canadian Ecology Centre	Sudbury	April 29–May 1	Prospecting Course	9
Canadian Ecology Centre: Grade 12 Earth and Space Science students	Mattawa	July 4, 2013	What is Prospecting?	25
Canadian Ecology Centre: Mohawk College Mining Engineering students on “Northern Ontario Mining Tour”	Mattawa	October 21	Introduction to Prospecting	40
Conferences, Field Trips	Location	Date	Activity	
MNDM Mineral Exploration and Development Workshop, Technical Staff Training Session	Sudbury	February 26–28		
Prospectors Developers Association Conference	Toronto	March 3–6		
Northeastern Ontario Mines and Minerals Symposium	Sault Ste. Marie	April 16–17		
Timmins Mine Expo	Timmins	May 29–30	Introduction to Prospecting Course (attended)	
Canadian Land Reclamation Association Annual Symposium	Cobalt	June 18–19		
Kapuskasing First Nation Youth Gathering	Timmins	July 25–27		
Whish Ki Yak It “Restoring and Managing Our Lands After Mining”	Timmins	September 10–12		
Nishnawbe Aski Development Fund’s Mining Summit	Timmins	October 16–17		
MNDM Mineral Exploration Development’s Mining Awareness Workshop	Timmins	October 22–24		
Canadian Aboriginal Minerals Association	Vancouver	November 3–6		

*organized, but cancelled due to lack of participants

Highlights of events attended in the Kirkland Lake District:

- The course presented to the Temiskaming Native Women’s Association in May in Kirkland Lake was part of a six-week Mining Readiness course delivered by Mining Industry Human Resources Council.
- The Canadian Land Reclamation Association’s annual symposium in June featured talks from leading experts in the area of mining land reclamation and toured the mining legacy area of Cobalt. The symposium attracted a record number of delegates. More than 150 environmental specialists attended this event, which was organized by the Ontario Mining Association in collaboration with the Ontario Chapter of the Canadian Land Reclamation Association (CLRA). The purpose of this mine rehabilitation event was to encourage the pursuit of excellence in mine reclamation; to share knowledge, information and research results; and to share best practices. The symposium also focussed on promoting a better understanding of the outstanding achievements in mine reclamation to Ontario’s mining industry, the environmental community and the broader public.

Highlights of events attended in the Sudbury District:

- The April–May visit to the Canadian Ecology Centre was also attended by Southern Ontario Regional Resident Geologist Pam Sangster who delivered a presentation on Industrial Mineral Potential in Southern Ontario.
- Sudbury District Geologist Dan Farrow and District Geological Assistant Lesley-Anne Bardeggia accompanied Suzanne for the “What is Prospecting?” presentation at the Canadian Ecology Centre in July, and for the Wikwemikong First Nation Skills Tradeshow in August.

Highlights of events attended in the Southern Ontario Region:

- The final day of the June course held in Curve Lake First Nation was attended by Southern Ontario Regional Resident Geologist Pam Sangster and District Geologist Peter LeBaron. Pam delivered a talk on the Industrial Mineral Potential in Southern Ontario, and Peter delivered a hands-on demonstration of various prospecting tools available to the prospector such as the beep mat, scintillometer, gold pan and magnetic susceptibility meter.
- The Algonquins of Ontario Nations Gathering in Bancroft in July was also attended by Southern Ontario Regional Resident Geologist Pam Sangster and District Geologist Peter LeBaron who set up a booth that was visited by many attendees of the Nations Gathering. Aboriginal Relations Unit Land Claim Specialist Leslie Joynt also attended the event.
- Southern Ontario Regional Resident Geologist Pam Sangster provided a presentation on Industrial Mineral Potential in Southern Ontario to the Algonquins of Ontario as part of their course in August and then delivered a half-day field tour of the rocks in the area.

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. S.E. Zurevinski was the northwestern Ontario MDCG from January until August 2013 and T. Pettigrew was hired in December 2013 as the new northwestern Ontario MDCG.

In April 2013, a new MDI database was released to the public. The database was released as *Mineral Deposit Inventory—2013* and is available as a free digital download from MNDM's GeologyOntario web site (also available on CD). *Mineral Deposit Inventory—2013* can be viewed using through OGS Earth using the Google Earth™ mapping service. Mineral Deposit Inventory data are also searchable through the Ministry's GeologyOntario web site.

An updated version of the MDI database (*Mineral Deposit Inventory—2014*) will be released to the public in April 2014 (replacing *Mineral Deposit Inventory—2013*).

Throughout the year, emphasis was placed on updating and correcting the reserve and resource figures for developed prospects with reserves and past producing mines with reserves, as well as prospects. Commodities of particular focus this year included graphite and silica sand. Geographic areas of focus included Cobalt and the southern part of the Swayze greenstone belt. Mineral deposit records were also updated for 3 OGS mapping projects in the Sault Ste. Marie District and 1 OGS mapping project in southeastern Ontario.

Total changes to the MDI database for the province in 2013 include 791 records updated, 37 records deleted and 32 new records. A breakdown of the provincial records revised, by office, appears in Table 22.

Table 22. Mineral Deposit Inventory records revision—2013.

Resident or District Office	Updates	Deletions	New
Kenora	22	0	0
Kirkland Lake	83	1	3
Red Lake	3	0	0
Sault Ste. Marie	111	2	17
Southeastern Ontario	159	31	4
Southwestern Ontario	11	2	0
Sudbury	84	0	1
Timmins	259	1	7
Thunder Bay North	16	0	0
Thunder Bay South	59	0	0
Total	791	37	32

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 is an additional tool for making new mineral discoveries in Ontario.

ACKNOWLEDGMENTS

The authors from the Southern Ontario Regional Resident Geologist's office would like to recognize 3 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. S.E. Halet, First Nations Minerals Information Officer, not only provided a summary of activities for this report, but also made every effort to include the Southern Ontario Resident Geologist Office in First Nation outreach opportunities.

The authors would like to thank all producers, exploration companies, prospectors and developers who provided access to their operations or supplied information throughout 2013. Strong communication links between stakeholder groups and government ministries are essential for effective program delivery and ultimately improve the delivery of government services.

GIUSEPPE PALU (1939–2013)

The Tweed Resident Geologist Office and the southern Ontario prospecting community lost a long-time client in 2013. Before his retirement Giuseppe "Joe" Palu, had investigated and developed dimension-stone prospects across Ontario. He was well known to MNDM Mineral Development staff in Sudbury as well as many in the Resident Geologist Program offices. Most recently, he had been acting as a consultant to companies and individuals developing new limestone dimension-stone quarries on the Bruce Peninsula and on Manitoulin Island. His legacy includes the names of well-known Ontario dimension stones: Arctic Green Marble, Temagami Pink Marble and Tweed Blue Marble.

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**Ontario Geological Survey
Regional Resident Geologist Program**

Petroleum Operations Section—2013

by

L. Fortner and T.R. Carter

2014

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Petroleum Operations—2013

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Petroleum Operations Section—2013

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INTRODUCTION

Drilling activity in southern Ontario was consistent from 2012 to 2013 after many years of steady decline. The average price of oil sold in Ontario during the year was \$98 per barrel: significantly higher than the average for 2012 of \$88. The price of natural gas in Ontario averaged \$3.88 per MMBtu in 2013, significantly higher than the average of \$2.96 in 2012.

Produced oil volumes fell to a new low in 2013. Data compiled from annual production reports submitted to the Petroleum Operations Section indicate that annual oil production dropped 16.2% to 70 187 m³ in 2013 with an estimated value of \$43.3 million, compared to 83 778 m³ with an estimated value of \$46.6 million in the previous year.

The recent decline in oil production has been directly related to reduced levels of drilling activity since 2004, such that there is insufficient new production to replace that from existing wells. The slight increase in oil volume produced in 2012 was apparently not a reversal of the trend. Sales value fell in 2013, as the higher average unit price for oil could not compensate for substantially decreased production.

Natural gas production declined another 7% in volume to 185 719 × 10³ m³, but increased in value to an estimated \$26.1 million, compared to 200 297 × 10³ m³ with an estimated value of \$21.4 million in 2012. A recovery in the unit price of gas in 2013 from recent lows prevented attaining a new low in total sales value.

EXPLORATION ACTIVITY

A total of 21 licences to drill and operate new wells were issued by the Ministry of Natural Resources in 2013, compared to 20 in 2012. An additional 76 licences were issued to plug or operate existing wells.

Drilling of 18 new wells was reported in 2013, the same number as in 2012. These consisted of 9 exploratory wells, 6 development wells, 1 stratigraphic test, and 2 service wells. Three of the wells drilled in 2013 were horizontal.

Successful development drilling in 2013 resulted in 1 well reported to be an active oil producer, 1 potential oil well, and 4 private gas wells. The commercial success rate in 2013 was on par with 2012.

Exploratory drilling in 2013 resulted in 1 active oil well, 1 active gas well, 2 potential gas wells, 1 potential oil well, with 4 dry holes (Table 1; Figure 1).

Cambrian Play

Two exploratory wells were drilled to test Cambrian targets for oil and gas in 2013. One in Elgin County was reported as an active oil well. The other, in Brant County, was plugged and abandoned. One exploratory well and one stratigraphic test had been drilled to the Cambrian in 2012.

There have been no development wells drilled to Cambrian targets since 2010.

Ordovician Play

There were 4 exploration wells drilled to Ordovician targets in 2013: 3 in Essex County and 1 in Oxford County. The well in Oxford was reported as a potential oil producer. The 3 wells in Essex County were reported as an active gas well, a potential gas well, and a plugged and abandoned well. No exploration wells were drilled to Ordovician targets in 2012.

One development well was drilled in Essex County to test the Ordovician in 2013. It was reported as a successful oil producer. Two Ordovician development wells had been drilled in Essex County in 2012.

Silurian Sandstone Play

As in 2012, no exploration wells tested Silurian sandstone targets in 2013.

Four development wells were drilled to Silurian sandstones in 2013. All were successful private gas producers: 2 in Welland County, 1 in Haldimand County, and 1 in Lincoln County. Only 1 development well, also a private gas producer, was drilled to Silurian sandstones in 2012.

Silurian Carbonate Play

One exploratory well was drilled to test Silurian Guelph Formation reef and/or Salina Group targets in 2013. It was reported as a potential gas well in Lambton County. Two exploratory wells were drilled for Silurian Guelph Formation reef and/or Salina Group targets in 2012.

One development well was also drilled in Lambton County for Silurian Guelph Formation reef and/or Salina Group targets in 2013. It was reported as a potential oil well. Two development wells were drilled for Silurian Guelph Formation reef and/or Salina Group targets in 2012.

Devonian Play

Two exploration wells tested Devonian targets in 2013 and were both reported as dry and abandoned in Middlesex County. One exploration well tested Devonian targets in 2012.

As in 2012, no development wells were drilled to test Devonian targets in 2013.

EXPLORATION TRENDS

North American natural gas prices have recovered modestly from recent record lows, but have remained weak, relative to historic highs. Low natural gas prices have a dramatic impact on exploration and development activity, which has been reduced to a minimum in Ontario. Exploration activity focussing on oil has not increased significantly in spite of oil prices that have been consistently robust. 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.

Exploration activity, especially that targeting new play types, is not expected to increase significantly under the current economic pressure. The development of unconventional resources, which has progressed rapidly in the northeast United States, has yet to be introduced into Ontario. Equivalent targets of organic-rich facies, including the Georgian Bay–Blue Mountain Formation, that have been explored and/or exploited in other jurisdictions remain unevaluated in the province.

Table 1. Successful oil and gas exploration wells in southern Ontario in 2013 (see Figure 1 for well locations).

Well #	Well Name	Results	Target	TD	Latitude	Longitude	TD Date
1	Clearbeach et al. #44, Dunwich 1-A-VSA	OP - ACT	CAM	1145	42.70797361	81.43067972	24/04/2013
2	Dundee, Tilbury North 6-9-IV	GS - SUS	ORD	1115	42.2604625	82.53402111	25/06/2013
3	Dundee (Horiz. #1), Rochester 8-17-IIIIBR	GP - ACT	ORD	1373	42.24169167	82.66646556	12/07/2013
4	NRG 13-02 Oxford on Thames, East Oxford 3-20-VIII	OS - SUS	ORD	963	43.02079722	82.14701611	21/10/2013
5	Den-Mar Brines #15 (Dev. #1), Moore 5-17-XII	GP - POT	SAL	800	42.90339583	82.14701611	05/12/2013

Abbreviations: CAM = Cambrian; ORD = Ordovician; SAL = Salina/Guelph; GP = gas producer; GS = gas show; OP = oil producer; OS = oil show; ACT = active; POT = potential; SUS = suspended; TD = total depth (in metres).



Figure 1. Successful oil and gas exploration wells in southern Ontario in 2013 (current and historical county names are shown).

Metric Conversion Table

Conversion from SI to Imperial			Conversion from Imperial to SI		
<i>SI Unit</i>	<i>Multiplied by</i>	<i>Gives</i>	<i>Imperial Unit</i>	<i>Multiplied by</i>	<i>Gives</i>
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

	<i>Multiplied by</i>	
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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