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**Ontario Geological Survey  
Open File Report 6302**

**Report of Activities, 2014  
Resident Geologist Program**

**Thunder Bay North Regional  
Resident Geologist Report:  
Thunder Bay North District**

**2015**





ONTARIO GEOLOGICAL SURVEY

Open File Report 6302

Report of Activities, 2014  
Resident Geologist Program

Thunder Bay North Regional Resident Geologist Report:  
Thunder Bay North District

by

G.D. White, R.M. Cundari, M.R. Brunelle, T.K. Pettigrew, A. Tims and R.L. Debicki

2015

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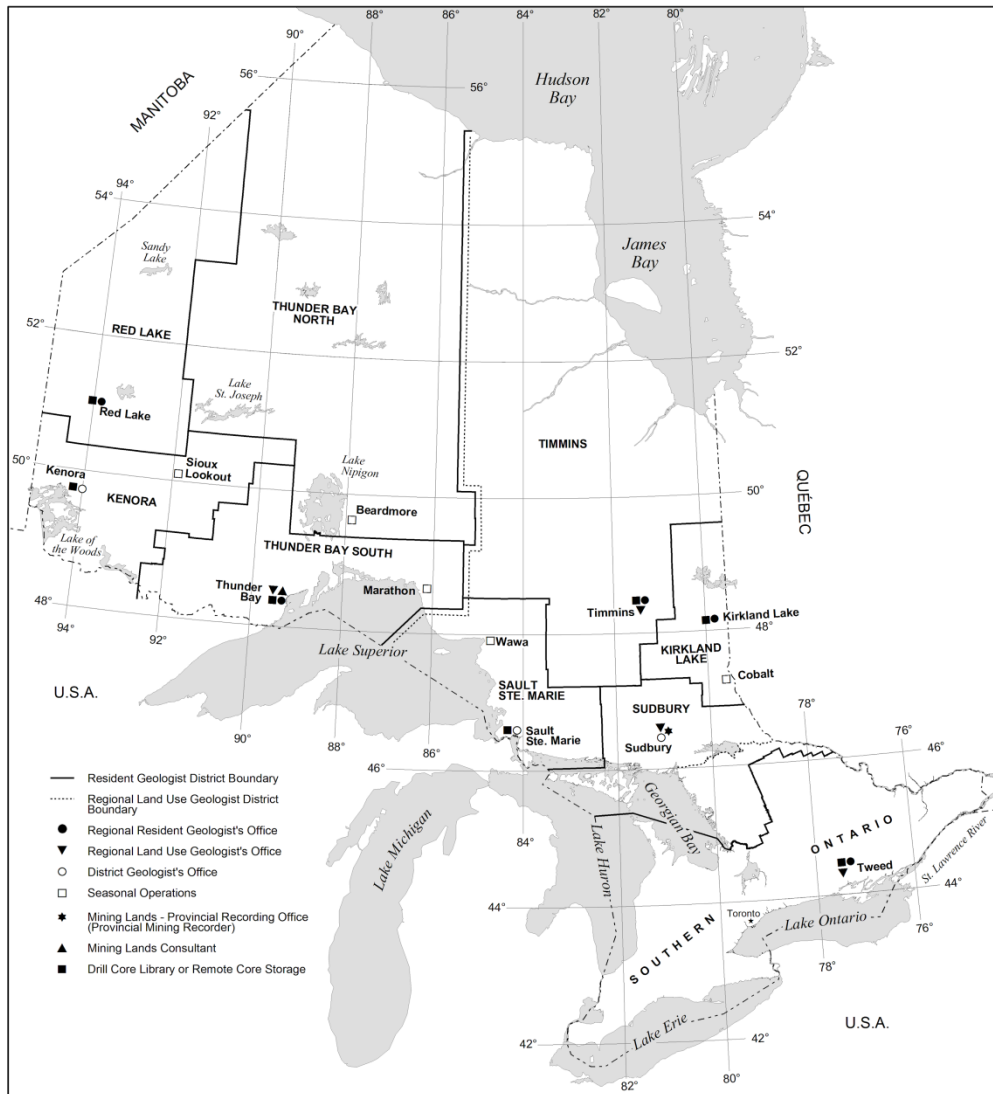
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## **Ontario Geological Survey Regional Resident Geologist Program**

**Thunder Bay North Regional Resident Geologist  
(Thunder Bay North District)—2014**

**by**

**G.D. White, R.M. Cundari, M.R. Brunelle, T.K. Pettigrew, A. Tims and  
R.L. Debicki**

**2015**

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# Thunder Bay North Regional Resident Geologist (Thunder Bay North District)—2014

G.D. White<sup>1</sup>, R.M. Cundari<sup>2</sup>, M.R. Brunelle<sup>3</sup>, T.K. Pettigrew<sup>4</sup>, A. Tims<sup>5</sup>, and R.L. Debicki<sup>6</sup>

<sup>1</sup>Regional Resident Geologist, Thunder Bay North District, Resident Geologist Program, Ontario Geological Survey

<sup>2</sup>District Geologist, Thunder Bay North District, Resident Geologist Program, Ontario Geological Survey

<sup>3</sup>District Geological Assistant, Thunder Bay North District, Resident Geologist Program, Ontario Geological Survey

<sup>4</sup>Mineral Deposit Compilation Geologist – Northwestern Ontario, Resident Geologist Program, Ontario Geological Survey

<sup>5</sup>Regional Land Use Geologist – Northwest Region, Resident Geologist Program, Ontario Geological Survey

<sup>6</sup>Land Use Policy and Planning Co-ordinator, Resident Geologist Program, Ontario Geological Survey

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## INTRODUCTION

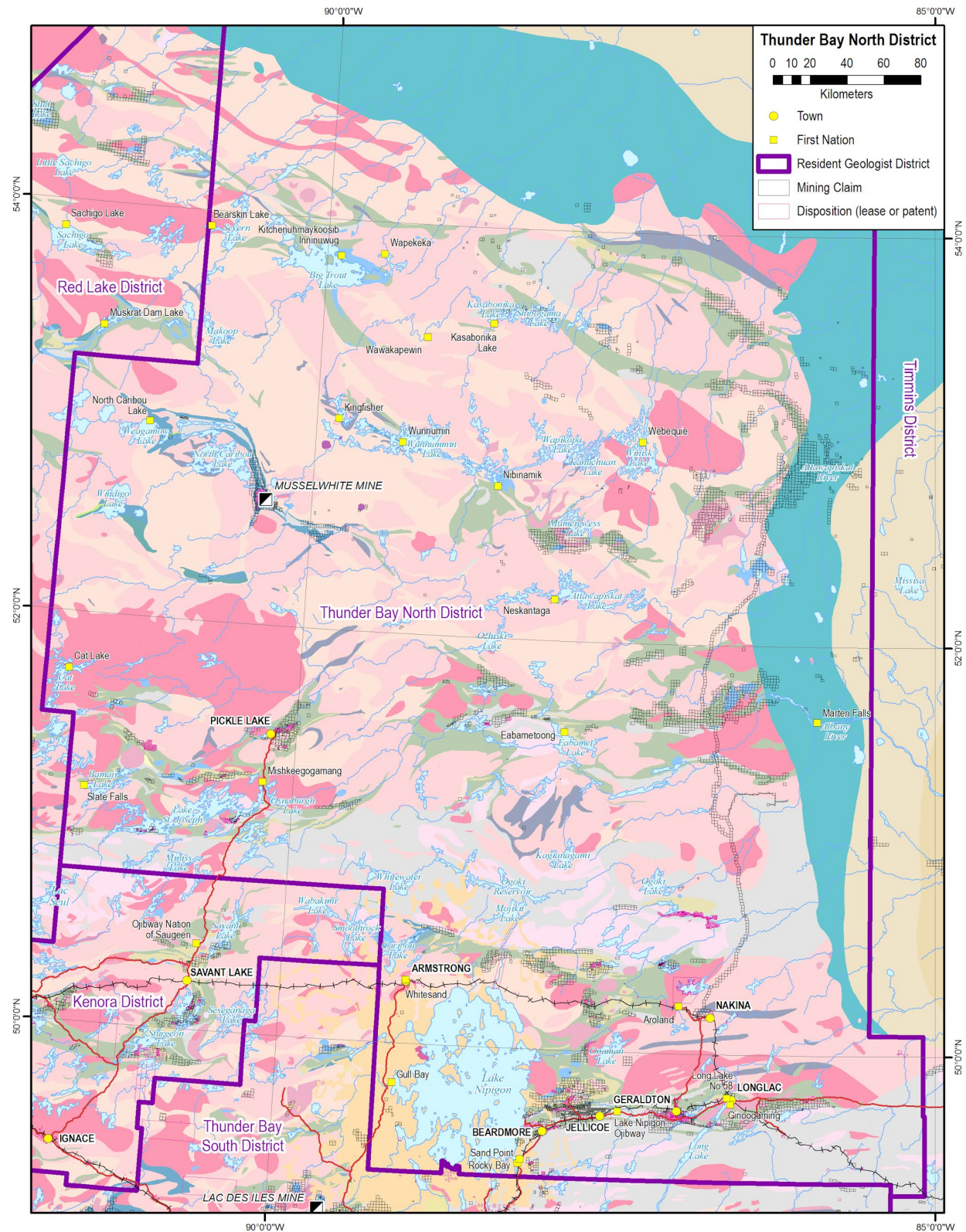
The Thunder Bay North District encompasses Lake Nipigon, extends over 700 km north from Highway 11 to the Hudson Bay coast and includes the western portion of the James Bay Lowland hosting the “Ring of Fire” area (Figure 1). The following communities are situated within the District: Angling Lake (Wapakeka First Nation (FN)); Armstrong; Beardmore; Bearskin Lake FN; Big Trout Lake (Kitchenuhmaykoosib Inninuwug FN); Cat Lake FN; Fort Hope (Eabametoong FN); Fort Severn FN; Geraldton; Gull Bay FN; Jellicoe; Kasabonika FN; Kingfisher Lake FN; Lansdowne House (Neskantaga FN); Longlac; Macdiarmid; Marten Falls; Nakina; North Caribou Lake (Weagamow FN); Osnaburgh House (Mishkeegogamang FN); Pickle Lake; Summer Beaver (Nibinamik FN); Webequie FN; and Wunnummin Lake FN.

The authors note that, for ease of reading, all Web addresses were accessed on February 21, 2015, unless otherwise noted. All Universal Transverse Mercator (UTM) co-ordinates are reported in North American Datum 1983 (NAD83), zones 15 and 16, unless otherwise noted.

## MINING ACTIVITY

Mine production and reserves in the Thunder Bay North District for 2014 are shown in Table 1. Active exploration programs in the District, by commodity, are shown in Figure 2. Work completed within the Thunder Bay North District and filed for assessment credits, or otherwise provided, is shown in Table 3.

Musselwhite Mine is the only active mining operation in the Thunder Bay North District. In 2014, 35 exploration programs were undertaken in the District by prospectors, junior and major exploration companies (Table 4; Figures 4 and 5). Gold was the most sought-after commodity, followed by copper-nickel-platinum group elements (PGE), rare metals, copper-zinc and other commodities (e.g., iron, molybdenum). There were 5008 active claims (totalling 50 458 active claim units) covering an area of 807 319 ha, in the Thunder Bay North District as of January 2, 2015.



**Figure 1.** Location of the Thunder Bay North District showing active mining claims as of January 2, 2015. Bedrock geology from Ontario Geological Survey (2011).

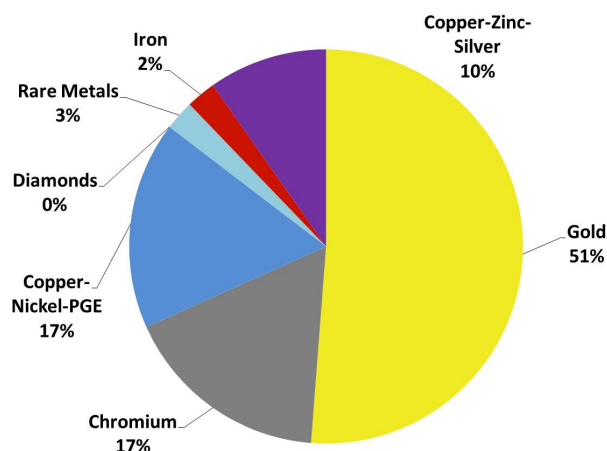


**Table 1.** Mine production and reserves in the Thunder Bay North District in 2014.

Mine	Production to end of 2013		Production in 2014	
	Tonnage @ Grade	Total Commodity	Tonnage @ Grade	Total Commodity
Musselwhite Mine	21 933 094 t @ 5.69 g/t Au	3 840 131 ounces	1 221 200 t @ 7.38 g/t Au	278 300 ounces

Reserve Classification	Tonnes (× 1000)	Gold Grade (g/t Au)	Gold (Ounces (× 1000))
Proven and Probable	7610	6.79	1660
Measured and Indicated	980	5.62	180
Inferred	7020	5.61	1270

**Figure 2.** Active exploration programs by commodity in the Thunder Bay North District in 2014.

On April 1, 2013, new provisions came into effect under the *Mining Act* requiring Exploration Plans and Permits for certain prescribed early mineral exploration activities.

- Exploration Plans must be filed for geophysical surveys requiring a power generator; line cutting where the line widths are less than 1.5 m; drilling with a drill rig lighter than 150 kg; mechanized stripping where the total surface area stripped does not exceed 100 m<sup>2</sup> within a 200 m radius; and test pitting and trenching of bedrock where the volume extracted is between 1 and 3 m<sup>3</sup> within a 200 m radius ([www.mndm.gov.on.ca/en/mines-and-minerals/mining-act/mining-act-modernization/exploration-plans](http://www.mndm.gov.on.ca/en/mines-and-minerals/mining-act/mining-act-modernization/exploration-plans)).
- Exploration Permits must be obtained for line cutting where the line widths exceed 1.5 m; drilling with drill rigs heavier than 150 kg; mechanized stripping where the total surface area stripped exceeds 100 m<sup>2</sup> within a 200 m radius; and test pitting and trenching of bedrock where the total volume extracted exceeds 3 m<sup>3</sup> within a 200 m radius ([www.mndm.gov.on.ca/en/mines-and-minerals/mining-act/mining-act-modernization/exploration-permits](http://www.mndm.gov.on.ca/en/mines-and-minerals/mining-act/mining-act-modernization/exploration-permits)).

Plan submissions and Permit applications for projects located in the Thunder Bay North District are processed by the MNDM Northwest Region Mineral Development and Lands Branch office in Thunder Bay. As of December 31, 2014, 2 Exploration Plans had been filed, and 14 Exploration Permits had been issued for projects in the Thunder Bay North District.

## Musselwhite Mine

The **Musselwhite Mine** (Goldcorp Inc., [www.goldcorp.com](http://www.goldcorp.com)) is located 126 km north of Pickle Lake. Access to the mine site is by means of an all-weather airstrip or a 43 km, all-weather gravel road connecting the mine site to the northern extension of Highway 599. Musselwhite is a fly-in operation with pickup points in Thunder Bay and 5 northern communities. The mine employs 770 people in underground mine operations and a processing plant. The

first gold bar was poured on March 10, 1997, and commercial production began on April 1, 1997 (*Canadian and American Mines Handbook*, 2014–2015). Musselwhite Mine established an innovative agreement with Cat Lake, North Caribou Lake, Wunnummin Lake and Kingfisher Lake First Nations, which provides for a range of education, training and employment opportunities and business-related services for these communities (Goldcorp Inc., [www.goldcorp.com](http://www.goldcorp.com) (under Operations – Canada & US, Musselwhite)).

The Musselwhite Mine is situated in the Weagamow–North Caribou greenstone belt of the North Caribou Terrane (see Figure 1). Gold mineralization is predominantly hosted within metamorphosed chemical sedimentary rocks (banded iron formations (BIFs)) and, in particular, within garnet-magnetite-grünerite BIFs (locally termed the Northern Iron Formation). All lithologies have been metamorphosed at middle- to upper amphibolite facies. (see “Musselwhite - Location and Geology” page on Goldcorp’s website).

In 2014, the mine produced 278 300 ounces of gold from 1 221 200 milled tonnes at a grade of 7.38 g/t Au (Goldcorp Inc., Management’s Discussion and Analysis, February 18, 2015). From 1997 to 2013, 21 933 094 t of ore, with an average grade of 5.69 g/t Au, were mined and milled to produce 3 840 131 ounces of gold (see Table 1). Proven and probable reserves (as of December 31, 2014), were 7 610 000 t at a grade of 6.79 g/t Au, representing 1 660 000 million ounces of contained gold (Goldcorp Inc., news release, February 19, 2015). Measured and indicated resources (as of December 31, 2014) stood at 980 000 t at a grade of 5.62 g/t Au, representing 180 000 ounces of contained gold, whereas inferred resources stood at 7 020 000 t at a grade of 5.61 g/t Au, representing 1 270 000 ounces of contained gold (Goldcorp Inc., news release, February 19, 2015).

A total of 46 106 m of diamond drilling was completed on the Musselwhite Mine property from underground operations in 2014 (up from 43 807 m in 2013). Details of the operations are summarized in Table 2 (J. Edwards and J. Biczok, Goldcorp Inc., personal communication, January 2015).

**Table 2.** Summary of drilling activities on the Musselwhite Mine site in 2014.

Underground Drilling		
Project	Metres	Type of drilling
DEL, LNX and PQE	8341	Production
West Limb	26 527	Mine Exploration
PQ Deeps	11 238	Mine Exploration
Total	46 106	

Goldcorp Inc. provided a synopsis of production, development and exploration activity (Figure 3) for 2014:

Gold production for 2014 of 278,300 ounces was 22,000 ounces, or 9%, higher than in 2013 due to 25% higher grades, partially offset by 12% lower mill throughput. Higher grades were realized as a result of mining higher grade material from the Lynx Zone and the C-Block of the PQ Deeps, coupled with improved dilution and ore control which increased grades above expectations. Mill throughput was lower primarily due to more stringent ore control practices focused on delivering better quality ore to the mill and a planned maintenance shutdown during the third quarter of 2014 to perform plant and conveyor maintenance and to upgrade electrical infrastructure.

All-in sustaining costs for 2014 were \$811 per ounce and include by-product cash costs of \$629 per ounce, which were \$277 per ounce and \$131 per ounce lower compared to 2013, respectively. The 25% decrease in all-in sustaining cash costs (inclusive of the by-product cash cost impacts) was due to lower sustaining capital expenditures (\$103 per ounce), higher gold production (\$100 per ounce), a weaker Canadian dollar (\$51 per ounce), and lower operating costs (\$23 per ounce). The decrease in operating costs was primarily due to decreased contractor usage for raise development (\$7 million), while the decrease in sustaining capital expenditures was primarily due to a decrease in construction projects and capital development, as planned (\$29 million).

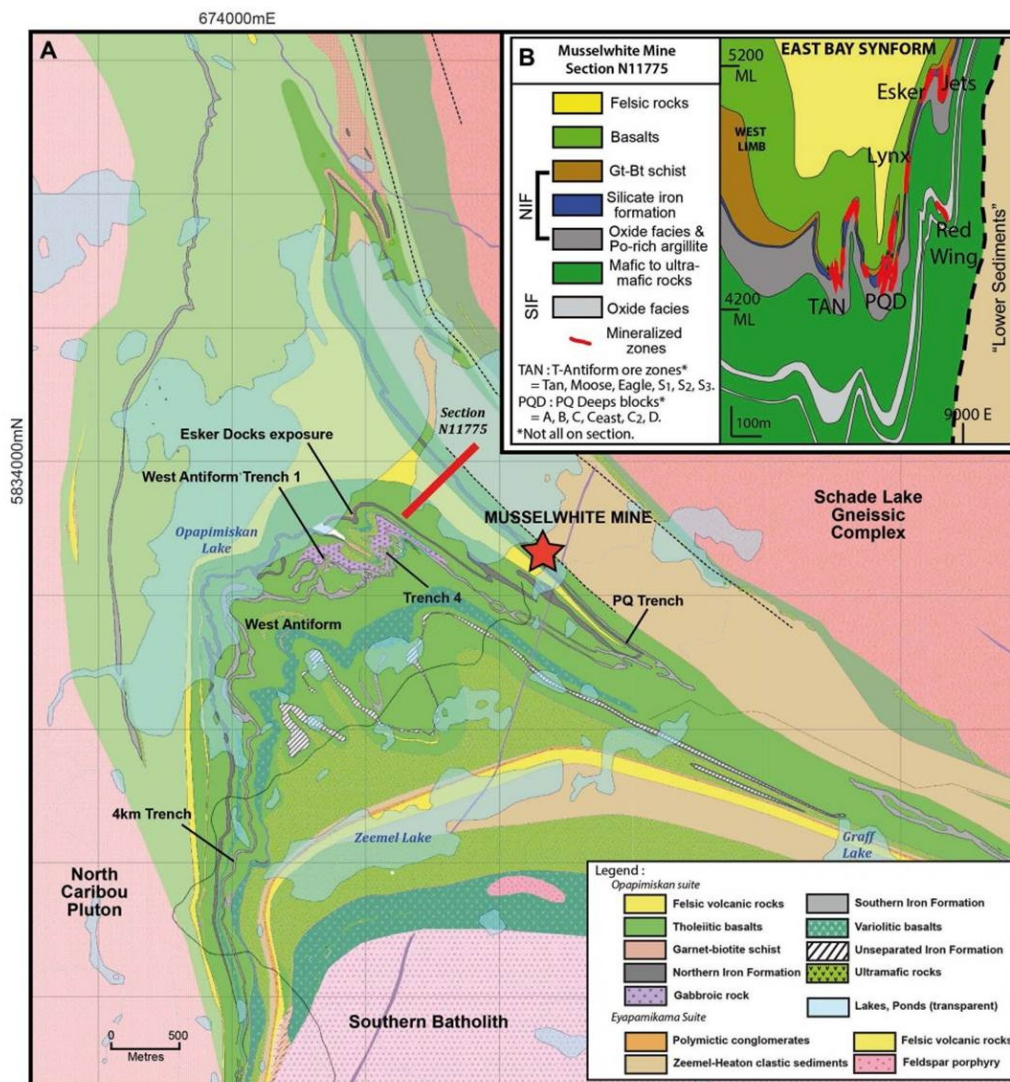
Gold production at Musselwhite for the fourth quarter of 2014 was 10,600 ounces, or 17%, higher than in the third quarter of 2014 due to a 18% higher mill throughput, partially offset by 3% lower grades. The higher mill throughput was due to the 14-day planned maintenance shutdown during the third quarter of 2014. Mining in the fourth quarter of 2014 continued to focus in the higher grade areas of the Lynx Zone and PQ Deeps with a slight decrease in grade, as planned.

All-in sustaining costs for the fourth quarter of 2014, including by-product cash costs, were \$118 per ounce and \$35 per ounce lower than the third quarter of 2014, respectively. The 13% decrease in all-in sustaining costs (inclusive of the by-product cash cost impacts) was due to higher gold production (\$210 per ounce), lower sustaining capital expenditures (\$18 per ounce), and a weaker Canadian dollar (\$14 per ounce), partially offset by higher operating costs (\$124 per ounce). The increase in operating costs was primarily due to increased labour associated with mine development (\$4 million), increased maintenance parts, explosives and site costs, as planned (\$3 million), increased contractor costs (\$2 million), and increased propane and power usage due to colder weather conditions in the fourth quarter of 2014 (\$2 million).

The 2014 exploration program focused on drilling of the West Limb target to define an Inferred resource and determine whether further exploration was warranted. Results by mid-year 2014 were positive enough to trigger the start of an access drift toward the West Limb to establish a drilling platform closer to the mineralized zones. Extensional drilling on the C-Block of the PQ Deeps succeeded in extending the reserve by 150 metres to the north.

Musselwhite mine contained 1.66 million ounces of proven and probable gold reserves at December 31, 2014, compared to 1.85 million ounces at December 31, 2013, due to mining depletion partially offset by increased reserves in the PQ Deeps.

(Goldcorp Inc., Management's Discussion and Analysis, February 18, 2015)



**Figure 3.** Exploration targets and surface traces of ore zones, Musselwhite Mine (from Goldcorp Inc., [www.goldcorp.com](http://www.goldcorp.com) [accessed January 2015]).

**Table 3.** Assessment files received in the Thunder Bay North District in 2014.

Abbreviations					
AEM .....	Airborne electromagnetic survey	IM .....	Industrial mineral testing and marketing		
AGRAD .....	Airborne gravity gradiometric survey	IP .....	Induced polarization survey		
AM .....	Airborne magnetic survey	Lc .....	Line cutting		
ARA .....	Airborne radiometric survey	Met .....	Metallurgical testing		
ASD .....	Assay data	OD .....	Overburden drilling		
Beep .....	Beep Mat survey	ODH .....	Overburden drill hole(s)		
Bulk .....	Bulk sampling	PEM .....	Pulse electromagnetic survey		
DD .....	Diamond drilling	PGM .....	Platinum group metals		
DDH .....	Diamond drill hole(s)	Rehab .....	Rehabilitation		
DGP .....	Down-hole geophysics	Pr .....	Prospecting		
ENV .....	Environmental study	REP .....	Report (data interpretation)		
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		
Interp .....	Interpretation	VLFEM .....	Very low frequency electromagnetic survey		

Township or Area (Property)	Company Name	Year	Type of Work	AFRO Number	Resident Geologist Office File Designation*
Akow Lake area (Lundmark–Akow Lake property)	Romios Gold Resources Inc.	2014	AEM, AM	2.55021	<b>53B16SW-024</b> 53B15SE-030
Ashmore Tp. (Eldee Lake property)	Hodgson, R.	2013	ASD, GL, GM	2.54650	42E10NW-097
Ashmore Tp. (Hardrock property)	Hardrock Extension Inc. / Malouf, S.	2012	ASD, Samp	2.54655	<b>42E10NW-098a,b</b> 42E10NE-070a,b
Ashmore Tp. (Hardrock property)	Premier Gold Mines Limited	2013–2014	ASD, DD	2.55107	42E10NW-099a-c
Bertoia Lake area (Monsoon property)	Northern Shield Resources Inc./ O’Keefe, G.	2013–2014	ASD, GL Pr	2.54954	42M14SE-002
BMA 526 862 area (McFaulds property)	Cliffs Chromite Far North Inc./ KWG Resources Inc.	2013–2014	Interp	2.54710	<b>43D09NW-031a,b</b> 43D10NE-023
BMA 527 861 area (Tamarack property)	Probe Mines Limited	2014	GC	2.55443	43D16SE-050
BMA 527 861 (Cliffs Chromite property)	Cliffs Chromite Ontario Inc.	2012–2013	ASD, DD	2.54823	43D16SE-049
BMA 535 863 area (Winisksis Channel property)	Sinocan Resources Corp.	2013	ASD, DD	2.54557	43E10SE-004a-d
BMA 536 864 area (Golden City property)	China International Resources Development Ltd.	2013	AEM, AM	2.54957	<b>43E10NW-003</b> 43E07NE-008 43E08NW-007 43E09SW-010 43E10NE-003 43E10SE-005a,b 43E15SW-003
Calamity Lake area (Field Goal property)	China Metallurgical Exploration Corp.	2013	ASD, GC	2.55073	<b>42M11NW-006</b> 42M09NE-006 42M09NW-005 42M08SW-005
Calamity Lake area (Triumph property)	China Metallurgical Exploration Corp.	2014	ASD, DD	2.55126	<b>42M11NW-007</b> 42M11SW-003
Connell Tp. (PC Gold - Pickle Crow property)	PC Gold Inc./ Teck Resources Limited / English, P.	2014	ASD, GL, DD	2.55342	<b>52O09SE-131</b> 52O08NE-131

<b>Township or Area (Property)</b>	<b>Company Name</b>	<b>Year</b>	<b>Type of Work</b>	<b>AFRO Number</b>	<b>Resident Geologist Office File Designation*</b>
Crump Lake area (Field Goal property, areas 1-3)	China Metallurgical Exploration Corp.	2012–2013	AEM, AM	2.54541	<b>42M11NE-009</b> 42M11NW-005 42M11SE-004 42M11SW-002 42M07NE-005a,b 42M07NW-004 42M08NE-003 42M08NW-003 42M08SE-002a,b 42M08SW-004 42M09NE-005 42M09NW-003a,b 42M16SE-004 42M16SW-012a,b
Dona Lake area (Pickle Lake property)	Newcastle Minerals Ltd.	2012	ASD, GL	2.53486	52O08NE-021a,b
East of Dusey River area (Nakina property)	Debut Diamonds Inc./ Canada Chrome Corporation / 6398651 Canada Inc.	2012–2013	DD	2.54620	<b>42M08SW-003a-d</b> 42M08SE-001a,b 42M01NE-001a-c 42M01NW-001a,b 42M02NE-005 42M02NW-001 42M07SE-006a,b 42L15SE-005a,b 42L15SW-017a,b
Errington Tp. (Hardrock property)	Premier Gold Mines Limited	2013	ASD, DD	2.54370	42E10NW-096a-d
Gittens Lake area (Tempest property)	Northern Shield Resources Inc.	2013–2014	ASD, GL	2.54985	42M16SW-013
Irwin Tp. (Claim #TB4264030)	Metalore Resources Limited	2014	ASD, GC	2.55130	42E12NW-261
Kapkichi Lake area (Thierry Mine property)	Cadillac Ventures Holdings Inc.	2012–2014	Met	2.54937	<b>52O09SW-002</b> 52O08NW-039
Klotz Lake area (Klotz Lake property, KLMS grid)	Goldstream Exploration Ltd.	2013	GC, Met	2.54715	42F13SW-056
Klotz Lake area (Milestone property)	Goldstream Exploration Ltd. / Jubilee Gold Exploration Ltd.	2012	ASD, DD	2.54578	42F13SW-054
Klotz Lake area (Titan Klotz Lake property)	Goldstream Exploration Ltd.	2013	GC	2.54609	42F13SW-055
Laponen Lake area (Longlac Project, LL1 and LL3 blocks)	Melkior Resources Inc.	2013	ASD, Pr	2.54568	<b>42E09NW-034</b> 42E16SE-036
Metapesatakun Bay area (Sky Lake property)	Tri Origin Exploration Ltd. / Kitrinor Metals Inc.	2012–2013	ASD, DD	2.54470	<b>52O02NE-035</b> 52O07SE-006
Metapesatakun Bay area (Sky Lake property)	Tri Origin Exploration Ltd. / Manicouagan Minerals Inc. / Kitrinor Metals Inc.	2012–2013	ASD, GC	2.54456	<b>52O02NE-034</b> 52O07SE-005
Metcalf Lake area (Wascanna Mine property)	Markinch Resources Inc./ Advantel Minerals (Canada) Ltd./ Plum Tree Gold Corp./ Checkley, F./ Malouf, J./ Rantz, T./ Goodman, L.	2013–2014	ASD, DD	2.55348	42L04NE-154
Neawagank Lake area (Forester Lake property)	Parkside Resources Corporation / Benton Resources Inc.	2013–2014	ASD, DD	2.55038	53A05NW-005a,b
Pagwachuan Lake area (Pagwachuan Lake property)	Goldstream Minerals Inc. / 52/86 Northwest Company Ltd.	2013	IP, Lc, GM	2.54573	42E09NE-031

## THUNDER BAY NORTH DISTRICT—2014

Township or Area (Property)	Company Name	Year	Type of Work	AFRO Number	Resident Geologist Office File Designation*
Pagwachuan Lake area (Pagwachuan Lake property)	Goldstream Minerals Inc. /52/86 Northwest Company Ltd.	2012–2014	ASD, DD, GL, Pr	2.55083	<b>42E09NE-032a-c</b> 42E16SE-037
Pineimuta River area (Heaton Lake property)	Goldcorp Canada Ltd.	2012	ASD, GC	2.54974	53A05NE-002
Salsberg Tp. (Hardrock property)	Premier Gold Mines Limited	2014	ASD, DD	2.55252	<b>42E11NE-059</b> 42E11SE-005
Skinner Lake area (PQ North property)	Premier Gold Mines Limited	2010–2013	ASD, DD	2.54505	53B09NW-023
Summers Tp. (Golden Heart property)	Cote, R. / Cote, D.	2013	ASD, Pr, GL	2.54930	<b>42E12NW-260</b> 42E12SW-076 52H09NE-074 52H09SE-057
Summers Tp. (Northern Empire Mine property)	Goldstone Resources Inc.	2013–2014	Rehab	2.55155	42E12SW-077
Summit Lake area (Marshall Lake property)	White Tiger Mining Corp. / Rainy Mountain Royalty Corp.	2012–2014	ASD, DD, Interp	2.55291	42L05NE-058
Venton Lake area (Wabassi property)	Northern Shield Resources Inc./ Discovery Harbour Resources Corp.	2012–2014	ASD, DD, GM, Grav, DGP, GEM	2.54970	<b>42M10NE-014a-c</b> 42M10SW-005a,b 42M09NW-004 42M15SE-013
Venton Lake area (Wabassi property)	Northern Shield Resources Inc./ Discovery Harbour Resources Corp.	2012–2014	DGP	2.54763	42M10NE-013
Zapus Lake area (Devork Lake property)	Panoramic PGMS (Canada) Limited	2011–2013	ASD, GRA, Pr	2.54502	42E08NW-002
Zeemel Lake area (Musselwhite Mine property)	Goldcorp Canada Ltd.	2012	AEM, AM, ASD, DD	2.54903	53B09SW-010

\*Bolded files relate to the location of the main hard copy file in the Thunder Bay North District office.

**Table 4.** Exploration activity in the Thunder Bay North District in 2014, keyed to Figures 4 and 5.

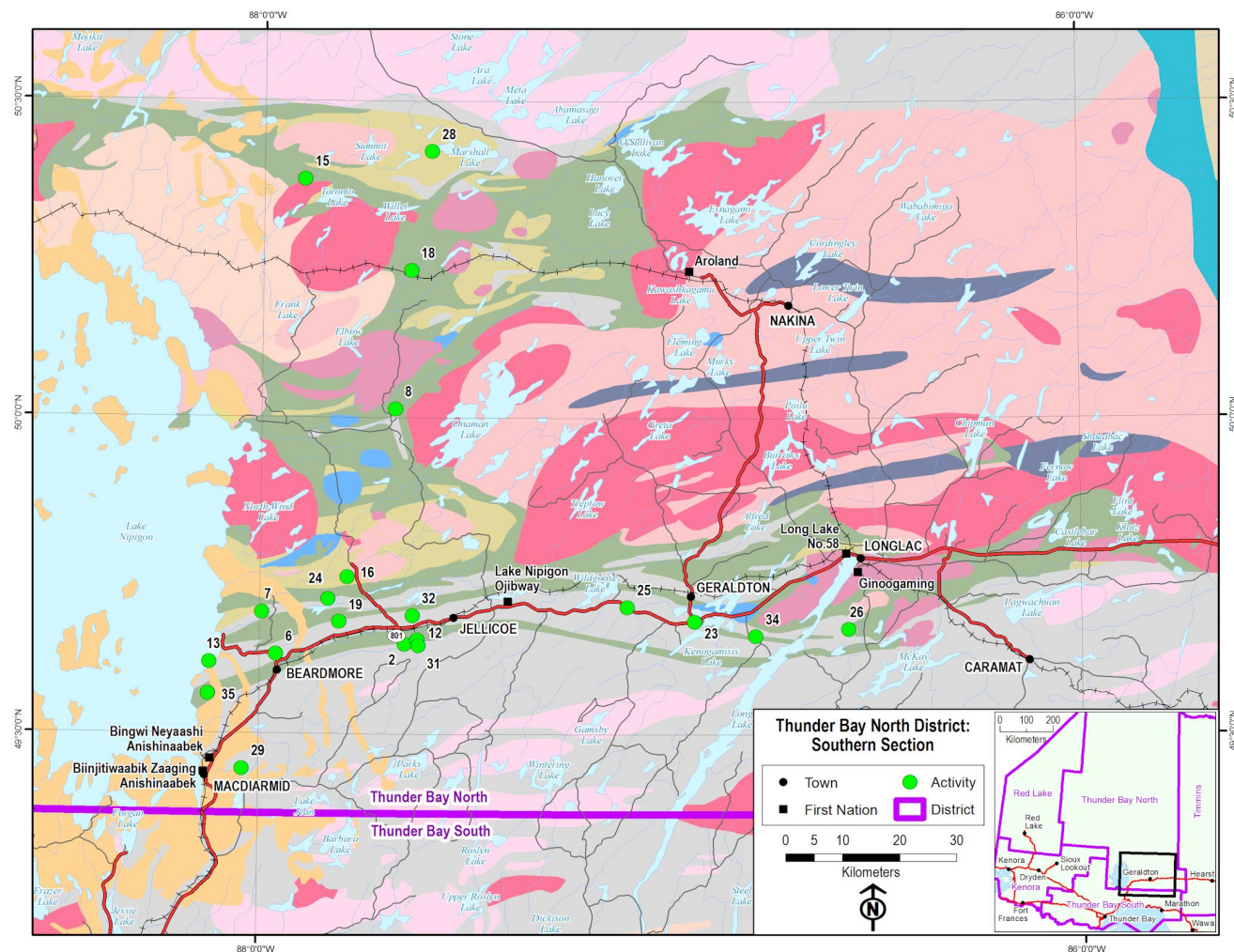
No.	Company	Property Name	Commodity	Easting	Northing	Zone	NTS	Township/Area	Activity
1	Bold Ventures Inc./ KWG Resources Inc. / Fancamp Exploration Ltd.	Koper Lake (Black Horse)	chromium	549735	5842806	16	43D09NW	BMA 526 862	drilling, metallurgical work, assay results, resource estimate, property acquisition
2	Brideau, Rudy	Dalton occurrence	gold	453300	5499150	16	42E12SE	Vincent Township	prospecting, sampling
3	China Metallurgical Exploration Corp.	Triumph	copper, nickel, PGE, zinc	482607	5723466	16	42M11	Grump and Calamity Lake areas	drilling, assay results
4	Cliffs Natural Resources Inc.	Black Label	chromium	554111	5849791	16	43D16SE	BMA 527 861	resource estimate
5	Cliffs Natural Resources Inc.	Black Thor	chromium	553031	5847817	16	43D16SE	BMA 527 861	resource estimate
6	Cote, R. / Cote, R.	Golden Heart	gold	430700	5497580	16	42E12NW	Summers Township	prospecting, sampling
7	Cote, R. / Cote, R.	Nortoba	gold	428250	5505000	16	42E12NW	Sandra Township	prospecting, sampling
8	Cote, R. / Cote, R.	Two Rivers	gold	451739	5540466	16	42L04SE	Coughlan Lake area	prospecting, sampling

No.	Company	Property Name	Commodity	Easting	Northing	Zone	NTS	Township/Area	Activity
9	Discovery Harbour Resources Corp. / Great Lakes Resources LLC	Wabassi	copper, zinc, silver	525817	5733188	16	42M15SW	Oxtoby Lake area	drilling, assay results, property acquisition
10	Goldcorp Inc.	Musselwhite	gold	678485	5832467	15	53B09SW	Zeemel Lake area	production, exploration, drilling
11	GoldON Resources Ltd.	Slate Falls	gold, silver	600851	5671146	15	52O04NE	Wesleyan Lake area	compilation, prospecting, sampling, assay results
12	Goodman, H., Jr. / Nelson, T. A.	Clist Lake	gold	455500	5499900	16	42E12NE	Leopard Lake area	prospecting, sampling
13	Goodman, H. / Goodman, D.	High Hill	gold	419000	5496300	16	52H09SE	Maryjane Lake area	prospecting, sampling
14	KWG Resources Inc. / Cliffs Natural Resources Inc.	Big Daddy	chromium	551560	5845927	16	43D16SE	BMA 527 861	resource estimate
15	Landore Resources Ltd.	Junior Lake	copper, nickel, iron, gold	436000	5581000	16	42L05	Junior Lake area	drilling, assay results, ground electromagnetic survey, very low frequency electromagnetic survey, ground magnetic survey, 3D direct current induced polarization survey, magnetotellurics survey
16	Laurion Mineral Exploration Inc.	Ishkoday (Sturgeon River)	gold	444306	5511192	16	42L05	Irwin Township	drilling, assay results, compilation
17	MacDonald Mines Exploration Ltd.	Butler	copper, nickel, chromium, zinc, vanadium	514000	5840500	16	43D10NW	BMA 526 864	compilation
18	Markinch Resources Inc. (Subsidiary of TrinCan Capital Corp.) / Advantel Minerals Ltd.	Tashota	gold	454591	5564791	16	42L04NE	Metcalf Lake area	drilling, assay results
19	Metalore Resources Ltd.	Nordic Lake	gold	441776	5503212	16	42E12NW	Irwin Township	soil sampling, assay results
20	Noront Resources Ltd.	Eagle's Nest	copper, nickel, PGE, gold	547200	5843645	16	43D09NW	BMA 526 862	update, property acquisition
21	Northern Superior Resources Inc.	Ti-pa-haa-kaaning (TPK)	gold	440412	5813204	16	43D05NW	Wapitotem Lake area	update
22	PC Gold Inc.	Pickle Crow	gold	704347	5709744	15	52O09SE	Connell Township	drilling, assay results, property acquisition, resource estimate, compilation

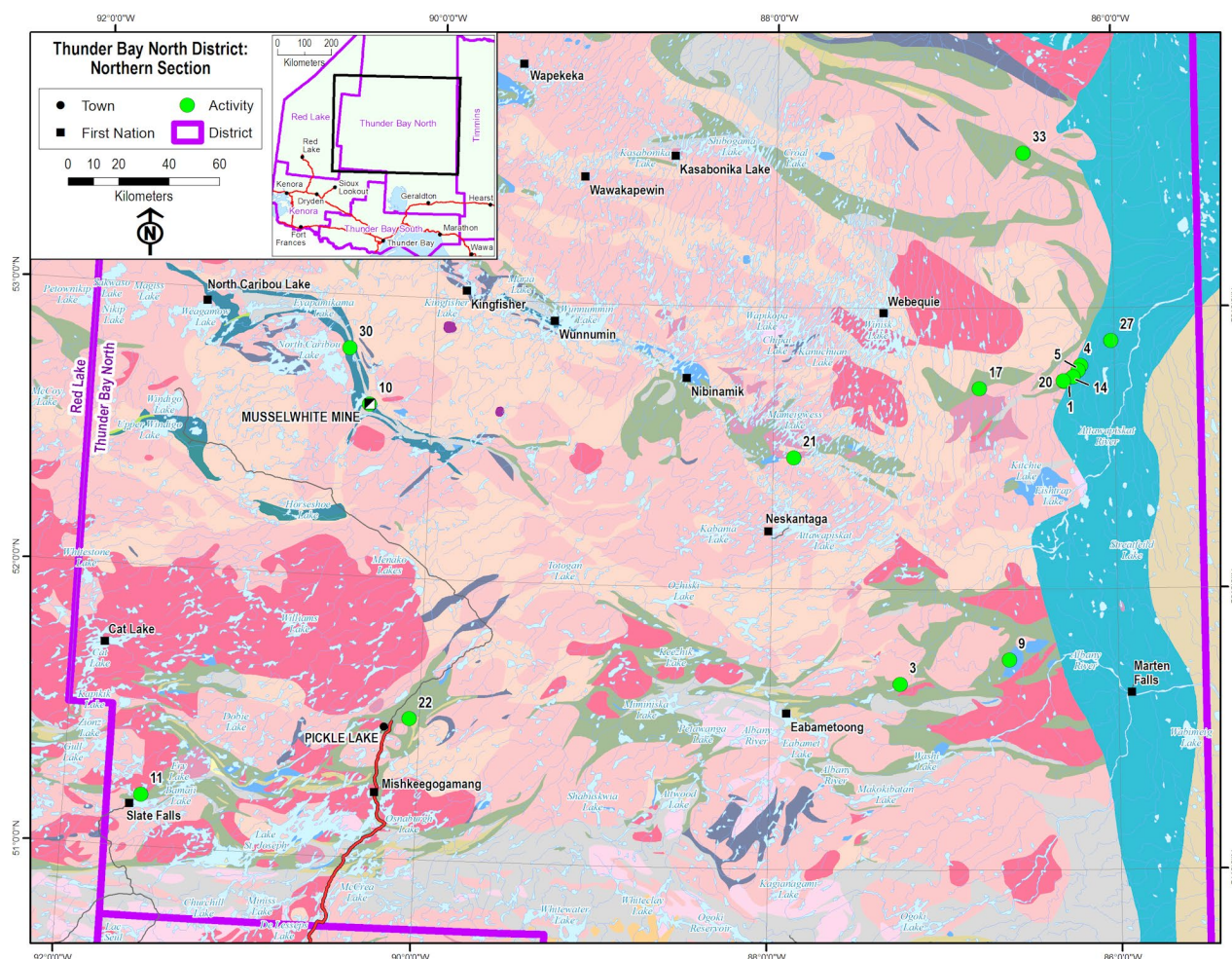
THUNDER BAY NORTH DISTRICT—2014

No.	Company	Property Name	Commodity	Easting	Northing	Zone	NTS	Township/Area	Activity
23	Premier Gold Mines Limited	Hardrock	gold	504224	5502987	16	42E10NW	Errington and Ashmore townships	drilling, Preliminary Economic Assessment, assay results, environmental assessment, geotechnical work, resource estimate
24	Premier Gold Mines Limited	Brookbank	gold	439849	5507214	16	42E12	Irwin Township	Preliminary Economic Assessment
25	Premier Gold Mines Limited	Bankfield West	gold	492395	5505544	16	42E11NE	Lindsley Township	compilation
26	Premier Gold Mines Limited	Viper	gold	531253	5501726	16	42E10NE	McBean Lake Area	compilation
27	Probe Mines Ltd.	Tamarack	copper, nickel, PGE, chromium	566026	5859682	16	43D16	BMA 528 861	soil sampling, assay results
28	Rainy Mountain Royalty Corp. / White Tiger Mining Corp.	Marshall Lake	copper, zinc, silver, gold	458245	5585650	16	42L05NE	Summit Lake Area	compilation
29	Rock Tech Lithium Inc.	Georgia Lake	lithium, rare metals	424636	5477492	16	52H8NE	Kilkenny Township	property acquisition
30	Romios Gold Resources Inc.	Lundmark-Akow	gold	668900	5854000	15	53B16SE	Akow Lake area	versatile time-domain electromagnetic survey
31	Sage Gold Inc.	Clist Lake	gold	455670	5498870	16	42E12NE	Leopard Lake area	update
32	Silver Stream Mining Corp. / Sage Gold Inc.	Solomon's Pillars	gold	454653	5504131	16	42E12NE	Leduc Township	compilation
33	Sinocan Exploration	Winiskisis Channel	copper, nickel, PGE, chromium	531272	5933833	16	43E10	BMA 535 863	drilling
34	The Quaternary Mining and Exploration Company Ltd.	Hardrock Extension	gold	514926	5500437	16	42E10	Coltham Township	compilation
35	Transition Metals Corp.	Eva Kitto	copper, nickel, PGE	418752	5490700	16	52H09SE	Eva and Kitto townships	property acquisition





**Figure 4.** Thunder Bay North District (southern portion) exploration activity, 2014 (keyed to Table 4). Bedrock geology from Ontario Geological Survey (2011).



**Figure 5.** Thunder Bay North District (northern portion) exploration activity, 2014 (keyed to Table 4). Bedrock geology from Ontario Geological Survey (2011).

## ADVANCED EXPLORATION

There were 2 properties in Thunder Bay North District in 2014 with Advanced Exploration status: Cadillac Ventures Inc.'s Thierry Mine project at Pickle Lake and Premier Gold Mines Limited's Hardrock project in Geraldton. Since only minimal work, in the form of environmental monitoring, was conducted on the Thierry Mine property by Cadillac Ventures, discussions are limited to Premier's Hardrock project (Figure 6).

**Premier Gold Mines Limited** ([www.premiergoldmines.com](http://www.premiergoldmines.com)) released a positive Preliminary Economic Assessment (PEA) for the **Hardrock** and **Brookbank** deposits (News Release, Premier Gold Mines Limited, January 28, 2014). The Hardrock PEA was prepared as an open-pit only project using the resource estimate released in the Fall of 2013 (News Release, Premier Gold Mines Limited, October 29, 2014). The PEA estimates an average annual gold production at the Hardrock of 253 100 ounces at a grade of 1.50 g/t Au during the first 8 years and 202 700 ounces per year thereafter over the projected 15-year mine life. The Brookbank PEA was issued using a combined open-pit and underground operation based on the resources release in the winter of 2012 (News Release, Premier Gold Mines Limited, December 19, 2012). The PEA estimates average annual gold production for the Brookbank project to be 48 700 ounces per year over the 7-year life of the mine.

Premier also commenced the formal Environmental Assessment (EA) and permitting process for the Hardrock project at Geraldton. The company has retained a range of consultants necessary for the completion of a Feasibility Study expected in the first half of 2015. Mr. Bertho Caron has assumed the role of Engineering and Construction

Manager and will oversee the EA and permitting process. Geotechnical work was also completed assessing the pit wall slopes of the proposed open pit on the Hardrock property. The report concludes that the rock mass quality within the Hardrock Pit is good to very good, with gold mineralization within the saddles of tightly folded, upright, broadly subvertical axial planes that trend roughly east. The report also stated that given the moderate slope height of 460 m, rock mass failure is not a concern. (News Releases, Premier Gold Mines Limited, May 15 and June 24, 2014.)

Premier has identified prospective open-pit targets adjacent to the Hardrock project (News Release, Premier Gold Mines Limited, April 23, 2014). The company initiated exploration programs at the Bankfield West and Viper open-pit targets which both lie along strike from the Hardrock deposit. The Bankfield West target (formerly the Twomey target) is located 11 km west of Hardrock and was identified in a review of diamond-drill hole records from work conducted by Placer Dome in the 1990s. The target displays potential for widespread gold mineralization hosted within a porphyry unit. The Viper target is located 30 km east of Hardrock and was recently staked by Premier based on similar geological characteristics to the Hardrock deposit. It is described as an area of intense folding, suggested by geophysical results, in iron formation and porphyry. The Viper target consists of 2 primary targets (Target 1 and Target 2) which are covered by overburden and have never been drill-tested.

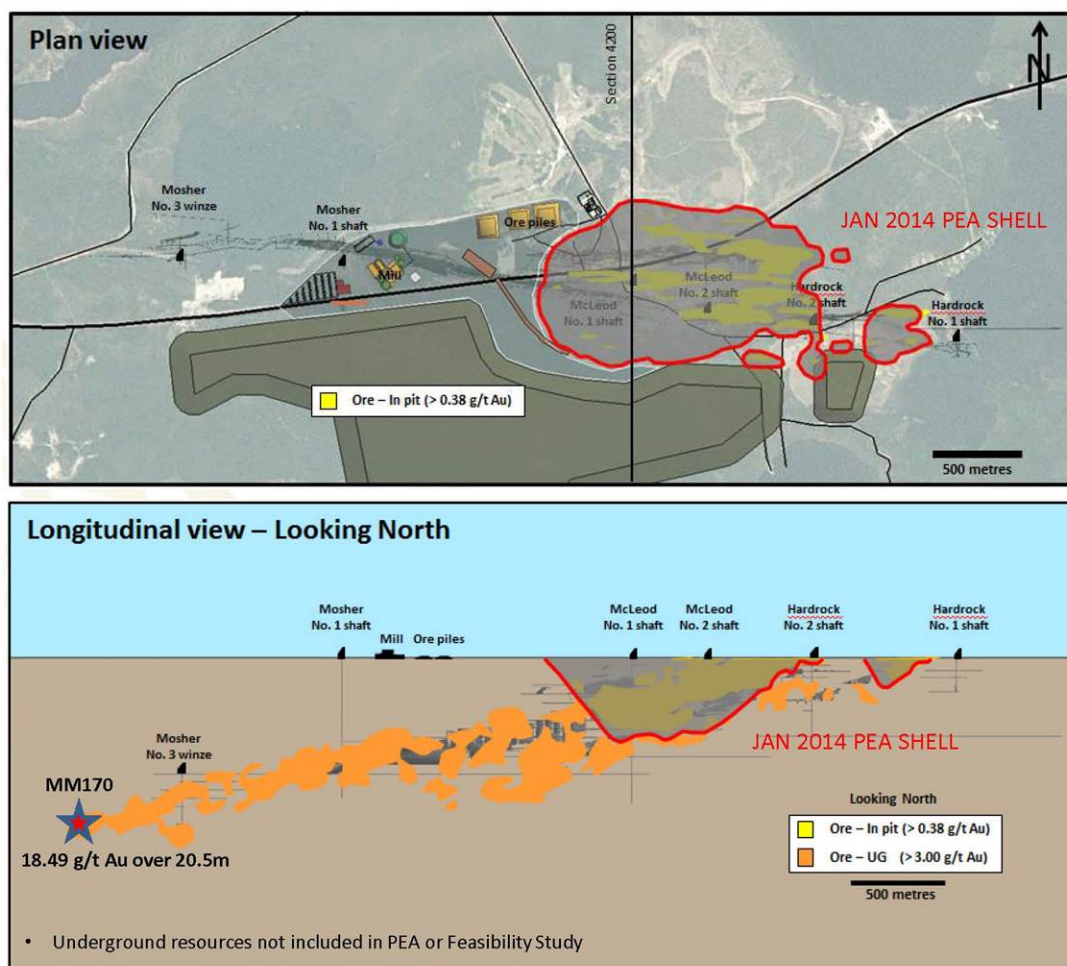
Premier completed 153 diamond-drill holes for a total of 56 121 m in 2014 (M. Gollat, Premier Gold Mines Limited, personal communication, February 18, 2015). The infill drill program was designed to upgrade the inferred portion of the open pit resource estimate to Indicated status. In addition to defining a higher grade core within the recently discovered North Wall Zone, mineralization has been intersected within multiple zones. Highlights from the drilling program are included in the table below.

Hole ID	From (m)	To (m)	Interval (m)	Au (g/t)	Zone
MM534	172.0	178.0	6.0	15.13	In-Pit
MM538	295.0	322.3	27.3	2.90	In-Pit
MM544	376.0	383.0	7.0	12.40	In-Pit
MM545	181.0	216.8	35.8	1.56	In-Pit
MM552	238.5	264.0	25.5	18.54	In-Pit
MM556	258.0	287.5	29.5	1.67	Near-Pit
MM571	111.0	122.0	11.0	29.20	North Wall Zone (In-Pit)
MM573	189.0	193.5	4.5	80.57	North Wall Zone (Near Pit)
MM597	543.9	547.0	3.1	10.15	North
MM598	209.0	232	23.0	3.25	North
<i>Including</i>	209.0	322.5	2.5	25.93	North
MM599	142.5	180.0	37.5	3.01	Tenacity
<i>Including</i>	153.1	163.0	9.9	5.75	Tenacity
MM604	229.5	245.5	16.0	0.87	Porphyry

Premier also released an updated NI 43-101 resource estimate for the Hardrock property at Geraldton (News Release, Premier Gold Mines Limited, July 8, 2014). The resource estimate includes over 130 000 m of drilling as well as a historic underground mine void modelling. The details of the updated resource estimate are provided in the table below.

Area	Category	Tonnage (t)	Grade (g/t Au)	Contained Au (oz)
Open Pit (>0.5 g/t Au)	Indicated	83 868 000	1.47	3 972 000
	Inferred	10 225 000	1.53	501 000
Underground (>3 g/t Au)	Indicated	5 169 000	5.40	898 000
	Inferred	12 922 000	5.40	2 242 000
Combined	Total Indicated	89 037 000	1.70	4 870 000
	Total Inferred	23 147 000	3.69	2 744 000





**Figure 6.** Plan and longitudinal views of the Premier Gold Mines Limited Hardrock deposit showing the extensions of the main zones and proposed pit shells (*modified from Premier Gold Mines Limited, [www.premiergoldmines.com](http://www.premiergoldmines.com) (under Projects, Canada, Trans-Canada Project, Hardrock – Presentations).*

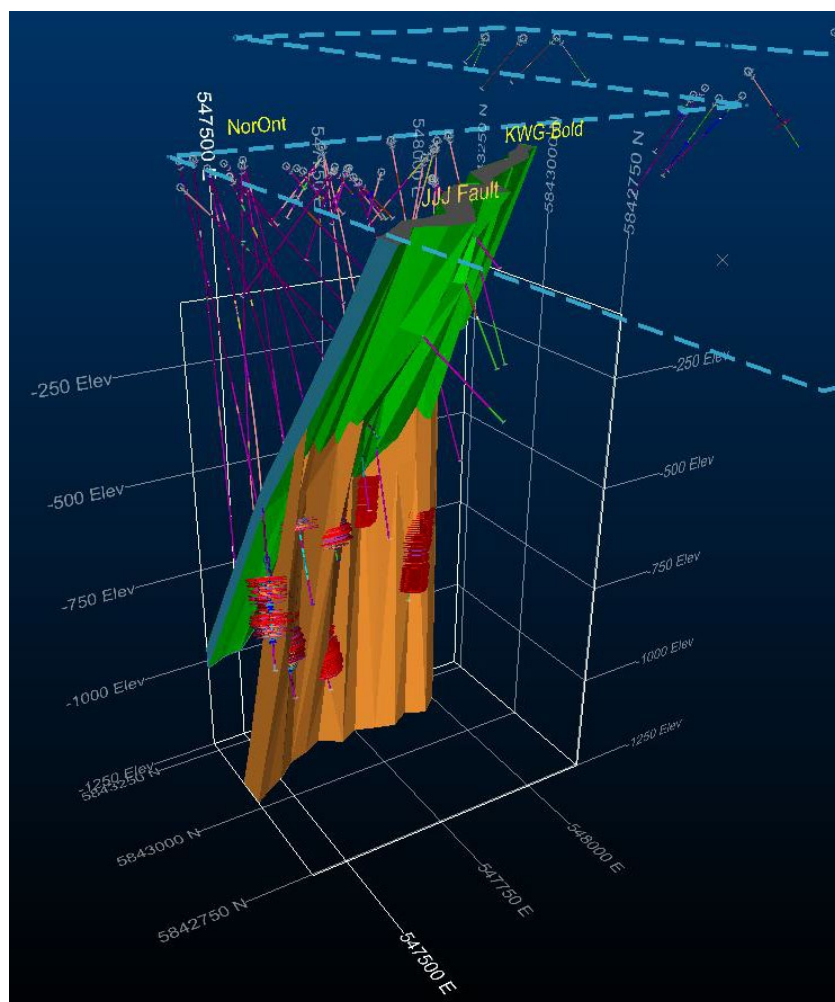
## Major Exploration Projects

**Bold Ventures Inc.** (<http://www.boldventuresinc.com/>) and its joint-venture partner, **KWG Resources Inc.** (<http://www.kwgresources.com/>), completed a winter diamond-drilling program on the **Koper Lake project** in the “Ring of Fire” area (News Release, Bold Ventures Inc., March 27 and May 7, 2014). The program consisted of 6 holes (FN-14-038 to 043) and totaled 4645 m. The drilling program was a follow-up to the previous winter’s drilling and targeted the possible down-dip extension of the currently delineated resource. Three holes targeted the Black Horse deposit (Figure 7) at depth and 3 additional holes targeted an untested gravity anomaly known as the C-6 target, 1 km northeast of the Black Horse deposit. Details of the individual holes can be viewed in the company’s press release (see above). Holes targeting the C-6 anomaly intersected highly sheared rock which is interpreted to be the northeastern extension of the Triple J gold zone to the southwest, first discovered by Noront Resources Ltd. Low-grade chromite mineralization was also intersected in 2 of the 3 holes drilled at the C-6 target. A 1 m sample (assayed in duplicate) from the C-6 target, returned 2.2 g/t Au and 2.45 g/t Au from a sulphide-poor, quartz-magnesite-talc breccia. Additionally, a 0.5 m quartz vein containing 15% chalcopyrite and 1% pyrrhotite, returned 8.85 g/t Au. The 3 holes, aimed at extending the Black Horse deposit at depth, all intersected variable amounts of massive, semi-massive and disseminated chromite intervals with thicknesses of 87.93 m, 139.8 m and 167.3 m, respectively. Highlights of the drilling program are summarized in the table below. Also included are assay results from hole FNCB-13-031, which was drilled with an unusually high curvature and subsequently crossed onto Noront Resources Ltd.’s property.

Hole-ID	From (m)	To (m)	Interval (m)	% Cr <sub>2</sub> O <sub>3</sub>
FNCB-13-031	795.28	925.5	130.22	25.31
including	795.28	840.09	44.81	32.08
including	869.2	895.07	25.87	35.6
FN-14-040	1053	1182	129	37.63
including	1111.5	1182	70.5	42.02
including	1111.5	1131	19.5	45.78
FN-14-042	901.07	1055.14	154.07	25.04
including	918.99	954.77	35.78	31.92
FN-14-043	712	800.51	88.04	24.71
including	756.26	792.69	36.43	36.43

Bold and KWG released an updated resource estimate for the Black Horse chromite deposit on the Koper Lake project (News Release, KWG Resources Inc., May 13, 2014). Details of the resource estimate are summarized in the table below:

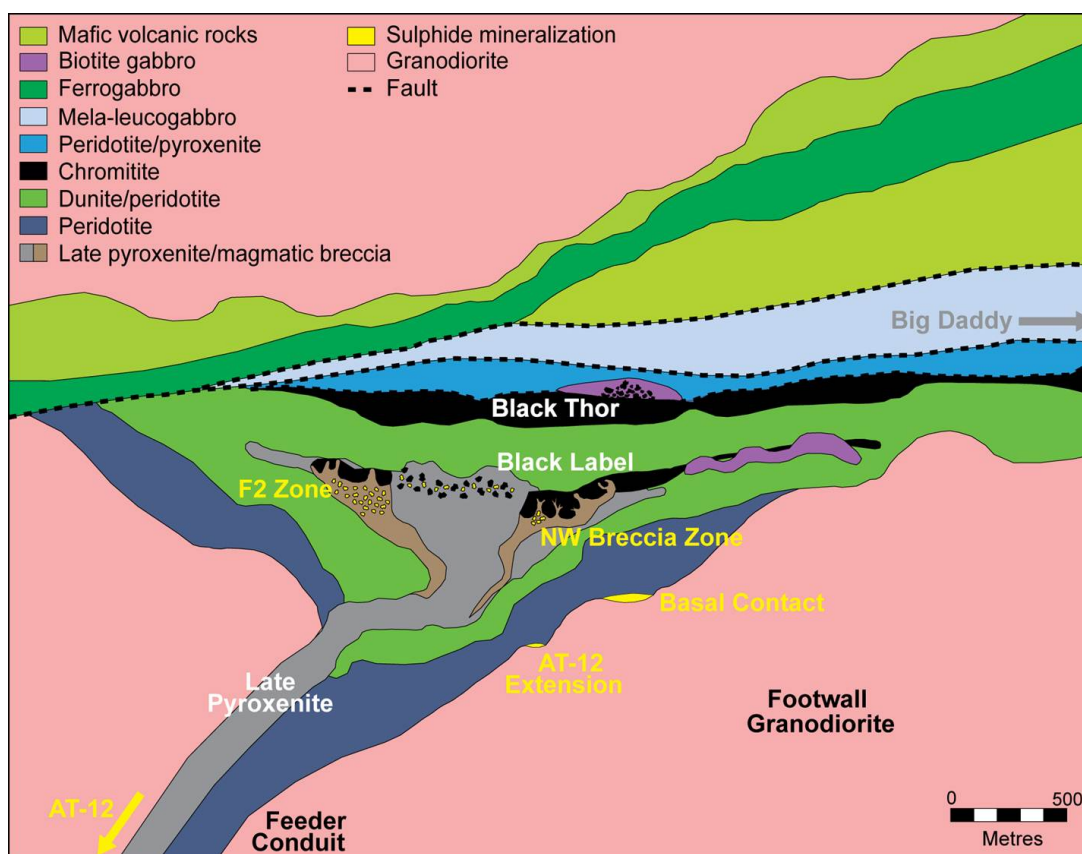
Deposit	Category	Tonnage	Grade (% Cr <sub>2</sub> O <sub>3</sub> )	Cutoff Grade
Black Horse	Inferred Resource	77.9 Mt	35.3	20%



**Figure 7.** Block model of the Black Horse deposit (orange) and the Triple J fault (green). Claims are outlined in blue. (from KWG Resources Inc. (M. Lavigne, KWG Resources Inc., personal communication).

**Cliffs Natural Resources Inc.** ([www.cliffsnaturalresources.com](http://www.cliffsnaturalresources.com)) released updated Mineral Resource Estimates for their chromite deposits (Figure 8) in the Ring of Fire (Annual Report, Cliffs Natural Resources, February 14, 2014). The resource estimates were based on the latest exploration drilling and geological models for the **Black Thor** and **Black Label** deposits. Chromite resources increased by 25.7 million and 1.1 million tons for the Black Thor and Black Label deposits, respectively. Details of the resource estimates are provided below:

Deposit	Category	Tonnage	Grade (% Cr <sub>2</sub> O <sub>3</sub> )	Cut-off grade
Black Thor	Measured and Indicated Resource	137.7 Mt	31.5	20%
Black Label	Measured and Indicated Resource	5.4 Mt	25.3	20%



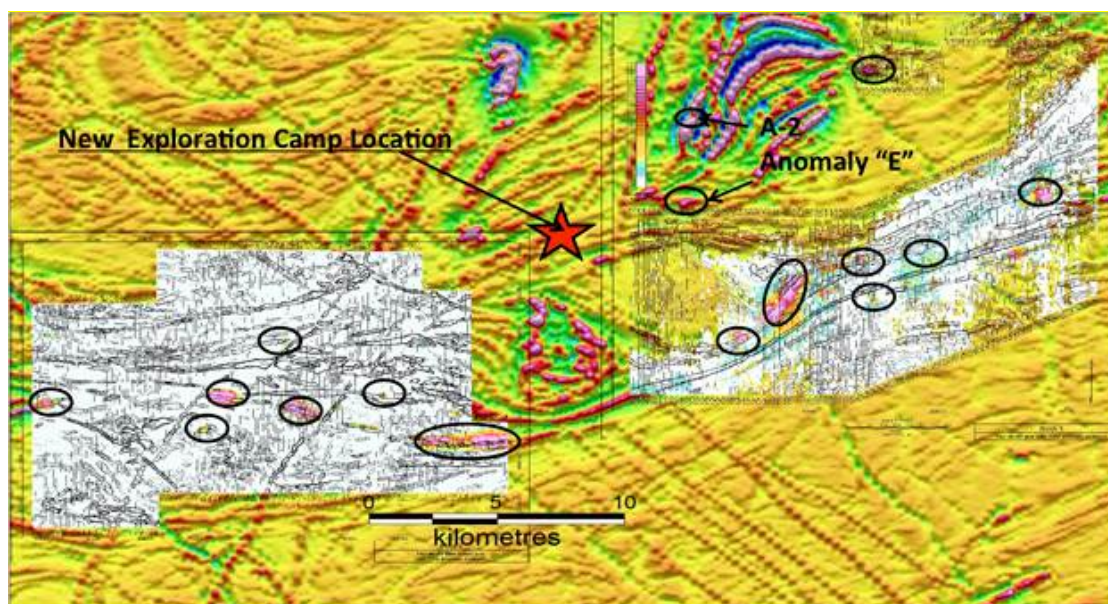
**Figure 8.** Idealized stratigraphic section of the Black Thor intrusive complex, including the Black Thor and the Black Label chromite deposits (from Carson et al. 2013).

**Discovery Harbour Resources Corp.** ([www.discoveryharbour.com/](http://www.discoveryharbour.com/)) and its (former, *see below*) joint-venture partners **Northern Shield Resources Inc.** and **Great Lake Resources LLC**, announced results of a fall diamond-drilling program at the **Wabassi** project (Figure 9), east of Fort Hope (News Release, Discovery Harbour Resources Inc., January 15, 2014). An exploration program was initiated on October 4, 2013, and consisted of ground and bore-hole electromagnetic (EM) surveys on 5 separate grids. It also included the drilling of surface and bore-hole EM anomalies, totalling 2881 m in 7 holes. Expenditures for the exploration program totalled \$1.65 million. The most significant results from drilling were obtained at Anomaly “E” (14.22 m of 4.88% Zn, 0.6% Cu, 18.9 g/t Ag and 0.183 g/t Au in hole 13WA-43). Other drill holes did not intersect appreciable mineralization but did encounter favourable rock types that typically host volcanogenic massive sulphide (VMS)-style mineralization. Down-hole EM surveys also identified a number of off-hole anomalies which displayed sufficient size and intensity to warrant follow-up drill testing.

Northern Shield Resources Inc. subsequently announced that it sold its remaining interest in the Wabassi property, east of Eabametoong (Fort Hope) First Nation, to Great Lakes Resources LLC (private company) (News Release,



Northern Shield Resources Inc., June 18, 2014). The sale agreement transferred Northern Shield's 49% interest in the Wabassi property and its 59% interest in the Max property to Great Lakes for a cash payment of \$1.4 million. Northern Shield will maintain a 0.5% net smelter return (NSR) on the Wabassi and a 0.6% NSR on the Max property. Northern Shield also granted Great Lakes a first right of refusal for its 100%-owned Storm property.



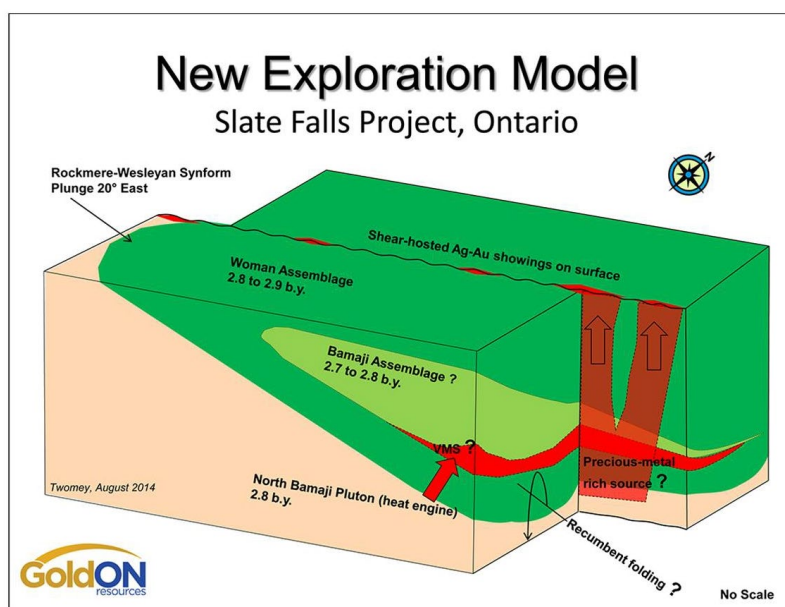
**Figure 9.** Map showing versatile time-domain electromagnetic (VTEM) results for the Wabassi property, with key targets circled in black ([www.discoveryharbour.com/](http://www.discoveryharbour.com/) (under Projects, Wabassi)).

**GoldON Resources Ltd.** (formerly Newcastle Minerals Ltd.) (<http://goldonresources.com/>) released previously undisclosed information pertaining to its recently acquired **Slate Falls** gold-silver property, 30 km southwest of the past-producing Golden Patricia Mine (News Release, GoldON Resources Ltd., March 4, 2014). The work was carried out by Fortune Tiger Resources Ltd. (private company) in 2012 and involved the examination of trenches and verification of historical grab sampling. The Sanderson Zone returned gold values ranging from 0.03 g/t Au up to 40.21 g/t Au, associated with mineralized quartz veins in a 600 to 700 m long shear zone. Values from the Trail Zone ranged from 0.11 g/t up to 151.51 g/t Au over a strike length of nearly 200 m.

In 2014, GoldON Resources carried out a comprehensive review of historical exploration data, as well as a prospecting and sampling program. Gold at the Trail and Sanderson showings occurs in quartz veins containing 1 to 7% disseminated sulphides, including pyrite, galena, chalcopyrite, pyrrhotite, sphalerite and possibly tetrahedrite. The company released assay results from its Slate Falls property (News Release, GoldON Resources Ltd., August 19, 2014) and highlights from the sampling program are shown below.

Sample #	Au (g/t)	Ag (g/t)	Description
549652	220.94	>2000.00	Trail showing: rusty quartz vein with 2-3% pyrite, galena, chalcopyrite, sphalerite
549653	30.40	1111.23	Sanderson showing: rusty quartz vein with 5% galena, pyrite, chalcopyrite
549654	4.40	280.50	Sanderson showing: rusty quartz vein
549655	1.49	118.63	Sanderson showing: 5% fine-grained pyrite in wallrock
549656	172.33	1400.05	Trail showing: rusty quartz vein with 2-3% pyrite, galena, chalcopyrite, sphalerite

GoldON proposed a new exploration model for its Slate Falls property (Figure 10) (News Release, GoldON Resources Ltd., September 2, 2014). To date, work has only explored the high-grade vein systems to a vertical depth of 30 m from surface. The company believes that the property has potential to host a larger, precious metal-rich deposit underneath the narrow high-grade showings. The new exploration model proposes to use the Bamaji pluton as the “heat engine” driving the creation of a precious metal-rich, volcanogenic massive sulphide (VMS) mineralizing event in the overlying Bamaji assemblage. This may have also created the high-grade veins noted in the Woman Assemblage rocks.



**Figure 10.** Graphic showing the proposed exploration model for the Slate Falls Project (from GoldON Resources Ltd., <http://goldonresources.com> (under Projects, Slate Falls Projects)).

**KWG Resources Inc.** ([www.kwgresources.com/](http://www.kwgresources.com/)) and its joint-venture partner, **Cliffs Natural Resources Inc.** ([www.cliffsnaturalresources.com](http://www.cliffsnaturalresources.com)) released an updated NI 43-101-compliant technical resource estimate for the **Big Daddy** chromite deposit in the Ring of Fire. The report can be accessed on KWG's Sedar profile. A summary of the resource estimate for the Big Daddy Chromite deposit is listed in the table below.

Category	Tonnage	Grade (% Cr <sub>2</sub> O <sub>3</sub> )	Cut-Off Grade
Measured and Indicated Resource	29.1 Mt	31.7	20%
Inferred	3.4	28.1	20%

**Landore Resources Ltd.** ([www.landore.com](http://www.landore.com)) announced results from a ground geophysical survey conducted in December 2013 on the **Junior Lake property**, 235 km north-northeast of Thunder Bay (News Release, Landore Resources Ltd., January 13, 2014). Ground electromagnetic (EM), very low frequency electromagnetic (VLF-EM) and magnetic geophysical surveys were completed from line 900E, through the VW deposit to line 4000E. The survey revealed numerous near-surface conductors along the VW trend, 2 of which were 600 m long by 25 m wide and 900 m long by 35 m wide.

The company also completed a deep-penetrating Quantec 3D Direct Current Induced Polarization and magnetotellurics (DCIP+MT) geophysical survey over the B4-7 and VW Nickel trends (News Releases, Landore Resources Ltd., February 18, March 24 and April 23, 2014). Results from the ground geophysical survey identified 9 significant new zones, ranging from approximately 400 to 1200 m in length. Each of the new zones has potential for nickel sulphide mineralization along strike and adjacent to the B4-7 and VW nickel-copper-cobalt-platinum group element (PGE) deposits. These results are consistent with the VLF-EM and magnetic surveys carried out in December 2013.

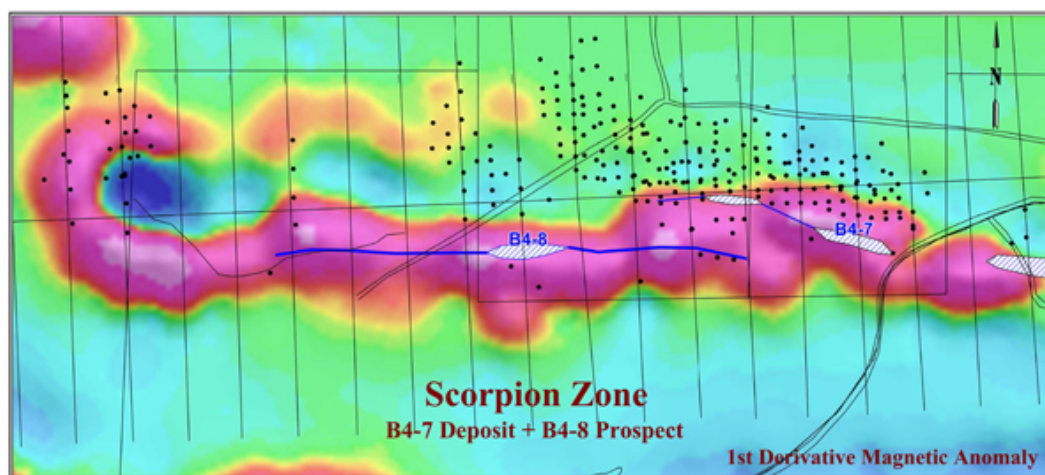
Landore completed a preliminary diamond-drilling program on the Junior Lake property in 2014 (News Releases, Landore Resources Ltd., July 7, August 19, and September 15, 2014). The program totalled 4201 m over 16 holes (0414-477 to 0414-492), focussing on targets generated from the 2014 DCIP+MT ground geophysical survey on the B4-7 zone and adjacent areas (Figure 11). Drilling successfully intersected a copper-gold-mineralized structure containing disseminated sulphides, extending 1000 m eastward from the B4-7 deposit. The mineralized structure correlates with the ground EM, VLF-EM and magnetic geophysical anomalies. Significant assays from the drilling program are included in the table below.



Drill-hole No.	From (m)	Width (m)	Ni (%)	Cu (%)	Co (%)	Pd (ppb)	Pt (ppb)	Au (ppb)
0414-478	183	6.75	0.31	0.07	0.02	1016	196	5
including	186	0.75	1.28	0.27	0.07	2960	164	12
0414-478	245.37	0.26	0.94	0.10	0.05	130	53	23
0414-479	292.38	1.42	0.21	1.42	0.01	185	30	105
0414-482	174.5	1.00	0.14	1.15	0.02	136	38	187
and	226.20	0.80	0.09	1.14	0.01	20	7	76
0414-489	6.28	3.02	0.32	0.95	0.02	533	123	134
0414-491	137.00	1.00	0.09	1.25	0.01	93	12	54

Landore also completed a fall diamond-drilling program focused on following up targets identified from ground geophysical surveys, as well as on complementing the preliminary summer drilling program (News Release, Landore Resources Ltd., November 19, 2014). The fall drilling program was completed during September and October and consisted of 12 drill holes (0414-493 to 0414-504), totalling 2673 m. The program targeted several areas spanning from the B4-7 deposit to the VW deposit and was successful in intersecting the down-dip extension of the main B4-7 massive sulphide zone, 140 m below the existing resource. High-grade PGE-mineralized rocks in the Alpha Zone (Holes 0414-503 and 0414-504), as well as near-surface, precious metal-rich mineralized rocks southwest of the VM Nickel deposit (Hole 0414-495), were intersected. Significant assays from the fall program are summarized below.

Drill-hole No.	From (m)	Width (m)	Ni (%)	Cu (%)	Co (%)	Pd (g/t)	Pt (g/t)	Au (g/t)
0414-495	7.34	0.34	0.02	0.06	0.04	0.06		1.21
0414-503	378.57	20.15	0.11	0.04	0.01	1.54	0.64	0.01
including	385.44	0.56	0.08	0.01	0.01	10.90	11.50	0.08
0414-504	18.46	2.90	0.78	0.14	0.04	1.54	0.06	
and	74.90	0.93	0.68	0.22	0.04	2.25	0.70	0.02



**Figure 11.** First derivative magnetic expression of the Scorpion Zone showing the location of the B4-7 deposit and the B4-8 prospect (from Landore Resources Inc., [www.landore.com](http://www.landore.com) (under Properties, Canadian Properties, Junior Lake, The Scorpion Zone)).

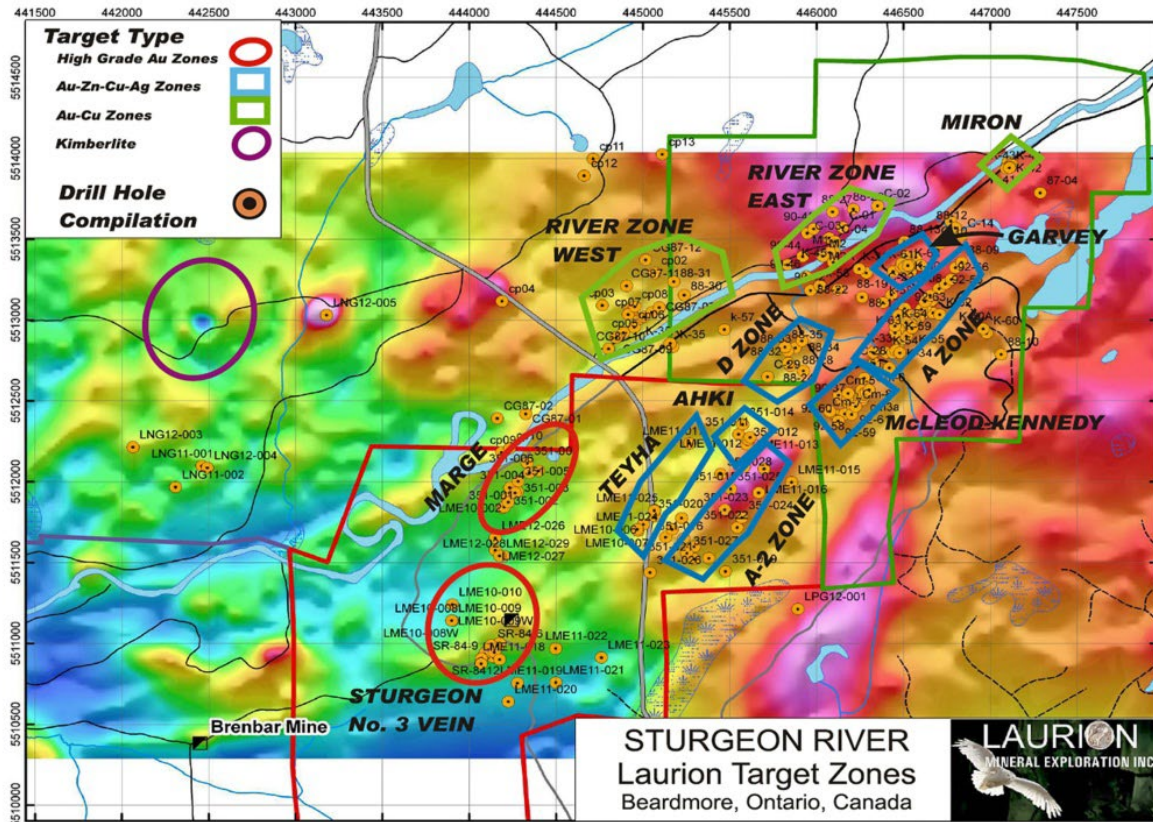
**Laurion Mineral Exploration Inc.** ([www.laurion.ca](http://www.laurion.ca)) completed a winter diamond-drilling program on the Ishkoday property, northeast of Beardmore (News Releases, Laurion Mineral Exploration Inc., January 28, 2014, February 27, 2014, March 14, 2014). The program consisted of 533 m of drilling in 4 holes and was designed to test mineralization within the A-zone of the Loki trend (Figure 12). Two holes targeted high-grade channel and grab samples reported in the fall of 2013 while 2 holes were designed to follow up diamond drilling carried out in 2012 along the northeastern extension of the A-zone in the Loki trend. Significant results from all 4 holes are summarized in the table below.

Hole ID	From (m)	To (m)	Interval (m)	Au (g/t)	Ag (g/t)	Cu (%)	Zn (%)
LME14-030	77.00	81.20	4.20	0.32	3.94	0.10	1.76
	86.63	92.19	4.37	0.56	3.11	0.09	1.38
LME14-031	23.00	25.00	2.00	0.49	0.80	0.02	0.28
	47.00	48.80	1.80	27.8	13.10	0.16	1.21
LME14-016	103.65	108.00	4.35	0.30	1.46	0.05	0.52
including	103.65	104.00	0.35	0.58	14.20	0.34	4.64
LME14-017	60.00	61.00	1.00	0.50	8.70	0.11	1.44
	136.00	139.00	3.00	0.17	1.57	0.05	0.56

Laurion conducted a drilling program in Spring of 2014 to follow-up on results obtained from the winter drilling program (details above) (News Release, Laurion Mineral Exploration Inc., May 14, 2014). The program consisted of 2 holes, totalling 424 m, targeting the high-grade A-zone of the Loki trend. Detailed information on both holes can be viewed in the company's press release (see above). Highlights from the drilling program are summarized in the table below.

Hole ID	From (m)	To (m)	Interval (m)	Au (g/t)	Ag (g/t)	Cu (%)	Zn (%)
LME14-018	100.00	147.16	47.16	0.18	1.5	0.04	0.39
Including	107.00	114.84	7.85	0.40	4.3	0.09	1.03
Including	137.50	139.50	2.00	0.61	2.3	0.05	2.62
LME14-019	2.40	49.83	47.43	0.31	4.0	0.03	0.52
including	46.00	49.15	3.15	1.14	13.1	0.08	3.47
And	65.72	162.37	96.65	0.60	5.0	0.08	0.68
Including	78.90	89.12	10.22	2.27	10.1	0.09	2.05

Laurion also announced its intention to refocus exploration efforts on the Ishkoday property. Laurion recently sold its interest in the Midlothian property southwest of Kirkland Lake, stating that the company's focus will be directed towards the Ishkoday gold-base metal property. The company also conducted an independent expert geological and structural evaluation related to the property's exploration potential. The property was evaluated for its base metal potential by Dr. Harold Gibson, who concluded that "... extensive development of the mineralized zones (within a 1 km by 3 km area), suggested that the veins are a product of a large, magmatic hydrothermal system and may have greater tonnage potential than recognized by previous workers". Structural controls on mineralization were evaluated by Dr. Stefan Kruse who concluded that, "The combination of fold repetition and hinge-zone thickening make fold zones attractive exploration targets." The full statements can be viewed in the company's September 3, 2014, news release. (News Releases, Laurion Mineral Exploration Inc., July 22 and September 3, 2014.)

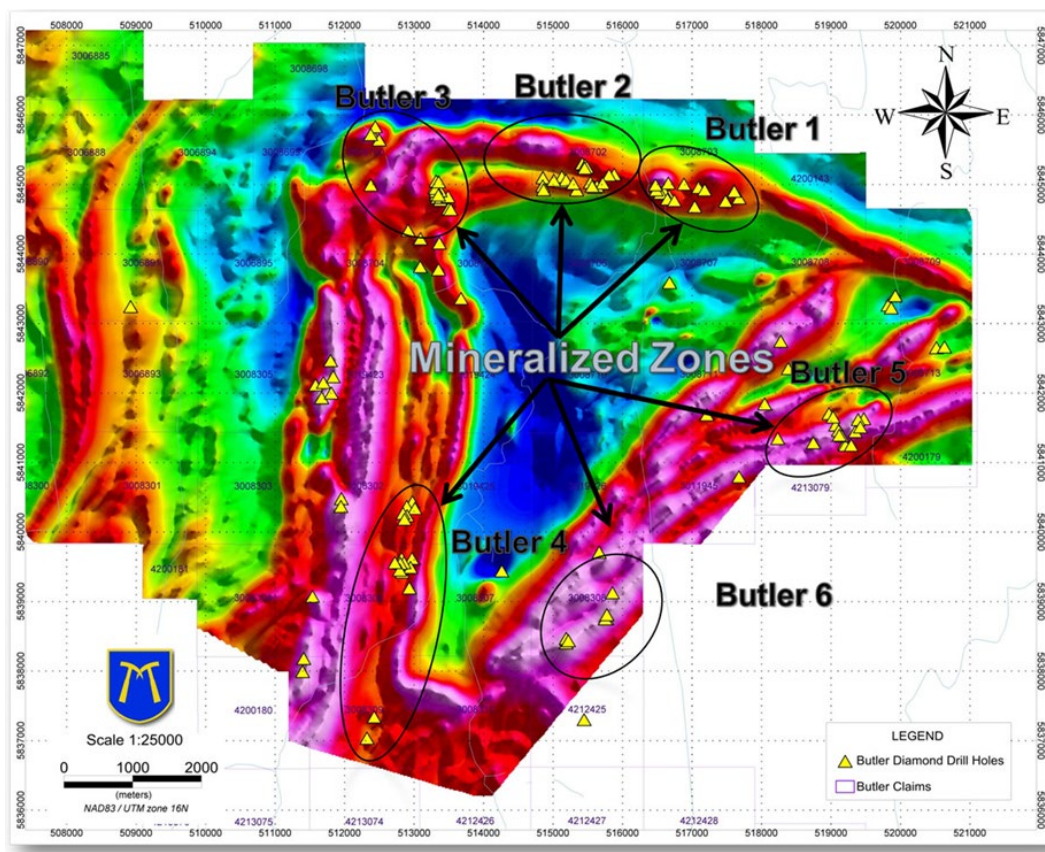


**Figure 12.** Geophysical map of the Laurion Mineral Exploration Inc. Ishkoday property, showing location of the main trends, zones and drill holes (from Laurion Mineral Exploration Ltd., [www.laurion.ca](http://www.laurion.ca) (under Projects, Sturgeon River – Ontario, Ishkoday Property)).

**MacDonald Mines Exploration Ltd.** ([www.macdonaldmines.com](http://www.macdonaldmines.com)) provided a summary and future plans for the Butler property in the western portion of the Ring of Fire area (Management Discussion and Analysis, MacDonald Mines Exploration Ltd., November 10, 2014). The Butler property exhibits high potential for significant VMS mineralization, with at least 4 zinc-copper VMS centres (Butler 1 through 4)(Figure 13). The property displays all the necessary components for significant discovery: a large heat source (komatiites); laterally extensive alteration; known mineralization (zinc, copper, silver, lead); and geophysical signatures. The company also highlighted the potential for nickel-copper-PGE and titanium-vanadium mineralization on the Butler property.

MacDonald Mines intends to focus on the Butler 3 and Butler 4 targets in the intermediate term. Previous drilled core is being analyzed to determine the structural controls on Butler 3 and 4, which will be used to target further mineralization. The company intends to commence a 1200 m drilling program, subject to the availability of funds and receipt of a drilling permit from the Ontario Ministry of Northern Development and Mines (MNDM).





**Figure 13.** Map showing the MacDonal Mines Exploration Butler property, with locations of Butler targets 1 through 6 (from MacDonald Mines Exploration Ltd., [www.macdonalmines.com](http://www.macdonalmines.com) (under Projects, Butler Property)).

**Noront Resources Ltd.** ([www.norontresources.com](http://www.norontresources.com)) provided an update on the Eagle's Nest project in the Ring of Fire area (News Release, Noront Resources Ltd., September 26, 2014). The company agreed to support Marten Falls First Nation as the proponent in building a winter road connected to the existing network, which will access its Eagle's Nest property. The road will be used to transport materials to the Eagle's Nest project site once the necessary approvals are in place. Noront is also working on updating its 2012 Feasibility Study which is based on detailed cost estimates provided by companies contributing to the eventual construction of the Eagle's Nest mine. The company is progressing through the Environmental Assessment process, addressing additional studies required by government reviewers and concerns from First Nations parties.

Noront closed a previously announced transaction with Cliffs Chromite Ontario Inc. to acquire its exploration camp and equipment at McFaulds Lake. Noront intends to use the Cliffs camp as its construction base for development of the Eagle's Nest project (News Releases, Noront Resources Ltd., May 23, 2014, October 8, 2014). Noront also planned for a 2014–2015 winter exploration program, which will include geophysical surveys followed by drill-testing of any newly discovered targets. This work is contingent on obtaining approvals from the provincial government, local community support and financing.

**Northern Superior Resources Inc.** provided an outlook for the Ti-pa-haa-kaa-ning (TPK) property, 30 km northeast of the Neskantaga First Nation (Management's Discussion and Analysis, Northern Superior Resources Inc., May 12, 2014). The company intends to maintain the TPK exploration camp and fuel cache. They will also engage and develop the company's relationship with Neskantaga First Nation as well as surrounding communities. Northern Superior is currently seeking joint-venture partnerships to assist in advancing exploration programs on the TPK property.

**PC Gold Inc.** ([www.pcgold.ca](http://www.pcgold.ca)) completed a diamond-drilling program on the **Pickle Crow property**, 9 km east of Pickle Lake. The program consisted of 21 holes, totalling 4026 m of diamond drilling, targeting the near-surface locations of the No. 22 and No. 23 veins (Figure 14)(News Releases, PC Gold Inc., May 20, 2014, June 25, 2014, July 2, 2014, July 16, 2014, July 22, 2014). The program was aimed at expanding the strike length and increasing drill density from surface to approximately 150 m depth. The No. 22 and 23 veins are approximately 400 m south of the No. 3 shaft and are hosted within metavolcanic and gabbroic rocks of the Confederation assemblage. Complete details of the drilling program are in the company's press release, including links to maps and photographs. A total of 62 holes and 11 167 m have now targeted the No. 22 and 23 veins.

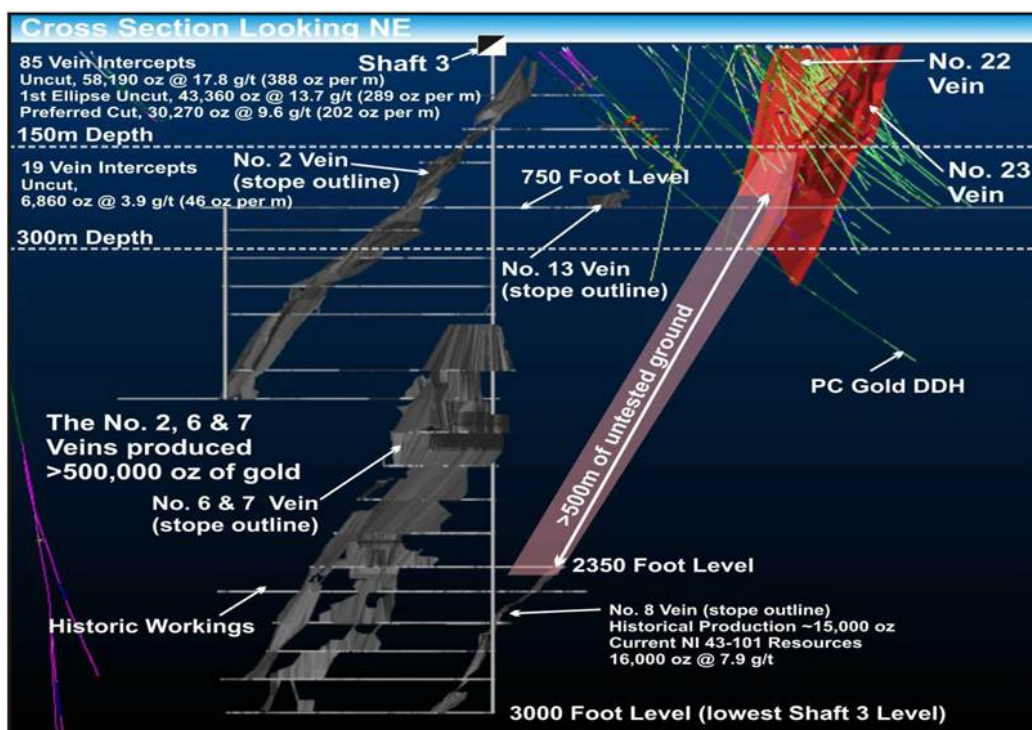
Zone	Hole ID	Interval (m)	From (m)	To (m)	Au (g/t)
Upper No. 23	PC-14-283	0.90	65.89	66.79	878.69
Middle No. 23	PC-14-283	5.55	71.45	77.00	10.60
Upper No. 23	PC-14-284	4.03	66.20	70.23	12.72
Middle No. 23	PC-14-284	2.63	73.42	76.05	28.51
No. 23	PC-14-287	1.50	162.90	164.40	10.64
No. 23	PC-14-287	1.50	180.70	182.20	8.33
No. 22	PC-14-288	21.08	148.85	169.93	0.87
No. 22	PC-14-291	0.50	100.22	100.72	68.71
Upper No. 23	PC-14-293	0.55	140.88	141.43	16.10
Middle No. 23	PC-14-297	1.50	162.90	164.40	10.64
No. 22	PC-14-298	21.08	148.85	169.93	0.87

PC Gold released an initial resource estimate for the No. 22 and 23 veins (News Release, PC Gold Inc., September 15, 2014). The estimate used 58 diamond drill holes and 4 historic drill holes, totalling 10 851 m, and 226 assays. Further details of the resource estimate can be viewed in the company's press release (see above link). The resource is considered an interim internal update to the company's initial overall resources estimate for the Pickle Crow property (1.26 million ounces at 3.9 g/t Au) (News Release, PC Gold Inc., April 18, 2011). The details of the initial resource estimate for the No. 22 and 23 veins are included in the table below.

Category	Tonnage (t)	Grade (g/t Au)	Contained Au
Inferred Resource	153 000	7.6	37 100 ounces

PC Gold consolidated a considerable land package in the Pickle Lake gold camp in 2014. The company entered into a mineral claim purchase agreement with GoldON Resources Ltd. for claims adjacent to PC's Pickle Crow property. The agreement includes 38 mining claims owned by GoldON and an additional 5 mining claims under option to GoldON, totalling 6480 ha. PC entered into a mineral claim purchase agreement with Frontline Gold Corporation for claims to the east of PC's Pickle Crow property. The agreement includes 8 patented mining claims and 21 unpatented mining claims, totalling 4106 ha. PC also completed the acquisition of additional mining claims from MetalCorp Ltd. for a claim package to the northeast of the Pickle Crow property. The purchase includes 28 claims, representing 5600 ha. The acquisitions bring PC's total land holding in the Pickle Lake Gold Camp to 20 354 ha. (News Releases, PC Gold Inc., June 6, August 6, September 12 and 26, 2014.)

PC Gold released an outline concerning the potential of the Pickle Crow property and provided an outlook for future work (Management's Discussion & Analysis, PC Gold Inc., October 28, 2014). The company is studying the feasibility of commissioning the onsite 225 tonne-per-day (tpd) gravity mill to generate cash flow which could be applied to dewatering of the underground workings and to the planned underground exploration program. Work also continued on studying the potential of mining the No. 22 and 23 veins to feed the 225 tpd gravity mill. Mining of the No. 22 and 23 veins by ramp access would not intersect the historical workings at Pickle Crow.



**Figure 14.** Cross-section showing location of No. 22 and No. 23 veins in relation to historical mine workings, Pickle Crow property (from PC Gold Inc. [www.pcgold.ca](http://www.pcgold.ca) (under Investors, Presentations)).

**Romios Gold Resources Inc.** ([www.romios.com](http://www.romios.com)) planned to conduct a VTEM airborne geophysical survey over its Lundmark–Akow Lakes claims, north of Goldcorp’s Musselwhite Mine, approximately 140 km north of Pickle Lake (News Release, Romios Gold Resources Inc., March 20, 2014). The survey covers areas where widespread gold mineralization was identified in earlier exploration programs conducted by Romios. Mineralization on the property is associated with banded iron formation, a deformation zone and an extensive zone of stringer-type copper mineralization.

**Sage Gold Inc.** ([www.sagegoldinc.com](http://www.sagegoldinc.com)) executed a non-binding letter of intent with **Premier Gold Mines Limited** ([www.premiergoldmines.com](http://www.premiergoldmines.com)) to purchase the Northern Empire Mill and Mine in Beardmore and other exploration properties in the Greenstone area (News Release, Sage Gold Inc., April 25, 2014). The acquisition will result in Sage doubling its land position in the Beardmore–Geraldton camp to approximately 15 578 ha, as well as adding historic gold resources to its portfolio. In addition to the Northern Empire Mill and Mine, the company will acquire the Leitch–Sand River property, the Nortoba Tyson gold and molybdenum occurrence, the Pifher property, the Ozone Creek property and Eva–Summers property as part of the purchase.

**Silver Stream Mining Corp.** ([www.silverstreammining.com](http://www.silverstreammining.com)) recovered approximately 5000 m of drill core from historic drilling on the Solomon’s Pillars property, east of Beardmore (News Release, Silver Stream Mining Corp., January 30, 2014). The drill core represents 30 diamond-drill holes completed by Canadian Nickel Company Limited (which later became INCO) during the mid-1980s which tested the main mineralized zone proximal to the shaft, as well as the west mineralized zone. Silver Stream planned to review and resample the core.

**Sinocan Exploration** completed a winter drilling program on the Winiskisis Channel property in the Ring of Fire area. The program consisted of 1021 m of drilling in 5 holes. Results have not been released (Resident Geologist’s Office Files, Thunder Bay North District, Thunder Bay).

**Transition Metals Corp.** ([www.transitionmetalscorp.com](http://www.transitionmetalscorp.com)) staked a large portion (2512 ha) of the Midcontinent Rift-related, mafic-ultramafic Kitto intrusion, approximately 10 km west of Beardmore (News Release, Transition Metals Corp., November 17, 2014). The Kitto intrusion shares geological similarities to Transition’s Sunday Lake intrusion, north of Thunder Bay. The Kitto intrusion has been explored since 2003 with 9 diamond-drill holes,



totalling 2354 m. Elevated copper, nickel and PGE values (0.28% Ni, 0.13% Cu and 563 ppb Pt+Pd over 1.22 m) were reported by Kennecott Canada Exploration Inc. in 2003.

**TrinCan Capital Corp.** ([www.trincapital.com](http://www.trincapital.com)) and its wholly owned subsidiary, **Markinch Resources Inc.** ([www.markinchresources.com](http://www.markinchresources.com)), announced assay results from a winter drilling program on the Tashota property, north of Jellicoe (News Release, TrinCan Capital Corp., January 22, 2014). Results from the first two drill holes were released in December of 2013 (News Release, TrinCan Capital Corp., December 27, 2013). All holes targeted the Wascanna zone on the Tashota property where mineralization is characterized by gold-bearing quartz veins. Drill holes W13-03 and W13-04 were drilled on the same section line as W13-01 and W13-02 and returned assays of 4.95 g/t Au over 1.90 m and 18.5 g/t Au over 2.50 m, respectively. Drill holes W13-05 and W13-06 were drilled on a parallel section 10 m to the north and returned assays of 11.84 g/t Au over 3.65 m and 3.96 g/t Au over 3.10 m, respectively.

**White Tiger Mining Corp.** ([www.whitetigermining.com](http://www.whitetigermining.com)), along with its joint-venture partner **Rainy Mountain Royalty Corp.** ([www.rmroyalty.com](http://www.rmroyalty.com)), initiated a geophysical review of the Marshall Lake property, 30 km west of Nakina (News Release, White Tiger Mining Corp., August 25, 2014). The companies commissioned Caracle Creek International Consultants of Toronto to merge several generations of geophysical data into a high quality three-dimensional inversion model. This will assist in evaluating the mineralization potential of copper showings between the RM Zone and the historic Billiton deposit.

## RESIDENT GEOLOGIST STAFF AND ACTIVITIES

In 2014, the Thunder Bay North Resident Geologist Program (RGP) comprised Gerry White, P.Geo. (Regional Resident Geologist), Robert Cundari, P.Geo. (District Geologist), Marcia Brunelle (District Geological Assistant) and Rosey Pelaia (Administrative Assistant). Significant support was also provided by Cheryl McDonald (Administrative Assistant), Stuart Dunlop (A/GIS/Data Specialist), Genevieve Dorland (GIS/Data Specialist), Therese Pettigrew, P.Geo. (Mineral Deposit Compilation Geoscientist), Ryan Tuomi (Regional Land Use Geologist), Andrew Tims (A/Regional Land Use Geologist) Melanie Mathieson (Aboriginal Relations Branch), Mike Grant and staff (Mineral Development and Lands Branch), especially in dealing with Far North and First Nations issues, and Cailey Anderson and Brad Dragan (Exploration Inspectors/Rehabilitation and Compliance Section).

In 2014, 34 property visits were conducted to 27 properties in the Thunder Bay North, Thunder Bay South, Kenora and Southern Ontario districts by Thunder Bay North District staff (Table 5). Thunder Bay North staff dealt with over 542 visitors and over 398 telephone, facsimile and e-mail inquiries in the Thunder Bay office, in the field and at symposia. Thunder Bay North RGP staff attended, or assisted in the production of materials for, the following symposia in 2014: Cordilleran Round-Up, Vancouver (display); Prospectors and Developers Association of Canada Annual Meeting, Toronto (display); Grow Greenstone Expo (display); Northwestern Ontario Mines and Minerals Symposium, Thunder Bay (presentation and display); Geraldton Chamber of Commerce Trade Show (display); Institute on Lake Superior Geology, Hibbing, Minnesota (presentation); the Kenora District Exploration Information Session, Dryden (field trips); the “Ke-ondaatiziying, How we will Sustain Ourselves 2014” conference, Sioux Lookout (field trip); the Greenstone Economic Development Corporation (GEDC) Mining Showcase Conference, Longlac (presentation and display); Manitoba Mining and Minerals Convention, Winnipeg (display); and the Ontario Exploration and Geoscience Symposium, Sudbury (display). Regional and district exploration, mining activity and geology presentations were also made to various local organizations including the GEDC (Geraldton), several community groups and First Nation communities, as well as primary and secondary school students in Thunder Bay.

G.D. White continued in his position as a certified member of the Joint Health and Safety committee for the Thunder Bay Mines and Minerals office and co-ordinated tasks associated with the Thunder Bay Drill-Core Library, Northwest Region Summary and Recommendations For Exploration booklets.

**Table 5.** Property visits conducted by the Thunder Bay North District Geologists and staff in 2014.

Number	Property / Occurrence
1	Altered Zone
2	Amethyst Mine Panorama*
3	Anaconda Iron
4	Bovin-Gilbert
5	Central Patricia No. 1
6	Copper Point*
7	Foisey <sup>PE</sup>
8	Georgia Lake
9	Goldlund*
10	Hardrock
11	Hercules
12	Junior Lake-VW
13	Junior Lake-Lamaune
14	KM 61
15	Leitch
16	Lun-Echo
17	Missing Link Extension
18	Musselwhite Mine
19	Pickle Crow Mine
20	Nordic Lake
21	Solomon's Pillars
22	Sor Lake
23	Tashota-Nipigon Mine
24	Tatlock Marble Quarry*
25	Thierry Mine
26	Van Horne Gold*
27	Vent

<sup>PE</sup> described in "Property Examinations", this report.

\* not in Thunder Bay North District.

## PROPERTY EXAMINATIONS

### Foisey Property

The Foisey property, also named the Orphan or Dikdik Mine property, is located in the northeastern corner of Rickaby Township, north of Atigogama Lake on the Kinghorn road and 40 km northeast of Beardmore. Access to the main occurrence on the property is via the Kinghorn Road, which intersects Highway 11 approximately 7.5 km east of Jellicoe. Travel north and west for approximately 21 km on the Kinghorn Road to the Foisey trail. The main showings are located at the end of this bush trail 3.4 km north of the Kinghorn Road, within the northeastern portion of claim TB3011563. The claim group consists of 2 parts: to the north, 27 units in 5 staked claims; and to the south, along the Kinghorn Road, a group of 9 patented claims (TB11070 to 11078) which constitute the original Orphan Mine property. The property is currently held by Mantis Explorations Inc., a subsidiary of Mantis Mineral Corp., and was explored by the company during the 2007 to 2008 field season. (In February 2014, the company name changed to Gondwana Oil Corp. in an amalgamation with Gondwana Energy Corp.).

This region, in the southeastern part of the Onaman–Tashota metavolcanic belt centred on altered granodioritic rocks of the Elmhirst and Kaby lake plutons, has seen extensive exploration activity within the past 10 years. During this period, Kodiak Exploration Limited completed a \$30 million trenching and diamond-drilling program on their Hercules property in Elmhirst Township, west of the Foisey claims. This resulted in the discovery of a small



NI 43-101-compliant gold resource (total Indicated and Inferred resource of 212 500 ounces of gold) within a large fracture zone of the Elmhirst Lake pluton (Stott et al. 2002). The Kaby Lake pluton, which hosts the Foisey property and lies 9 km east of the Elmhirst pluton, has a very similar geological setting both in terms of the fracturing and alteration of the granodiorite host rocks, based on field examinations conducted by staff of the Thunder Bay North Resident Geologist's office. Ages reported by Stott et al. (2002) from the Elmhirst and Kaby Lake plutons range from 2734 to 2736 Ma. These plutons are syntectonic with the 2740 to 2780 Ma felsic to intermediate metavolcanic rocks (Stott et al. 2002). This has positive implications for future exploration in this area. The similar character of the 2 granodioritic intrusions highlights the importance of identifying and exploring any northwest-trending fracture zones for gold mineralization. Also, in certain locations the northwest-trending shear structures hosting the gold mineralization penetrate the surrounding metavolcanic rocks. Tracing these structures into the metavolcanic host rocks may lead to the discovery of additional gold occurrences.

The original Foisey occurrence, west of Dilla Lake, was first discovered by Frank Foisey in 1926 and later reported on by E.M. Burwash in a 1934 Canadian Mining Journal article (Burwash 1933). The article stated the best analysis of grab samples from the occurrence where the fracture zone crosses a lamprophyre dike returned 11.6 to 17.6 g/t Au. Burwash (1933) also stated that channel sample assays ranging from 4.5 to 7.4 g/t Au in widths up to 1.5 m were traced along the vein structure for 260 m. The property was also mentioned in a 1933 Northern Miner newspaper report, stating that gold values on the Foisey find ranged up to 12.8 g/t Au over widths up to 4.6 m. During this same period in 1933, T.A. Johnson discovered gold at a location 2.7 km southeast of the Foisey showing and 200 m north of Atigogama Lake, which later became the Dikdik Mine. A shaft was sunk to a total depth of 80 m and ore was taken from 2 levels. The mine operated from 1933 to 1935, producing 2460 ounces of gold and 1558 ounces of silver (Resident Geologist's Office Files, Thunder Bay North District, Thunder Bay). It is interesting to note that in addition to the Leitch Mine (average grade of 26.1 g/t Au) at Beardmore, the Dikdik or Orphan Mine had one of the highest production grades in the Beardmore–Geraldton camp, averaging 19.8 g/t Au (Ferguson et al. 1971).

The Foisey occurrence was “rediscovered” in 1988 by Beardmore prospector F. Houghton and subsequently optioned the same year to joint-venture partners Freewest Resources Inc. and Murgor Resources Inc. From 1988 to 1992, operator Freewest Resources conducted geological mapping, stripping, trenching, sampling, ground magnetic and very low frequency electromagnetic (VLF-EM) surveys, and staked an additional 75 claims covering various sections of the Kaby Lake pluton. Channel samples from the Foisey property returned up to 16.8 g/t Au and grab samples returned up to 20.9 g/t Au. In 1989, a prospecting, mapping and stripping program was carried out by Noranda Exploration for Freewest-Murgor. Channel sample results across the stripped zones ranged up to 5.5 g/t Au over 2.0 m and grab samples returned up to 19.4 g/t Au (Resident Geologist's Office Files, Thunder Bay North District, Thunder Bay). It is also important to mention during this same time period (ca. 1991), exploration work was performed by F. and P. Houghton and a joint-venture optionor (Consolidated Gold Hawk Resources Inc. and Hemlo Gold Mines Inc.) on the historical Larson occurrence. The Larson occurrence is located approximately 1.4 km due south of the main Foisey showing and was first discovered by J.A. Moore in 1933. Burwash's (1933) original report in the Canadian Mining Journal also discusses the Larson claims. Assessment file records indicate numerous trenches on the property hosted in mineralized (1 to 2% pyrite), sericite- and chlorite-altered shear zones within granodiorite of the Kaby Lake pluton. Surface sampling by the joint-venture partners from one of the historical trenches on the Larson occurrence returned 1.7 g/t Au over 20 m (Resident Geologist's Office Files, Thunder Bay North District, Thunder Bay). As part of an Ontario Geological Survey Historical Research project (Speed and Craig 1992), both the Foisey and Larson occurrences were visited and numerous grab samples were collected for analysis. Speed and Craig (1992) reported up to 17.6 g/t Au from “recent” (1988) trenching on the Foisey property (average ranging from 0.5 to 1.5 g/t Au) and up to 3.5 g/t Au from some of the old trenches on the Larson property. It should be mentioned that the Larson property, which is located in the northwest quadrant of claim TB4209056, is currently held by Canadian Prospectors Inc. and is not part of the Foisey-Orphan Mine property.

Mantis Exploration Ltd., a subsidiary of Mantis Mineral Corp., initiated exploration work on the Foisey property in 2007 and completed 4 separate trenches, totaling 220 m of excavation along a 200 m northwest-trending zone. Bedrock exposures revealed a 7 to 10 m wide zone of brittle deformation generated by quartz vein-silica flooding that brecciated the host granodiorite. The average gold values from numerous channel line samples across the vein structure in the 2 main trenches ranged from 0.44 g/t Au across 6.23 m to 0.86 g/t Au across 8.97 m, respectively. The highest average gold value obtained from a single channel line was 5.13 g/t Au (Hanych and Ewanchuk 2010). In 2008, the company performed Spectral induced polarization (IP) / resistivity and magnetic surveys, combined

with detailed geological mapping, over a grid that covered the Foisey gold showings and extended southeast across Dilla Lake to the Orphan Mine patents. An eight-hole, 1483 m diamond-drilling program identified an 850 m long, northwest-trending structural corridor termed the “Foisey Fault” (Hanych and Ewanchuk 2010).

The Foisey property is situated within Neoarchean intermediate to felsic metavolcanic and intrusive rocks of the southeastern portion of the Onaman–Tashota greenstone belt, which is part of the eastern Marmion domain of the Wabigoon Subprovince. Mackasey and Wallace (1978) mapped the area within Elmhirst and Rickaby townships. They described the intermediate to felsic metavolcanic rocks in the Rickaby Township area as consisting primarily of tuff-breccia, lapilli tuff, crystal tuff, pyroclastic breccia and related feldspar- and quartz-feldspar porphyries. Intermediate to felsic intrusive rocks consist mostly of massive pink to light grey quartz diorite to granodiorite with local occurrences of granite and quartz monzonite. Local contact metamorphism surrounding the granodioritic plutons is superimposed on the regional lower greenschist facies metamorphism. Silicification, recrystallization and feldspathization of the surrounding metavolcanic rocks are the most obvious effects of the contact metamorphism. Prominent northeast- and lesser northwest-trending faults, lineaments or shear structures predominate in the map area. (Mackasey and Wallace 1978). However, the less-prominent, northwest-trending structures (e.g., Foisey Fault in the Kaby Lake Pluton and the Golden Mile Shear on the Hercules property in the Elmhirst Lake pluton) appear to be economically more significant.

Parker (1995) provided a detailed description of some of the vein-hosted mineralization associated with the 3 granodioritic intrusions (Kaby, Elmhirst and Coyle Lake plutons) in Elmhirst and Rickaby townships:

The 3 dioritic to granodioritic intrusions in the area are intersected by major structures that control gold-bearing quartz veins. The Larson and Foisey occurrences, in the Kaby Stock, are hosted by northwest-striking brittle faults with associated mylonite and breccia zones. The Foisey occurrence consists of a 7 m wide breccia in strongly pyritic, K-feldspathized granodiorite hosting complex quartz vein stockworks containing pyrite, chalcopyrite and minor molybdenite. The Larson occurrence consists of a 30 m wide zone of intensely altered carbonatized, K-feldspathized granodiorite hosting abundant disseminated pyrite, minor chalcopyrite and quartz veins. Other gold properties, such as the Oliver-Severn (Coyle Stock) and Miron (Elmhirst Stock) occurrences, consist of shear zone and fracture-hosted quartz veins in K-feldspathized and sericitized diorite rocks.

Gold mineralization at the past-producing Orphan Mine along the southeastern portion of the Kaby Lake pluton, is hosted in discontinuous quartz lenses within a shear zone at the contact of the granodiorite and the surrounding metavolcanic rocks. Bruce (1937) noted that the *en-echelon* boudinaged quartz veins in the shear zone strike at 320° and dip at close to 90°. The shear zone hosting the Orphan Mine is situated within a parallel, northwest-trending structure approximately 1 km east of the Foisey structure and south of Dilla Lake. Quartz lenses ranging up to 1.8 m and 2.7 m wide were noted. The highest polymetallic values in the veins correlate to the highest gold values. Pyrite is by far the most abundant sulphide, with lesser amounts of chalcopyrite, pyrrhotite, sphalerite and galena (Bruce 1937). Sulphide-mineralized samples of quartz vein material and chlorite-sericite-altered host rock (metavolcanic and granodiorite) were collected from the Orphan Mine waste dump by staff of the Thunder Bay North Resident Geologist office. Most samples contained from 2 to 15% fine-grained, disseminated subhedral to euhedral pyrite. Fine-grained, secondary biotite patches and calcite veinlets were also noted in sheared metavolcanic rocks adjacent to the veining, which was also mentioned by Bruce (1937) in his report. Assay results from these grab samples ranged up to 163.9 g/t Au, averaging 1.1 to 3.4 g/t Au (Resident Geologist’s Office Files, Thunder Bay North District, Thunder Bay).

As mentioned previously, Mantis Exploration Ltd. completed an eight-hole diamond-drilling program in 2008 and defined an 850 m long, northwest-trending structural corridor (Foisey Fault) west of Dilla Lake. The Foisey occurrence is located within the northwestern portion of this corridor. The drilling program tested the northeastern down-dip extension of the structure to a 75 m vertical depth. Two distinct zones were identified and a discussion of the results is provided by Hanych and Ewanchuk (2010):

Although the results of the program did not yield economic concentrations of gold, the project did establish that the Foisey Structure is anomalous in gold characterized by two zones. The upper zone is defined by the fault structure (Foisey Fault) exhibiting hematite and sericite alteration and consisting of silica-crushed rock-gouge of an earlier quartz vein phase and quartz veining. This zone averages 42 m in drill width and contains anomalous values up to 3.20 g/t Au. The lower zone which hosts the highest gold values, is characterized by intense silicification which in some sections is manifested as massive grey quartz flooding. This zone averaged 5.55 m in drill width and contains an average gold content of 0.56 g/t Au. The highest gold value obtained within this lower zone is 1.31 g/t Au.

The main Foisey occurrence, exposed approximately 600 m west of Dilla Lake (UTM 462729E 5519809N, Zone 16) was visited by staff of the Thunder Bay North Resident Geologist office in the fall of 2014. A 5 to 6 m wide by 45 m long northwest-striking stripped bedrock exposure was examined. The exposure consists of quartz stockwork and breccia, with veins averaging 0.5 to 4.0 cm wide in pink to red, hematite-altered, medium- to coarse-grained quartz diorite to granodiorite (Photo 1). In places, both the quartz vein material and granodiorite have been heavily recrystallized and sericitized. Mineralization generally consists of 1 to 2% disseminated, fine-grained subhedral to euhedral pyrite with the greatest amounts in areas of heaviest gossan. Samples collected by staff of the Thunder Bay North Resident Geologist office along the trend of the exposure returned values ranging from 317 ppb Au to 5.62 g/t Au (Resident Geologist's Office Files, Thunder Bay North District, Thunder Bay).

Exploration activity and expenditures within the southern portion of the Onaman–Tashota greenstone belt reached a peak from 2006 to 2010. More than half a dozen companies conducted exploration programs in this area during the period, including Kodiak Exploration Limited., Sage Gold Inc., Ontex Resources Ltd., Alto Ventures Ltd. and St Andrews Goldfields Ltd., among others. The most significant player in this area was Kodiak Exploration on their Hercules property in Elmhirst Township, 9 km west of the Foisey occurrence. Expenditures on the Hercules property exceeded \$30 million and in excess of 250 000 m of diamond drilling was completed. Much of the work was focused on a 400 m section of the Golden Mile Shear Zone (GMSZ) within the Elmhirst Lake pluton near its southeastern contact with the host metavolcanic rocks. The Golden Mile structure, in addition to other parallel to subparallel, northwest-trending structures, was identified from detailed ground geophysical surveys as well as from extensive stripping and mapping. The veins exposed on surface at the core (within the 400 m section) of the Hercules gold deposit are described as multiphase and stockwork quartz veins, hosting spectacular visible gold in places and yielding bonanza-grade values such as 3876 g/t Au over 0.3 m. Detailed channel sampling along the 400 m section of the GMSZ averaged 20.2 g/t Au across 3.8 m (Resident Geologist's Office Files, Thunder Bay North District, Thunder Bay).

The recent discovery of the Hercules gold deposit within the Elmhirst Lake pluton and the presence of the Foisey and Orphan Mine properties in the Kaby Lake pluton, enhance the economic potential of these northwest-trending shear structures. All 3 plutons of the southern Onaman–Tashota belt (including the Coyle Lake pluton) and adjacent metavolcanic rocks should be examined for gold mineralization where these structures are recognized. Particular attention should be paid to the hematite alteration that, in both the Hercules and Foisey structures, appears show a direct relationship to gold mineralization.



**Photo 1.** Staff of the Thunder Bay North Resident Geologist's office examining a hematite-altered, quartz-veined bedrock exposure of medium- to coarse-grained granodiorite on the Foisey property.

## RECOMMENDATIONS FOR EXPLORATION

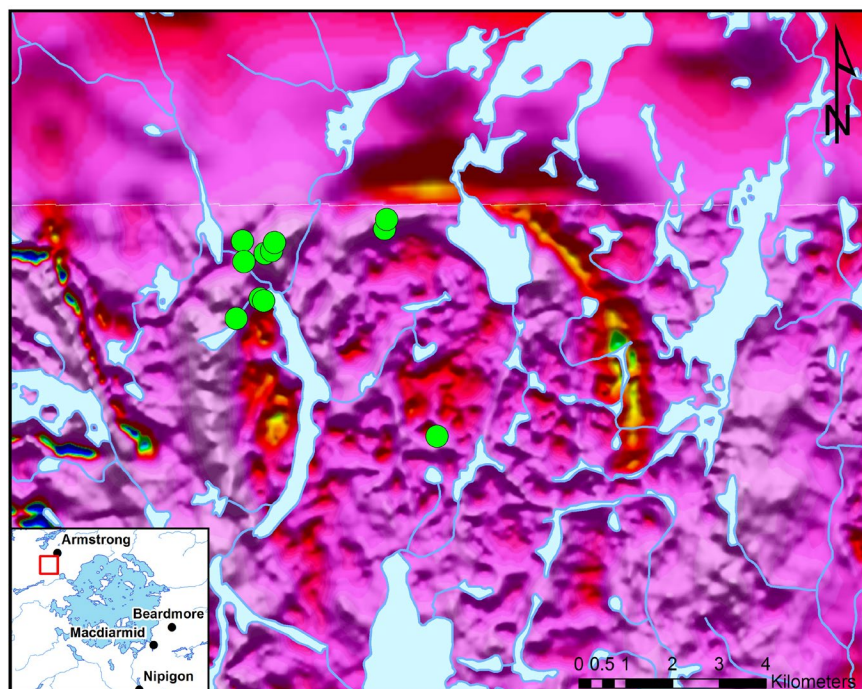
### Copper-Nickel-Platinum Group Element and Titanium-Vanadium Potential in the Mesoproterozoic Badwater Intrusive Complex, Armstrong, Ontario

The Mesoproterozoic Badwater intrusive complex (a.k.a. Waweig Troctolite complex; *cf.* Borradaile and Middleton 2006) intrudes Archean Wabigoon Subprovince country rocks, 13 km southwest of Armstrong. The complex comprises the Badwater gabbro (BG) and the Badwater syenite (BS). It is believed to form a multi-phase, intrusive complex which is expressed by a circular magnetic anomaly 12 km in diameter (Middleton and Bennett 2008). Initial mapping by MacDonald (2004) identified a variety of intrusive rocks, ranging from gabbro to quartz monzonite and syenite. High-precision U/Pb dating of baddeleyite yielded an emplacement age of  $1598.7 \pm 1.1$  Ma for the BG and a U/Pb zircon age of  $1590.1 \pm 0.8$  Ma for the BS, which supports observed cross-cutting relationships (Heaman et al. 2007). The BG and BS are unconformably overlain and largely obscured by Pillar Lake volcanic rocks which were possibly erupted at  $1129 \pm 4.6$  Ma (U/Pb age from titanite; Heaman et al. 2007; Smyk, Hollings and Cundari 2011).

The poorly exposed BG was first recognized in 2000 by East West Resources Corp. (Middleton 2004) and was tested for platinum group element (PGE) mineralization in drilling campaigns carried out in 2004 and 2008. The BG is described as a layered troctolite-gabbro complex consisting of olivine gabbro, anorthosite, troctolite, glomeroporphyritic rocks and layers of magnetite with sulphides (Middleton and Bennett 2008). Minor ultramafic rock types have also been reported from drill core. Magmatic layering dips  $\sim 45$  to  $\sim 55^\circ$  to the southeast. Modal mineralogy for typical olivine gabbro is listed as follows: plagioclase (labradorite/bytownite) 55%; clinopyroxene (augite?) 25%; biotite 10%; olivine (partly relict) 3%; talc/sericite (after olivine) 2%; amphibole (secondary actinolite) 2%; opaque (magnetite? pyrrhotite?) 2%; clay?/sericite (after plagioclase) trace (Middleton and Bennett 2008). The BG is undeformed and displays generally fresh plagioclase and relatively unaltered olivine.

Although no appreciable assay results have been reported for the Badwater gabbro, potential for the unit to host significant copper-nickel-PGE and/or titanium-vanadium mineralization remains high. Several holes have been drilled into selected parts of the layered gabbro complex (Figure 15). However, several areas of the complex remaining untested. The Badwater gabbro is poorly understood and insights into the intrusive history and structural control of the unit should aid in developing targets for mineralization. Ground and bore-hole geophysical methods are recommended, in addition to further drilling to test previously undrilled areas of the unit, as well as any newly identified targets. An honours thesis by S. Hinz under the supervision of Dr. P. Hollings of Lakehead University, will focus on the geology and petrogenesis of the Badwater gabbro. The study involves the geochemical analysis of drill-core samples obtained during the 2014 field season. The majority of drill core recovered from previous campaigns is currently held at the MNDM's off-site core storage facility in Comnee Township, west of Thunder Bay, and is available for viewing.





**Figure 15.** Total field magnetic map showing the circular magnetic expression of the Badwater intrusive complex with drill holes marked as green dots. (Data from Ontario Geological Survey 1999, 2004.)

## Targeting Gold and Base Metals in Banded Iron Formation and Ultramafic Metavolcanic Rocks, Western Caribou Lake Greenstone Belt

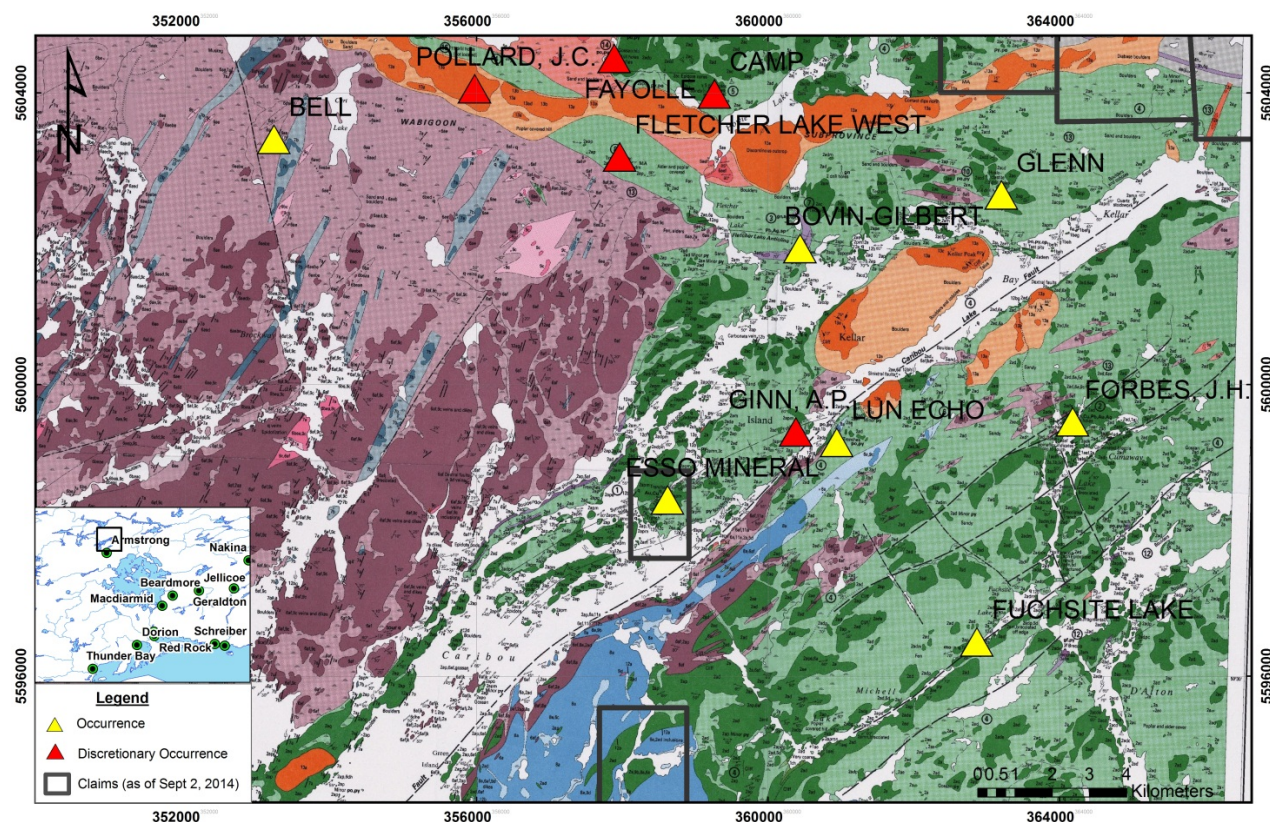
The Caribou Lake greenstone belt (CLGB) is located approximately 20 km north of Armstrong and is bounded by Caribou Lake to the west and the Summit Lake area to the east. The east-central portion of the CLGB is accessible by the Airport Road or Jackfish logging road east of Armstrong, as well as a network of older logging roads. The western portion of the belt is accessible via Caribou Lake by boat, float-plane, helicopter or sled in winter.

The CLGB ranges from 3.5 to 15 km wide and extends from Caribou Lake, 80 to 100 km eastward where it merges with the Onaman–Tashota greenstone belt (MacDonald et al. 2009). The area recommended for exploration lies within the western portion of the belt around Caribou Lake. The supracrustal rocks in this part of the belt were mapped by Sutcliffe (1988) and consist of (1) ultramafic to mafic metavolcanic rocks; (2) clastic metasedimentary rocks, ranging from argillite to metaconglomerate; (3) chert and banded iron formation (BIF) with interbedded metavolcanic and metasedimentary rocks; and (4) metamorphosed subvolcanic and felsic volcanic rocks (Figure 16). The supracrustal rocks were intruded by several phases of Archean intrusive rocks including: (1) early felsic to intermediate plutonic rocks, dominantly biotite tonalite; (2) northeast-trending amphibolite and gabbro dikes; (3) the gabbroic Caribou Lake pluton; and (4) late felsic to intermediate plutonic rocks, dominantly granite. Mesoproterozoic gabbroic sills, associated with the Midcontinent Rift, also occur in the area.

In June 2014, the staff of the Thunder Bay North Resident Geologist office visited the Caribou Lake greenstone belt, focussing on the western portion of the belt around Caribou Lake. A traverse was conducted around the Fletcher Lake anticline, which is host to the Bovin-Gilbert occurrence. The Fletcher Lake anticline is manifested in chert to magnetite-amphibole BIF (Sutcliffe 1988). Outcrops in the area are generally small. Several historical pits have been sunk near the eastern end (i.e., near the fold “nose”) of the unit along a hillside. Quartz veining (up to 40 cm wide), sulphide mineralization and iron carbonate alteration are present throughout the unit, suggesting that the Fletcher Lake anticline is a favourable environment for iron formation-hosted gold mineralization. High-grade lead

and silver mineralization have been previously reported at 3 locations within the Fletcher Lake anticline, with assay results of up to 47.3% Pb and 98.44 ounces Ag per ton from a high-grade galena vein (Thurston and Carter 1970). Samples taken by Resident Geologist staff from one of these locations consisted of approximately 15 to 20% massive galena and 3 to 5% sphalerite within a BIF. Assay results for samples taken during this field work are pending.

The Cumaway Lake area, east of Caribou Lake, hosts favourable geology for both gold and copper-lead-zinc mineralization. Ultramafic rocks in this area are associated with zones of deformation and alteration, likely related to 2 sets of intersecting faults as mapped by Sutcliffe (1988). Mineralization previously reported at the J.H. Forbes occurrence (*aka* Lett occurrence) is hosted by a 25 m wide fault breccia consisting of angular country rock fragments cemented by quartz-calcite, with disseminated and/or massive chalcopyrite, sphalerite and galena (Sutcliffe 1988). Two grab samples (1105 and 1006) from this area taken in 1988 by the OGS yielded 0.05 ounce Au per ton, 12.03 ounce Ag per ton, 2.0% Cu, 11.05% Zn, 2.10% Pb; and 0.04 ounce Au per ton, 0.46 ounce Ag per ton, 0.73% Cu, 0.15% Zn, 0.02% Pb, respectively (Sutcliffe 1988). Further work is warranted in this area to evaluate the potential for both precious and base metal mineralization within the fault-breccia zone described above as well as in the surrounding metamorphosed and altered ultramafic-mafic volcanic rocks.



**Figure 16.** Geology of the northern section of Caribou Lake, showing claim units as of September 2, 2014 (geology from Sutcliffe 1988).

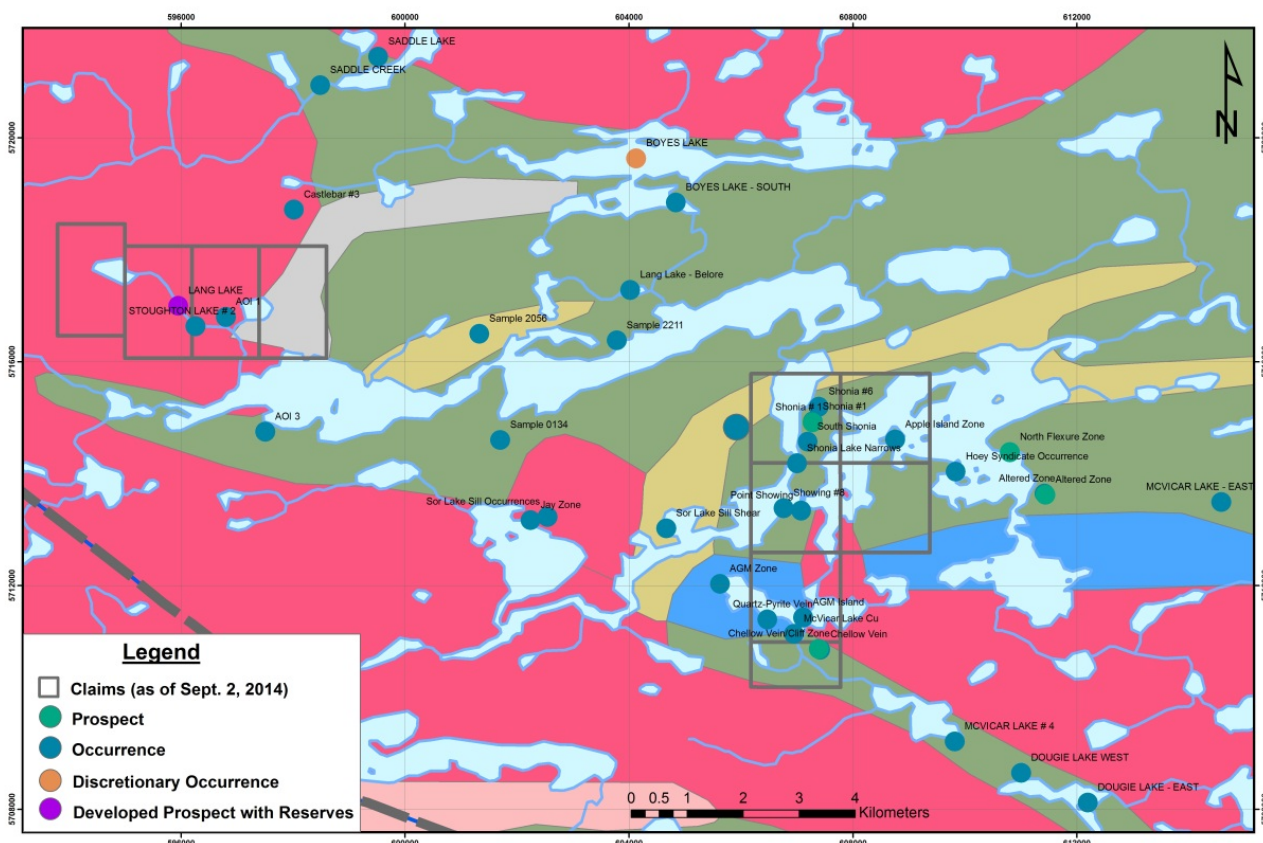
## Gold Potential at the Sor Lake and Altered Zone Properties, Lang–McVicar Greenstone Belt

The Lang–McVicar Lake greenstone belt (LMGB) is located approximately 80 km west of Pickle Lake and 20 km southeast of the Cat Lake First Nation. The LMGB is accessible by fixed-wing aircraft or helicopter. A winter road from Pickle Lake to Cat Lake is situated 3 km south of the belt; a backhoe trail leads north from the winter road to the central portion of the belt.

The LMGB, previously mapped by Fenwick (1970, 1971) and Fenwick and Srivastava (1972), is approximately 40 km long and varies in width from 8 to 11 km (Sage and Breaks 1982). Stott and Corfu (1991) described the LMGB as being dominated by tholeiitic basalt flows and calc-alkaline pyroclastic deposits, with the eastern portion of the belt containing a significant metasedimentary package hosting iron formation horizons. The entire belt has been folded into an east-trending and east-plunging syncline (Thomas 1988). Late-stage intrusive rocks intrude older, folded rocks and form a large, elongated mafic sill in the Sor–McVicar Lakes area. A north-trending felsic intrusion in the Shonia–McVicar Lakes area divides the mafic intrusion into 2 parts (Sage and Breaks 1982). The dominant structural feature in the region is the Bear Head Fault Zone, a northwest-striking, regional-scale, dextral shear zone in the southwestern portion of the belt (Stott and Corfu 1991). Splays off the Bear Head fault are interpreted to be the main controls on gold mineralization in the Lang–McVicar greenstone belt (S. Magnus, Ontario Geological Survey, personal communication, September 2014). Thomas (1988) interpreted the LMGB to originally be part of the Meen–Dempster greenstone belt (to the south) from which it was separated during late-stage, extensional tectonics.

The Lang–McVicar greenstone belt is currently being mapped by the Earth Resources and Geoscience Mapping Section (ERGMS) of the Ontario Geological Survey which will provide insights into the general geology, litho-tectonic evolution and mineral potential of the belt (Magnus 2014). In 2009 Staff of the Resident Geologist Program visited the LMGB, evaluating and sampling several gold occurrences, including the Altered Zone, Chellow Vein, Shonia #1 and the Sor Lake Sill (Smyk, White and Lockwood 2010). The staff of the Resident Geologist Program revisited the LMGB with the ERGMS crew in August of 2014. Several occurrences in the belt were visited and traverses were conducted to study and map the local geology. Of particular interest were 2 significant properties which remain open for staking: the Sor Lake property and the Altered Zone property. The Sor Lake property (Figure 17, centre of the map) is approximately 100 to 300 m wide and up to 2 km in length and contains the Sor Lake sill occurrences (MDI52O12SE00006), the Jay Zone (MDI000000000273) and the Sor Lake sill shear (MDI52O11SW00013). The occurrences are hosted within the Sor Lake sill, which is a variably altered and deformed tonalite intrusion with alteration consisting of calcium- and iron-rich carbonate, sericite and silicification (McKay 2004). Mineralization occurs within quartz veins and shear zones, where the most significant assay results returned 3.20 g/t Au over 1.0 m from a quartz vein (channel sample; referred to as Occurrence #6 by McKay (2004)) and 122.94 g/t Au from a shear zone ~1 km east of Occurrence #6, (grab sample; referred to as Occurrence #10 by McKay (2004)). The Altered Zone prospect (east-central part of Figure 17) is located at the eastern end of McVicar Lake and is hosted within a northwest-trending ductile shear zone. Gold mineralization at the Altered Zone is present within a dilational zone associated with the faulting. Gold occurs in lenticular quartz  $\pm$  iron carbonate veins with minor pyrite and rare chalcopyrite, within mafic metavolcanic and gabbroic rocks. Channel sampling returned values up to 12.77 g/t Au over 0.8 m. The most significant historical drill intersections, completed by Continuum Resources Ltd. and Prospector Consolidated Resources Inc., are reported as 14.4 g/t Au and 33.0 g/t Au over 4.63 m and 1.87 m, respectively (McKay 2004). The LMGB shows high potential for significant gold mineralization in a number of areas, especially the Sor Lake and Altered Zone properties. It is recommended that exploration efforts focus on large-scale structures and widespread alteration halos surrounding previously identified occurrences.





**Figure 17.** Geology map showing Mineral Deposit Inventory (MDI) points (coloured dots), Lang–McVicar Lake greenstone belt (UTM coordinates, NAD 83, Zone 15). Claim units are as of September 2, 2014. (Bedrock geology from OGS 2011.)

## OGS ACTIVITIES AND RESEARCH BY OTHERS

**B. Azar** (Ontario Geological Survey) and **S.A. Ferguson** (Memorial University) completed field mapping work in the Attwood Lake area as part of the multi-year Fort Hope greenstone belt bedrock geology mapping project (Azar and Ferguson 2014). The current mapping complements previous mapping completed in the Keezhik Lake area (Buse and Purdy 2010) and the Miminiska Lake area (Buse 2011). Results presented in 2014 included descriptions of the metavolcanic and metasedimentary terranes, structural geology, mineralization and alteration. The 1:50 000 scale bedrock map and associated geochemical and geochronological data will be released in April 2016.

**R.D. Dyer** (Earth Resources and Geoscience Mapping Section, OGS) and **L.A. Handley** (Earth Resources and Geoscience Mapping Section, OGS) conducted field work related to a high-density lake sediment and water geochemical survey of the Nakina–Marshall Lake area (Dyer and Handley 2014a). The goal of the survey was to fill in the gaps between existing high-density geochemistry coverage to the east, west and south. A total of 1567 water samples and 2970 lake sediment samples were collected in 2014 over an area of approximately 4000 km<sup>2</sup>.

**R.D. Dyer** (Earth Resources and Geoscience Mapping Section, OGS) and **L.A. Handley** (Earth Resources and Geoscience Mapping Section, OGS) also conducted helicopter-supported field work related to a lake, stream and glacial till sampling geochemical study over the McFaulds Lake (“Ring of Fire”) region of far northern Ontario (Dyer and Handley 2014b). Lake sediment and water sampling was done to augment and fill-in the medium-density sampling previously completed in the area (Dyer and Handley 2013), define the lateral extent of the postulated chromium (chromite) down-ice glacial dispersal plume, and continue to build the baseline surficial geochemical database over, down-ice and down-drainage from the known chromite deposits.



**B. Gourcerol** (Laurentian University) and **P. Thurston** (Laurentian University) completed field work on the geochemistry of iron formation-hosted gold deposits. The goals of the study are to determine why gold mineralization occurs in some but not all iron formations and whether a semi-hydrothermal footprint can be detected around gold in iron formation. This project is examining the Musselwhite Mine (Goldcorp) and the gold deposits in the Beardmore–Geraldton greenstone belt (Premier Gold Mines Limited), as well as the Meadowbank Mine and the Meliadine project in the Churchill Province (Agnico-Eagle Mines) (Mineral Exploration Research Centre Web site, <http://laurentian.ca/mineral-exploration-research-centre>, see Current Research Projects; [accessed March 2014]).

**Y. Lu** (University of Western Australia) is working on a geochemical and geochronological study to better define terrane boundaries within the Wabigoon Subprovince of northwestern Ontario. Many mineral deposit types tend to occur near terrane boundaries, and knowledge of their locations can help to focus mineral exploration programs. Thunder Bay North Resident Geologist Program staff assisted with the collection of field samples for this study during 2012. This research is part of a larger project studying the four-dimensional crust-mantle evolution and mineral system distribution of the Superior Province. A comprehensive description of the project is provided by Bjorkman et al. (2014).

**S.J. Magnus** (Earth Resources and Geoscience Mapping Section, OGS) completed a field mapping campaign over the Lang Lake greenstone belt, 35 km southeast of Cat Lake First Nation (Magnus 2014). The 1:20 000 scale bedrock mapping project resulted in an improved understanding of the facies present within the belt, while providing refinement of the structural and lithological features identified in recent airborne geophysical surveys. The preliminary conclusions presented by Magnus (2014) will be supported by geochemical and geochronological data.

## Targeted Geoscience Initiative (TGI-4)

**Z. Tóth, B. Lafrance** (Mineral Exploration Research Centre, Laurentian University) **B. Dubé, P. Mercier-Langevin and V.J. McNicoll** (Geological Survey of Canada) presented results and interpretations from ongoing efforts studying gold mineralization in the Geraldton area (Tóth et al. 2014). This project is part of a PhD thesis undertaken by Z. Tóth at Laurentian University, Sudbury, supervised by B. Lafrance, in collaboration with the Ontario Geological Survey and Premier Gold Mines Limited. The main goals of the project are to 1) improve knowledge of the geological settings and footprints of selected gold deposits or districts in mature and emerging camps; 2) provide key descriptive and genetic parameters and improved geological and exploration models; 3) develop more robust exploration vectors and means to help identify fertile mineral systems; and 4) train and mentor students in order to increase the number of highly qualified personnel (Tóth et al. 2013). A total of 8 stripped outcrops have been mapped during the past 3 field seasons, while the 2014 field season focused on 2 exposures: 1) the hinge of the Hardrock anticline at Porphyry Hill; and 2) the gold-mineralized F Zone on the northern limb of the Hardrock anticline. The goal of the 2014 field season was to define the relative timing of the gold mineralization and associated hydrothermal alteration in relation to the various deformation events.

**W. Oswald** (Institut national de la recherche scientifique, centre Eau Terre Environnement), **S. Castonguay** (Geological Survey of Canada), **B. Dubé** (Geological Survey of Canada), **P. Mercier-Langevin** (Geological Survey of Canada), **M. Malo** (Institut national de la recherche scientifique, centre Eau Terre Environnement), **J. Biczok** (Goldcorp Inc.) and **V.J. McNicoll** (Geological Survey of Canada) presented results and interpretations from a project studying the geological and structural setting of the Musselwhite Mine (Oswald et al. 2014). The aim of this project is to study the geology of the Musselwhite banded iron formation-hosted gold deposit, specifically the controls on the formation and distribution of the mineralization and the geochemical footprint of the hydrothermal system. Field work conducted in 2014 focused on the geology and structure of 2 stripped exposures and how information gathered can be extrapolated to regional and deposit scales.

**H.J.E. Carson, C.M. Leshner** (Laurentian University) **M.G. Houlié** (Geological Survey of Canada), **R.J. Weston** and **D.A. Shinkle** (Cliffs Natural Resources) continued work on a project focusing on the stratigraphy, geochemistry and petrogenesis of the Black Thor intrusive complex and associated chromium and nickel-copper-platinum group element mineralization in the McFaulds Lake greenstone belt (Carson et al. 2013). This project is part of a PhD thesis undertaken by H.J.E. Carson at Laurentian University and is supported by Cliffs Natural Resources, the Natural Sciences and Engineering Research Council of Canada (NSERC), the Ontario Geological Survey (OGS) and the Targeted Geoscience Initiative 4 (TGI 4) of the Geological Survey of Canada.

**N. Farhangi, III, C.M. Leshner** (Laurentian University) and **M.G. Houlé** (Geological Survey of Canada) continued work on the mineralogy, geochemistry and petrogenesis of nickel-copper-platinum group element mineralization in the Black Thor intrusive complex in the McFaulds Lake Greenstone Belt. The objective of the project is to constrain the metallogenesis and sulphide saturation history of nickel-copper-platinum group element mineralization within the Black Thor intrusive complex (Farhangi et al. 2013). The work constitutes part of an MSc thesis undertaken at Laurentian University which is supported by Cliffs Natural Resources, the Natural Sciences and Engineering Research Council of Canada (NSERC), the Ontario Geological Survey (OGS) and the Targeted Geoscience Initiative 4 (TGI 4) of the Geological Survey of Canada.

**B. Kuzmich, P. Hollings** (Lakehead University) and **M.G. Houlé** (Geological Survey of Canada) completed a study on the ferrogabbroic intrusions that host iron-titanium-vanadium-phosphorus mineralization within the McFaulds Lake greenstone belt. The main objective of this project is to characterize the Butler West, the Butler East and the Thunderbird intrusions and provide insight into the key characteristics that lead to the formation of these mineralized intrusions (Kuzmich, Hollings and Houlé 2013). The work constituted part of an MSc thesis undertaken at Lakehead University which was supported by the Targeted Geoscience Initiative 4 (TGI 4) of the Geological Survey of Canada and the Ontario Geological Survey (OGS) with in-kind support from MacDonald Mines Exploration Ltd. and Noront Resources Ltd.

**C.S. Spath III, C.M. Leshner** (Laurentian University) and **M.G. Houlé** (Geological Survey of Canada) continued work on the geology and genesis of mobilized chromitite in the Black Label Pyroxenite Zone of the Black Thor intrusive complex in the McFaulds Lake greenstone belt. The objective of the project is to characterize the geology and genesis of the late pyroxenite unit, which intruded the lower ultramafic series and part of the middle ultramafic series, and investigate the unit's influence on the Black Label chromitite horizon (Spath, Leshner and Houlé 2013). The work constitutes part of an MSc thesis undertaken at Laurentian University which is supported by Cliffs Natural Resources, the Natural Sciences and Engineering Research Council of Canada (NSERC), the Ontario Geological Survey (OGS) and the Targeted Geoscience Initiative 4 (TGI 4) of the Geological Survey of Canada.

**K. Mehrmanesh, H.J.E. Carson, C.M. Leshner** (Laurentian University) and **M.G. Houlé** (Geological Survey of Canada) continued work studying the geochemistry and petrogenesis of the Black Label chromitite horizon of the Black Thor intrusive complex in the McFaulds Lake greenstone belt. The objectives of the project are to establish the stratigraphy and genesis of the Black Label chromitite horizon with a focus on the layering, textures, mineralogy, geochemistry and petrogenesis of the horizon (Mehrmanesh et al. 2013). The work constitutes part of an MSc thesis undertaken at Laurentian University which is supported by Cliffs Natural Resources, the Natural Sciences and Engineering Research Council of Canada (NSERC), the Ontario Geological Survey (OGS) and the Targeted Geoscience Initiative 4 (TGI 4) of the Geological Survey of Canada.

**R.T. Metsaranta** (Earth Resources and Geoscience Mapping Section, OGS) and **M.G. Houlé** (Geological Survey of Canada) continued work on a regionally focused, geological compilation and bedrock mapping project in the McFaulds Lake, or “Ring of Fire”, region in northern Ontario (Metsaranta and Houlé 2013). The project is part of the Ontario Geological Survey's core bedrock geology mapping program, but it is also an in-kind contribution to the Targeted Geoscience Initiative 4 (TGI 4) of the Geological Survey of Canada (GSC). As outlined in Metsaranta and Houlé (2011), the main objectives at the outset of the project were to

- update the regional bedrock geological mapping in the McFaulds Lake region;
- clarify and characterize the major lithologic units;
- better understand the stratigraphy and age relationships between the various lithologies;
- develop a better understanding of the actual extent of the mafic to ultramafic intrusions hosting recently discovered nickel-copper-platinum group elements and chromium deposits in the region;
- develop a better understanding of the structural and metamorphic history of the area; and
- improve our understanding of the relationship of geophysical features to bedrock geology.

Theses and other research projects currently in progress at Laurentian University, Sudbury, are shown in Table 6.

**Table 6.** Lakehead University HBSc and MSc theses and other research projects (2014).

Faculty Member	Research Topic(s)
Dr. P. Hollings	Greenstone belt geochemistry; Midcontinent Rift-related intrusions (with M.C. Smyk, OGS)
Dr. P.W. Fralick	Precambrian sedimentary sequences (English River–Wabigoon–Quetico–Wawa subprovinces; banded iron formation; Sibley Group)
<b>MSc Theses:</b>	
Ben Kuzmich (Completed)	Petrogenesis of the gabbroic intrusions and their associated iron, titanium-vanadium mineralization within the McFaulds greenstone belt, Superior Province, northern Ontario, Canada
Bret Timmis (in progress)	Nutrient controls on the effectiveness of sulphate-reducing permeable reactive barriers
<b>HBSc Theses:</b>	
Matt Arges (in progress)	Mineralogy and petrology of the spodumene-rich pegmatites and associated veinlets from the Rock Tech Lithium project, Georgia Lake area, Quetico Subprovince, Ontario
Sheree Hinz (in progress)	Geochemistry of the Badwater intrusive complex, Armstrong, Ontario
Jordan Quinn (completed)	Lithogeochemical and petrological analysis of a mafic metavolcanic sequence south of Musselwhite Mine, North Caribou greenstone belt

Publications received in the Thunder Bay North Resident Geologist office in 2014 are shown in Table 7. Mineral deposits not being mined in the district are listed in Table 8.

**Table 7.** Publications received by the Thunder Bay North Resident Geologist's Office in 2014.

Title	Author(s)	Type and Year of Publication
Institute on Lake Superior Geology 2014, Hibbing, Minnesota; Part 1: Programs and Abstracts	Edited by J. D. Miller	Institute on Lake Superior Geology Proceedings, v.60 (2014)
<i>Specific abstracts of interest:</i>		
Geology and Geochemistry of the Mesoproterozoic Badwater intrusive complex, Ontario: Implications for Geon 15 Magmatism	R. Cundari, M. Smyk and P. Hollings	p.27
Strain Analysis on the Max Lake Polymictic Conglomerates in the Wabigoon Subprovince, Ontario, Canada	S. Dolega and M.L. Hill	p. 31
Geochemistry and Mineralogy of Fe-Ti-V-P-Mineralized Ferrogabbroic Intrusions of the McFaulds Greenstone Belt, Superior Province, Northern Ontario, Canada	B. Kuzmich, P. Hollings and M.G. Houle	p.71
Geochemistry and Petrography of a Mafic Metavolcanic Sequence South of Musselwhite Mine	J. Quinn, P. Hollings and J. Biczok	p.103
Institute on Lake Superior Geology 2014, Hibbing, Minnesota; Part 2: Field Trip Guidebook		
Index to Maps, Bedrock Geology, 1991–2013	Ontario Geological Survey	Ontario Geological Survey, Set of 4 maps, scale 1:1 000 000 (2014)
Index to Maps, Surficial Geology, 1991–2013	Ontario Geological Survey	Ontario Geological Survey, Set of 4 maps, scale 1:1 000 000 (2014)
Miscellaneous Paper (MP) 177 (Supplement 2011–2013): Index to Published Reports, Maps and Digital Data, 2011–2013	Ontario Geological Survey	Ontario Geological Survey, Miscellaneous Paper 177 (Supplement 2011–2013), 2014 <a href="#">MP177 (Supplement 2011–2013)</a> (PDF, 53p)
Miscellaneous Paper (MP) 178 (Supplement 2011–2013): Geographic Index to Published Reports, Maps and Digital Data, 2011–2013	Ontario Geological Survey	Ontario Geological Survey, Miscellaneous Paper 178 (Supplement 2011–2013), 2014 <a href="#">MP178 (Supplement 2011–2013)</a> PDF, 56p)

Title	Author(s)	Type and Year of Publication
Report of Activities 2013, Resident Geologist Program, Thunder Bay North Regional Resident Geologist Report: Thunder Bay North District	G.D. White, R.M. Cundari, R.D. Tuomi, M.R. Brunelle, R.L. Debicki, P. Moses, A.C. Wilson and S.E. Zurevinski	Ontario Geological Survey, Open File Report 6292, 63p. (2014); <a href="#">OFR6292</a> (PDF, 8.5Mb)
Summary of Field Work and Other Activities, 2014	Ontario Geological Survey	Ontario Geological Survey, Open File Report 6300, 430p. (2014) <a href="#">OFR6300</a> (PDF, 176.1Mb)
Mineral Deposit Inventory - 2014	Resident Geologist Program	Ontario Geological Survey, Mineral Deposit Inventory-2014 (2014) <a href="#">MDI</a> (PDF, 0.3Mb; ZIP, 26.8Mb)
Ontario Mineral and Exploration Statistics 2013	B. Greenwell and S. Jessome	Ontario Geological Survey, Annual Statistical Report (ASR) 9, 64p. (2014)
Surficial Geology of the Wunnummin Lake Area Northeast, Northern Ontario	P.J. Barnett and K.H. Yeung	Ontario Geological Survey, Map P.3695, scale 1:100.000 (2014) <a href="#">P3695</a> (PDF, 7.6Mb; ZIP, 29.4Mb)
Surficial Geology of the Wunnummin Lake Area Southeast, Northern Ontario	P.J. Barnett, and K.H. Yeung	Ontario Geological Survey, Map P.3708, scale 1:100.000 (2014) <a href="#">P3708</a> (PDF, 10.7Mb; ZIP, 22.0Mb)
Surficial Geology of the Lansdowne House Area Southwest, Northern Ontario	P.J. Barnett, and K.H. Yeung	Ontario Geological Survey, Map P.3709, scale 1:100.000 (2014) <a href="#">P3709</a> (PDF, 12.1Mb; ZIP, 29.3Mb)
Surficial Geology of the Fort Hope Area Northwest, Northern Ontario	P.J. Barnett, and K.H. Yeung	Ontario Geological Survey, Map P.3723, scale 1:100.000 (2014) <a href="#">P3723</a> (PDF, 9.8Mb; ZIP, 41.6Mb)

**Table 8.** Identified mineral resources in the Thunder Bay North District in 2014.

Abbreviations					
AF.....	Assessment Files	MDIR.....	Mineral Deposit Inventory record		
CAMH.....	Canadian and American Mines Handbook	MLS.....	Mining Lands, Sudbury		
CMH.....	Canadian Mines Handbook	MR.....	Mining Recorder		
GR.....	Geological Report	NM.....	The Northern Miner		
MDC.....	Mineral Deposit Circular [No.15–] [formerly Mineral Resources Circular, No.1-14]	OFR.....	Open File Report		
		PC.....	Personal Communication		

Deposit Name/ NTS	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References*	Status
Arseno Lake (53B14/NE)	Zn, Pb, Cu, Ag	920 000 t @ 8.7% Zn+Pb, 1.5 opt Ag	Energold Minerals Inc. – Northern Dynasty Minerals Ltd. (CAMH 2011–2012, p.230; CAMH 2009–2010, p.207, 424)	CAMH 2006–2007, p.157	Inactive
Aumacho River (Brink) (42E05/SW)	Li	855 475 t @ 1.633% Li <sub>2</sub> O	Rock Tech Lithium Inc. (CAMH 2014-2015, p.367)	GR 31, p.64 (1965)	Active
B4-7 (42L05/NW)	Ni, Cu, Co, PGE	Indicated Resource: 2 695 000 t @ 0.70% Ni, 0.46% Cu, 0.07% Co, 0.14 g/t Pt, 0.55 g/t Pd, 0.03 g/t Au (1.24% Ni Equivalent) (NI 43-101-compliant resource)	Landore Resources Inc., Annual Report, 2011	Landore Resources Inc., news release, January 17, 2013	Active

Deposit Name/ NTS	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References*	Status
Barton Bay (42E10/NW)	Fe	500 Mt (grade ~25.2%)	Premier Gold Mines Limited (formerly Roxmark Mines Limited, CAMH 2009–2010, p.498)	Thunder Bay North Resident Geologist's office files	Optioned in 2007 by Premier Gold Mines Limited as part of Hardrock (Geraldton) project
Big Daddy ("Ring of Fire" area) (43D16/SE)	Cr	Measured and Indicated Resource: 29.1 Mt @ 31.7% Cr <sub>2</sub> O <sub>3</sub> Inferred Resource: 3.4 Mt @ 28.1% Cr <sub>2</sub> O <sub>3</sub> (cut-off grade of 20% Cr <sub>2</sub> O <sub>3</sub> ) (NI 43-101-compliant resources)	Cliffs Natural Resources Inc. / KWG Resources Inc. (CAMH 2014–2015, p.109, 247)	NI 43-101 Technical Report, KWG Resources Inc., May 29, 2014	Inactive
Blackbird ("Ring of Fire" area) (43D09/NW)	Cr	Measured and Indicated Resource: 20.5 Mt @ 35.76% Cr <sub>2</sub> O <sub>3</sub> Inferred Resource: 23.5 Mt @ 33.1% Cr <sub>2</sub> O <sub>3</sub> (using a cut-off grade of 30% Cr <sub>2</sub> O <sub>3</sub> ) (NI 43-101-compliant resources)	Noront Resources Ltd. (CAMH 2014–2015, p.306)	Noront Resources Ltd., news release, March 20, 2012	Inactive
Black Creek ("Ring of Fire" area) (43D16/SE)	Cr	Measured and Indicated Resource: 8.645 Mt @ 37.41% Cr <sub>2</sub> O <sub>3</sub> Inferred Resource: 1.61 Mt @ 37.78% Cr <sub>2</sub> O <sub>3</sub> (NI 43-101-compliant resources)	Probe Mines Limited (CAMH 2014–2015, p.347)	CAMH 2014–2015, p.347	Inactive
Black Horse (Koper Lake) ("Ring of Fire") (43D16/SW)	Cr	Inferred Resource: 77.2 Mt @ 35.1% Cr <sub>2</sub> O <sub>3</sub> (cut-off grade of 20% Cr <sub>2</sub> O <sub>3</sub> ) (NI 43-101-compliant resource)	Fancamp Exploration Ltd. / Bold Ventures Inc. / KWG Resources Inc. (CAMH 2014–2015, p.162, 77 and 247)	CAMH 2014–2015, p.162, 77, 247	Active
Black Label ("Ring of Fire") (43D16/SE)	Cr	Measured and Indicated: 5.4 Mt @ 25.3% Cr <sub>2</sub> O <sub>3</sub> (cut-off grade of 20% Cr <sub>2</sub> O <sub>3</sub> )	Cliffs Natural Resources Inc. (CAMH 2014–2015, p.109)	Cliffs Natural Resources Inc., Annual Report, February 14, 2014	Inactive
Black Thor ("Ring of Fire" area) (43D16/SE)	Cr	Measured and Indicated: 111.9 Mt @ 30.9% Cr <sub>2</sub> O <sub>3</sub> (cut-off grade of 20% Cr <sub>2</sub> O <sub>3</sub> )	Cliffs Natural Resources Inc. (CAMH 2014–2015, p.109)	Cliffs Natural Resources Inc., Annual Report, February 14, 2014	Active
Brookbank (42E12/NW)	Au	Open Pit: Measured and Indicated Resource: 2.64 Mt @ 2.02 g/t Au (171 000 ounces) Inferred Resource: 0.171 Mt @ 2.38 g/t Au (13 000 ounces) Underground: Measured and Indicated Resource: 1.85 Mt @ 7.21 g/t Au (429 000 ounces) Inferred Resource: 0.403 Mt @ 4.02 g/t Au (53 000 ounces) (NI 43-101-compliant resources)	Premier Gold Mines Limited (CAMH 2014– 2015, p.344)	Premier Gold Mines Limited, news release, December 19, 2012	Active
Central Onaman Range (42L03/NW)	Fe	200 Mt @ ~ 30% Fe	1401385 Ontario Inc. (MDC 11, p.407)	MDC 11, p.407	Inactive
Dobie Zone (52O06/NE)	Au	301 000 t @ 5.5 g/t Au	White Metal Resources Corp. (formerly Trillium North Minerals Ltd.) (CAMH 2014–2015, p.466)	OFR 5869, p.161-162	Inactive
Doran Lake (52J15/NE)	Fe	171 Mt @ 22.3% magnetic Fe; 205 Mt @ 16.7% magnetic Fe	Rockex Mining Corporation (CAMH 2014–2015, p.368)	MDC 11, p.450	Inactive

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Deposit Name/ NTS	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References*	Status
Eagle Island (52J14/NE)	Fe	Indicated Resource: 1,287 Mt grading 28.39% Fe Inferred Resource: 108 Mt grading 31.03% Fe (31.3% iron cut-off grade) (NI 43-101-compliant resources)	Rockex Mining Corporation (CAMH 2014-2015, p.368)	CAMH 2014-2015, p.368	Inactive
Eagle's Nest (43D09/NW)	Ni, Cu, PGE, Au	Reserves (Proven and Probable): 11.13 Mt @ 1.68% Ni, 0.87% Cu, 0.89 g/t Pt, 3.09 g/t Pd and 0.18 g/t Au Inferred Resource: 8.966 Mt @ 1.10% Ni, 1.14% Cu, 1.16 g/t Pt, 3.49 g/t Pd and 0.30 g/t Au (NI 43-101-compliant resources)	Noront Resources Ltd. (CAMH 2014-2015, p.306)	CAMH 2014-2015, p.306	Active
Eva Township (52H09/NE)	Fe, P	A.L. 414: 3.5 Mt @ 33.5% Fe, 0.118% P to 600 foot depth A.L. 416: 5 Mt @ 30% Fe		MDC 11, p.378	Inactive
Georgia Lake (Nama Creek Main Zone North, Conway, Line 60, Nama Creek Main Zone Southwest, Harricana) (52H08/NE)	Li	Indicated Resource: 3.19 Mt @ 1.10% Li <sub>2</sub> O Inferred Resource: 6.31 Mt @ 1.00% Li <sub>2</sub> O (NI 43-101-compliant resources)	Rock Tech Lithium Inc. (CAMH 2014-2015, p.367)	Rock Tech Lithium Inc., news release, September 10, 2012	Active
Goss Lake (Fron Lake) (52P09/SW)	Au	271 000 t @ 5.10 g/t Au	Landore Resources Limited website	Landore Resources Inc., Annual Report, 2011	Inactive
Hardrock (Ashmore / Errington) (42E10/NW)	Au	Open Pit and Underground: Indicated Resource: 89.04 Mt @ 1.70 g/t Au (4.87 M oz Au) Inferred Resource: 23.15 Mt @ 3.69 g/t Au (2.74 M oz Au) (NI 43-101-compliant resources)	Premier Gold Mines Limited (CAMH 2014- 2015, p.345)	CAMH 2014-2015, p.345)	Active
Headway Coulee (42L04/SE)	Zn, Ag	250 000 t @ 4.44% Zn, 1.32 opt Ag	N. Cox, L. Holt (optioned to Sage Gold Inc.) (Sage Gold Inc., news release, May 4, 2006)	OFR 5630, p.41	Inactive
Hercules (Elmhirst) (42E13/SE)	Au	Indicated Resource: 231 800 t @ 14.95 g/t Au (111 450 ounces) Inferred Resource: 761 300 t @ 4.13 g/t Au (101 050 ounces) (NI 43-101-compliant resources)	Argonaut Gold Inc., (formerly Prodigy Gold Inc.) (Argonaut Gold Inc., news release, December 11, 2012)	CAMH 2012-2013, p.539	Inactive
Howells Lake (52P10/SW)	Au	83 000 t @ 0.07 opt Au (+1.37% Sb) and 660 000 t (+3.1% Sb) with erratic gold values	Barrick Gold Corporation	OFR 5926, p.68	Last active in 1988
Ishkoday (Sturgeon River) (42E13/SW)	Au	Inferred Resource: 281 571 t @ 1.14 g/t Au (10 327 oz in low grade stockpile and tailings) (NI 43-101-compliant resources)	Laurion Mineral Exploration Inc. (CAMH 2014-2015, p.251)	CAMH 2014-2015, p.251	Active
Jacobus (42E13/SE)	Cu, Ni	1 Mt @ 0.94% Cu+Ni	Sage Gold Inc. (CAMH 2014-2015, p.375)	CAMH 2006-2007, p.305	Inactive
Jean Lake (42E05/NW)	Li	1.689 Mt @ 1.30% Li <sub>2</sub> O	Rock Tech Lithium Inc. (CAMH 2011-2012, p.545)	Jean Lake Lithium Mines Ltd., Annual Report (1957)	Active

Deposit Name/ NTS	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References*	Status
Kailey Lake (Ashmore) (42E10/NW)	Au	Open Pit: Measured and Indicated Resource: 8.630 Mt @ 0.95 g/t Au (265 000 ounces) Inferred Resource 3.688 Mt @ 0.97 g/t Au, (115 000 ounces) (NI 43-101-compliant resources)	Premier Gold Mines Limited (CAMH 2014– 2015, p.344)	Premier Gold Mines Limited, news release, December 19, 2012	Active
Karl Zeemel (53B09/SW)	Au	Historical Resource: 327 000 t @ 4.6 g/t Au; revised resource figures n/a	Goldcorp Inc.	n/a	Active as part of Musselwhite Mine-based exploration
Kasagiminnis Lake (52O08/SW)	Au	2.9 Mt @ 5.8 g/t Au	White Metal Resources Corp. (formerly Trillium North Minerals Ltd.) (CAMH 2014–2015, p.466)	NM, April 18, 1988	Inactive
Key Lake (Lindsley) (42E11/NE)	Au	Open Pit: Measured and Indicated Resource: 2.572 Mt @ 1.17 g/t Au (97 000 ounces) Inferred Resource: 1.345 Mt @ 1.29 g/t Au (56 000 ounces)  Underground: Measured and Indicated Resource: 0.031 Mt @ 6.48 g/t Au (6000 ounces) Inferred Resource: 0.058 Mt @ 3.57 g/t Au (7000 ounces) (NI 43-101-compliant resources)	Premier Gold Mines Limited (CAMH 2013– 2014, p.365)	CAMH 2013–2014, p.365	Active
Kilometre 61 (52I08/NW)	Mo, Cu, Ag	Indicated Resource: 66.6 Mt @ 0.063% Mo-Equivalent (127.7 million lbs Cu, 78.2 million lbs Mo and 5.5 million ounces Ag) Inferred Resource: 38.9 Mt @ 0.065% Mo-Equivalent (78.0 million lbs Cu, 46.5 million lbs Mo and 3.4 million ounces Ag) (NI 43-101-compliant resources)	Stockport Exploration Inc. (CAMH 2014–2015, p.408)	CAMH 2014–2015, p.408	Inactive
Koval–Ohman (52O07/SE)	Au	471 589 t @ 5.81 g/t Au	Barrick Gold Corp.	OFR 5869, p.317	Inactive
Lake St. Joseph (52O01/SW)	Fe	616 Mt @ 23.0% soluble Fe to 550 foot depth	J. and J. Buchanan	MDC 11, p.455	Inactive
Lamaune (42L05/NW)	Fe	545 519 350 t at an average grade of 36.6% Fe @ a cut-off grade of 30% Fe, to a depth of 400 m (estimate, non-NI 43-101 compliant)	Landore Resources Limited website	Landore Resources Limited, news release, June 4, 2010	Inactive
Lavoie Lake (43D05/NE)	Cu, Ni	14.6 Mt @ 0.58% Cu, 0.37% Ni	INV Metals Inc. (CAMH 2010–2011, p.322); International Nickel Ventures Corporation (news release, November 12, 2007)	OFR 5926, p.101	Inactive
Lynx (Onaman) (42L04/SE)	Cu, Ag, Au	Inferred Resource: 1.936 Mt @ 1.44% Cu, 39.6 g/t Ag, 0.58 g/t Au (NI 43-101-compliant resource)	Sage Gold Inc. (CAMH 2013–2014, p.398)	Sage Gold Inc., news release, January 26, 2015	Inactive

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Deposit Name/ NTS	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References*	Status
Magnet Mine (42E11/NE)	Au	Measured and Indicated Resource: 69 200 t @ 0.34 opt Au	Premier Gold Mines Limited (CAMH 2010– 2011, p.282)	CAMH 2006–2007, p.376	Active
Marshall Lake (42L05/NE)	Cu, Zn, Ag, Au	2.211 Mt @ 1.22% Cu, 4.2% Zn, 2.45 opt Ag, 0.012 opt Au	Marshall Lake Mining PLC/ Rainy Mountain Royalty Corp. / Copper Lake Resources Ltd.(formerly White Tiger Mining Corp.) (CAMH 2014–2015, p.354, 120)	CAMH 2005–2006, p.289	Active
McFaulds 1 (43D16/SE)	Cu, Zn	Inferred Resource: 279 000 t @ 2.13% and 0.58% Zn (NI 43-101-compliant resource)	Cliffs Natural Resources Inc. / KWG Resources Inc. (CAMH 2013–2014, p.115, 263)	CAMH 2013–2014, p.115, 263	Inactive
McFaulds 3 (43D16/SE)	Cu, Zn	Indicated Resource: 802 000 t @ 3.75% Cu and 1.1% Zn (NI 43-101-compliant resource)	Cliffs Natural Resources Inc. / KWG Resources Inc. (CAMH 2013–2014, p.115, 263)	CAMH 2013–2014, p.115, 263	Inactive
McVittie (52H08/NE)	Li	261 000 t @ 1.03% Li <sub>2</sub> O	Rock Tech Lithium Inc. (CAMH 2010–2011, p.503)	GR 31, p.89 (1965)	Inactive
Miminiska Lake (52P09/SW)	Au	232 000 t @ 5.62 g/t Au	Landore Resources Ltd. website	Landore Resources Limited, Annual Report, 2011	Inactive
Nortoba–Tyson (52H09/NE)	Mo	72 000 t @ 1.04% Mo	Premier Gold Mines Limited (CAMH 2014– 2015, p.345)	Roxmark Mines Limited Technical Report, P.A. Bevan, April 2006 (Thunder Bay North Resident Geologist's office files)	Inactive
Norton Lake (42M14/NW)	Ni, Cu, Co, Pd	Measured and Indicated Resource 2 258 654 t @ 0.67% Ni, 0.61% Cu, 0.03% Co and 0.46 g/t Pd Inferred Resource: 198 571 t @ 0.66% Ni  (NI 43-101-compliant resource)	Copper Lake Resources Ltd. (formerly White Tiger Mining Corp. / Rainy Mountain Royalty Corp. / White Metal Resources Corp. (formerly Trillium North Minerals Ltd.) (CAMH 2014–2015, p.120, 354, 466)	CAMH 2014–2015, p.120, 354, 466	Inactive
Northern Empire Mine (42E12/SW)	Au	Indicated Resource: 86 652 t @ 10.70 g/t Au (29 807 ounces) Inferred Resource: 64 748 t @ 9.95 g/t Au (20 719 ounces) (NI 43-101-compliant resources)	Premier Gold Mines Limited (CAMH 2014– 2015, p.345)	CAMH 2014–2015, p.345	Active
Paulpic (42L04/NE)	Au	200 000 t @ 0.231 ounce Au per ton	Advantel Minerals (Canada) Ltd. website / Markinch Resources Inc.	OFR 5630, p.465	Active
Pickle Crow Mine (52O09/SE)	Au	Inferred Resource: 10.303 Mt @ 3.9 g/t Au (1 299 000 ounces) (NI 43-101-compliant resource)	PC Gold Inc. (CAMH 2014–2015, p.333)	CAMH 2014–2015, p.333	Active
Skibi Lake (42L10/NW)	Fe	335 Mt @ 26.2% acid-soluble Fe		MDC 11, p.445	Inactive
Stewart Lake (42L11/NW, NE)	Fe	49.5 Mt @ 30% Fe		MDC 11, p.446	Inactive
Summit Lake (42L05/NE)	Fe	40 Mt @ 30% Fe to 1000 foot depth	Landore Resources Limited, news release, November 30, 2010	MDC 11, p.438	Inactive



Deposit Name/ NTS	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References*	Status
Thierry Mine (52O08/NW)	Cu, Ni, PGE	Main Deposit (Underground): Measured and Indicated Resource: 8.131 Mt @ 1.46% Cu, 0.18% Ni, 3.7 g/t Ag Inferred Resource: 11.507 Mt @ 1.46% Cu, 0.15% Ni, 6.1 g/t Ag K1-1 deposit (Open Pit): Inferred Resource: 51.044 Mt @ 0.31% Ni, 0.08% Cu, 1.5 g/t Ag (NI 43-101-compliant resource)	Cadillac Ventures Inc. (CAMH 2014–2015, p.84)	Cadillac Ventures Inc. (CAMH 2014– 2015, p.84)	Active
Umex–Dorothy Lake (52O06/NW)	Au	236 220 t @ 6.17 g/t Au	White Metal Resources Corp. (formerly Trillium North Minerals Ltd.) (CAMH 2014–2015, p.466)	OFR 5869, p.260; NM, June 11, 1990, p.13	Inactive
Vegan–Newkirk (42E05/SW)	Li	750 000 t @ 1.38% Li <sub>2</sub> O	Rock Tech Lithium Inc. (CAMH 2011–2012, p.545)	NM, March 22, 1956	Inactive
VW (42L05/NW)	Ni, Cu	Indicated Resource (@ 0.25% Ni cut-off): 3.73 Mt @ 0.49% Ni Inferred Resource (@ 0.25% Ni cut-off): 0.72 Mt @ 0.72% Ni (NI 43-101-compliant resources)	Landore Resources Inc. (CAMH 2008–2009, p.341)	Landore Resources Limited, Annual Report, 2011	Active
Zulapa (42M12/SW)	Au	700 000 t @ 0.28 opt Au to 200 m	Eabametoong (Fort Hope) First Nation	OFR 5926, p.208	Inactive (within First Nation boundary)

\*N.B. This table contains tonnage and grade estimates, referred to as “reserves” (indicated, possible, probable), which were determined at various times by methods largely unreported. Many of these estimates are not in compliance with the reporting standards required by National Instrument 43-101.

Resources estimate values presented as measured, indicated or inferred are in compliance with the reporting standards required by National Instrument 43-101.

**Unit abbreviations used:** g/t = grams per ton; lbs = pounds; Mt = million tonnes; opt = ounces per ton; t = tonnes.

## REGIONAL LAND USE GEOLOGIST ACTIVITIES—NORTHWEST REGION

### Land Use Planning Activities

The northwest Regional Land Use Geologist, based in Thunder Bay, co-ordinates input into land use planning activities in the Thunder Bay South, Thunder Bay North and Red Lake–Kenora Resident Geologist districts. Ryan Tuomi, *P.Geo.*, Hugh Lockwood, *P.Geo.* and Andrew Tims, *P.Geo.*, filled this position throughout 2014.

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, energy and groundwater to support sustainable economic activity; and
  - highlighting areas where natural geological hazards and mining-related hazards pose a threat to people and property, whether on Crown land or on private land.

The competing interests for land use vary from place to place across the province, but most have the potential to restrict the availability of land, access to it and/or the activities on it. In 2014, the northwest Regional Land Use Geologist dealt with a variety of land use planning issues throughout the Northwest Region and the Far North area. 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 and Forestry (MNRF) when Crown land use planning activities have the potential to impact provincial mineral interests, or to expose those using Crown land to natural geological or mining-related hazards. These activities include Forest Management Planning; energy and other major infrastructure projects; Far North land use planning; proposals to modify existing parks or create new ones; and various other initiatives related to Crown land use.

#### Crown Land Use Policy Atlas

During the year, MNRF proposed an amendment to the Crown Land Use Atlas in the Thunder Bay District. This amendment was to add an Enhanced Management Area in the Loon Lake area of McTavish Township. The Regional Land Use Geologist reviewed the proposed Enhanced Management Area to ensure that mineral potential, mineral industry activity, and mining related hazards are identified and considered in the process.

### Forest Management Planning

The forest management planning process involves 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*. The northwest Regional Land Use Geologist normally provides input into the development of forest management plans, including

- maps showing the areas of high mineral potential, so that forestry planners are aware of 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 locations of natural geological hazards and 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.

During 2014, the northwest Regional Land Use Geologist provided input into the Ogoki Forest 2008–2018 plan; the Sapawa Forest 2010–2020 plan; the Trout Lake Forest 2009–2019 plan; and the Wabigoon Forest 2008–2018 plan.

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 MNRF web site ([www.efmp.lrc.gov.on.ca/efMP/home.do](http://www.efmp.lrc.gov.on.ca/efMP/home.do)).

## Far North Land Use Planning

Providing geoscience advice in support of the community-based land use planning initiatives of First Nation communities in the Far North remains a priority in the Northwest Region. In 2014, the northwest Regional Land Use Geologist, together with Resident Geologist Program and Ring of Fire Secretariat staff ([www.mndm.gov.on.ca/en/ring-fire-secretariat](http://www.mndm.gov.on.ca/en/ring-fire-secretariat)), continued to work with MNRF staff on Far North land use planning initiatives.

In 2013, staff of the Resident Geologist Program, led by the northwest and northeast Regional Land Use Geologists, began to compile a suite of geoscience atlases, including a comprehensive set of geoscience themes, for all communities engaged in Far North community-based land use planning. Each atlas includes a comprehensive set of geoscience themes, with more than 20 themes in each atlas. The atlases are intended to make relevant geoscience information available for use during the planning process.

This work continued in 2014. It is intended make relevant geoscience information available for use during the planning process. A first draft atlas has been completed for the all First Nation communities in and around the “Ring of Fire” (McFaulds Lake) area. Atlases for the remaining communities in the westernmost part of the Far North will be completed in early 2015.

In 2014, new mineral values mapping and mineral industry activity information was provided for several communities currently engaged in land use planning, including the Matawa First Nations, Deer Lake First Nation, Mishkeegogamang First Nation, and Eabametoong First Nation. A presentation on MNDM’s role in community-based land use planning was also given to the Webequie First Nation land use planning committee.

Following discussions with representatives of First Nation communities that had received the atlases, and feedback from MNRF colleagues engaged in Far North land use planning, MNDM made 2 major changes to the atlases that will be implemented in 2015.

The boundaries of the atlases will be standardized to align with the map co-ordinates used by National Topographic System (NTS) maps. This will allow maps to be prepared before communities finalize their planning area boundaries. It will also allow the adoption of a standard scale for the maps, so that maps from one atlas can be aligned with maps from another atlas. The scales of earlier versions of the atlas were dependent upon the size of the planning area. A suite of atlases that covers the entire Far North, at the same scale, will be completed in 2015.

The atlases will also be enhanced by simple explanatory notes for each of the themes in the atlas. The northwest Regional Land Use Geologist contributed to these explanatory notes.

In addition to the geoscience and other information provided in support of active planning processes, the northwest Regional Land Use Geologist also provided comments on the Terms of Reference for the Marten Falls First Nation and Wawakapewin First Nation Far North Planning initiatives. These communities are now moving ahead with their land use planning processes.

## Withdrawal Orders

Other work related to Crown land use in the Northwest Region included reviews of 5 applications for withdrawal of lands from staking under Section 35 of the *Mining Act*. All applications were for surface both surface and mining rights. The requests were made for a wide range of reasons, including

- creating private hunting and forestry lands;
- creating private nature reserves;
- facilitating access to 3 sites where aggregate extraction is proposed;
- supporting First Nation land claims and treaty entitlement negotiations; and
- the federal Nuclear Waste Management Organization review of candidate sites in the Ignace, Schreiber and Manitouwadge areas for underground storage of spent nuclear fuel.

Reviews by the northwest Regional Land Use Geologist ensured that mineral potential, mineral industry activity, and mining related hazards are identified and considered before decisions were made.

## Forfeited Mining Lands

The northwest Regional Land Use Geologist reviewed a list of 23 properties that were scheduled to be forfeited and re-opened for staking for non-payment of taxes. Comments were provided with regard to nearby mining-related hazards and the mineral potential of the mining lands being considered for forfeiture.

## MUNICIPAL AND PRIVATE LANDS

The Ministry of Northern Development and Mines supports municipal and private land use planning through the One-Window Planning Service led by the Ministry of Municipal Affairs and Housing (MMAH). When requested, the northwest Regional Land Use Geologist provides input into, and reviews, draft Official Plans, Official Plan Amendments, draft plans of subdivision and consent (severance) applications to ensure that provincial mineral interests, and natural geological hazards and mining-related hazards are appropriately considered in the planning process. Input from MNDM 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 by-laws and consents (lot severances);
- reviewing land use policies proposed in municipal planning documents and providing comments on those policies to MMAH “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 municipal planning 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 begun 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 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 ([www.mah.gov.on.ca/Page10679.aspx](http://www.mah.gov.on.ca/Page10679.aspx)). Along with colleagues in the southern and northeast regions and the Land Use Policy and Planning Co-ordinator, the northwest Regional Land Use Geologist provided facilitation support at regional training sessions for municipal staff to highlight main areas of policy changes in the PPS 2014.

As a participant in MMAH's one-portal service for Official Plans and their amendments, the northwest Regional Land Use Geologist provided comments, mineral values mapping and other input as required for Official Plans and Official Plan Amendments for the municipalities of Dorian, Gorham and Ware, Greenstone, Kenora, Oliver–Paipooonge, Red Lake, Shuniah, Terrace Bay and Thunder Bay.

In addition, information was provided, and reviews were done, in conjunction with 24 subdivision and consent applications, as listed in Table 9. Although such decisions are normally made by municipal governments, most of the area of the Northwest Region is outside of towns and cities. In the absence of a municipal government to manage planning decisions related to private land in those areas, decisions are made by the MMAH with the support of partner ministries including MNMD.

**Table 9.** Municipal planning initiatives with MNMD input, northwestern Ontario, 2014.

<b>Consent (Severance) and Subdivision Applications</b>	<b>Official Plans (Completed and Amended)</b>	<b>Land Use Planning (Unorganized Areas)</b>
Big Stone Bay, Area of (5)	Dorian	Clearwater Bay, Area of
Clearwater Bay, Area of (2)	Gorham and Ware	Red Rock, Township of
Docker, Township of	Greenstone	Upsala, Township of
Gundy, Township of	Kenora	Watten, Township of
Kirkup, Township of	Oliver–Paipooonge	
Lahontan, Township of ( 2)	Red Lake	
Rudd, Township of	Shuniah	
Sand Lake, Area of	Terrace Bay	
Sandy Lake, Area of	Thunder Bay	
Senn, Township of		
Sibley, Township of (2)		
Snowshoe Bay, Area of		
Stirling, Township of		
Umbach, Township of		
Upsala, Township of		
Watten, Township of		
Yellowgirl Bay, Area of		

The northwest Regional Land Use Geologist undertook a review and revision of MNMD Implementation Guidelines for PPS 2.4 (mineral resources) and 3.2 (mining-related hazards) to reflect the changes in the 2014 version of the PPS. In addition, the northwest Regional Land Use Geologist worked with MMAH and other partner ministries to present 2 training sessions in Thunder Bay: the 2014 MMAH interministerial training session; and the half-day Ontario Professional Planners Institute PPS training session.

## Exemptions from Mining Tax

Section 189 (1) of the *Mining Act* allows for owners of patented land to apply for exemption from paying mining tax. 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).

During 2014, 13 such applications were reviewed for the Northwest Region. Comments were provided to MNMD's Mining Lands Section to be consolidated with other information for the Minister's consideration and decision.

## **FIRST NATIONS**

In addition to doing work related to Far North land use planning, the northwest Regional Land Use Geologist participated in the following: Mining Week at Ginoogaming First Nation; a Community Based Land Use Planning Workshop for Matawa communities; Lac Seul First Nation Career Day and Mining Week; and career fairs at Webequie First Nation and Nibinamik First Nation.

## **Other Activities**

The northwest Regional Land Use Geologist also undertook other related work in 2014, 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.

The northwest Regional Land Use Geologist worked with staff from MNRF and other ministries to ensure that mineral values and mineral industry interests were identified and accommodated early in the planning process of projects subject to Class Environmental Assessments. Proponents seeking to develop infrastructure commonly require assistance in understanding the various mineral sector interests that might be affected by their projects, and how mining land tenure may restrict their development plans.

Claimholder’s interests, exploration activity, mining activity, mineral potential and mining-related hazards were evaluated for the following 5 Class Environmental Assessment reviews and 1 amended Environmental Assessment for the following projects within northwestern Ontario in 2014:

- clean-up of Mid-Canada Line radar sites near Fort Severn;
- Cat-Slate Forest Management Plan;
- the Nextbridge transmission line;
- land transfer to Biinjitiwaabik Zaaging Anishinaabek (Rocky Bay) First Nation;
- the amended Terms of Reference for the new transmission line to Pickle Lake; and
- Highway 102 Bridge rehabilitation.

## **ENVIRONMENTAL REGISTRY**

The Environmental Registry is an online resource that contains public notices about environmental matters being proposed by all Ontario government ministries covered by the Environmental Bill of Rights. The public notices contain information about proposals including new acts, regulations, policies and programs; plans to change or eliminate existing ones; and plans to issue permits for a wide range of activities across Ontario.

The northwest Regional Land Use Geologist monitored the Environmental Registry and compiled and distributed a monthly summary of postings of interest to MNDM staff.

## **OTHER**

In addition to the work outlined above with regard to land use planning, and other related work, the northwest Regional Land Use Geologist completed the following in 2014.



## Conferences

The northwest Regional Land Use Geologist engaged with mineral sector clients at the annual Kenora District Exploration Information Session in Dryden and the Ontario Prospector's Association's Northwestern Ontario Mines and Minerals Symposium in Thunder Bay. He also engaged with delegates from across Canada at the Canadian Aboriginal Minerals Association's annual conference in Toronto.

## General Client Service

In addition to the work outlined above, the northwest Regional Land Use Geologist provided day-to-day services to a range of clients. This work included

- being available to provide geoscience information at an MNRF-sponsored stakeholders meeting in Gore and Ware township regarding aggregate operations;
- assisting with a proponent's acquisition of a property owned by Ontario Realty Corporation;
- meeting with MNRF to discuss aggregate potential in an Enhanced Management Area on behalf of a proponent; and
- advising private land owners with regard to their mineral rights and the mineral potential of their property.

## 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. S. Ali was the contract northwestern MDCG from January through June 2014. T.K. Pettigrew is the current northwestern Ontario MDCG.

Throughout the year, emphasis was placed on updating annual production figures for producing mines in the Red Lake, Thunder Bay North and Thunder Bay South Districts as well as updating MDI records for the Far North Land Use Planning Geoscience Atlases initiative. Records were updated for the Webequie First Nations area of interest. In addition, corrections and updates were also made to MDI records in the Thunder Bay North and South Resident Geologist areas of responsibility in support of the Far North Geoscience Atlas initiative. For the latter half of the year, focus was placed on updating MDI records of developed deposits with reserves that are not yet in production.

Total changes, by the northwestern Ontario MDCG, to the provincial MDI database in 2014 included 168 updated records, 7 records deleted and 38 new records. A breakdown, by office, of the provincial records revised is provided in Table 10.

**Table 10.** Mineral Deposit Inventory records revisions in 2014.

Resident or District Office	Updates	Deletions	New
Kenora	18	0	0
Red Lake	67	4	7
Thunder Bay North	53	0	14
Thunder Bay South	30	3	17
<b>Total</b>	168	7	38

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

A searchable version of Mineral Deposit Inventory is available from the OGS online data warehouse—GeologyOntario ([www.ontario.ca/geology](http://www.ontario.ca/geology)). Users of this interface can specify a variety of deposit characteristics (e.g., commodity, deposit status, deposit classification, location) in order to discover properties of interest to stake or research. The Mineral Deposit Inventory can also be viewed geographically, and searched, using the OGSEarth application ([www.ontario.ca/ogsearth](http://www.ontario.ca/ogsearth)), which helps users with data discovery through a graphical interface (keyhole mark-up language (.kml) files for use with applications such as Google Earth™ mapping service).

It is planned that the current version of the MDI database (Ontario Geological Survey 2014) will be updated in April 2015 and will be included in both GeologyOntario and OGS Earth.

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# 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	<b>25.4</b>	mm
1 cm	0.393 70	inches	1 inch	<b>2.54</b>	cm
1 m	3.280 84	feet	1 foot	<b>0.304 8</b>	m
1 m	0.049 709	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	<b>1.609 344</b>	km
AREA					
1 cm <sup>2</sup>	0.155 0	square inches	1 square inch	<b>6.451 6</b>	cm <sup>2</sup>
1 m <sup>2</sup>	10.763 9	square feet	1 square foot	<b>0.092 903 04</b>	m <sup>2</sup>
1 km <sup>2</sup>	0.386 10	square miles	1 square mile	2.589 988	km <sup>2</sup>
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
VOLUME					
1 cm <sup>3</sup>	0.061 023	cubic inches	1 cubic inch	<b>16.387 064</b>	cm <sup>3</sup>
1 m <sup>3</sup>	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m <sup>3</sup>
1 m <sup>3</sup>	1.307 951	cubic yards	1 cubic yard	0.764 554 86	m <sup>3</sup>
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	<b>4.546 090</b>	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)	<b>31.103 476 8</b>	g
1 kg	2.204 622 6	pounds (avdp)	1 pound (avdp)	<b>0.453 592 37</b>	kg
1 kg	0.001 102 3	tons (short)	1 ton(short)	<b>907.184 74</b>	kg
1 t	1.102 311 3	tons (short)	1 ton (short)	<b>0.907 184 74</b>	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	<b>1016.046 908 8</b>	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	<b>1.016 046 9</b>	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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