ISSN 1916-6192 (online)
ISBN 978-1-4606-7406-2 (PDF)

ISSN 1484-947X (print)
ISBN 978-1-4606-7405-5 (print)

THESE TERMS GOVERN YOUR USE OF THIS DOCUMENT

Your use of this Ontario Geological Survey document (the "Content") is governed by the terms set out on this page ("Terms of Use"). By downloading this Content, you (the "User") have accepted, and have agreed to be bound by, the Terms of Use.

Content: This Content is offered by the Province of Ontario's *Ministry of Northern Development and Mines* (MNDM) as a public service, on an "as-is" basis. Recommendations and statements of opinion expressed in the Content are those of the author or authors and are not to be construed as statement of government policy. You are solely responsible for your use of the Content. You should not rely on the Content for legal advice nor as authoritative in your particular circumstances. Users should verify the accuracy and applicability of any Content before acting on it. MNDM does not guarantee, or make any warranty express or implied, that the Content is current, accurate, complete or reliable. MNDM is not responsible for any damage however caused, which results, directly or indirectly, from your use of the Content. MNDM assumes no legal liability or responsibility for the Content whatsoever.

Links to Other Web Sites: This Content may contain links, to Web sites that are not operated by MNDM. Linked Web sites may not be available in French. MNDM neither endorses nor assumes any responsibility for the safety, accuracy or availability of linked Web sites or the information contained on them. The linked Web sites, their operation and content are the responsibility of the person or entity for which they were created or maintained (the "Owner"). Both your use of a linked Web site, and your right to use or reproduce information or materials from a linked Web site, are subject to the terms of use governing that particular Web site. Any comments or inquiries regarding a linked Web site must be directed to its Owner.

Copyright: Canadian and international intellectual property laws protect the Content. Unless otherwise indicated, copyright is held by the Queen's Printer for Ontario.

It is recommended that reference to the Content be made in the following form:

van Hees, E., Bousquet, P., Pace, A., Daniels, C.M., Debicki, R.L., Wilson, A.C., Beauchamp, S.A. and Walmsley, J. 2016. Report of Activities 2015, Resident Geologist Program, Timmins Regional Resident Geologist Report: Timmins and Sault Ste. Marie Districts; Ontario Geological Survey, Open File Report 6317, 91p.

Use and Reproduction of Content: The Content may be used and reproduced only in accordance with applicable intellectual property laws. *Non-commercial* use of unsubstantial excerpts of the Content is permitted provided that appropriate credit is given and Crown copyright is acknowledged. Any substantial reproduction of the Content or any *commercial* use of all or part of the Content is prohibited without the prior written permission of MNDM. Substantial reproduction includes the reproduction of any illustration or figure, such as, but not limited to graphs, charts and maps. Commercial use includes commercial distribution of the Content, the reproduction of multiple copies of the Content for any purpose whether or not commercial, use of the Content in commercial publications, and the creation of value-added products using the Content.

Contact:

FOR FURTHER INFORMATION ON	PLEASE CONTACT:	BY TELEPHONE:	BY E-MAIL:
The Reproduction of the EIP or Content	MNDM Publication Services	Local: (705) 670-5691 Toll-Free: 1-888-415-9845, ext. 5691 (inside Canada, United States)	Pubsales.ndm@ontario.ca
The Purchase of MNDM Publications	MNDM Publication Sales	Local: (705) 670-5691 Toll-Free: 1-888-415-9845, ext. 5691 (inside Canada, United States)	Pubsales.ndm@ontario.ca
Crown Copyright	Queen's Printer	Local: (416) 326-2678 Toll-Free: 1-800-668-9938 (inside Canada, United States)	Copyright@ontario.ca

Ontario

Ontario Geological Survey
Open File Report 6317

Report of Activities, 2015 Resident Geologist Program

Timmins Regional Resident Geologist Report: Timmins and Sault Ste. Marie Districts

2016

Ontario

ONTARIO GEOLOGICAL SURVEY

Open File Report 6317

Report of Activities, 2015
Resident Geologist Program

Timmins Regional Resident Geologist Report:
Timmins and Sault Ste. Marie Districts

by

E. van Hees, P. Bousquet, A. Pace, C.M. Daniels, R.L. Debicki, A.C. Wilson,
S.A. Beauchamp and J. Walmsley

2016

van Hees, E., Bousquet, P., Pace, A., Daniels, C.M., Debicki, R.L., Wilson, A.C., Beauchamp, S.A. and Walmsley, J. 2016. Report of Activities 2015, Resident Geologist Program, Timmins Regional Resident Geologist Report: Timmins and Sault Ste. Marie Districts; Ontario Geological Survey, Open File Report 6317, 91p.

Users of OGS products are encouraged to contact those Aboriginal communities whose traditional territories may be located in the mineral exploration area to discuss their project.

Open File Reports of the Ontario Geological Survey are available for viewing at the John B. Gammon Geoscience Library in Sudbury and at the regional Mines and Minerals office whose district includes the area covered by the report (see below).

Copies can be purchased at Publication Sales and the office whose district includes the area covered by the report. Although a particular report may not be in stock at locations other than the Publication Sales office in Sudbury, they can generally be obtained within 3 working days. All telephone, fax, mail and e-mail orders should be directed to the Publication Sales office in Sudbury. Purchases may be made using cash, debit card, VISA, MasterCard, American Express, cheque or money order. Cheques or money orders should be made payable to the *Minister of Finance.*

John B. Gammon Geoscience Library 933 Ramsey Lake Road, Level A3 Sudbury, Ontario P3E 6B5	Tel:	(705) 670-5615
Publication Sales 933 Ramsey Lake Rd., Level A3 Sudbury, Ontario P3E 6B5	Tel: Toll-free: Fax: E-mail:	(705) 670-5691 (local) 1-888-415-9845 ext. 5691 (705) 670-5770 pubsales.mndm@ontario.ca

Regional Mines and Minerals Offices:

Kenora - Suite 104, 810 Robertson St., Kenora P9N 4J2

Kirkland Lake - 10 Government Rd. E., Kirkland Lake P2N 1A8

Red Lake - Box 324, Ontario Government Building, Red Lake P0V 2M0

Sault Ste. Marie - 875 Queen St. E., Suite 6, Sault Ste. Marie P6A 6V8

Southern Ontario - P.O. Bag Service 43, 126 Old Troy Rd., Tweed K0K 3J0

Sudbury - 933 Ramsey Lake Rd., Level A3, Sudbury P3E 6B5

Thunder Bay - Suite B002, 435 James St. S., Thunder Bay P7E 6S7

Timmins - Ontario Government Complex, P.O. Bag 3060, Hwy. 101 East, South Porcupine P0N 1H0

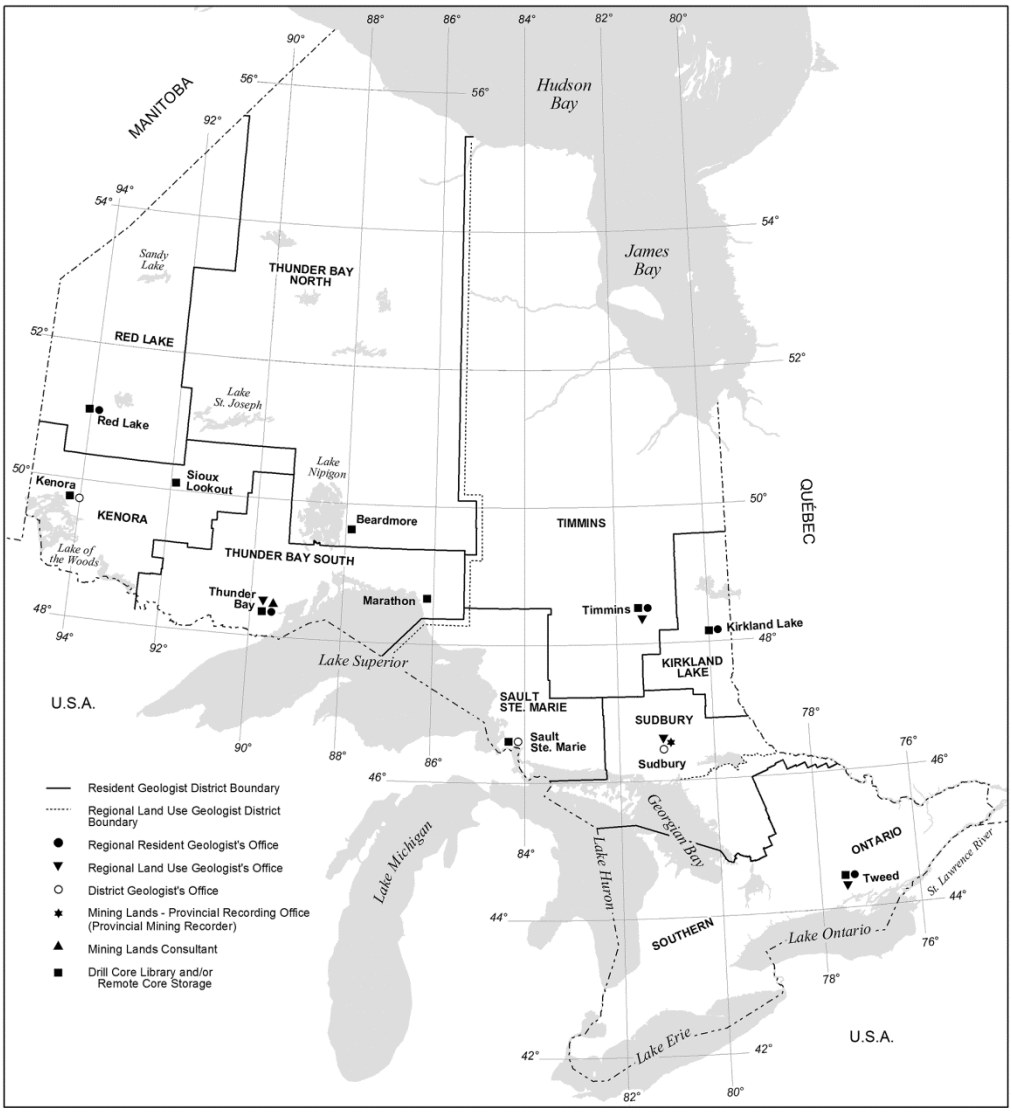
Every possible effort has been made to ensure the accuracy of the information contained in this report; however, the Ontario Ministry of Northern Development and Mines does not assume any liability for errors that may occur. Source references are included in the report and users are urged to verify critical information.

If you wish to reproduce any of the text, tables or illustrations in this report, please write for permission to the Manager, Publication Services, Ministry of Northern Development and Mines, 933 Ramsey Lake Road, Level A3, Sudbury, Ontario P3E 6B5.

Cette publication est disponible en anglais seulement.

Parts of this report may be quoted if credit is given. It is recommended that reference be made in the following form:

van Hees, E., Bousquet, P., Pace, A., Daniels, C.M., Debicki, R.L., Wilson, A.C., Beauchamp, S.A. and Walmsley, J. 2016. Report of Activities 2015, Resident Geologist Program, Timmins Regional Resident Geologist Report: Timmins and Sault Ste. Marie Districts; Ontario Geological Survey, Open File Report 6317, 91p.



Mines and Minerals Division Regional and District Offices

CITY	ADDRESS	OFFICE(S)	TELEPHONE	FAX
Kenora	Suite 104, 810 Robertson St., Kenora P9N 4J2	○ ■	(807) 468-2813	(807) 468-2930
Red Lake	227 Howey Street, P.O. Box 324, Red Lake P0V 2M0	● ■	(807) 727-3272	(807) 727-3553
Thunder Bay – North Thunder Bay – South	Suite B002, 435 James St. S., Thunder Bay P7E 6S7	● ■ ▼ ▲	(807) 475-1331 (807) 475-1663 (807) 475-1311 *Toll-Free (Canada, USA):* (888) 415-9845	(807) 475-1112 (807) 475-1112 (807) 475-1112 *Toll-Free (Canada, USA):* (877) 670-1444
Sault Ste. Marie	Suite 6, 875 Queen St. E., Sault Ste. Marie P6A 2B3	○ ■	(705) 945-6932	(705) 945-6935
Timmins	Ontario Government Bldg., P.O. Bag 3060, 1270 Hwy 101 East, South Porcupine P0N 1H0	● ■ ▼	(705) 235-1615 (705) 235-1612	(705) 235-1620 (705) 235-1620
Kirkland Lake	10 Government Rd. E., P.O. Box 100, Kirkland Lake P2N 3M6	● ■	(705) 568-4520	(705) 568-4524
Sudbury	Willet Green Miller Centre, Level A3, 933 Ramsey Lake Rd., Sudbury P3E 6B5	○ ▼ ★	(705) 670-5733 (705) 670-5887 (705) 670-5742 *Toll-Free (Canada, USA):* (888) 415-9845	(705) 670-5770 (705) 670-5770 (705) 670-5681 *Toll-Free (Canada, USA):* (877) 670-1444
Tweed (Southern Ontario)	P.O. Bag Service 43, 126 Old Troy Rd., Tweed K0K 3J0	● ■ ▼	(613) 478-3161 (613) 478-6223	(613) 478-2873 (613) 478-2873

ONTARIO GEOLOGICAL SURVEY

RESIDENT GEOLOGIST PROGRAM

REPORT OF ACTIVITIES—2015

TIMMINS REGIONAL RESIDENT GEOLOGIST REPORT

CONTENTS

Ontario

Ontario Geological Survey
Regional Resident Geologist Program

Timmins Regional Resident Geologist (Timmins District)—2015

by

**P. Bousquet, S.A. Beauchamp, C.M. Daniels, R.L. Debicki,
E. van Hees and A.C. Wilson**

2016

CONTENTS

Timmins District—2015

Tables

Figures

Photos

Timmins Regional Resident Geologist (Timmins District)—2015

P. Bousquet[1], S.A. Beauchamp[2], C.M. Daniels[3], R.L. Debicki[4], E. van Hees[5] and A.C. Wilson[6]

[1]District Geologist, Timmins District, Resident Geologist Program, Ontario Geological Survey

[2]Acting District Geological Assistant, Timmins District, Resident Geologist Program, Ontario Geological Survey

[3]Regional Land Use Geologist—Northeast Region, Resident Geologist Program, Ontario Geological Survey

[4]Land Use Policy and Planning Co-ordinator, Resident Geologist Program, Ontario Geological Survey

[5]Regional Resident Geologist, Timmins District, Resident Geologist Program, Ontario Geological Survey

[6]Mineral Deposit Compilation Geologist—Northeastern Ontario, Resident Geologist Program, Ontario Geological Survey

INTRODUCTION

In 2015, the global slump in mineral exploration activities had an impact on the Timmins District. Several exploration projects were put on hold, while others saw their owner being acquired by another company. At the end of 2015, 1 base metal mine, 1 industrial minerals mine, 1 diamond mine and 6 gold mines remained in operation within the district.

The Timmins District had a total of 49 active exploration projects. There was a 56% decrease in the number of claim units staked and a 15% decrease of claim units cancelled, compared to 2014. The number of claim units active decreased by 10.9% while the assessment work credits, in dollars, decreased by more than 17 million in the same amount of time. Mining claim activities of the past 20 years are presented in Table 1.

Table 1. Summary of statistical claims information in the Timmins District for the past 20 years.

Year	Claim Units Recorded	Claim Units Cancelled	Claim Units Active	Assessment Work Credits ($)
2015	3273	10 885	55 513	22 417 049
2014	7427	12 784	62 355	39 823 696
2013	5624	17 231	68 372	39 340 015
2012	9762	12 941	76 227	83 707 312
2011	13 519	16 330	79 139	35 303 634
2010	16 116	29 540	85 501	24 592 810
2009	18 018	14 318	97 506	41 270 807
2008	32 625	9789	93 675	19 504 181
2007	23 028	7261	66 423	18 406 983
2006	16 588	16 254	64 432	6 981 017
2005	16 069	13 147	64 889	6 258 661
2004	17 377	1280	56 478	14 269 311
2003	28 154	18 860	57 384	5 728 049
2002	11 423	14 705	39 964	5 419 054

Year	Claim Units Recorded	Claim Units Cancelled	Claim Units Active	Assessment Work Credits ($)
2001	18 258	11 759	42 835	4 996 755
2000	11 035	15 723	35 905	4 946 371
1999	12 312	16 557	42 270	10 665 577
1998	12 642	11 300	46 515	17 308 110
1997	10 771	16 908	45 173	10 707 864
1996	13 859	15 876	50 739	8 418 072
1995	14 376	7769	60 705	5 052 359

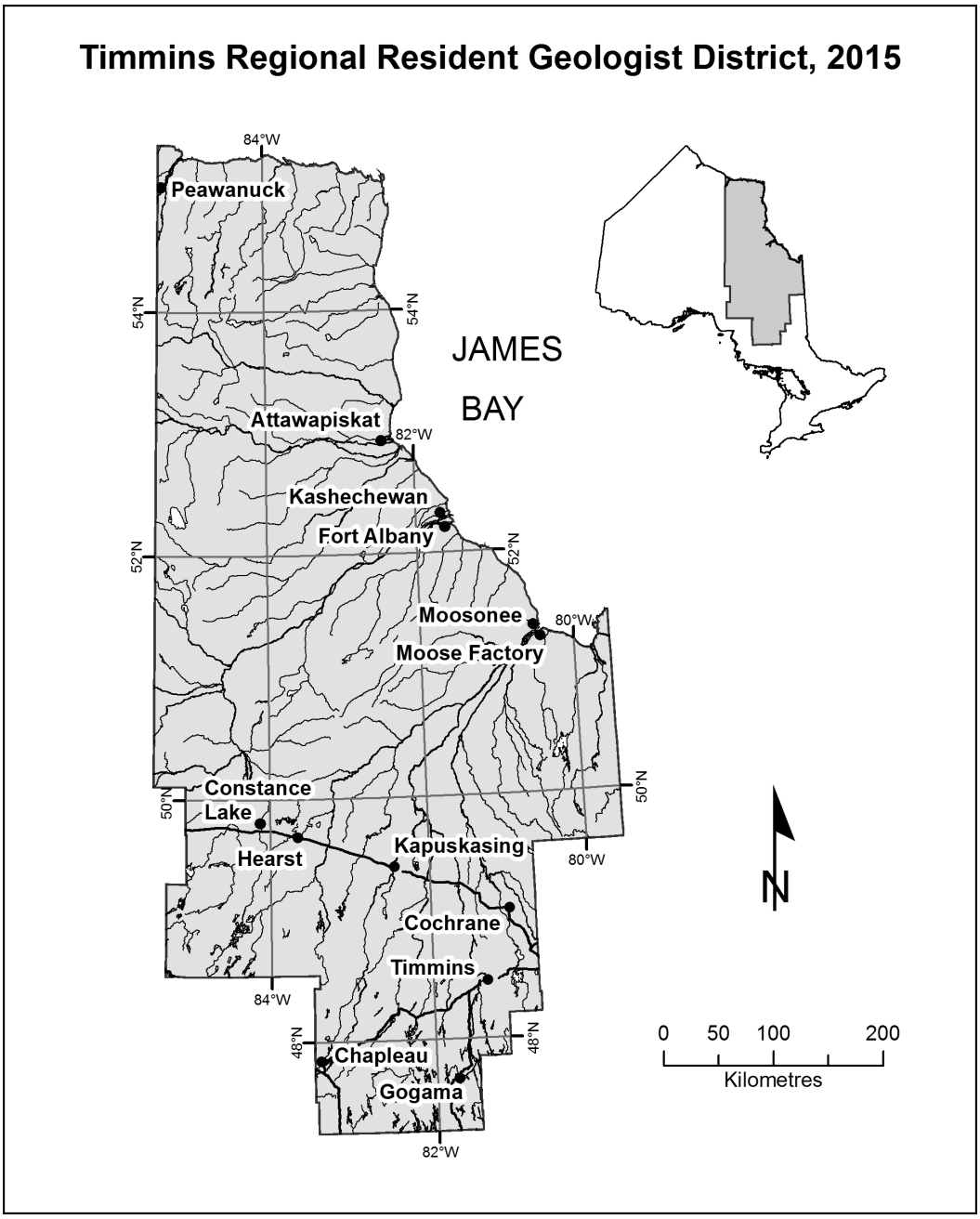


Figure 1. Timmins Regional Resident Geologist District.

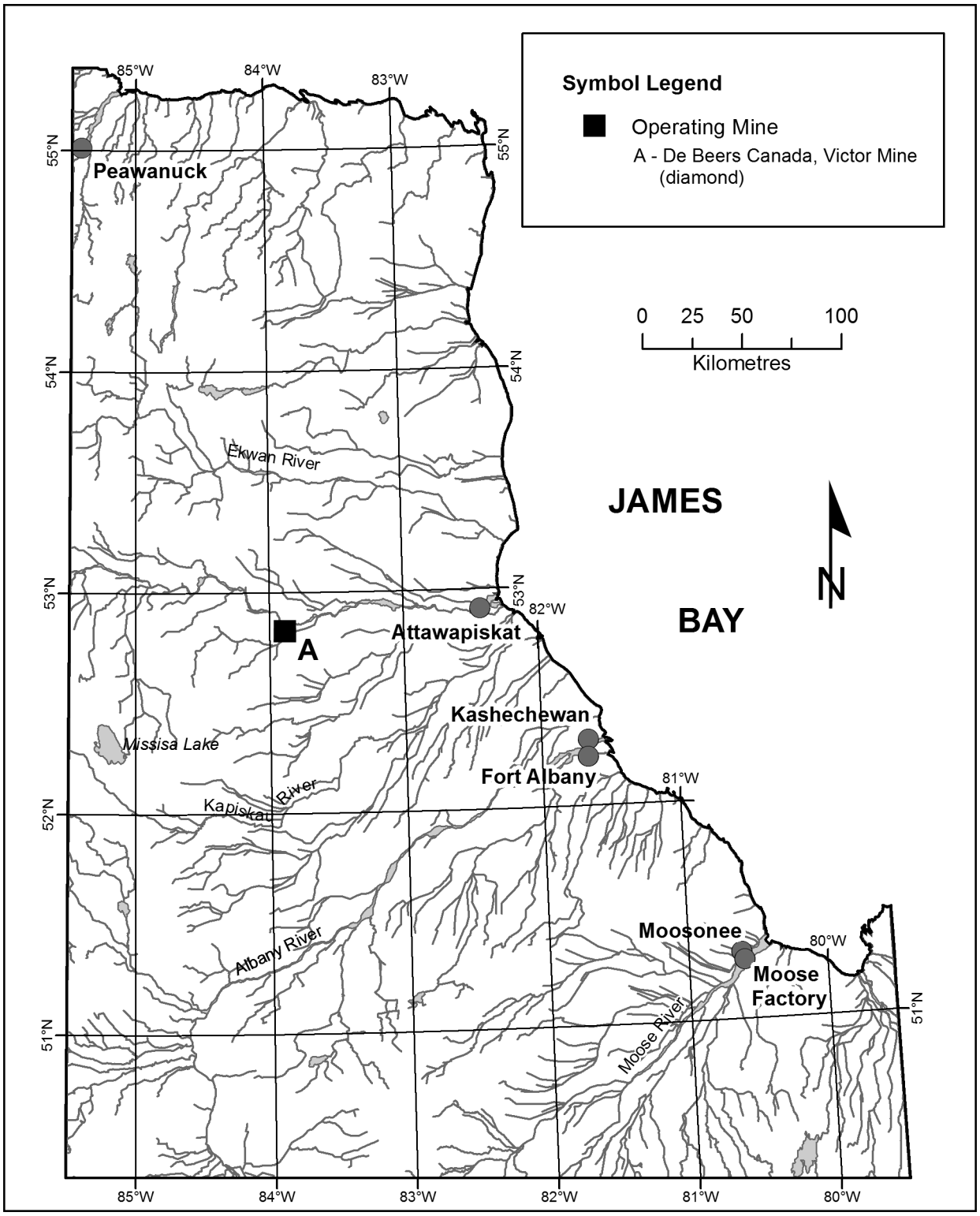


Figure 2. Exploration programs, advanced exploration and operating mines in the Timmins Regional Resident Geologist District (north part).

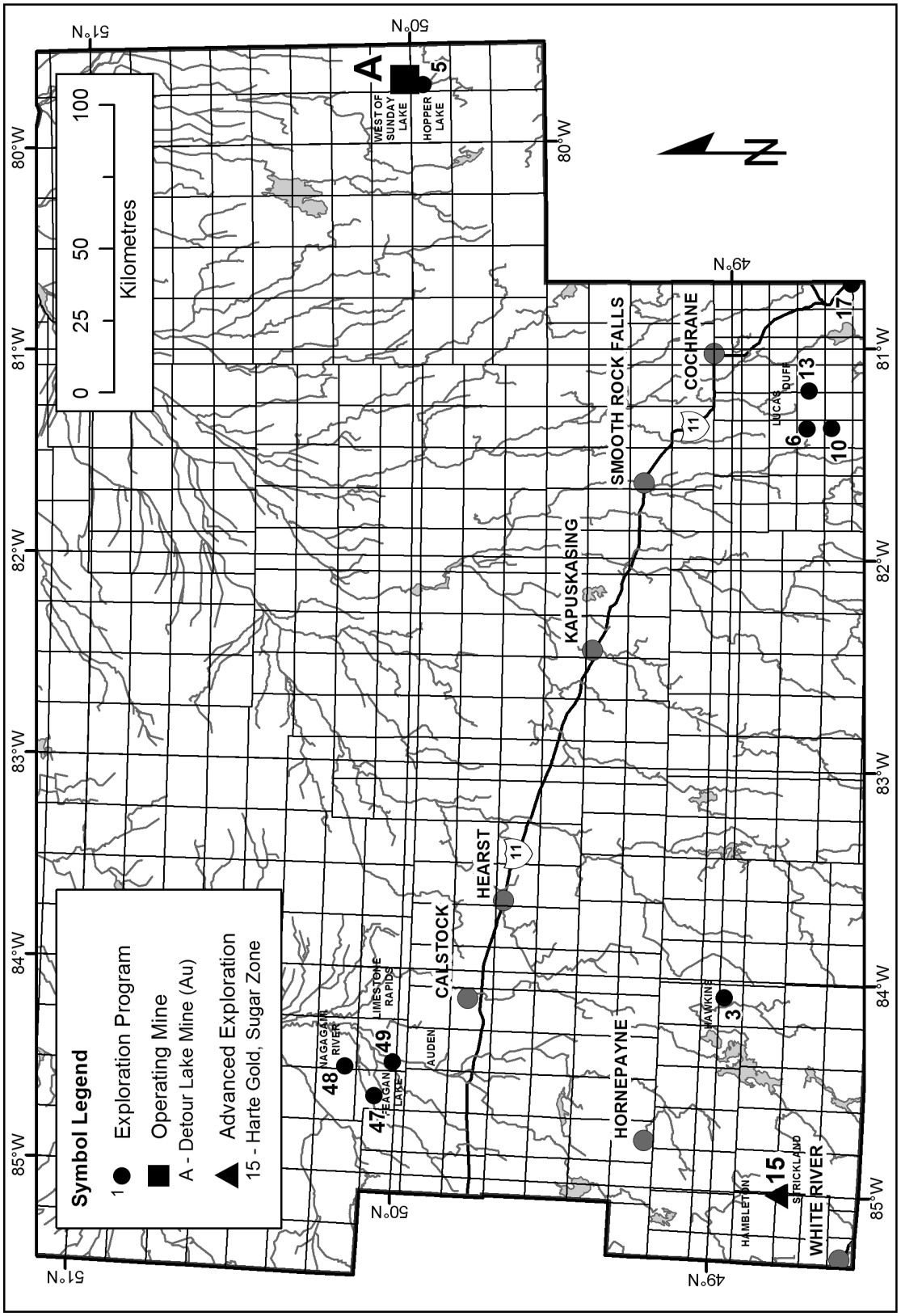


Figure 3. Exploration programs, advanced exploration and operating mines in the Timmins Regional Resident Geologist District (central part). Keyed to Table 2.

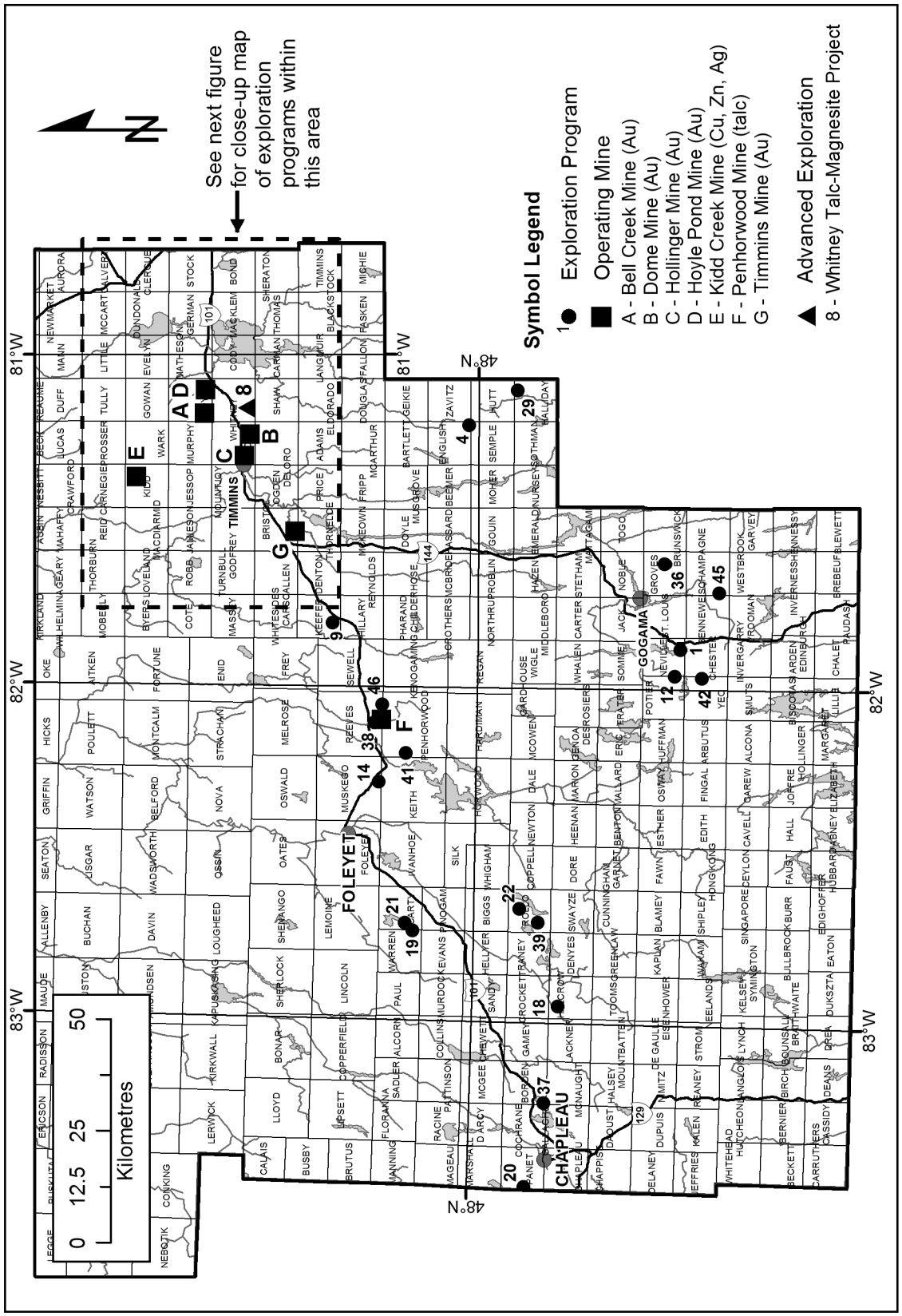


Figure 4. Exploration programs, advanced exploration, operating mines in the Timmins Regional Resident Geologist District (south part). Keyed to Table 2.

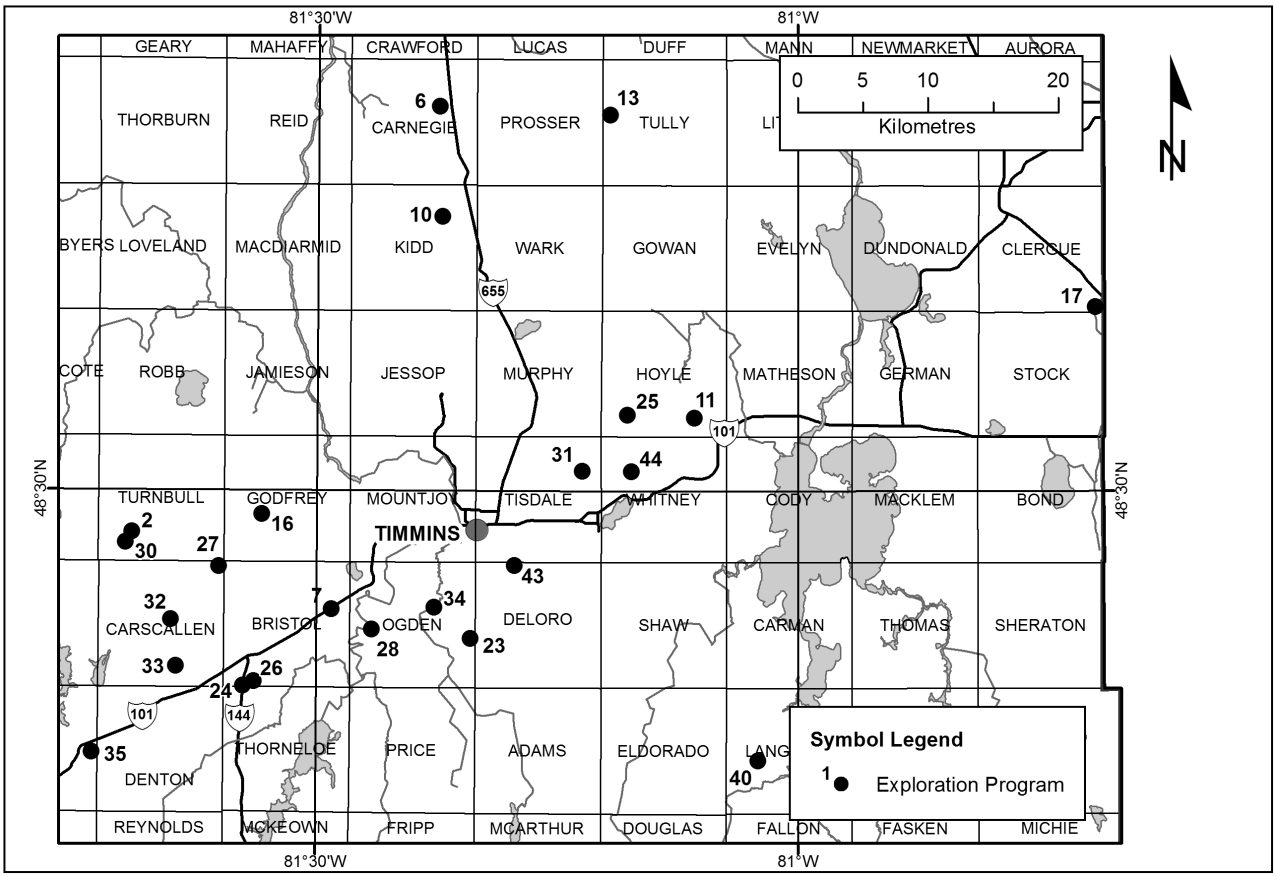


Figure 5. Exploration programs in the Timmins Regional Resident Geologist District (Timmins area). Enlargement of the area shown in the northeast part of Figure 4. Keyed to Table 2.

Table 2. Exploration activity in the Timmins District in 2015, keyed to figures 3, 4 and 5.

Abbreviations

AEM ..... Airborne electromagnetic survey	IP ..... Induced polarization survey
AMAG ..... Airborne magnetic survey	Lc ..... Line cutting
Anlys ..... Analysis	Mag ..... Ground magnetic survey
Assays ..... Assay data	Man ..... Manual work
Comp ..... Compilation	Met ..... Metallurgical testing
DD ..... Diamond drilling	Pr ..... Prospecting
DGP ..... Down-hole geophysics	Rcalc ..... Reserve calculation
EM ..... Ground electromagnetic survey	Samp ..... Sampling (other than bulk)
GC ..... Geochemical survey	Str ..... Stripping
GL ..... Geological survey	Tr ..... Trenching
IM ..... Industrial mineral testing and marketing	UGD ..... Underground exploration or development

No.	Company/Individual (Property Name)	Township/Area (Commodity)	Exploration Activity
1	1571925 Ontario Ltd. (Neville Property)	Neville (Au)	GC, Mag, Samp
2	Allaire, G.A. (Turnbull Property)	Turnbull (Au)	Assays, Man, Pr, Samp, Str
3	Canadian Orebodies Inc. (Hawkins)	Hawkins (Au)	GC

No.	Company/Individual (Property Name)	Township/Area (Commodity)	Exploration Activity
4	Croxall, J.E. (Zavitz Property)	Zavitz, Semple, English (Au)	Pr, Samp
5	Detour Gold Corporation (Zone 58N)	Lower Detour Lake (Au)	DD, Assays
6	Explor Resources Inc. (Carnegie Base Metal Property)	Carnegie (Base metals)	EM, Lc
7	Explor Resources Inc. (Timmins Porcupine West)	Bristol, Ogden (Au)	Anlys, Assays, Samp
8	General Magnesium Corp. (Whitney Talc-Magnesite Project)	Whitney (Talc, Mg)	DD
9	Gervais, L.N. (Crest Lake Property)	Keefer (Au)	EM, IP, Mag, Lc
10	Glencore (Kidd Creek Mine)	Kidd (Base metals)	DD, DGP
11	Goldcorp Inc. (Hoyle Deep Project)	Hoyle (Au)	DD
12	GoldON Resources Ltd. (Neville-Potier)	Neville, Potier (Au)	DD, EM
13	Gowest Gold Ltd. (North Timmins Gold)	Tully (Au)	GC, Samp
14	GTA Resources and Mining Inc. (Ivanhoe Property)	Keith, Muskego (Au)	IP, Lc, Mag
15	Harte Gold Corp. (Sugar Zone Property)	Odlum, Hambleton, Strickland (Au)	DD, Assays
16	International Explorers and Prospectors Inc. (Kamiskotia, Genex)	Godfrey, Jamieson, Robb (Base metals)	Comp
17	International Explorers and Prospectors Inc. (Montclerg)	Clergue (Au)	Met
18	Jubilee Gold Exploration Ltd. (Halcrow Creek Property)	Halcrow (Au)	GC
19	Kapuskasing Gold Corp. (Borden North Property)	Carty, Evans, Pinogami, Warren (Au)	Assays, GL, Pr, Samp
20	Kapuskasing Gold Corp. (Golden Route, Chapleau West)	Caouette, Panet, Strathearn (Au)	Pr, Samp
21	Kapuskasing Gold Corp. (Borden North Property)	Carty, Ivanhoe, Warren (Au)	AEM, GL, Pr, Samp
22	Kapuskasing Gold Corp. (Rollo)	Rollo (Au)	Assays, Pr, Samp
23	L.B.L. Richgold Mines Inc. (Ogden Grid)	Ogden (Au)	EM, Mag
24	Lake Shore Gold Corp. (144 Project)	Bristol, Thorneloe (Au)	DD, Assays, UGD
25	Lake Shore Gold Corp. (Bell Creek Mine)	Hoyle (Au)	DD
26	Lake Shore Gold Corp. (West Timmins Mine)	Bristol (Au)	DD, UGD
27	Lalonde, D. (Carscallen Property)	Carscallen (Au)	Assays, Man, Pr, Samp, Str

No.	Company/Individual (Property Name)	Township/Area (Commodity)	Exploration Activity
28	Lalonde, D. (Ogden Township Claim)	Ogden (Au)	Pr
29	Lalonde, D. (Halliday Claim)	Halliday (Au)	Pr, Samp
30	Lalonde, D. (Turnbull Property)	Turnbull (Au)	Assays, Man, Pr, Samp, Str
31	Lexam VG Gold Inc. (Davidson-Tisdale)	Tisdale (Au)	DD
32	Melkior Resources Inc. (Big Marsh)	Carscallen (Au)	IP, Lc
33	Melkior Resources Inc. (Carscallen Property)	Carscallen (Au)	DD, Pr
34	Metals Creek Resources Corp. (Ogden)	Ogden (Au)	DD
35	Moon Energy Corporation (Keefer Stargate 1 Project)	Keefer (Au)	Pr, Samp
36	Northern Sun Mining Corp. (Groves)	Groves (Ni, Cu)	EM, Mag, Samp, Tr
37	Goldcorp Inc./Probe Mines Ltd. (Borden Gold Project)	Borden (Au)	DD – 4 – 2519 m
38	Rapier Gold Inc. (Pen Gold)	Penhorwood, Reeves (Au)	DD, AMAG, Assays, GL, Samp
39	Richmond Minerals Inc. (Ridley Lake)	Rollo (Au)	DD, Assays
40	Rogue Resources Inc. (Langmuir Nickel)	Blackstock, Carman, Cody, Eldorado, Fallon, Langmuir, Thomas, Macklem (Ni)	Met
41	Rogue Resources Inc. (Radio Hill, Nat River)	Kenogaming, Muskego, Penhorwood, Sewell (Fe)	Met
42	Sanatana Resources Inc. and Trelawney Mining Exploration Inc. (Watershed)	Yeo, Chester (Au)	Assays, Rcalc, Samp, Str, Tr
43	Syracuse Gold (Central Timmins Gold Complex)	Deloro (Au)	DD
44	Temex Resources Corp. (Whitney Gold Project)	Whitney (Au)	Met
45	Trelawney Mining and Exploration Inc. (Sheridan Property)	Benneweis, Champagne	IP, Lc
46	White Metal Resources Corp. (West Porcupine Property)	Reeves (Au)	Assays, Pr, Samp
47	Xmet Inc. (Blackflake West)	Feagan Lake (Base metals)	DD
48	Zenyatta Ventures Ltd. (Albany Project – Block 4E)	Nagagami River (Base metals, PGMs, Graphite)	DD – 1 – 625 m
49	Zenyatta Ventures Ltd. (Albany Graphite Deposit)	Pitopiko River (Graphite)	DD, Anlys, IM

Note: *DD – 4 – 2519 m = 4 diamond-drill holes totalling 2519 m.*

MINING ACTIVITY

Timmins District saw production from 6 gold mines, 1 base metals mine, 1 diamond mine and 1 industrial mineral mine. The gold mines are Bell Creek Mine, Detour Lake Mine, Dome Mine, Hollinger Pit, Hoyle Pond Mine, and the West Timmins Mine. The Kidd Creek Mine sustained production of base metals. Imerys Talc produced talc from its Penhorwood Mine, and DeBeers Canada Inc. continued the operation of the Victor diamond mine in the Far North.

Glencore Canada Corporation – Kidd Operations

Glencore Canada Corporation operated the Kidd Creek Mine, the deepest base metal mine in the world, reaching a depth of 9889 feet (3014 m). The mine is located 25 km north of Timmins, in Kidd Township. In 2015, mine production amounted to 2 150 000 t at grades of 3.6% zinc, 1.9% copper and 46 g/t silver.

Proven ore reserves are 6 990 000 t at 4.06% zinc, 2.02% copper and 50 g/t silver. Probable ore reserves are 3 300 000 t at 4.7% zinc, 1.8% copper and 46 g/t silver. Total ore reserves are 10 000 000 t at 4.3% zinc, 2.0% copper and 49 g/t silver. The mine life is anticipated to be 6.3 years (early 2022) (Glencore, press release, February 11, 2016, www.glencore.com, *under* Investors, Reports and Results, Resources & Reserves [accessed February 16, 2016]).

De Beers Canada Inc. – Victor Mine

In 2015, De Beers Canada Inc. operated the Victor Mine, the only active diamond mine in Ontario. The mine is located 100 km west from the community of Attawapiskat. In 2015, the mine produced 644 000 carats of diamonds (Anglo American plc, news release, January 28, 2016).

Detour Gold Corporation – Detour Lake Mine

Detour Gold Corporation operated the Detour Lake Mine, located in the Sunday Lake Area, 160 km to the northeast of Cochrane. It produced 505 558 ounces of gold for the year from 19.8 Mt of ore milled at an average head grade of 0.88 g/t gold (Detour Gold Corporation, news release, January 14, 2016).

Goldcorp Inc. – Porcupine Gold Mines

Goldcorp Inc. operated 3 mines in the Timmins area: Dome Mine, Hoyle Pond Mine and the Hollinger Pit. Gold production for their Porcupine operations amounted to 274 300 ounces of gold. The Porcupine operations contained 2.13 million ounces of proven and probable gold reserves at December 31, 2015. The individual data for the mines are reported in Table 3 below (Goldcorp Inc., Management's Discussion and Analysis, and Financial Statements, February 25, 2016, www.goldcorp.com, *under* Investor Resources, Report & Filings, Annual Reports [accessed February 25, 2016]).

Table 3. Production from Goldcorp Inc. mines.

Operating Data	Tonnage	Grade g/t gold
Hoyle Pond	362 300	13.80
Dome	553 800	3.43
Hollinger	954 400	0.96

Mining operations at the Hollinger Pit began full production in mid-October 2015. The Hoyle Deep project focused on the completion of the installation of the shaft and apparatus for the operation of the shaft and ensuing development. It is expected to be available for operations in the first quarter of 2016. Goldcorp Inc. acquired Probe Mines Ltd. in March 2015. The principal asset of Probe Mines Ltd. was the Borden gold project, 10 km east from Chapleau, Ontario. Exploration on the property focused on infill drilling to convert resources to reserves, then changed into step-out drilling to test for plunge extensions and parallel structures (Goldcorp Inc., Management's Discussion and Analysis, and Financial Statements, February 25, 2016, www.goldcorp.com, under Investor Resources, Report & Filings, Annual Reports [accessed February 25, 2016]).

Lake Shore Gold Corp. – Timmins Operations

Lake Shore Gold Corp. produced gold ore from the Timmins West and the Bell Creek mines. Together, they produced a total of 183 300 ounces of gold. The Bell Creek mill processed 1 307 200 t of ore, at a grade of 4.4 g/t gold, with a recovery rate of 96.6% (Lake Shore Gold Corp., press release, January 8, 2016).

Underground exporation continued at the Bell Creek Mine. Diamond drilling and development work focused on increasing the reserve and resource base in order to further extend mine life as well as to assist in evaluating longer term options for mine production from the Labine Deep Zone. In May, the company announced expanding the exploration efforts, adding 32 500 m of underground drilling and 800 m of development for an underground drill station to the 2015 program; 15 550 m of drilling and 150 m of development were planned for exploration acceleration and resources conversion between the 775 and 1100 levels; and 17 000 m of drilling and 650 m of development were planned for inferred resources upgrade and exploring for new resources below the 1100 level (Lake Shore Gold Corp., press release, May 4, 2015).

ADVANCED EXPLORATION ACTIVITY

Harte Gold Corp. – Sugar Zone Project

During 2015, Harte Gold Corp. continued its evaluation of the Sugar Zone property, located approximately 25 km northeast of the community of White River. The property is situated in Hambleton, Odlum and Strickland townships, within the Dayohessarah Lake greenstone belt.

Significant assays from the Lower Sugar Zone include 0.64 m grading 10.32g/t gold (SZ-15-85), and 0.62 m grading 7.39 g/t gold (SZ-15-86) (Middleton, Forslund and Laarman 2015). Both drill holes were located at the northern end of the Sugar Zone in Hambleton Township and intersected a sequence of mafic metavolcanic rocks intruded by porphyry dikes. Drill hole SZ-15-85 ended in gabbro and drill hole SZ-16-85 ended in mafic metavolcanic rocks and granodiorite.

The drilling program also tested the Contact Zone and encountered Hemlo style geochemistry in 2 of 6 holes drilled (Harte Gold Corp. press release April 8, 2015).

A bulk sampling agreement was signed in May 2015 with Sudbury based Technica Mining. A road to the portal site was completed at the end of July and the initial blasting of the portal took place in July, with collaring taking place in August. Shipping of a 70 000 tonne bulk sample is anticipated to begin early in 2016. Harte Gold has entered into a contract milling agreement with Barrick Gold to process its 70 000 tonne bulk sample at the nearby Hemlo mill. Bulk sampling should conclude in the first quarter of 2016.

Commercial production is anticipated to commence in the third quarter of 2016 (Harte Gold Corp., press releases, July 16 and November 10, 2015).

The Sugar Zone deposit occurs in a series of quartz veins within strongly foliated amphibolitized basaltic flows injected by felsic sills that are either very fine grained, or contain quartz or feldspar phenocrysts. The quartz veins range from 2 to 45 cm in width, but veins up to 1 m in width also have been observed. The deposit extends for over 3500 m (Stott 1999).

EXPLORATION ACTIVITY

Detour Gold Corporation – Lower Detour Area

Detour Gold Corporation continued to explore in the Lower Detour Lake Area, 6 km south from the Detour Mine. Following last year's discovery of Zone 58N, the company completed a 30 000 m infill diamond-drilling program in 2015.

Infill drilling at a 50 m spacing intersected gold mineralization to the east and to the west of the discovery over a distance of 450 m, from surface to a depth of 800 m. Zone 58N remains open at depth. The bottom of the mineralization has not been reached. The gold mineralization occurs within the southern portion of an altered feldspar porphyry intrusive that is deformed in brittle fashion and hosts quartz and/or tourmaline veins with up to 5% pyrite. Several intersections contained gold. The feldspar porphyry narrows towards the east and west. Significant intercepts include 4.35 g/t gold over 14 m (hole DLD-15-177), 23.32 g/t gold over 4.3 m (hole DLD-15-178), 17.26 g/t gold over 4.3 m and 14.01 g/t gold over 4.4 m (Detour Gold Corporation, press release, December 17, 2015).

Kapuskasing Gold Corp. – Rollo Property

Kapuskasing Gold Corp. prospected and channel sampled on its Rollo property, located 50 km east from Chapleau, Ontario. Channel sampling at the Hanson Lake occurrence returned assays up to 8.59 g/t gold and 11.41 g/t gold, over lengths of 0.3 to 0.9 m, associated with 2 different mineralized systems. One system consists of a north-bearing quartz-carbonate that crosscuts east-trending mafic volcanic rocks. The second system consists of a syenite/porphyry dike system which trends conformably to the metavolcanic rocks (Kapuskasing Gold Corp., press release, August 6, 2015).

Lake Shore Gold Corp. – 144 Property

The 144 property, located southwest of the Timmins West Mine and Thunder Creek deposit, was a focus of the company's exploration efforts during 2015. Exploration shifted underground once a drift extending from the West Timmins Mine was completed in July. The drift provided access to the 144 Gap Zone.

The company has also continued its surface diamond-drilling program on the property, which includes the 144 Gap, 144 Gap SW, 144 North and 144 South zones, all located along the same rock contact that hosts the Timmins West and Thunder Creek deposits.

Lake Shore Gold reported numerous intersections over the year in the 144 Gap. Underground diamond drilling intersected 26.09 g/t gold over 7.8 m (hole HW820-010), 79.52 g/t gold over 8.3 m (hole HW820-016), 11.64 g/t gold over 8.9 m (hole HW820-019), and 6.85 g/t gold over 59.20 m (hole HW820-055). Surface holes drilled in 2015 intersected 3.11 g/t gold over 19.1 m (hole HWY-15-142, 144-South), 3.19 g/t gold over 10.4 m (hole HWY-15-143, SW Zone), 5.76 g/t gold over 24.5 m (DDH HWY-15-

87W3, 144-Gap). Company interpretation of the drilling results suggests the 144 Gap Zone is associated with a 100 m wide zone of hydrothermal alteration and deformation, containing multiple syenite porphyry intrusions and quartz veins containing pyrite, scheelite, galena and visible gold (Lake Shore Gold Corp., press release, October 28, 2015).

Lexam VG Gold Inc. – Davidson-Tisdale Property

In March 2015, Lexam VG Gold Inc. increased its interest in the Davidson-Tisdale property to 100%. At the same time, the company acquired the adjoining Kinch claims to the north, west and south of the property. Subsequently, the company completed a soil gas hydrocarbons (SGH) geochemistry survey, a geological prospecting and mapping program, and a diamond-drilling program on both the Davidson-Tisdale property and the Kinch claims. Grab samples taken from the Kinch claims returned 5 samples over 1 g/t gold, with a best of 10.7 g/t gold in a quartz stockwork. Diamond drilling targeting the Davidson-Tisdale Main Zone was successful, identifying gold mineralization at depth and better defining the alteration envelope which hosts the quartz veins and gold mineralization. The best assays from that phase were 7.84 g/t gold over 1 m and 7.67 g/t gold over 1.5 m. In addition to grade, the economics to the Main Zone depends upon the density or quantity of the quartz veining. In that aspect, the diamond-drilling program did not meet expectations.

The company completed 5 diamond-drill holes on the Kinch claims. The best assay was 4.36 g/t gold over 2 m (hole VGK-15-05) (Lexam VG Gold Inc., Management's Discussion and Analysis, November 5, 2015).

Melkior Resources Inc. – Carscallen Project

After completing data compilation and interpretation on its Carscallen project, Melkior Resources Inc. completed surface work and prospecting in the vicinity of the AuMo shaft (MDI42A05SE00028). Grab samples taken from a dump in the AuMo shaft area returned assays up to 8.02 g/t gold and 2.95% zinc. The company discovered a new zone in the south of the property, which returned anomalous assays in gold and arsenic from grab samples. This South Zone was traced over a distance of 136 m through old trenches, rusty zones and quartz veining. The company also completed a short induced polarization survey covering the South Zone as well as surface sampling on the ZamZam, Jowsey and Shenkman zones that returned assays ranging from 0.001 g/t gold to 58.5 g/t gold (Melkior Resources Inc., press release, September 9 and December 2, 2015).

Following the prospecting, the company completed a five-hole diamond-drilling campaign in December to test the AuMo, Jowsey, Shenkman and South zones. The best intersection was 4.4 g/t gold over 2 m from hole MKR-15-06, which tested the Jowsey Zone (Melkior Resources Inc., press release, January 22, 2016).

Metals Creek Resources Corp. – Ogden Property

Metals Creek Resources Corp. completed a three-hole diamond-drilling program on its Ogden property, in Ogden Township, in Timmins. The program targeted the Naybob South Zone and a potential second, parallel mineralized zone in the footwall, which was encountered in previous drilling programs. The holes, OG-15-37, -38 and -39, showed strong albitization of the rock units, with associated pyrite and arsenopyrite. The highlight intersections are reported in Table 4.

The company is planning for additional drilling on both the Thomas Ogden and Naybob South zones (Metals Creek Resources Corp., Management's Discussion and Analysis, November 23, 2015).

Table 4. Intersections from diamond drilling program on Metals Creek Resources Corp.'s Ogden property.

Diamond-Drill Hole	Naybob South Zone Intercept	Footwall Intercept
OG-15-37	4.07 g/t gold over 6.54 m	0.90 g/t gold over 2.54 m
OG-15-38	1.60 g/t gold over 4.98 m including 5.67 g/t gold over 1 m	0.73 g/t gold over 5.62 m
OG-15-39	2.358 g/t gold over 3.98 m	2.84 g/t gold over 8.29 m including 7.03 g/t gold over 2.16 m 2.96 g/t gold over 1.1 m

Rapier Gold Inc. – Pen Gold Project

Rapier Gold Inc. completed geological mapping on the Fox outcrop, located between the mill and the talc mine pit of Imerys' Penhorwood Mine. The company took 51 grab samples, the most significant returning an assay of 20.7 g/t gold. The sample was taken near the vertical projection of the high-grade intersection (the "New Vein Zone"; 13.0 g/t gold over 4.3 m) encountered in hole PG13-108. Gold mineralization is associated with tourmaline-bearing quartz veins that occur at the contact between talc-carbonate rock and intensely carbonatized ultramafic rock. The company completed a seven-hole diamond-drilling program in the area of the Fox outcrop to test the strike and dip of the veins. It also flew a high-resolution aeromagnetic survey over the northern portion of the Pen Gold property (Rapier Gold Inc., Management's Discussion and Analysis, January 27, 2016).

Richmond Minerals Inc. – Ridley Lake Property

Richmond Minerals Inc. completed an induced polarization and a magnetic survey on its Ridley Lake property in Rollo Township. The surveys identified a high chargeability, high resistivity anomaly coincident with a magnetic response. Named the Aguara East anomaly, it has a northeast strike and a length in excess of 825 m (Richmond Minerals Inc., press release, November 19, 2015).

The company completed a six-hole diamond-drilling program—4 diamond-drill holes to test the Aguara East anomaly and 2 diamond-drill holes to test another induced polarization anomaly—without significant results. Each of the diamond-drill holes that tested the Aguara East anomaly intersected gold mineralization associated with intermediate to mafic metavolcanic rocks, and with a porphyry unit. The gold mineralization is widespread, with intersections ranging from 0.42 g/t gold over 44 m to 0.39 g/t gold over 87 m. The highest grade reported was 3.87 g/t gold over 1 m in diamond-drill hole RS15-19 (Richmond Minerals Inc., press release, November 19, 2015).

Sanatana Resources Inc. and Trelawney Mining and Exploration Inc. – Watershed and Clam Lake Properties

Trelawney Mining and Exploration Inc., which has a 80%/20% agreement with Trelawney Augen Acquistion Corporation (TAAC) and Sanatana Resources Inc., explored the Clam Lake property located in Chester and Yeo townships, adjacent to the Watershed property. Trelawney, a subsidiary of IAMGOLD Corporation, completed surface work and trenching, focused on 2 areas of the Clam Lake property: the Hava Deformation Zone and the Pyrite-Sphalerite Zone. The Hava Deformation Zone is characterized by a ductile shear zone along the east-trending contact between quartz diorite and tonalite. The shear zone hosts sheeted boudinaged quartz veins trending east. Sanatana reports that chalcopyrite, pyrite, pyrrhotite and bornite occur along fracture faces. The company also reports accessory telluride

minerals, electrum and visible gold associated with the sulphides. The Hava Deformation Zone is reported to be 300 m in length and has been drilled to a depth of 185 m (Sanatana Resources Inc., press release, November 10, 2015).

The Pyrite-Sphalerite Zone is characterized by a series of narrow quartz sulphide and massive sulphide veins trending at 75°N through tonalite. It is believed, by the company, that both Hava Deformation Zone and the Pyrite-Sphalerite Zone are not related. Assays results for several grab samples from a stripped area were reported: assay values up to 77.5 g/t gold, 0.36% copper, 0.04% lead and 0.13% zinc (Sanatana Resources Inc, press release, November 10, 2015).

Sanatana Resources Inc. released an NI 43-101 compliant maiden resources estimate for the Watershed property, under an option agreement (50/50) with TAAC, which is a subsidiary of Trelawney Mining and Exploration Inc. Based on an open-pit scenario and 25 diamond-drill hole results completed on claim 3011820, the mineral resources comprise an inferred resources of 4.3 million tonnes grading 1.22 g/t gold for 168 700 ounces of gold, at a cut-off grade of 0.3 g/t gold (Sanatana Resources Inc, press release, September 15, 2015).

Xmet Inc. – Blackflake West Project

Xmet Inc. completed a four-hole, 1200 m diamond-drilling program on its Blackflake West project in February 2015. The Blackflake West Project is located 75 km northwest of the town of Hearst. Three holes tested the El Gordo target, a large airborne electromagnetic anomaly, and 1 hole tested the El Nino target, a smaller but more conductive anomaly. All 4 holes intersected “heavy and widespread” sulphide mineralization with sections of semi-massive to massive sulphides as stringers associated with heavy amphibole alteration. The mineralization is hosted by mafic and felsic gneiss interpreted to be of volcanic origin and subject to intense volcanogenic massive sulphide-style hydrothermal alteration prior to metamorphism. The best assay from the El Gordo target returned 0.34% zinc over 4 m, hosted in siliceous metarhyolite with sulphide stringers. The El Nino target returned 0.36% zinc and 503 ppm copper over 3 m in semi-massive to massive sulphide (Xmet Inc., press release, June 19, 2015; Management’s Discussion and Analysis, November 30, 2015).

RESIDENT GEOLOGIST STAFF AND ACTIVITIES

The Timmins Resident Geologist Office was staffed by E. van Hees, Regional Resident Geologist, who started early August 2015; P. Bousquet, District Geologist; and A. Samuel, District Geological Assistant until September 2015. S. Beauchamp served as Acting District Geological Assisant since December 2015. A. Wojtczak provided field and office support under the 2015 Summer Experience Program.

The Timmins Office serves as the regional centre for the Northeastern Ontario Regional Resident Geologist Program. R. Ferguson is the Senior Manager of the Resident Geologist Program. The Northeast Regional Manager position was filled by G. Seim. F. Boucher retired as the Regional Administrative Assistant in June 2015. Her position was filled by J. Delost in August 2015. C. Daniels, D. Draper and A. Wilson were respectively the Northeastern Regional Land Use Geologist, GIS/Data Specialist Northeastern Ontario, and Mineral Deposit Compilation Geologist for Northeastern Ontario.

The Timmins Regional Resident Geologist Office summary statistics are provided in Table 5. The office updated 36 and created 3 new Mineral Deposit Inventory (MDI) points. Assessment files received in 2015 are listed in Table 8 and publications received are listed in Table 7.

Table 5. Summary statistics for the Timmins Regional Resident Geologist Office, 2015.

Product or Service Rendered	Contact Method			
	Office Visit	Phone / E-mail	Remote	Totals
Assessment Files	302	67	0	369
Mining Lands Related	19	3	2	24
Educational	21	7	52	80
General Geological Information	39	71	58	168
Land Use/Planning Related	7	3	0	10
Drill Core Library	6	6	1	13
Publication Sales	1	1	0	2
Technical Advice	20	6	0	26
Other	291	63	0	354
TOTALS	706	227	113	1046

PROPERTY EXAMINATIONS

The staff of the Timmins Regional Resident Geologist office made a number of property visits during the course of the year. Some of these are described below. Property visits provide geological insight into a region and help in identifying indicators that could be evaluated favourable for the discovery of new mineral deposits. Explorationists are encouraged to contact the Timmins office to arrange for a possible visit to their property. The reader is encouraged to use "Activity Reports-Mineral Exploration" data available through the OGSEarth application found on MNDM's Web site to locate and view the locations of property visits discussed below.

North of Horwood Lake

LOCATION AND ACCESS

The outcrop is located approximately 2 km north of Horwood Lake, in Keith Township, and can be accessed by driving 75 km west on Highway 101 from Timmins, and turning left on Horwood Lake Road (Road 616), then by driving down the road for 7 km until an intersection is reached. Turning right towards Hoodoo Lake, drive another 7 km until a bush trail is reached. The outcrop is located 700 m along the bush trail on the south side. The UTM co-ordinates for the outcrop are: Zone 17, 402690E 5326897N.

PREVIOUS WORK

The area was mapped by Ayer (1995) and Breaks (1978). P. Bousquet examined the outcrop in 2014, and visited it this year in order to confirm the anomalous titanium and vanadium analytical results obtained last year.

GEOLOGY

The area to the north of Horwood Lake is underlain by rocks of the Tisdale assemblage (Ayer and Trowell 2001), which were formerly considered to be part of the Horwood assemblage (Jackson and Fyon 1991). The rocks are part of the Horwood assemblage (Jackson and Fyon 1991). The area is characterized

by tholeiitic mafic rocks, with minor sequences of fine-grained clastic and chemical sedimentary rocks, calc-alkalic felsic pyroclastic rocks and komatiitic ultramafic flows (Ayer 1995). Breaks (1979) described the outcrop as being composed of fine-grained to massive mafic to intermediate metavolcanic rocks.

Field observations are that the outcrop is a deformed mafic metavolcanic flow breccia (Photo 1). Sampling in 2014 returned anomalous values in titanium (11 471 ppm) and vanadium (494 ppm) (Bousquet et al. 2015). Three samples were collected from different areas on that outcrop in 2015, and all 3 samples returned anomalous titanium and vanadium values (9722 to 11 480 ppm titanium, 429 to 494 ppm vanadium).

However, a donated file in the Timmins Resident Geologist Office relates of a grabbed sample that returned an assay of 4% titanium (Linekar 1967; MDI000000001407). Strangely, the area prospected is 20 km away in the township west of Keith Township: Ivanhoe Township. However, no further work was pursued in the area, which is now located in Ivanhoe Lake Provincial Park.

Photo 1. Mafic flow breccia from the North of Horwood Lake outcrop.

West of Hanrahan Lake

LOCATION AND ACCESS

The area is located approximately 1 km west from Hanrahan Lake in Penhorwood Township. The area is accessed by driving 55 km west on Highway 101 from Timmins, and turning left on Kenogaming Road. Follow Kenogaming Road for 8 km until reaching the fork of Penhorwood Road. Take right on Penhorwood Road and follow it for 4 km. A narrow bush road on the south of the Penhorwood Road leads to the outcrop. The UTM co-ordinates are: Zone 17, 424010E 5334716N.

PREVIOUS WORK

The immediate area was investigated in the 1950s for iron by Kukatush Mining Corporation Ltd. (Low 1960). The iron formation appears at the intersection of Penhorwood Road and the narrow bush road leading to the area of interest. Quinterra Resources Ltd. mapped the area and performed a ground magnetic survey in the early 1980s (Hallé 1984). Grab samples taken for assay returned anomalous amounts of zinc (~5%) and silver (~11.5 ppm). Mrs Fred Ross, George Ross and Roger Denomee prospected intensively in the area in the late 1980s to early 1990s. Sampling of trenched and stripped areas returned some low values in gold and appreciable zinc (Morin 1991).

In the mid 1990s, Band-Ore Resources completed geological mapping, an induced polarization survey and a ground magnetic survey (Durham 1996). Band-Ore drilled one diamond-drill hole on an induced polarization anomaly, but did not report any anomalous gold values. Golden Chalice Resources Inc. explored the area between 2005 and 2010, completing a long list of work: airborne geophysical survey, sampling and assays, ground geophysical surveys, stripping, geochemical survey, diamond drilling and assays (Montgomery 2010). The drill holes intersected some disseminated sphalerite zones within ash tuffs, and a narrow semi-massive sulphide zone at the contact between a sulphidic chert horizon and peridotites (Montgomery 2010). The felsic ash tuff returned an intersection of up to 3.46% zinc over 0.75 m (TW-10-2, Montgomery 2010). The most recent work in the area was a ground magnetic survey performed by Rogue Resources Inc. (Grant 2012).

GEOLOGY

The Hanrahan Lake area rocks are part of the Deloro assemblage (Jackson and Fyon 1991). The area is characterized by an anticline plunging 65° to the northwest. The core of the anticline consists of intermediate to feldspar-phyric, fragmental metavolcanic rocks of greenschist to amphibolite facies, intruded by ultramafic bodies (Milne 1972). The ultramafic intrusions occur as conformable sheets of serpentinite, paralleling the country rock foliation and conforming to the major folding (Milne 1972). This fold core is capped by an oxide-facies iron formation consisting of chert, magnetite and iron-rich silicate (Milne 1972). The core and the iron formation are enclosed by mafic metavolcanic rocks, except on the Akweska Lake side, where it is in contact with a hornblende-biotite granodiorite (Milne 1972). The primary features in the volcanic rocks are erased partially by an east-striking foliation axial planar to the anticline (Milne 1972). Late mafic intrusive rocks cut the fold.

The outcrop of interest is a stripped exposure, possibly left by Golden Chalice, showing dark green mafic to intermediate metavolcanic rocks to the north side and white to pinkish green syenite to the south. The metavolcanic rocks show sparse iron staining, and contain 1 to 40 cm thick quartz veins. Both the metavolcanics rocks and the syenite are truncated by a north-striking (330°) magnetic diabase dike, probably of the Matachewan swarm, which seems to have bleached the syenite (Photo 2).

Four grab samples were collected from the area and were analysed for gold, silver and trace elements. No anomalous gold or silver value were obtained. Interestingly, a sample of mafic metavolcanic rocks returned 1788 ppm in barium, which is considered anomalous. The site is in close proximity to a fault associated with the Cryderman-Ravenna barite deposit 12 km to the southwest.

CONCLUSION AND RECOMMENDATION

The West of Hanrahan Lake area seems to have some potential for volcanogenic massive sulphide (VMS) deposits. This is supported by the anomalous barium, as it can be associated with some VMS deposits. Golden Chalice Resources Inc. drilling did intersect anomalous values of silver and zinc in rocks in the area, as outlined in Montgomery (2010), further hinting at VMS mineralization potential.

Photo 2. West of Hanrahan Lake outcrop, showing the intensely bleached rocks truncated by a north-striking (330°) diabase dike. A. Wojtczak is sampling the metavolcanic rocks.

RECOMMENDATIONS FOR EXPLORATION

Targeting Nickel in the Timmins Area

The Timmins District is known for its rich, 100 year-long history of mining and exploration for gold. Nickel, although it does not have the same notoriety as gold, has also had a mining and exploration history of 100 years in the Timmins District. The geology of the Timmins District is favourable for several types of nickel deposits that vary in grade, tonnage and origin. Descriptions of the nickel deposits discovered in the Timmins District are summarized.

KOMATIITE

Komatiites are the extrusive equivalent of a peridotite intrusion. Komatiite lavas spread at very high temperature (~1600°C) and very low viscosity. These lavas can be easily identified by the texture represented by skeletal blades of olivine or needles of pyroxene called “spinifex”. When these lavas are contaminated by a sulphur source, an immiscibility results, which allows the precipitation of metal sulphides. These metal sulphides then precipitate at the bottom of the flow (Arndt, Lesher and Barnes 2008). The nickel deposits formed are of relatively low tonnage (<5 Mt), but are of fair grade (0.5 to 3% Ni).

In Timmins, most of the past-producing nickel mines are located in the Shaw Dome. The Shaw Dome is composed of 2 volcanic episodes: the Deloro assemblage (2734–2724 Ma) and the Tisdale assemblage (2710–2704 Ma) (Préfontaine 2014). The komatiites are located at the bottom of the Tisdale assemblage in close contact to the Deloro–Tisdale assemblages boundary where many of the nickel deposits have been mined. Nickel, hosted within Shaw Dome rocks, was produced from the following mines: Langmuir #1 (MDI42A06SE00095), Langmuir #2 (MDI42A06SE00006), McWatters (MDI42A06SE00062) and Redstone (MDI42A06SE00080) (Ontario Geological Survey 2015).

Similar to the Shaw Dome, the Bartlett Dome is composed of the same 2 volcanic episodes: the Deloro (2734–2724 Ma) and the Tisdale (2710–2704 Ma) assemblages (Préfontaine 2014). The nickel potential of the Bartlett Dome is proven by the past-producing Texmont Mine in Bartlett Township.

PERIDOTITE

Peridotite-hosted nickel deposits follow the same immiscibility phenomenon as the komatiite-hosted deposits. However, the immiscibility occurs in a magmatic chamber where sulphide-rich liquid separates itself from the magma during the cooling process. That can occur through cooling, silication, sulphur assimiliation and magma mixing (Evans 1993). These nickel deposits are hosted within a layered intrusion, with a layer of sulphides located in the lower part of the intrusive body. The peridotite-hosted nickel deposits can also coincide geographically with komatiite flows, like at the McWatters Mine, located in the Langmuir Township.

The Montcalm Gabbroic Complex, in Montcalm, Nova, Strachan and Belford townships, is an example of a peridotite-hosted nickel deposit. From 2004 to 2009, the Montcalm Mine produced 3 931 610 tonnes of ore at a grade of 1.25% Ni, 0.67% Cu and 0.051% Co (Atkinson et al. 2011). The orebodies are located at an intermediate level within clinopyroxene plagioclase cumulates (Barrie 1990). The geology of the deposit reveals that the sulphides were remobilized from a more pyroxenitic rock, either deeper within the Montcalm Gabbroic Complex, or from a separate intrusion (Barrie 1990). There may be a possibility that another Montcalm deposit exists in the area.

In recent years, other peridotite-hosted nickel deposits are being targeted in the Timmins District. These orebodies have low sulphur content, but the non-sulphidic nickel is not retained in the silicates entirely, but in a nickel-iron alloy: awaruite. In Quebec, Royal Nickel Corporation’s Dumont nickel project orebody displays the same characteristics. The Dumont sill is estimated to hold “approximately 6.9 billion pounds of nickel in the proven and probable reserve categories” (Royal Nickel Corporation, news release, June 17, 2013, p.6). Noble Mineral Exploration Inc.’s Project 81 explored an ultramafic intrusion in Kingsmill Township, which yielded average results, yet found the presence of awaruite (Noble Mineral Exploration Inc., news release, August 22, 2012). But there are other peridotitic plutons or sills that may be host to an orebody.

The Hanrahan Lake area is located in the eastern part of the northern Swayze greenstone belt, in Kenogaming and Penhorwood townships (Figure 6). The area is characterized by an anticline cored by felsic to intermediate calc-alkalic metavolcanic rocks that are capped by an iron formation, which in turn is overlain by mafic metavolcanic rocks (*see also* "Property Examinations"). The felsic to intermediate metavolcanic rocks are cut by mafic and ultramafic intrusions. Some of these ultramafic bodies show cumulate texture and, thus, could be regarded as being sills. These ultramafic bodies comprise approximately 20% of the core of the anticline, and can be up to 15 km in length and 500 m in width (Ayer 1995).

In 1971, International Norvalie Mines Ltd. drilled one of these intrusions. Samples from 1 diamond-drill hole (*see* Hole #4 on Figure 6) returned assays grading 0.2% to 0.26% Ni, over a length of 51 feet in the bedrock (International Norvalie Mines Ltd. 1971). Sections of the core from this diamond-drill hole displaying sparse sulphides are stored in the Timmins Regional Resident Geologist Office Drill Core Library. The hole was drilled to try to duplicate results from a hole drilled in 1957 that intersected 1020 feet of rock at a grade of 0.26% Ni (International Norvalie Mines Ltd. 1971). Other samples and work within the Hanrahan Lake area demonstrate the potential for the discovery of a potentially economic nickel deposit.

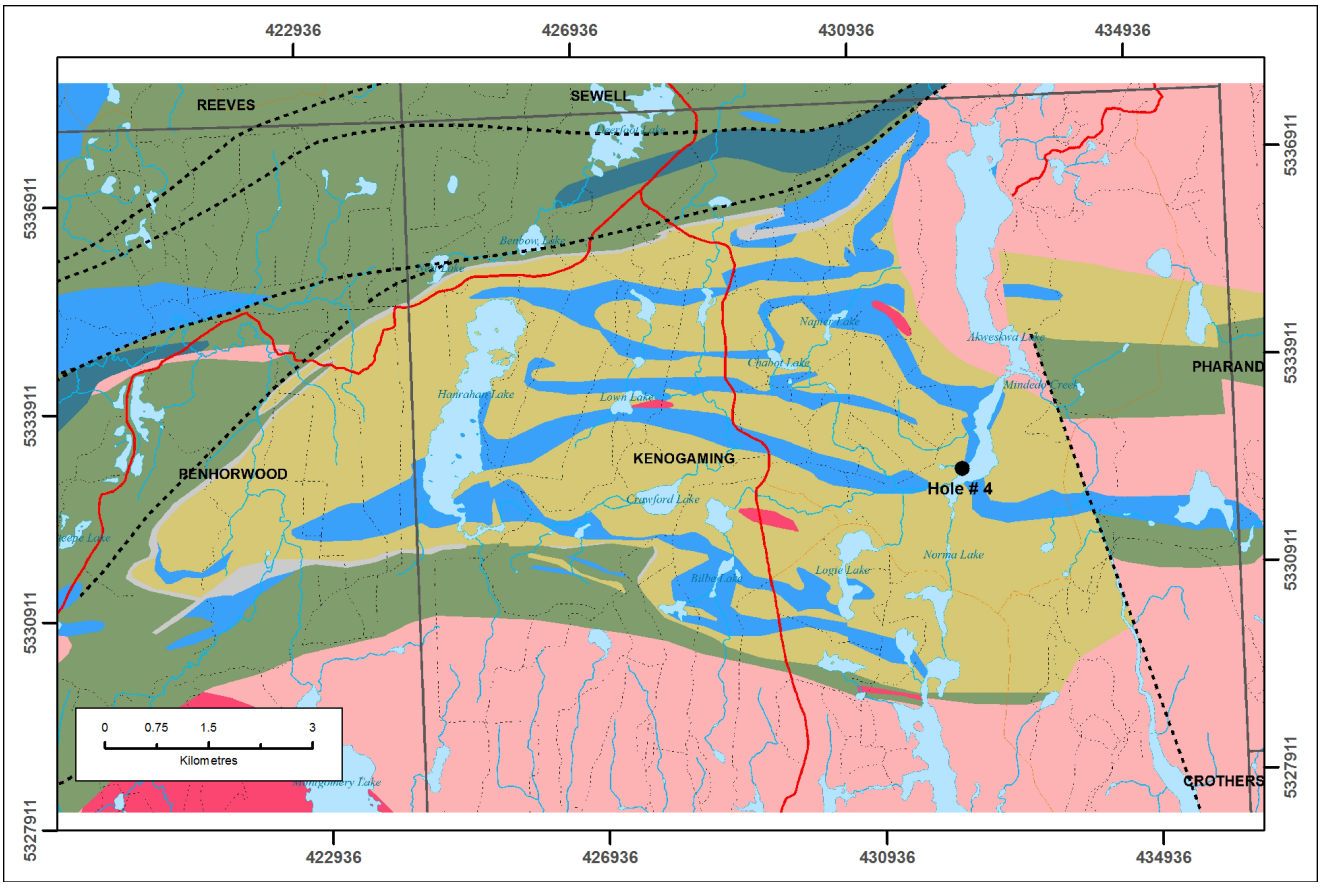


Figure 6. The location of the Hanrahan Lake area in Penhorwood and Kenogaming townships, also showing the location of International Norvalie Mines Ltd. diamond-drill hole #4 (432235E 5332386N) (geology *from* Ayer 1995).

Gold in Overburden

Pamorex Minerals Inc. discovered the largest and richest "documented" overburden gold anomaly in the Porcupine Mining Camp in 1986 (Anonymous 1986a). Located in the south half, Lot 6, Concession 4 of Matheson Township (Figure 7, Location 1), the highest-grade part of the Pamorex Matheson North anomaly extends over a 600 by 425 m area and has 20 samples that contain more than 10 000 ppb Au (in concentrate), including 7 samples with more than 100 000 ppb Au (one assayed 616 017 ppb Au), as well as pyrite.

Nine other gold-bearing overburden anomalies are known in the area south of the Pipestone and Buskegau River faults and are listed in Table 6.

There are at least 4 other areas where tight clusters of overburden drill holes, some drilled in successive years, might indicate that gold-bearing overburden was discovered. These areas are shown on Figure 7 as Location 11 (St. Joe Minerals Corporation) and Locations 12, 13 and 15 (Cominco Ltd.). A fifth cluster of overburden drill holes (Location 14) was drilled by Brightwest Resource Exploration Inc., but these drill holes only sampled the bedrock.

Table 6. Overburden gold anomalies in the eastern Porcupine Mining Camp.

Location No.	Anomaly Name	Highest Gold Value ppb Au (in concentrate)
1	Pamorex North	616 017
2	Pamorex South	64 972
3	BHP West	36 900
4	Asarco/Falconbridge	120 000
5	Falconbridge	15 000
6 and 7	Kangeld	3 663
8	BHP East	31 700
9	Falconbridge North	100 000
10	Falconbridge East	220 000

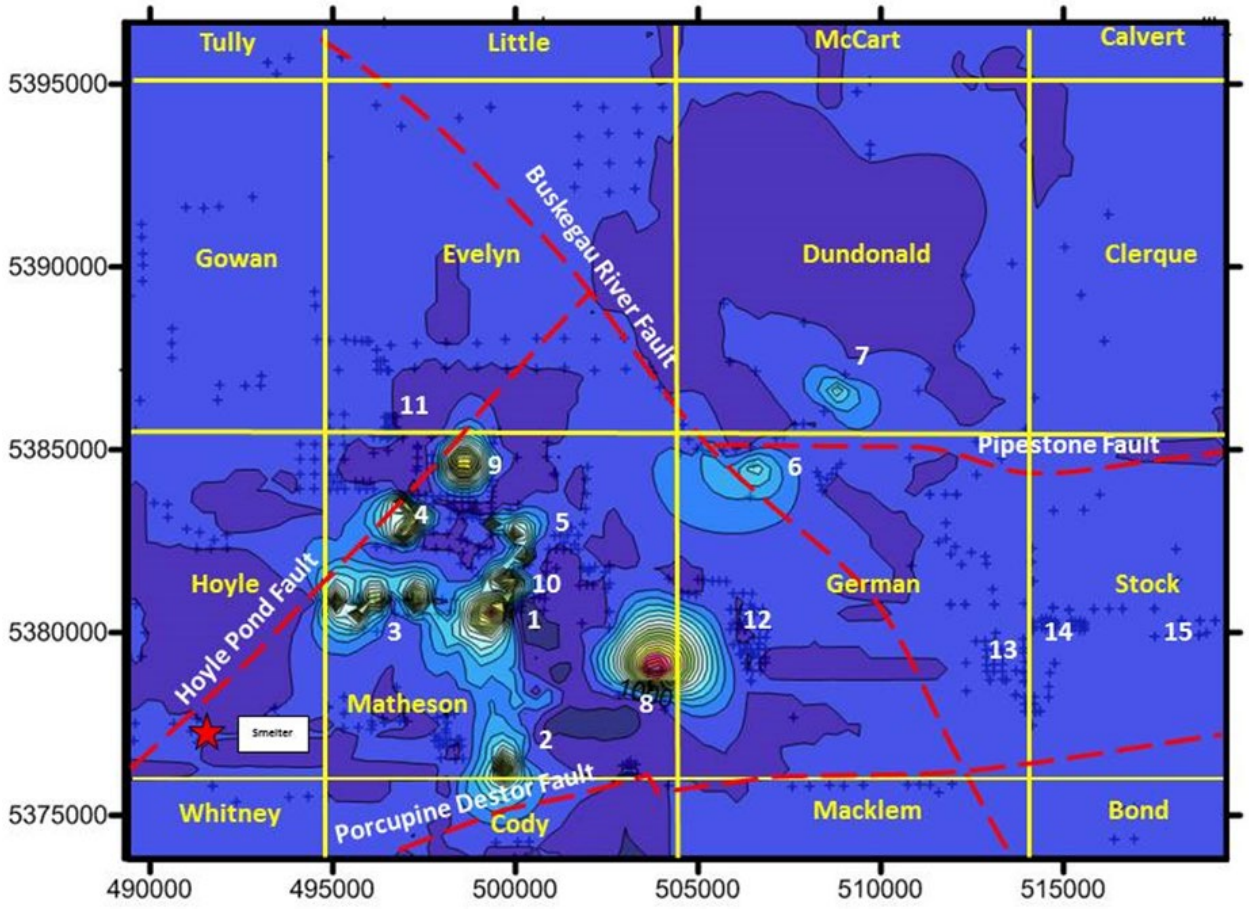


Figure 7. Contoured gold content of heavy mineral concentrates (in parts per billion – ppb) separated from overburden samples recovered by reverse circulation drilling, Timmins area. All high gold values were cut to 10 000 ppb. Drill holes without reported assays were cut to 10 000 ppb. Drill holes without reported assays were assigned a value of 5 ppb to permit contouring of the results. The contour interval is 500 ppb Au. Purple-coloured areas indicate those with the lowest values gold values and red, those with the highest gold values. Numbers on the map indicate anomalies discussed in the text and in Table 6. "Smelter" is the location of the Kidd Creek metallurgical complex. The red star is the location of the Hoyle Pond Mine. Plus signs ("+") indicate drill-hole locations.

BEDROCK TOPOGRAPHY

Bedrock topography in the area, as determined from overburden and diamond-drill assessment data, ranges from 185 to 315 m above sea level (Figure 8). A prominent, 50 m deep, north-northwest-trending bedrock valley with a floor that drops from an elevation of about 240 m at the north end to about 210 m at the south end, cuts the map area. The 30 m increase in depth of the valley over its 25 km length results in an overall south gradient of 1.2 m/km.

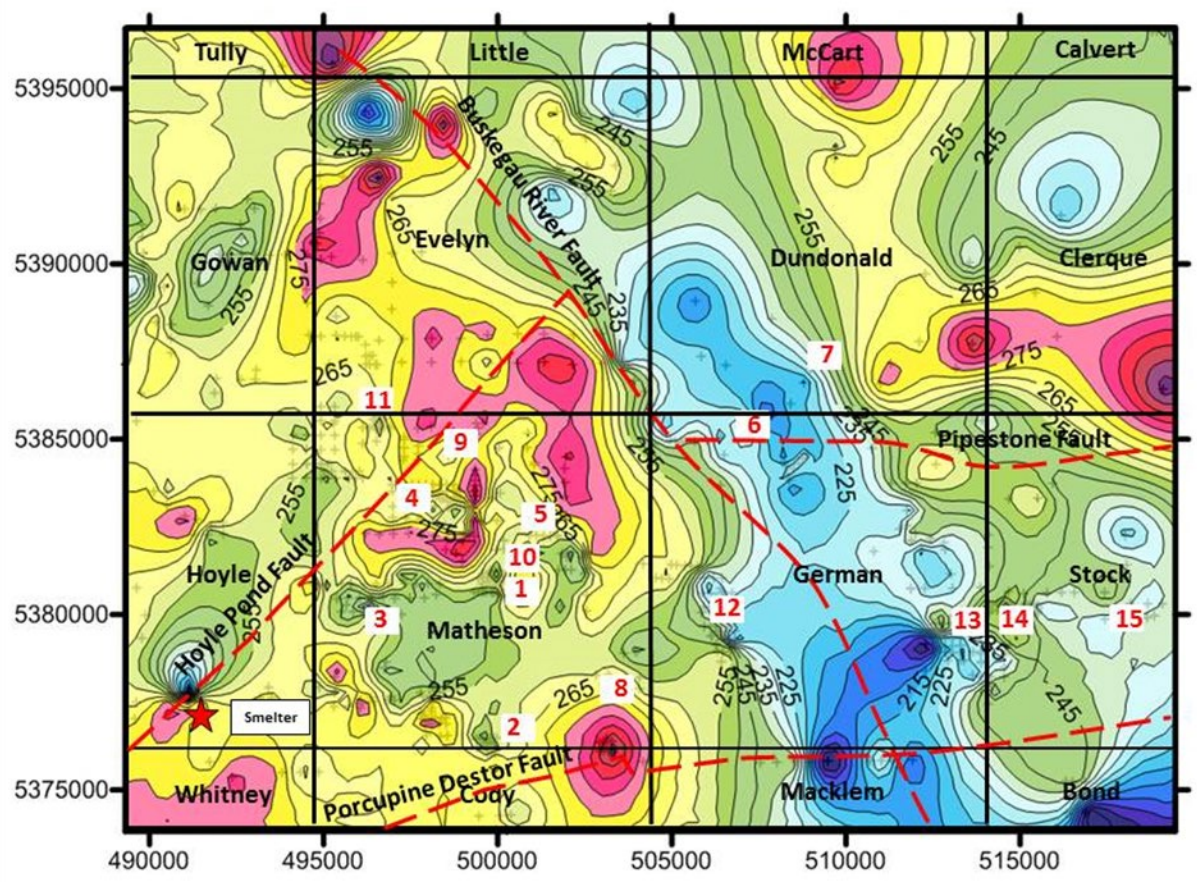


Figure 8. Bedrock topography map, Timmins area, constructed by subtracting overburden thickness, obtained from drill-hole data submitted for assessment credit ("+" symbols indicate hole location), from land surface elevation obtained from Google Earth™ mapping service. The bedrock surface was generated using the Kriging method and is contoured at 5 m intervals (red-coloured areas on the map have the highest elevations; dark blue, the lowest). The numbers on the map correspond with the overburden anomalies discussed in the text. "Smelter" is the location of the Kidd Creek metallurgical complex. The red star is the location of the Hoyle Pond Mine.

A number of other bedrock valleys are present in the map area (*see* Figure 8), including

- A 6 km long north-trending valley that extends northward from the Pamorex North overburden anomaly (Location 1, 500000E 5381000N) to a topographic high (500000E 5387000N);
- a 20 km long east-trending valley that extends eastward from the projected Hoyle Pond Fault (495000E 5381000N) to the western edge of the deep bedrock valley (507000E 5379000N);
- a 5 km long east-trending valley that extends westward from the centre of Matheson Township (499000E 5383000N) to just inside Hoyle Township (494000E 5383500N) near the projected Hoyle Pond Fault;
- a broad east-northeast-trending valley that extends from the centre of Dundonald Township (510000E 5390000N) through the northwest corner of Clergue Township (519000E 5394000N);
- a northeast-trending valley that extends from central Gowan Township (490000E 5390000N) into the northwest corner of Evelyn Township (497000E 5395000N) to near the Buskegau River Fault; and
- a valley that appears to follow the northern end of the Buskegau River Fault into Evelyn Township (498000E 5393000N) from the deep valley (505000E 5389000N).

The northeast-trending Hoyle Pond Fault, which is intimately associated with gold mineralization in the Hoyle Pond Mine (Rhys 2015), appears to continue to the Buskegau River Fault based on the termination of bedrock topographic highs and rapid changes in elevation.

The 6 km long valley that hosts the Pamorex North gold anomaly (Figure 8, Location 1) drops 25 m from a topographic high of about 275 m to less than 250 m at its southern end and has a gradient of 4.0 m/km. This gold anomaly occurs just topographically upstream of the junction where the 6 km long valley meets the 20 km long east-trending valley and is 5 to 10 m higher than the floor of the east-trending valley. The Falconbridge gold overburden anomaly (Figure 8, Location 5) occurs about 2.5 km north and topographically upstream of the Pamorex North anomaly.

The 20 km long east-trending bedrock valley hosts the BHP West gold anomaly at its western end (Figure 8, Location 3), the BHP East gold anomaly about 4 km from the eastern end (Location 8), and another overburden gold anomaly at the eastern end (Location 12), as indicated by a cluster of Cominco drill holes. The 4 km long BHP West anomaly occurs along the northern edge of the valley where the elevation drops from 280 m to 250 m. The western end of this gold anomaly occurs in close proximity to the proposed projection of the Hoyle Pond Fault. The BHP East anomaly occurs on the south side of the valley, about 2 km north of the Destor–Porcupine Fault, in a valley that trends and slopes to the northeast. A large cluster of overburden drill holes located at the east end of the 20 km long valley, where it drops 25 m over 0.5 km into the deep north-northwest-trending valley (Figure 8, Location 12), suggests that a Cominco exploration program encountered a gold anomaly. The lack of drill-hole data along the length of east-trending valley results in it being poorly defined and not having an obvious drop in elevation.

The 5 km long valley associated with the Asarco/Falconbridge gold anomaly (Figure 8, Location 4) extends west from central Matheson Township and drops 15 m from a topographic high of about 275 m to 260 m at its western end, resulting in a gradient of 3.0 m/km. The Asarco/Falconbridge anomaly occurs along the northern edge of the valley where the elevation drops more than 5 m from a 270 m high terrace to the valley floor at less than 265 m. The west end of this anomaly is located close to the projected extension of the northeast-trending Hoyle Pond Fault.

The broad valley that extends east-northeast from Dundonald into Clergue Township is similar in depth to the prominent 50 m deep north-northwest-trending valley. The broad valley is oriented parallel to the direction of the earliest glaciation event in the Timmins area (MacNeil and Averill 1996). The weak Kangeld gold anomaly (~3600 ppb Au) occurs where the 2 deep valleys meet (Figure 8, Location 7). The second Kangeld gold anomaly occurs on the west side of the northwest-trending valley (Location 6).

There is an irregular-shaped, northeast-trending valley defined by a string of bedrock lows that extends from Gowan into Evelyn Township and is up to 25 m deep. There are no known overburden gold anomalies or clusters of drill holes in this valley.

The northwest-trending valley that follows the Buskegau River Fault is approximately 35 m deep and drops from 260 m at the northwest end to 220 m at the southeast end. This 40 m drop over 8 km results in the valley having a gradient of 5 m/km. This valley might be a finger extending off from, or a bifurcation in, the prominent north-northwest-trending valley. There are no known overburden gold anomalies or clusters of drill holes in this valley.

CHARACTER OF OVERBURDEN GOLD

Heavy mineral separates prepared from the Pamorex North overburden samples (*see* Figure 7, Location 1) contained a total of 156 gold grains. The grain-size distribution of this gold is comparable to that found in gold-bearing veins at the Dome and Pamour mines and coarser than gold grains found in wallrock-hosted mineralization at these same deposits (Figure 9) (van Hees 2000). These gold grains are predominantly

irregular in shape and frequently accompanied by 10 to 50% pyrite (in concentrate), as well as hematite and ilmenite. Only a trace amount of arsenopyrite was found in some mineral separates.

Heavy mineral separates prepared from overburden samples recovered from the BHP overburden anomalies contained 897 gold grains of which 793 occurred in the west anomaly and 104 in the east anomaly (Figure 7, Locations 3 and 8, respectively). The gold grains are predominantly reshaped (56%) or modified (32%) in habit, and are accompanied by pyrite and cobaltite 92% and 50% of the time, respectively. Ninety-six percent of the gold grains recovered from drill hole MA-96-2 at the east end of the BHP west anomaly are pristine in habit (MacNeil and Averill 1996).

Other than the assay values, there is no information available about the shape of the gold grains or gangue minerals collected in the heavy mineral concentrate for both the Asarco/Falconbridge and Falconbridge overburden anomalies (Figure 7, Locations 4 and 5, respectively); (van Hees et al. 1989; MacRae 2008).

Gold grains in the Kangeld overburden anomalies (Figure 7, Locations 6 and 7) are primarily reshaped or modified, with only a few having a pristine, or delicate, habit. These gold grains are almost always accompanied by arsenopyrite (Hutteri 1988).

Overburden drilling conducted by Brightwest Resource Exploration Inc. (Figure 7, Location 14) differs from all other programs in the area because it sampled only bedrock and not the overburden (Karvinen 1989).

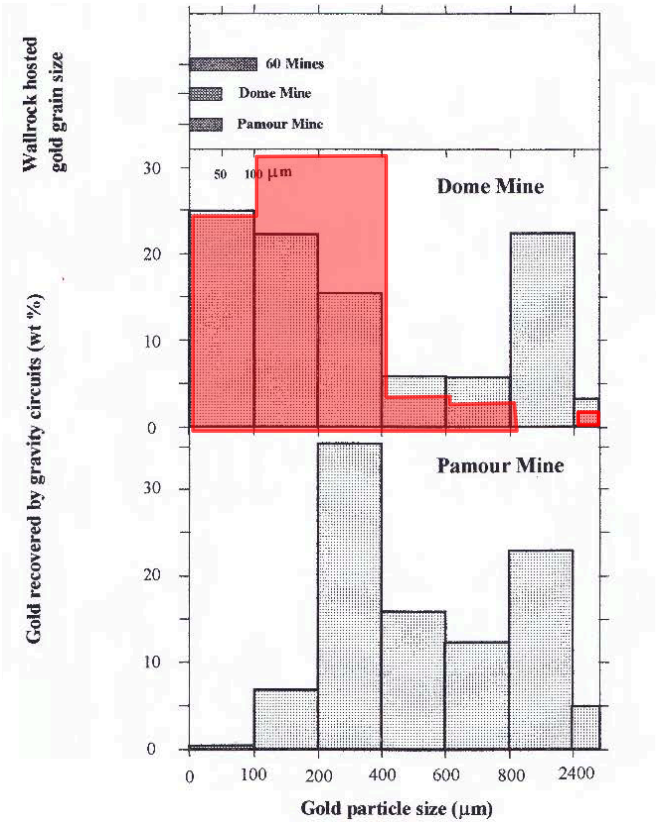


Figure 9. Grain size of gold recovered by gravity circuits in the Pamour and Dome mines compared to that of gold in wallrock-hosted deposits. Gold observed in polished sections of wallrock-hosted mineralization is smaller than most free gold recovered in the gravity mill circuits at both the Pamour and Dome mines. This difference indicates that the bulk of the gold recovered by gravity circuits cannot be derived from wallrock-hosted mineralization and must originate from vein-hosted deposits. The grain size of the 156 gold grains recovered from North Matheson overburden (in red) is comparable to that found in veins at the Pamour and Dome mines by van Hees (2000).

KNOWN BEDROCK GOLD SOURCES

There are 2 known bedrock sources of gold near the Pamorex North overburden anomaly (Figure 7, Location 1). The first, intersected in diamond-drill hole DMA2, is a 1 m wide vein that contains 2.5 g/t Au. Asarco Exploration Company of Canada Limited spotted this hole about 1 km north of the overburden anomaly (499855E 5382349N) (van Hees et al. 1989). The Porcupine Joint Venture (51% Goldcorp Inc. and 49% Kinross Gold Corporation) discovered the second bedrock source when they drilled hole MT04-22 (498948E 5383654N) in 2004 and encountered a 0.45 m wide vein containing 2.16 g/t Au about 2.5 km north-northwest of the overburden anomaly (Waychison 2005).

ORIGIN OF GOLD ANOMALIES

The Pamorex North and other overburden gold anomalies might have been formed by a number of different processes that affected the area, including (1) concentration by a stream into a placer deposit, before or after glaciation; (2) weathering of bedrock to form a regolith; or (3) erosion of bedrock by a glacier to form a till. Knowing the process that formed the gold anomalies has implications for finding their bedrock source(s).

Seven gold values, between 100 000 and 600 000 ppb Au, in the Pamorex North heavy mineral fraction are equivalent to gold values of between 0.08 and 1.8 ppm (1:350 concentrate) in the original overburden and appear to support the idea of the anomaly being formed by a gold concentrating process. A fast-flowing river could readily form a placer gold deposit and would account for the abundance of sand and/or gravel in many of the gold-bearing samples (Anonymous 1986a). A fluvial process is also consistent with the close proximity of the anomaly to extensive gravel deposits and a greater than 100 km long esker (Lee 1979a, 1979b). The location of the Pamorex North anomaly in the north-trending valley and topographically above the flat-dipping east-trending valley (Figure 8, Location 1) is also consistent with the formation of a gold placer. Additionally, the 2 known gold-bearing veins located in bedrock about 1 and 2.5 km north and topographically upstream from the Pamorex North anomaly indicate that there are gold-bearing bedrock sources nearby.

Formation of a regolith by weathering could concentrate gold to form the Pamorex North anomaly, but follow-up diamond drilling (9 holes) did not encounter weathered bedrock or gold-bearing mineralization underlying the anomaly (Anonymous 1986a). Consequently, it is unlikely that the Pamorex North anomaly was formed by weathering.

Erosion of bedrock by glaciers causes gold mineralization to disperse in a down ice direction and would be inconsistent with high gold values like those found in Pamorex North anomaly or gold-bearing sediment depths of 20 m (Anonymous 1986a; MacNeil and Averill 1996). Additionally, sediment transported by a glacier originating from the northeast (e.g., Dundonald–Clergue valley) is likely to further disperse entrained gold when it passed through the 60 m deep north-northwest-trending bedrock valley.

The location of the BHP gold anomalies (Figure 8, Locations 3 and 8) in the 20 km long east-trending valley supports the hypothesis that they formed as placer deposits. Gold required to form the BHP anomalies might have been derived from (1) a topographic high north of the BHP west anomaly; (2) bedrock near the projected Hoyle Pond Fault; (3) sediment that washed past the Pamorex North anomaly to form the BHP east anomaly; or (4) a topographic high located south of the BHP east anomaly.

The pristine shape of gold grains found at the eastern end of the BHP west anomaly (Figure 7, Location 3) suggests that they were derived from a nearby bedrock source area, located just north of the valley. The dominantly abraded- to irregular-shaped gold grains found in the rest of the anomaly indicate that the gold

was derived from a bedrock source located more than 1 km away (MacNeil and Averill 1996). The abundant cobaltite accompanying this gold suggests both originated near ultramafic rocks. The west end of the anomaly lies near the projected Hoyle Pond Fault and is underlain by mafic and ultramafic rocks (Berger 1994) like those found in the Hoyle Pond and Owl Creek mines. The area near the projected Hoyle Pond Faults meets all the criteria of a possible source for the gold.

The Asarco/Falconbridge gold anomaly (Figure 8, Location 4) extends from 1 to 4 km downslope, to the south and west, of the second known bedrock gold source (498948E 5383654N; Waychison 2005), as well as close to the projected Hoyle Pond Fault. The close proximity of the Asarco/Falconbridge overburden anomaly to a known bedrock source suggests that the gold might be derived from the general area. The west end of the anomaly occurs close to both the projected Hoyle Pond Fault and to mafic and ultramafic bedrock (Berger 1994). The presence of both favourable structure and host rock support the suggestion that gold in the overburden anomaly might have originated from that general area. The lack of gold grain or heavy mineral descriptions precludes making any comments about transport distance or rock type in the source area.

The Falconbridge anomaly (Figure 8, Location 5) might also originate from a bedrock source located to the north or northwest and be related to the second known bedrock gold source.

The Kangeld gold anomalies (Figure 8, Locations 6 and 7) have lower gold values that are only 5 to 10% of those reported elsewhere and are associated with arsenopyrite most of the time. The close association of gold with arsenopyrite indicates that it likely originated from a sediment-hosted vein(s) (van Hees et al. 1989).

The Falconbridge North anomaly (Figure 8, Location 9) is defined by a single analytical result and no detailed sample descriptions (MacRae 2008). All that can be said about this anomaly is that it is located close to the projected Hoyle Pond Fault and to underlying mafic and ultramafic bedrock (Berger 1994).

The Falconbridge East anomaly (Figure 8, Location 10) is also defined by a single analytical result and no detailed sample descriptions (MacRae 2008). All that can be said is that it is located close to and northeast of the Pamorex North anomaly and the first known bedrock gold source.

SUMMARY

In summary, the Pamorex North anomaly appears to have been produced in a fluvial environment by a stream that flowed south from a topographic high. The source of the anomaly is likely more than 1 km from the anomaly. There are 2 other overburden anomalies located to the north and east, as well as 2 known bedrock gold sources to the north. Further exploration to the north of the anomaly is warranted.

Three different overburden anomalies (Figure 8, Locations 3, 4 and 9) are all closely associated with the northeast projection of the Hoyle Pond Fault where it cuts mafic and ultramafic bedrock units. The importance of the projected Hoyle Pond Fault as proposed, and other as-yet–unrecognized, northeast-trending faults that coincide with northeast-trending bedrock valleys (e.g., McGowan to Evelyn Tp.), should be taken into account when exploring the area.

Gold grains found in 1 overburden hole at the east end of the BHP west anomaly (Figure 8, Location 3) are predominantly pristine (92%), suggesting that the vein system source is located in bedrock just north of the hole.

Arsenopyrite found with gold in the Kangeld anomalies (Figure 8, Locations 6 and 7) indicates that the bedrock source is vein-hosted in metasedimentary rocks. There are large parts of Dundonald, Evelyn, German, Gowan, Little and Tully townships that have comparable geology and limited exploration history.

RESEARCH BY OTHERS

Academic research activities in the Timmins District in 2015 are listed below. Publications received in the Timmins District Geologist office during 2015 are listed in Table 7.

L. Brengman, University of Tennessee, is studying quartz genesis in banded iron formation, chert and silicified volcanic rocks in hydrothermal systems and near VMS deposits in the Rouyn, Timmins and Kirkland Lake area.

R. Campbell, University of Western Ontario, has completed an MSc thesis entitled Controls on Syenite-Hosted Gold Mineralization in the Western Timmins Camp.

E.C.G. Hastie, as part of a four-year PhD study of gold mineralization in the southern Swayze greenstone belt, conducted field work on the Kenty and Rundle deposits. Results were summarized in Hastie, Lafrance and Kontak (2015).

D. Lafontaine, Lakehead University, continued an MSc thesis studying the structural control on the Borden gold deposit, Chapleau, Ontario. The project is being supervised by Dr. M.L. Hill.

S. West, Lakehead University, has started an HBSc thesis on the paleoweathering effects of the Albany graphite deposit. The project is supervised by Dr. A. Conly.

Q. Wu continued work on his PhD thesis studying the structural evolution of the Swayze greenstone belt and its implications on Neoarchean tectonics. In the 2015 field season, structural mapping was carried out in both the central and the southern part of the Swayze greenstone belt to compare the deformation patterns between 2 major high-strain zones in the area: the Rundle high-strain zone and the Ridout high-strain zone. Results were summarized in Wu and Lin (2015).

Table 7. Publications received by the Timmins District Resident Geologist office in 2015.

Title	Author	Type and Year of Publication
Zircon alteration in wallrock of Pamour and Hoyle Pond Au deposits, Abitibi granite-greenstone belt: Constraints on timescales of fluid flow from depth-profiling techniques	J.M. Bachtel	MSc Thesis, University of Ottawa, 2010
Report of Activities 2014, Resident Geologist Program, Timmins Regional Resident Geologist Report: Timmins and Sault Ste. Marie Districts	P. Bousquet, A. Pace, C.M. Daniels, R.L. Debicki, A.C. Wilson, A. Samuel and A. Yukich	Ontario Geological Survey, Open File Report 6304, 2015
Controls on syenite-hosted gold mineralization in the western Timmins camp	R.A. Campbell	MSc Thesis, University of Western Ontario, 2015
Exploring for iron oxide copper-gold deposits – Canada and global analogues	L. Corriveau and H. Mumin	Geological Association of Canada, Short Course Notes 20, 2010
McFaulds Lake ("Ring of Fire") area stream sediment geochemistry	R.D. Dyer and L.A. Handley	Ontario Geological Survey Miscellaneous Release—Data 321, 2015
Summary of Field Work and Other Activities, 2015	R.M. Easton, A.F. Bajc, S.M. Hamilton, S. Préfontaine, M. Duguet, O.M. Burnham, J.R. Parker and R.D. Dyer, eds.	Ontario Geological Survey, Open File Report 6313, 2015
Results of regional till sampling in the Detour Lake and Burntbush area, northern Ontario	C. Gao	Ontario Geological Survey, Open File Report 6297, 2015
Till sample and indicator mineral data for the Detour Lake and Burntbush area, northern Ontario	C. Gao	Ontario Geological Survey, Miscellaneous Release—Data 312, 2015

Title	Author	Type and Year of Publication
Report of Activities 2014, Resident Geologist Program, Kirkland Lake Regional Resident Geologist Report: Kirkland Lake and Sudbury Districts	D.L. Guindon, D.G. Farrow, J. Suma-Momoh, C.M. Daniels, R.L. Debicki, L.A.F. Hall and N. Sabiri	Ontario Geological Survey, Open File Report 6305, 2015
Report of Activities 2014, Resident Geologist Program, Red Lake Regional Resident Geologist Report: Red Lake and Kenora Districts	A.F. Lichtblau, C. Ravnaas, C.C. Storey, A. Tims, R.L. Debicki, T.K. Pettigrew, A.C. Wilson and J. Wetendorf	Ontario Geological Survey, Open File Report 6301, 2015
Ore mineral atlas	D. Marshall, C.D. Anglin, and H. Mumin	Geological Association of Canada, 2011
Airborne magnetic and electromagnetic surveys, residual magnetic field contours with electromagnetic anomalies and keating coefficients, Kabinakagami Lake area	Ontario Geological Survey	Ontario Geological Survey Maps 82738 to 82753, 2015
Airborne magnetic and electromagnetic surveys, colour-filled contours of the residual magnetic field and electromagnetic anomalies, Kabinakagami Lake area	Ontario Geological Survey	Ontario Geological Survey Maps 82754 to 82757, 2015
Airborne magnetic and electromagnetic surveys, shaded colour image of the second vertical derivative of the residual magnetic field and keating coefficients, Kabinakagami Lake area	Ontario Geological Survey	Ontario Geological Survey Maps 82758 to 82761, 2015
Airborne magnetic and electromagnetic surveys, airborne magnetic and electromagnetic surveys, colour-filled contours of the EM decay constant and electromagnetic anomalies, Kabinakagami Lake area	Ontario Geological Survey	Ontario Geological Survey Maps 82762 to 82765, 2015
Airborne magnetic and electromagnetic surveys, colour-filled contours of the apparent conductivity and electromagnetic anomalies, Kabinakagami Lake area	Ontario Geological Survey	Ontario Geological Survey Maps 82766 to 82769, 2015
Airborne magnetic and gamma-ray spectrometric surveys, colour-filled contours of the residual magnetic field, Lac des Mille Lacs–Nagagami Lake area	Ontario Geological Survey	Ontario Geological Survey Maps 82686 to 82691, 2015
Airborne magnetic and gamma-ray spectrometric surveys, shaded colour image of the second vertical derivative of the residual magnetic field and keating coefficients, Lac des Mille Lacs–Nagagami Lake area	Ontario Geological Survey	Ontario Geological Survey Maps 82709 to 82714, 2015
Airborne Magnetic and Gamma-Ray Spectrometric Surveys, Ternary Radioelement Image, Lac des Mille Lacs–Nagagami Lake Area	Ontario Geological Survey	Ontario Geological Survey Maps 82732 to 82737, 2015
Airborne Magnetic and Electromagnetic Surveys, Colour-Filled Contours of the Residual Magnetic Field and Electromagnetic Anomalies, Matachewan–Timmins Area-Purchased Data	Ontario Geological Survey	Ontario Geological Survey Maps 60420 to 60425, 2015
Airborne magnetic and electromagnetic surveys, shaded colour image of the second vertical derivative of the residual magnetic field and keating coefficients, Matachewan–Timmins area—Purchased data	Ontario Geological Survey	Ontario Geological Survey Maps 60426 to 60431, 2015
Airborne magnetic and electromagnetic surveys, colour-filled contours of the EM decay constant and electromagnetic anomalies, Matachewan–Timmins area—Purchased data	Ontario Geological Survey	Ontario Geological Survey Maps 60432 to 60437, 2015
Report of Activities 2014, Resident Geologist Program, Thunder Bay South Regional Resident Geologist Report: Thunder Bay South District	M.A. Puumala, D.A. Campbell, A. Tims, R.L. Debicki, T.K. Pettigrew and M.R. Brunelle	Ontario Geological Survey, Open File Report 6303, 2015
Precambrian Geology of Brackin Township, Michipicoten greenstone belt	L. Robichaud, J. McDivitt, N.J. Krystopowicz and N. Szumylo	Ontario Geological Survey Preliminary Map P.3797, 2015

Title	Author	Type and Year of Publication
Report of Activities 2014, Resident Geologist Program, Southern Ontario Regional Resident Geologist Report: Southeastern and Southwestern Ontario Districts, and Petroleum Operations Centre	P.J. Sangster, P.S. LeBaron, S.J. Charbonneau, D.A. Laidlaw, R.L. Debicki, A.C. Wilson and L. Fortner	Ontario Geological Survey, Open File Report 6306, 2015
Atlas of alteration: A field and petrographic guide to hydrothermal alteration minerals	A.J.B. Thompson and J.F.H. Thompson, eds.	Geological Association of Canada, 1996
Trace element analysis of native gold by laser ablation ICP-MS: A case study in greenstone-hosted quartz-carbonate vien ore deposits, Timmins, Ontario	A. Velasquez	MSc Thesis, University of British Columbia, 2014
Report of Activities 2014, Resident Geologist Program, Thunder Bay North Regional Resident Geologist Report: Thunder Bay North District	G.D. White, R.M. Cundari, M.R. Brunelle, T.K. Pettigrew, A. Tims and R.L. Debicki	Ontario Geological Survey, Open File Report 6302, 2015

Table 8. Assessment files received in the Timmins District in 2015.

Abbreviations

AEM ..... Airborne electromagnetic survey
AMAG ..... Airborne magnetic survey
Assays ..... Assays
Comp ..... Compilation
DD ..... Diamond drilling
DGP ..... Down-hole geophysics
GC ..... Geochemical survey
GL ..... Geological survey
GT ..... Geotechnical survey
EM ..... Ground electromagnetic survey
Mag ..... Ground magnetic survey
IP ..... Induced polarization survey
Lc ..... Line cutting
Man ..... Manual labour
Mech ..... Mechanized labour
OVD ..... Overburden drilling
Pet ..... Petrographic analyses
Pr ..... Prospecting
Samp ..... Sampling (other than bulk)
Str ..... Stripping
Tr ..... Trenching
UGD ..... Underground drilling

Township/Area	Company Filing Report	Year	Work Performed	AFRO Number	Resident Geologist Office File Designation
Auden, Burrell, Fegan Lake Area, Fintry, Limestone Rapids, Mulloy, Rogers, Rowlandson, Pitopiko River Area, Shuel	GTA Resources and Mining Inc.	2013	AEM, AMAG	2.55570	T-6781
Benneweis	Trelawney Mining and Exploration Inc.	2014	DD - 3 - 815m, Assays	2.55730	T-6768
Benneweis, Champagne	Trelawney Mining and Exploration Inc.	2015	IP, Lc	2.55874	T-6798
Benneweis, Chester	Trelawney Mining and Exploration Inc.	2014	Assays, GL, Pr, Samp	2.55860	T-6792
Blamey	Skead Holdings Ltd.	2014	Assays, Pr, Samp	2.55565	T-6760
BMA 527 834	De Beers Canada Inc.	2013	DD - 6 - 1419m, Pet, Samp	2.55473	T-6764
Borden	Probe Mines Limited	2015	DD - 4 - 2519m	2.56202	T-6822
Borden, Cochrane	Probe Mines Limited	2014	DD - 32 - 12730m, Assays	2.55910	T-6812
Bristol, Byers, Carnegie, Carscallen, Cote, Godfrey, Jamieson, Jessop, Loveland, Macdiarmid, Massey, Moberly, Reid, Robb, Thorburn, Thornloe, Turnbull, Whitesides	International Explorers and Prospectors Inc.	2013–2014	Comp	2.55335	T-6785

Township/Area	Company Filing Report	Year	Work Performed	AFRO Number	Resident Geologist Office File Designation
Bristol, Byers, Carnegie, Carscallen, Cote, Godfrey, Jamieson, Jessop, Loveland, Macdiarmid, Massey, Moberly, Reid, Robb, Thorburn, Thornloe, Turnbull, Whitesides	International Explorers and Prospectors Inc.	2013–2015	Comp	2.55277	T-6788
Bristol, Carscallen	Melkior Resources Inc.	2014	EM, Mag	2.56073	T-6836
Canfield	6398651 Canada Inc.	2014	DD - 1 - 291m	2.56087	T-6825
Carnegie	Explor Resources Inc.	2015	EM, Lc	2.55794	T-6782
Carnegie	Explor Resources Inc.	2015	EM	2.55926	T-6805
Carscallen	Lalonde, D.	2015	Pr	2.56135	T-6839
Carscallen	Lalonde, D.	2015	Assays, Man, Pr, Str, Samp	2.56134	T-6840
Carscallen	Lalonde, D.	2015	Pr	2.56133	T-6841
Carty, Chewett, Collins, Crockett, Evans, Hellyer, Ivanhoe, Murdock, Pinogami, Raney, Sandy	Probe Mines Limited	2014	Assays, GC, Pr, Samp	2.55905	T-6801
Carty, Crockett, Hellyer, Pinogami, Sandy	Probe Mines Limited	2014	DD - 11 - 3348m	2.55546	T-6754
Carty, Evans, Pinogami, Warren	Kapuskasing Gold Corp.	2015	Assays, GL, Pr, Samp,	2.56030	T-6815
Chester	1571925 Ontario Ltd.	2014	EM, Mag	2.56068	T-6818
Chester	Sanatana Resources Inc.	2012–2013	DD - 16 - 4996m, Assays	2.56059	T-6820
Chester	Trelawney Mining and Exploration Inc.	2012	DD - 18 - 5156m, Assays	2.55855	T-6799
Chester	Trelawney Mining and Exploration Inc.	2013	DD - 2 - 484m, Assays, Samp	2.56146	T-6827
Chester, Yeo	Sanatana Resources Inc.	2012	DD - 18 - 7971m, Assays, GL, Samp	2.56033	T-6814
Chewett, Collins	Sarissa Resources Inc.	2014	DD - 3 - 736m, Assays, Samp	2.55962	T-6833
Cochrane	Probe Mines Limited	2013	DD - 19 - 6357m, Assays, Samp	2.56136	T-6828
Cody	Moneta Porcupine Mines Inc.	2014	DD - 1 - 567m, Assays, Mech	2.55540	T-6752
Cunningham	Skead Holdings Ltd.	2014	Mag	2.55566	T-6753
Cunningham	Skead Holdings Ltd.	2014	EM	2.55814	T-6784
Cunningham	Skead Holdings Ltd.	2014	Assays, Pr, Samp	2.55812	T-6786
Cunningham	Skead Holdings Ltd.	2014	Mag	2.55818	T-6793
Cunningham	Skead Holdings Ltd.	2014	Mag	2.55816	T-6794
Cunningham	Skead Holdings Ltd.	2014	EM	2.55819	T-6795
Cunningham	Skead Holdings Ltd.	2014	EM	2.55820	T-6796
Cunningham	Skead Holdings Ltd.	2014	Pr	2.55825	T-6809
Cunningham, Greenlaw	Broomhead, F.A. and Broomhead, K.W.	2014	Assays, Pr, Samp	2.55419	T-6756
Deloro	Kornik, W.T., Robert, P.	2010	IP	2.55932	T-6807
Deloro	San Gold Corporation	2010	DD - 1 - 110m, Assays, Samp	2.55720	T-6772
Devitt	C. Villeneuve Construction Co. Ltd.	2014–2015	GC, Pr, Samp	2.55772	T-6771

Township/Area	Company Filing Report	Year	Work Performed	AFRO Number	Resident Geologist Office File Designation
Dundonald	C. Villeneuve Construction Co. Ltd.	2014	GC, Samp	2.55673	T-6787
Evelyn	Teck Resources Limited	2014	DD - 6 - 1182m, Assays, Samp	2.55642	T-6766
Feagan Lake	Xmet Inc.	2014	Mag	2.56054	T-6835
Feagan Lake Area	Alibaba Graphite Corp.	2014	AEM, AMAG	2.56046	T-6817
Feagan Lake Area	Xmet Inc.	2013	AEM, AMAG	2.56132	T-6821
Feagan Lake Area, Fintry, Mulloy, Rowlandson	GTA Resources and Mining Inc.	2013–2014	DD - 10 - 1217m, Assays, Lc, EM, Mag	2.55558	T-6790
Feagan Lake, Kabinakagami River, Nagagami River, Pitopiko River, Squirrel River, South of English River Post	Metals Creek Resources Corp.	2014	AEM, AMAG	2.56051	T-6834
Fripp	Daxl, H.	2014	Assays, GC, Pr, Samp	2.55883	T-6802
Gallagher, McNaught	Probe Mines Limited	2012	Assays	2.56150	T-6823
Geary	Jubilee Gold Exploration Ltd.	2014	GC, Samp	2.55687	T-6778
Greenlaw	Gibson and Associates Inc.	2014	Assays, Pr, Samp	2.55795	T-6783
Groves	Northern Sun Mining Corp.	2014	EM, IP, Lc, Mag	2.55599	T-6765
Halcrow	Jubilee Gold Exploration Ltd.	2015	GC	2.56404	T-6842
Halliday	Lalonde, D.	2015	Pr, Samp	2.56095	T-6838
Hambleton	Harte Gold Corp.	2014	DD - 16 - 1885m, Assays	2.55735	WP Hambleton.22
Hambleton	Harte Gold Corp.	2015	DD - 8 - 1140m. Assays	2.55984	WP Hambleton.24
Hambleton, Odlum, Gourlay	Harte Gold Corp.	2014	GL, Pr, Samp	2.55786	WP Hambleton.23
Hoyle	Goldcorp Porcupine Gold Mines	2013	UGD - 206 - 54898m, Assays	2.55927	T-6811
Jamieson	1571925 Ontario Ltd	2014–2015	Assays, Samp	2.55686	T-6774
Keefer	Gervais, L.N.	2015	Lc, IP, Mag	2.55845	T-6797
Keefer	Gervais, L.N.	2015	IP, Lc, Mag, EM	2.56034	T-6813
Keefer	Gervais, L.N.	2015	EM, Mag	2.56118	T-6837
Keefer	Moon Energy Corporation Foundation Canada	2015	Pr, Samp	2.56124	T-6832
Keefer	Renforth Resources Inc.	2014	Assays, Pr, Samp	2.55425	T-6761
Keith, Foleyet, Muskego, Reeves	GTA Resources and Mining Inc.	2014	Pr, Samp	2.55669	T-6773
Keith, Muskego	GTA Resources and Mining Inc.	2015	IP, Lc, Mag	2.56053	T-6816
Lizar	Trelawney Mining and Exploration Inc.	2014	Assays, GC, Pr, Samp	2.55474	WT Lizar. 37
Lizar	Trelawney Mining and Exploration Inc.	2015	IP, Lc, Mag	2.55975	WT Lizar.38
Lower Detour Lake Area, West of Sunday Lake Area	Detour Gold Corporation	2012–2013	Assays, GL, Samp, Str, Tr	2.55579	T-6732
Macklem	Goldcorp Canada Inc.	2013	DD - 20 - 9763m, Assays	2.55552	T-6762
Nagagami River	Zenyatta Ventures Ltd.	2015	DD - 1 - 625m	2.55943	T-6804
Neville	1571925 Ontario Ltd.	2015	GC, Mag, Samp	2.55783	T-6780
Neville	GoldOn Resources Ltd.	2014	DD - 2 - 402m, Assays, Samp	2.55723	T-6776

Township/Area	Company Filing Report	Year	Work Performed	AFRO Number	Resident Geologist Office File Designation
Neville, Potier	GoldOn Resources Ltd.	2014	OVD - 21 - 249m, GT, Lc, Mech, Samp	2.55775	T-6770
Neville, Potier	GoldOn Resources Ltd.	2014	Assays, GL, Pr, Samp	2.55721	T-6777
Ogden	Knick Exploration Inc.	2010–2011	EM, Mag	2.55553	T-6759
Ogden	Knick Exploration Inc.	2011	IP, Lc	2.55554	T-6757
Ogden	L.B.L. Richgold Mines Incorporated	2014	EM, Lc, Mag	2.55484	T-6763
Ogden	L.B.L. Richgold Mines Incorporated	2015	EM, Mag	2.56194	T-6824
Ogden	Lalonde, D.	2015	Pr	2.56177	T-6826
Penhorwood, Reeves	Rapier Gold Inc	2010	Assays, Pr, Samp	2.55945	T-6808
Quantz Lake Area, Wataiabei River South of, Wataiabei River Southeast of	Zenyatta Ventures Ltd.	2010	AEM, AMAG	2.55801	T-6791
Quantz Lake South of, Wataiabei River South of, Wataiabei River Southeast of	Zenyatta Ventures Ltd.	2010	AEM, AMAG	2.55800	T-6789
Reeves	Rapier Gold Inc.	2013	DD - 2 - 618m, Assays	2.55934	T-6806
Reeves	White Metal Resources Corp.	2015	Assays, Pr, Samp	2.56163	T-6829
Reeves, Penhorwood	Rapier Gold Inc.	2015	AMAG	2.56120	T-6831
Rollo	Currah, L.	2015	EM, Mag	2.56402	T-6844
Rollo, Raney	Richmond Minerals	2014	Comp	2.55900	T-6803
Sothman	2128700 Ontario Inc.	2014	Assays, Pr	2.55446	T-6767
Tisdale	Goldcorp Canada Inc.	2013–2014	UGD - 53 - 6700m, Assays	2.55544	T-6755
Tisdale	Goldcorp Canada Inc.	2014	UGD - 1 - 171m, Assays	2.55384	T-6758
Tully	Gowest Gold Ltd.	2013	DD - 2 - 854m	2.55672	T-6775
Tully	Gowest Gold Ltd.	2013	DD - 6 - 1546m, Assays	2.55846	T-6800
Tully	Gowest Gold Ltd.	2015	GC, Samp	2.56160	T-6830
Tully	SGX Resources Inc.	2012	EM, IP, Lc, Mag	2.55666	T-6769
Turnbull	Allaire, G.A.	2015	Assays, Man, Pr, Samp, Str	2.56052	T-6819
Turnbull	Lalonde, D.J.	2015	Assays, Man, Pr, Samp, Str	2.55994	T-6810
Whitney	Robert, J.	2014	GC, Samp	2.55539	T-6751
Zavitz	Beyer, B. Sr., Beyer, B. Jr. and Beyer, N.	2013–2014	Assays, Pr, Man, Samp	2.55778	T-6779
Zavitz, Semple, English	Croxall, J.E.	2015	Pr, Samp	2.56422	T-6843

Note: *DD - 3 - 815m = 3 diamond-drill holes totalling 815 m.*

Table 9. Mineral deposits not being mined in the Timmins District in 2015.

Abbreviations

CMH.....Canadian Mines Handbook
MDA .....Management's Discussion and Analysis
MDC.....Mineral Deposit Circular
NI 43-101 Rpt..... Technical Report filed under instrument NI-43-101F1
OFR..... Open File Report
PEA .....Preliminary Economic Assessment

Deposit Name/ Township	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References	Status
Albany Graphite Deposit Pitopiko River Area MDI000000001484	Graphite	Total indicated resource 25.1 Mt @ 3.89% Cg; Total inferred resource 20.1Mt @ 2.2% Cg	Zenyatta Ventures Ltd.	NI 43-101 Rpt 16/01/2014	Diamond drilling in 2013
Augdome Property Tisdale Tp. MDI42A06NE00086	Au	Historic Resource: 140 000 tonnes @ 0.15 oz/t Au	Lexam VG Gold Inc.	CMH 1986-87 p.50	Last active 1987
Block A Property West of Sunday Lake MDI32L04SW00012	Au	Indicated resource estimate: 52 900 000 t grading 0.98 g/t Au (1 667 000 ounces); inferred resource estimate: 20 700 000 t @ 1.00 g/t Au (667 000 ounces)	Detour Gold Corporation	Detour Gold Corporation NI 43-101 Rpt 4/02/2014	Diamond drilling 2012
Borden Gold Project Cochrane Tp. MDI000000000908	Au	Total indicated resource: 9 300 000 tonnes @ 5.39 g/t Au (1 600 000 contained ounces) Total inferred resource: 3 000 000 tonnes @4.37 g/t Au (430 000 ounces)	Goldcorp Limited	Probe Mines NI 43-101 Rpt 6/10/2014	Diamond drilling 2014
Bradshaw Gold Deposit Tully Tp. MDI42A11NE00007	Au	Indicated resource: 6 016 544 tonnes @ 4.88 g/t Au (945 342 ounces) Inferred resource: 3 692 871 tonnes @ 4.22 g/t Au (536 773 ounces)	Gowest Gold Ltd.	NI 43-101 Rpt 15/11/2012	Diamond drilling 2013
Broulan Mine (past producer) Whitney Tp. MDI42A11SE00021	Au	Measured+indicated resource: 586 000 tonnes @ 7.37 oz/t Au (138 800 contained ounces) Inferred Resource: 88 000 tonnes @ 5.82 oz/t Au (16 500 contained ounces)	Temex Resources Corp. and Goldcorp Canada Inc.	Temex Resources Corp. NI 43-101 Rpt 14/01/2014	Diamond drilling 2010–2013. Past producer 1915-1965.
Buffalo Ankerite Property (past producer) Deloro Tp. MDI42A06NW00011 MDI42A06NW00015	Au, Ag	Indicated resource (open pit): 3.212 Mt @ 0.074 oz/t Au (239 800) ounces); Inferred resource (open pit): 3.018 Mt @ 0.067 oz/t Au (204 000 ounces) Indicated resource (underground): 3.597 Mt @ 0.139 oz/t Au (499 000) ounces); Inferred resource (underground): 3.099 Mt @ 0.118 oz/t Au (367 000 ounces)	Lexam VG Gold Corp.	NI 43-101 Rpt 05/06/2014	Past producer 1939–53. Diamond drilling 2012.
Carshaw Property Shaw Tp. MDI42A06NE00016	Au	145 250 t @ 5.17 g/t Au (proven and probable)	Marshall Minerals Corp.	CMH 2001, p. 234	Inactive

Deposit Name/ Township	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References	Status
Clavos Gold Mine (past producer) Stock and German Tp. MDI42A10SW00046	Au	Indicated resource: 1 258 400 tonnes @4.81 g/t (194 600 ounces); Inferred resource: 796 000 tonnes @ 4.7 g/t gold (120 000 ounces)	Sage Gold Inc.	NI 43-101 Rpt 12/04/2013	Diamond drilling 2010–2012
Clay-Howells Fe-REE Project Clay and Howells Tp. MDI42G16SE00006	Fe, REE	Inferred resource: 8 477 000 tonnes @ 0.661% LREO, 0.071% HREO, 0.732% TREO, 44.15% Fe_2O_3, 0.13% Nb_2O_5, 2.20% MnO and 0.07% ThO_2	Canada Rare Earth Corp.	NI 43-101 Rpt 26/09/2011	Diamond drilling 2011
Côté Lake Deposit Chester Tp. MDI41P12SW00036	Au	Indicated resource: 269 300 000 tonnes @ 0.88 g/t gold (7 606 000 contained ounces); Inferred resource: 43 800 000 tonnes @ 0.74 g/t gold (1 043 000 contained ounces)	IAMGOLD Corporation	CMH 2014-2015 p.222	Diamond drilling 2013
Davidson-Tisdale (past producer) Tisdale Tp. MDI42A11SE00011	Au	Measured + Indicated Davidson Tisdale Main Zone: (0.684 Mt @ 2.7 g/t Au (59 300 ounces); Inferred Davidson Tisdale Main Zone (underground): 0.071 Mt @ 4.2 g/t Au (9600 ounces)	Lexam VG Gold Corp.	NI 43-101 Rpt 05/06/2014	Diamond drilling 2003–04
De Santis Mine (past producer) Ogden Tp. MDI42A06NW00025	Au	Albitite Zone: 72 212 tons @ 0.229 oz/t gold (probable non-NI 43-101 compliant); Hydrothermal Zone: 334 308 tons @ 0.19 oz/t gold (estimated non-NI 43-101 compliant)	Excellon Resources Inc.	Lateegra Gold Corp. press release 08/02/2010	Diamond drilling 2012–13 (DD - 18 - 6686m)
Detour Lake West Gold Project West of Sunday Lake Area MDI32L04SW00016	Au	Indicated resource: 2 340 000 tonnes @1.16 g/t Au (87 400 ounces) Inferred resource: 4 040 000 tonnes @ 1.16 g/t Au (150 600 ounces)	Detour Gold Corporation	Trade Winds Ventures Inc. NI 43-101 Rpt 28/04/2009	Inactive
Dundonald South Deposit Dundonald Tp. MDI42A10NW00039	Ni	Inferred Resource: 116 000 tonnes @ 3.16% Ni (3658 tonnes Ni)	First Nickel Inc.	NI 43-101 Rpt 30/01/2009	Inactive
Extender Minerals (past producer) Penhorwood Tp. MDI42B01SE00004	Ba	Historic resource: 100 000 t @ 95% Ba	Extender Minerals of Canada Ltd.	Assessment file	Inactive
Fuller Deposit Tisdale Tp. MDI42A06NW00030	Au	Total Indicated (open pit and underground): 6.239 Mt @ 0.056 oz/t Au (351 000 oz); Total Inferred (open pit and underground): 3.911 Mt @ 0.063 oz/t Au (247 000 oz)	Lexam VG Gold Corp.	NI 43-101 Rpt 05/06/2014	Diamond drilling 2012

Deposit Name/ Township	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References	Status
144 Gap Deposit Thorneloe Tp. MDI42A05NE00121 MDI42A05SE00065	Au	Indicated resource: 1 734 000 tonnes @ 5.41 oz/t Au (301 700 ounces) Inferred resource: 1 914 000 tonnes @ 5.19 g/t Au (1 027 800 ounces)	Lake Shore Gold Corp.	CMH 2014–2015 p.249	Diamond drilling 2010–12
Goose Lake Iron Prospect Shaw Tp. MDI42A06NE00038	Fe	100 000 000 tonnes @ 68.8% Fe (historic resource)	Timnor Iron Ore	Assessment file	Diamond drilling 2013
Hart Prospect Eldorado Tp. MDI42A06SE00065	Ni, Cu	Total Indicated resource: 1 546 000 t @1.40% Ni, 0.10% Cu (47 779 000 lb Ni); Total inferred resource: 322 000 t @ 1.26% Ni, 0.08% Cu (899 000 lb Ni)	Northern Sun Mining Corp.	CMH 2014–2015 p.311	Diamond drilling 2012
James Bay Niobium Project (Argor Carbonatite) Centre Pt of South Bluff Creek MDI42I15SE00004	Nb_2O_5	54 431 000 tonnes @ 0.52% Nb_2O_5	N/A	OGS Study 41	Last active 1969
Jerome Gold Mine (past producer) Osway Tp MDI41O09SE00005	Au	Inferred resource: 18 737 000 tonnes @1.71 g/t gold (1 030 489ounces)	IAMGOLD Corporation	Augen Gold Corp. NI 43-101 Rpt 18/07/2011	Diamond drilling 2010
Kabinikagami Lake Occurrence Lizar Tp MDI42C16NW00004	Fe	10 100 000 tonnes @ 66.5% Fe	Crown Land	MDC 11	Staked 2014
Kelex Property Clergue Tp. MDI42A10NW00044	Ni, Cu, Co	Open pit indicated: 131 000 t @1.1% Ni, 0.04%Cu, 0.04% Co, 0.06 g/t Pd Underground indicated: 90 000 t @1.00% Ni, 0.04% Cu, 0.04% Co, 0.07 g/t Pd Underground inferred: 54 000 t @ 0.84% Ni, 0.04% Cu, 0.03% Co, 0.03 g/t Pd	Canadian Arrow Mines Limited	NI 43-101 Rpt 10/08/2012	Past producer. Dewatering, stripping 2012
Kenilworth (Naybob) Mine Ogden Tp. MDI42A06NW00022	Au	North Zone unclassified: 138 900 tons in 13 areas grades up to 0.25 oz/t Au; South Zone unclassified: 600 000 tons @ 0.23 oz/t Au	Goldcorp Canada Inc. and Metals Creek Resources Corp. JV	Assessment File	Diamond drilling 2009–2014
Kenty Mine Swayze Tp. MDI41O15SE00029	Au	Historic resource: #9 vein has possible resource of 43 300 tonnes @ 4.7 g/t Au	1098881 Ontario Ltd. and Emerald Isle Resources Inc	Assessment File	Inactive
Kidd #3 Zone Chester Tp. MDI41P12SW00122	Au	Historic resource: 408 000 tonnes @ 9.9 g/t Au	IAMGOLD Corporation	OFR5912	Inactive
Kipling Kaolin Kipling Tp. MDI42J01NE00005	kaolin, silica sand, ball clay	Historic resource: 30 000 000 tonnes	NA	OFR5918	Sampling 2009
Langmuir No. 1 Deposit Langmuir Tp. MDI42A06SE00095	Ni, Cu	Indicated resource: 1 733 000 t @ 0.51% Ni	Inspiration Mining Corporation	NI 43-101 Rpt 06/01/2010	Past producer

Deposit Name/ Township	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References	Status
Langmuir #2 North Deposit Langmuir Tp. MDI42A06SE00006	Ni, Cu	Indicated resource: 8 324 000 t @ 0.40% Ni; Inferred resource 1 017 000 t @ 1.38% Ni	Inspiration Mining Corporation	NI 43-101 Rpt 06/01/2010	Past producer
Langmuir W4 Project Langmuir Tp. MDI42A06SE00099	Ni, Cu	Indicated resource: 677 000t @ 1.00% Ni, 0.06% Cu Inferred resource: 171 000t @ 0.89% Ni, 0.06% Cu (combined open pit and underground)	Rogue Iron Ore Corp.	NI 43-101 Rpt 29/06/2010	Diamond drilling 2007–08
Loveland Property Loveland Tp. MDI42A12NE00028	Cu, Ni, PGE	Cominco Zone: 130 000 tons @0.68% Ni, 0.73% Cu (historic resource) Hollinger Zone: 422 000 tons @ 0.71% Ni, 0.42% Cu (historic resource)	Moneta Porcupine Mines Inc.	Amador Gold Corp. website 19/01/2011	Diamond drilling 2010
Lucas Prospect Lucas Tp. MDI42A14SE00005	Au	136 077 tonnes @ 3.4 g/t (drill indicated)	Noble Mineral Exploration Inc.	Assessment File	Diamond drilling 2012
Marlhill Mine Hoyle Tp. MDI42A11SE00007	Au	395 000 tonnes @ 4.5 g/t Au (57 000 contained ounces)	Lake Shore Gold Corp.	NI 43-101 Rpt 01/03/2011	Diamond drilling 2010
Martison Lake Deposit South of Ridge Lake MDI42J06SW00004	phosphate, REE	Measured and indicated resources (Anomaly A): 62 284 000 t @ 23.6% P_2O_5, 0.34% Nb_2O_5 Inferred resource: 55 677 000 t @ 21.9% P_2O_5, 0.34% Nb_2O_5	PhosCan Chemical Corp.	NI 43-101 Rpt 16/05/2008	Reverse circulation drilling 2011–12
Multi Minerals Zone 3 & 4 McNaught Tp. MDI41O14SE00024	phosphate, niobium	Historic resource: 37 000 000 @ 0.17% Nb_2O_5 and 21.3% apatite	6378366 Canada Inc., 6070205 Canada Inc.	OGS Study 32	Sampling 2010
Multi Minerals Zone 6 McNaught Tp. MDI41O14SE00011	iron, phosphate, niobium	Historic resource: 4 557 000 tonnes @ 69.9% magnetite, 21.88% apatite, 0.12% Nb	6378366 Canada Inc., 6070205 Canada Inc.	OGS Study 32	Sampling 2010
Murgold-Chesbar Property (Chester 1 Property) Chester Tp. MDI41P12SW00073	Au	Historic measured resource: 144 500 tonnes grading 14.7 g/t Au	IAMGOLD Corporation	Northville Gold Corporation Report 089/06/2002	Bulk sampling 2010
Nemegosenda Property Chewett Township MDI42B03SE00005	Nb_2O_5	Inferred Resource: 11 000 000 tons @ 0.46% Nb_2O_5 (non-compliant)	Sarissa Resources Inc. (Nio-Star Corp.)	Sarissa Resources Inc. NI 43-101 Rpt 21/07/2009	Diamond drilling 2014
Nighthawk Mine Cody Tp. MDI42A10SW00059	Au	Historic resource: 91729 tonnes @ 6.06 oz/t Au	NA	OFR6006	Past producer. Inactive
North Rundle Property Newton Tp. MDI41O16NW00002	Au	Historic estimated resource: 16 830 tonnes @ 7.1 g/t Au	Tamaka Gold Corporation	NI 43-101 Rpt 01/02/2011	Inactive
Onakawana Lignite Dyer Tp. MDI42I11SW00002	Lignite	21 MT @ 5246 BTU	Onakawana Development Ltd.	OFR5111	Inactive

Deposit Name/ Township	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References	Status
Orofino Mine Silk and Horwood Tp. MDI41O16NW00020	Au	Measured and indicated: 322 000 t @7.02 g/t Au; Inferred: 423 000 t @ 5.46 g/t Au	Tamaka Gold Corporation	NI 43-101 Rpt 01/02/2011	Inactive
Owl Creek East Hoyle Tp. MDI42A11SE00006	Au	Historic assay resource: 3 019 685 t @ 7.17 g/t Au	Goldcorp Canada Ltd.	OFR5985	Inactive
Owl Creek West Hoyle Tp. MDI42A11SE00006	Au	Inferred resource: 327 230 t @ 7.14 g/t Au	Goldcorp Canada Ltd. and Thundermin Resources Inc.	OFR5985	Inactive
Paymaster Property Tisdale Tp. MDI42A06NW00002	Au	Total Indicated (open pit and underground): 5.135 Mt @ 0.047 oz/t Au (242 000 oz); Total Inferred (open pit and underground): 1.781 Mt @ 0.065 oz/t Au (115 000 oz)	Lexam VG Gold Corp.	NI 43-101 Rpt 05/06/2014	Diamond drilling 2010
Porcupine West Property Bristol and Ogden Tp. MDI42A06NW00200	Au	Total indicated resource: 8 703 000 tonnes @ 2.17g/t gold (609 000 ounces) Total inferred resource: 6 325 000 tonnes @ 2.31 g/t gold (470 000 ounces)	Explor Resources Inc.	NI 43-101 Rpt 07/01/2013	Diamond drilling 2013
Radio Hill Iron Property Penhorwood Tp. MDI42B01NE00026	Fe	Historic resource: 296 000 tonnes raw magnetite @ 25.58% Fe	Rogue Iron Ore Corp.	NI 43-101 Rpt. 30/04/2010	Diamond drilling and metallurgical testing 2012
Redstone Mine Eldorado Tp. MDI42A06SE00080	Ni	Inferred resource: 737 000 tonnes @ 1.57% Ni (25 519 000 lb Ni)	Northern Sun Mining Corp.	MDA 31/12/2012	Property under care and maintenance
Rundle Mine Newton Tp. MDI41O16SW00003	Au	Measured and indicated: 349 000 tonnes @ 7.88 g/t Au; Inferred resource: 267 000 tonnes @ 6.68 g/t Au	Tamaka Gold Corporation	NI 43-101 Rpt. 01/02/2011	Inactive
Sangold Gold Project Keith Tp. MDI42B01NE00012	Au	125 000 tons @ 0.25 oz/t Au (historic resource)	Kalwea Financial Corp.	CMH 2001	Diamond drilling 2005
Shunsby Property Cunningham Tp. MDI41O10NE00056	Cu, Pb, Zn	Total mineral inventory 4 000 000 tons @ 0.59% Cu and 2.56% Zn	Black Widow Resources Inc.	Assessment file	DD - 6 -750m 2014
Sothman Property Sothman Tp. MDI41P14SE00005	Ni	317 515 tonnes @ 0.89% Ni (0.5% cutoff)	Glencore Canada Corporation	Liberty Mines Inc. press release 22/05/2008	Inactive
Sugar Zone Hambleton and Odlum Townships MDI42C14SE00005	Au	Indicated resource: 980 900 tonnes @ 10.13 g/t Au (uncapped) Inferred resource: 580 500 tonnes @ 8.36 g/t Au (uncapped)	Harte Gold Corp	NI 43-101 Rpt. 12/07/2012	Diamond drilling 2015; bulk sampling
Texmont Deposit Bartlett Tp. MDI42A03NE00002	Ni	Historic Measured and Indicated: 2 893 000 tons @ 0.92% Ni @0.70% Ni cut off (26 757 contained tons)	Fletcher Nickel Inc.	Fletcher Nickel Inc. prospectus 14/05/2007	Diamond drilling 2009

Deposit Name/ Township	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References	Status
Timmins Talc-Magnesite Deposit Adams, Deloro Tp. MDI42A06SW00024	Magnesite, Talc	A Zone Core: Indicated resource: 12 728 000 t @52.1% magnesite, 35.04% talc; Inferred resource: 18 778 000 t @ 53.1% magnesite, 31.7% talc; A Zone Fringe: Indicated resource: 5 003 000 tonnes @ 34.2% magnesite, 33.4% talc	Globex Mining Enterprises Inc.	NI 43-101 Rpt 16/04/2012	Infill and geotechnical drilling (DD - 46 - 7000m) 2013
Thunderwood JV Hoyle Tp. MDI42A11SE00113	Au	327 230 tonnes @ 7.14 g/t (assay)	Goldcorp Canada Inc.	OFR5985	
Timmins North Property Tully Tp. MDI42A11NE00034	Au	Indicated resource to 350 m: 362 090 t @8.0 g/t gold (93 140 ounces) Total inferred resource: 592 070 t @ 7.3 g/t gold (139 880 ounces)	SGX Resources Inc.	NI 43-101 Rpt 19/10/2010	Diamond drilling 2013
Upper Whitney Deposit Whitney Tp. MDI42A11SE00019	Au	Total Measured and Indicated Resource: 3 219 000 tonnes @ 6.85 g/t Au (708 600 oz); Inferred resource: 995 000 tonnes @ 5.34 g/t Au (170 700 ounces)	Lake Shore Gold Corp. and Goldcorp Canada Inc.	Temex Resources Corp. NI 43-101 Rpt 14/01/2014	Diamond drilling DD - 13 - 1600m, 2016
Vogel-Schumacher Property Hoyle Tp. MDI42A11SE00124	Au	Indicated resource: 2 219 000 tonnes @ 1.75 g/t Au (125 000 contained ounces); Inferred resource: 1 459 000 tonnes @ 3.6 g/t Au (168 800 contained ounces)	Lake Shore Gold Corp.	NI 43-101 Rpt. 14/06/2011	Diamond drilling 2010
Warren Township Anorthosite Warren Tp. MDI42B02NW00001	Anorthosite	858 504 tonnes @ 30.92 st% Al (drill indicated)	Avalon Rare Metals Inc.	Assessment file	Permitted 2012
Watershed Gold Property Chester Tp. MDI000000001866	Au	Inferred resource: 4 300 000 tonnes @ 1.22 g/t Au (cut-off grade 0.3 g/t)	Sanatana Resource Inc.	Press release; September 15, 2015	Diamond drilling 2015
Whitney Talc-Magnesite Deposit Whitney Tp. MDI000000000349 MDI42A06NE00020	Magnesite, Talc	Measured and Indicated Resources: 54 076 357 t Inferred Resource: 43 000 000 t	General Magnesium Corp.	OGS Study 28	Surface mining test 2015

Note: *This table contains tonnage and grade estimates referred to as reserves (indicated, possible, probable), which were determined at various times by methods largely unreported. Except where noted, none of these estimates are known to conform to the standards required for National Instrument 43-101 and should be considered inferred mineral resources not reserves.*

Unit abbreviations used*: lbs = pounds; Mt = million tonnes; opt = ounces per ton; oz = ounce(s); t = tonnes.*

Other abbreviations*: BTU = British Thermal Units; DD - 46 - 7000m = 46 diamond-drill holes totalling 7000 m; JV = joint venture; NA = not available; REE = rare earth elements; LREO = light rare earth oxides; HREO = heavy rare earth oxides; TREO = total rare earth oxides.*

REGIONAL LAND USE GEOLOGIST ACTIVITIES—NORTHEAST REGION

Land Use Planning Activities

The northeast Regional Land Use Geologist, based in Timmins, co-ordinates input into land use planning activities in the Sault Ste. Marie, Timmins and Kirkland Lake Resident Geologist districts and the part of the Sudbury District that is north of the French River. This report includes information about activities in all of these districts. The northeast Regional Land Use Geologist position was staffed throughout 2015 by Catherine Daniels, *P.Geo*.

The boundaries of the Regional Land Use Geologists' regions are indicated on Figure 10. Readers interested in Regional Land Use Geologist activities in the portion of the Sudbury or Sault Ste. Marie Resident Geologist districts that are within the Southern Land Use Region are advised to review a copy of the annual Report of Activities for Southern Ontario.

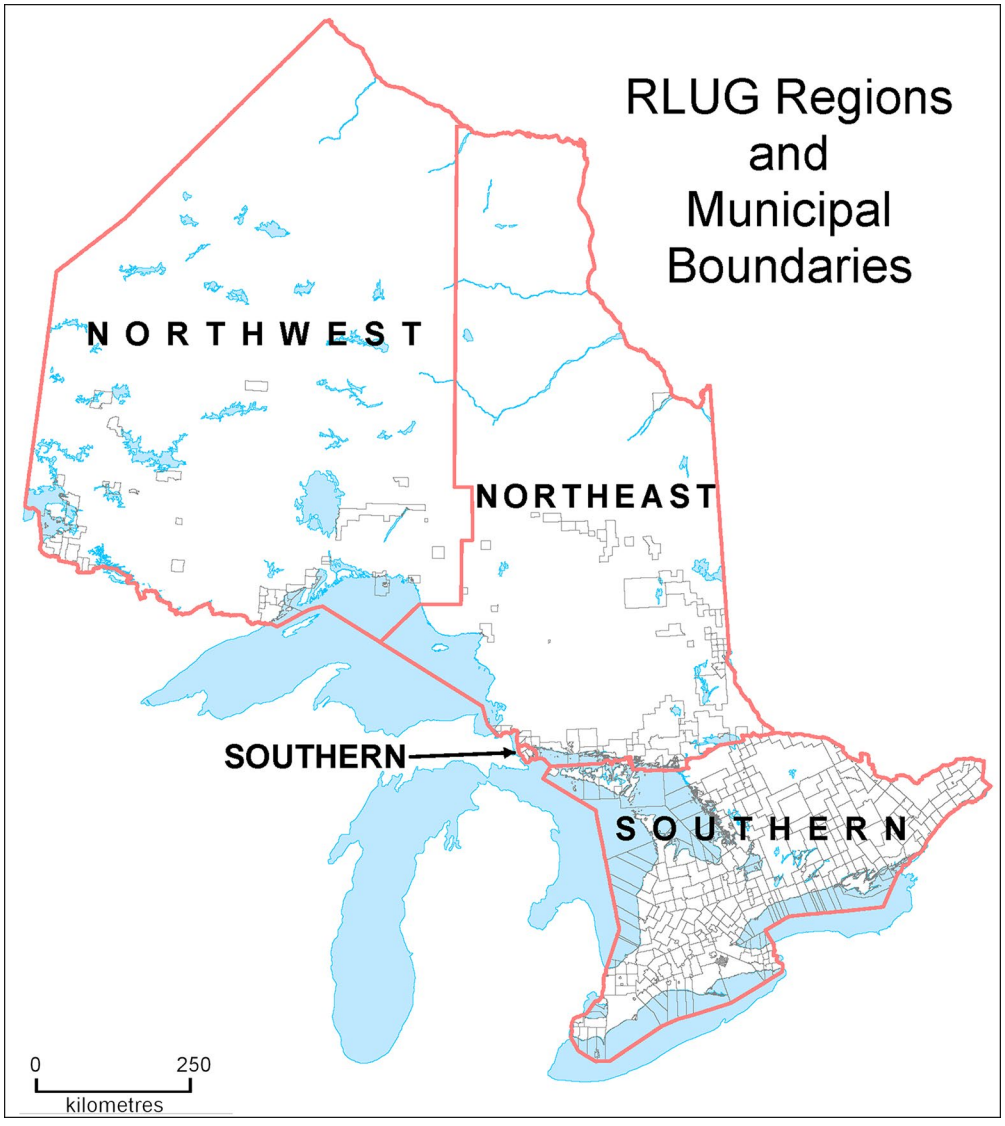


Figure 10. Extent of Regional Land Use Geologists' areas of responsibility (red lines indicate the regional boundaries; grey lines indicate the municipal boundaries).

The objective of the position is to ensure that geoscience information is considered in policy and land use planning decisions. The geoscience information relates to

- mineral-related values and economic opportunities;
- natural geological and mining-related hazards;
- renewable and non-renewable energy sources; and
- groundwater resources.

Program activities that support this objective include helping develop, deliver and administer provincial policies, practices and procedures; and providing advice and guidance to municipalities, agencies and others involved in or affected by land-use planning regarding geoscience-related matters.

In 2015, the northeast Regional Land Use Geologist dealt with a variety of land use planning issues throughout the northeast region. The following sections summarize the work that was done.

CROWN LANDS

The Ministry of Northern Development and Mines (MNDM) engages with the Ministry of Natural Resources and Forestry (MNRF) when Crown land use planning activities have the potential to impact provincial mineral interests, or to expose those using Crown lands to natural geological or mining-related hazards. These activities relate to 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

The Crown Land Use Policy Atlas (CLUPA) contains area-specific land use policies for Crown lands in central and northern Ontario, to the northern limit of forestry activities in the province. These policies are established under the authority of the *Public Lands Act*.

In 2006, a Crown land use planning initiative—referred to as the Crown Land Use Policy Atlas Harmonization (CLUAH) project—was initiated in MNRF's Wawa District. The initiative was intended to harmonize inconsistent policies in different portions of the District, and to introduce provisions that would reduce conflicts between forestry and tourism interests in the District. After several years of work involving a multi-stakeholder Working Group, the proposed land use designations and policies for the District were posted on the Environmental Registry on November 28, 2014.

Early in 2015, the northeast Regional Land Use Geologist and the Land Use Policy and Planning Co-ordinator discussed MNDM's assessment of the proposed policies with MNRF.

Crown Land Disposition

In 2015, MNRF announced that it planned to remind municipal governments that Crown land might be available to support economic development in communities in northern Ontario, and revamped its program for receiving and reviewing applications for Crown land sales. Such dispositions must be done in accordance with the *Public Lands Act*, as well as the *Planning Act* and municipal Official Plans.

The northeast Regional Land Use Geologist attended training sessions to become familiar with the new process to dispose of Crown lands. With the Land Use Policy and Planning Co-ordinator, she also continued discussions with MNRF and the City of Elliot Lake regarding the disposition of Crown land to the City of Elliot Lake for new cottage lot developments.

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 northeast Regional Land Use Geologist normally provides input into the development of forest management plans. Formal comments and mineral values maps were provided in 2015 for

- the Magpie 2009–2019 Forest Management Plan
  (reviewed draft planned operations for Phase II, 2015–2019);
- the Timiskaming 2011–2021 Forest Management Plan
  (reviewed proposed operations for Phase II, 2016–2021);
- the White River 2008–2018 Forest Management Plan
  (provided geoscience information for Phase I, 2018 –2020);
- the Abitibi River 2012–2022 Forest Management Plan 2017
  (provided geoscience information for Phase II Planned Operations 2017–2022);
- the Martel 2011–2021 Forest Management Plan
  (reviewed proposed operations for Phase II, 2016–2021); and
- the Sudbury Forest 2010–2020 Forest Management Plan
  (inspection of approved planned operations for Phase II 2015–2020).

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).

Far North Land Use Planning

The Far North Land Use Planning Initiative is about working with First Nations to identify where development can occur and where land will be dedicated to protection in the Far North of Ontario. The Far North encompasses 42% of Ontario's land mass in areas generally north of the areas where forest management planning is done (for the planning area boundary, *see* www.ontario.ca/rural-and-north/far-north-ontario). Detailed information about Far North Land Use Planning and the *Far North Act* is available (*see* www.ontario.ca/page/far-north-land-use-planning-initiative).

All but a few First Nation communities are working on a range of land use planning activities, although they are not all at the same stage in the planning process. In northeastern Ontario, Constance Lake First Nation has its Terms of Reference. Other communities are working on gathering information for their planning areas, and learning about the land use planning process.

In 2015, the northeast Regional Land Use Geologist attended 2 Far North land use planning workshops organized by MNRF's Far North Branch. The workshops were held for the Mushkegowuk Council communities and provided information and support to the MNRF Far North Branch with regard to the mineral sector and geoscience, as they apply to land use planning. She also participated in meetings with representatives from Kashechewan First Nation, and in meetings with the land use planning team and community meetings from Constance Lake First Nation.

In addition, she continued to assist with work on geoscience atlases that bring together information about more than 20 geoscience-related themes. Work on the atlases began in 2013 with the intention to make relevant geoscience information available for use during the planning process The atlases were also enhanced by simple explanatory notes and photographs for each of the themes in the atlas.

Copies of the atlases were provided to representatives of Constance Lake, Moose Cree, Attawapiskat, Kashechewan, Fort Albany and Peawanuk First Nations.

Withdrawal Orders

Other work related to Crown land use in the northeast region included reviews of 11 applications for withdrawal of lands from staking under Section 35 of the *Mining Act*. Some applications were for mining rights only and some were for both surface and mining rights. The requests were made for a wide range of reasons, including

- supporting First Nation land claims and Treaty Land Entitlement negotiations;
- reviewing sites where aggregate extraction is proposed;
- adding lands to provincial parks or conservation reserves; and
- reducing the risk of public exposure to mine hazards related to historic uranium mining.

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

Other

Information was prepared for the Ministry of Tourism, Culture and Sport, which was evaluating a public request to designate the La Vase Portage portages in the Nipissing District as a historical place or a UNESCO World Heritage Site.

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 northeast 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, natural geological hazards and mining-related hazards are appropriately considered in the planning process.

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 2014. The revision includes enhanced provisions to help ensure that municipal Official Plans recognize mining operations and areas with significant mineral potential, so that they can be protected from incompatible land uses.

As a participant in MMAH's one-window service for Official Plans and their amendments, the northeast 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 Greater Sudbury, Dubreuilville, Timmins, Thessalon, Moonbeam, Black River–Matheson, Kapuskasing, Hearst, and Nairn and Hyman, as listed in Table 10.

In addition, information was provided, and reviews were done, in conjunction with 12 by-law amendments, 6 consent (severance) applications and 1 subdivision proposal, as listed in Table 10.

Table 10. Municipal planning initiatives with MNDM input, northeastern Ontario, 2015.

Consent (Severance) Applications	Completed Official Plans and Related Initiatives	Official Plans and Related Initiatives Under Development
Coleman, Township of (4)	Dubreuilville, Township of	Black River–Matheson, Township of
Sudbury East, Township of (2)	Greater Sudbury, City of	Hearst, Township of
	Kapuskasing, Township of	Timmins, City of
	Moonbeam, Township of	
	Nairn and Hyman, Township of	
	Sudbury East, Township of	
	Thessalon, Town of	
	Timmins, City of (12)	

Exemptions from Mining Tax

Section 189 (1) of the *Mining Act* allows owners of patented land to apply for exemption from paying mining tax. Key factors that are considered when applications are reviewed, 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 2015, 34 such applications were reviewed for the Northeast Region. Comments were provided to MNDM'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 northeast Regional Land Use Geologist participated in meetings with Mushkegowuk Council to discuss options for sharing geoscience information with Mushkegowuk communities south of the Far North.

Other Activities

The northeast Regional Land Use Geologist also undertook other related work in 2015, as outlined below.

INVESTMENT READY SITES

Ontario's "Investment Ready: Certified Site" program, operated by the Ministry of Economic Development, Employment and Infrastructure promotes an inventory of sites that may be of interest to potential investors and purchasers. It pre-screens the suitability of sites for development, and provides detailed information about the sites' access to utilities and transportation, and their environmental status. In 2015, the northeast Regional Land Use Geologist provided information for 1 candidate site for certification in northeastern Ontario.

CLASS ENVIRONMENTAL ASSESSMENTS

Class Environmental Assessments ("Class EAs") are documents that set out a standard environmental assessment process to evaluate the potential environmental effects of a project. There are currently 11 Class EAs 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 northeast Regional Land Use Geologist worked with staff from MNRF and other ministries to ensure that relevant geoscience information and provincial mineral interests were identified and accommodated early in the planning process of projects subject to Class EAs. In 2015, feedback was provided for reviews of the following 10 Class EA projects within northeastern Ontario:

- a proposed aggregate pit in the Township of Merrick;
- a proposed motocross track as part of the Kamiskotia Ski Resort strategic plan;
- the Cochrane Solid Waste Disposal Capacity Study EA Terms of Reference;
- the draft Terms of Reference for the Municipality of Wawa's proposed waste disposal site capacity expansion;
- the approved Terms of Reference for the proposed Wawa waste disposal site capacity expansion project;
- the City of Sault Ste. Marie's Biosolids (sewage sludge) Management Plan;
- the proposed rehabilitation of the Hawk Creek Bridge and the McVeigh Creek Bridge, near Hawk Junction;
- the study commencement for the rehabilitation of Highway 552 and Highway 556 near Heydon;
- the study completion of the access review on Highway 17 at Echo Bay; and
- the study commencement related to rehabilitation of Highway 11, South of Cochrane.

GUIDANCE MATERIALS

In 2015, the northeast Regional Land Use Geologist was called upon by partner ministries to review and provide input on proposed new or updated policies, and/or supporting guidance materials. Comments were prepared and submitted for the following

- the Annotated Provincial Policy Statement;
- Resident Geologist Program initiatives that align with the Growth Plan for Northern Ontario 2011: Places to Grow – Better Choices. Brighter Future;
- a survey from Ministry of Agriculture, Food and Rural Affairs initiated by the ministry to help update guidance materials related to aggregate extraction on agricultural lands;
- the Ministry of Environment and Climate Change's draft Land Use Compatibility Guidelines (intended to replace its D-Series Guidelines); and
- the Guide to Acquisition of Crown Land to Support Municipal Cottage Lot Development for MNRF's Crown land disposition initiative on Crown land north of the French River.

CONFERENCES

The northeast Regional Land Use Geologist engaged with mineral sector clients at "The Big Event Canadian Mining EXPO 2015" in Timmins, and the "Northeastern Ontario Mines and Minerals Symposium", held in Kirkland Lake in 2015.

The northeast Regional Land Use Geologist also engaged with representatives from the northeastern municipalities at the Municipal Services Office North planning meeting, September 23–24 in Sudbury, and provided updates about MNDM data.

MINERAL DEPOSIT COMPILATION GEOLOGISTS—NORTHEASTERN ONTARIO

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

Throughout the year, emphasis was placed on updating MDI records for the Far North Land Use Planning Geoscience Atlases initiative. Additional records were corrected with updated and properly ranked commodities. A focus was also made on updating MDI records for the Black River–Matheson land-use planning update. To date, data for 6 of the townships have been compiled and entered into the database.

Complete township updates were compiled and entered for Bond, Bowman, Cairo, Carr, Currie, Harker, Powell, Stock and Taylor, in the Larder Lake Mining Division. Complete township updates were also compiled and entered for Bastard, Beckwith, Burgess, Dalhousie, Drummond, Elmsley, Kitley, Montague, North Crosby and South Sherbrooke, in the Southern Ontario Mining Division. These townships were part of a mapping project conducted by R.M. Easton of the Ontario Geological Survey. The northeastern MDCG also worked on changes and updates to MDI records for a variety of land use planning decisions in the Larder Lake Mining Division and the Sault Ste. Marie Mining Division.

Total changes to the provincial MDI database, completed by the MDCG—Northeastern Ontario, in 2015 included 531 updated records, 87 records deleted and 14 new records. A breakdown, by office, of the provincial records revised by the Mineral Deposit Compilation Geologist—Northeastern Ontario is provided in Table 11.

Table 11. Mineral Deposit Inventory records revisions in 2015.

Resident or District Office	Updates	Deletions	New
Thunder Bay North	1	0	0
Kirkland Lake	183	13	8
Sault Ste. Marie	10	0	0
Southeastern Ontario	276	73	4
Sudbury	1	1	0
Timmins	64	0	2
Total	535	87	14

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.

The MDI database was updated in February 2016 (Ontario Geological Survey 2016) and is available from the OGS online data warehouse—GeologyOntario (www.ontario.ca/geology). The Mineral Deposit Inventory can also be viewed geographically using the OGSEarth application (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).

ACKNOWLEDGMENTS

Information provided in this report is on past activities reported in the text identification from assessment files and other files of the Timmins Resident Geologist Office, unless otherwise noted. Information on current mining and exploration activities was provided by individual prospectors and exploration and mining company personnel, compiled from assessment files and obatined from public information sources, company websites and SEDAR®. Diane Draper drafted map figures and locations for Figures 1 to 6.

REFERENCES

Anonymous 1986a. Pamorex Minerals Inc. 1986 O.M.E.P. Report, Section 7 - North Matheson Project, p.796 to 907 (OGS file 42A11SE8407).

Arndt, N.T., Lesher, C.M. and Barnes, S.J. 2008. Komatiite; Cambridge University Press, New York, 467p.

Atkinson, B.T., Bousquet, P., Pace, A., Burnett, S., Butorac, S., Draper, D.M., Metsaranta, D.-A. and Wilson, A.C. 2011. Report of Activities 2010, Resident Geologist Program, Timmins Regional Resident Geologist Report: Timmins and Sault Ste. Marie Districts; Ontario Geological Survey, Open File Report 6264, 127p.

Ayer, J.A. 1995. Precambrian geology, northern Swayze greenstone belt; Ontario Geological Survey, Report 297, 57p.

Ayer, J.A. and Trowell, N.F. 2001. Project Unit 95-24: The Abitibi greenstone belt: A program update; *in* Summary of Field Work and Other Activities 2001, Ontario Geological Survey, Open File Report 6070, p. 4-1 to 4-9.

Barrie, C.T. 1990. Petrogenesis and tectonic evolution of the Kamiskotia–Montcalm area, Abitibi Subprovince, Ontario; unpublished PhD thesis, University of Toronto, Toronto, Ontario, 317p.

Berger, B.R. 1994. Geology of Matheson and Evelyn Townships, District of Cochrane; Ontario Geological Survey, Open File Report 5900, 109p.

Breaks, F.W. 1978. Geology of the Horwood Lake area, District of Sudbury; Ontario Geological Survey, Report 169, 67p.

Bousquet, P., Pace, A., Daniels, C.M., Debicki, R.L., Wilson, A.C., Samuel, A. and Yukich, A. 2015. Report of Activities 2014, Resident Geologist Program, Timmins Regional Resident Geologist Report: Timmins and Sault Ste. Marie Districts; Ontario Geological Survey, Open File Report 6304, 83p.

Durham, B. 1996. Band-Ore Resources Ltd.: Ross property: Summary report of exploration activities; Timmins Resident Geologist Office, assessment file T-3770, AFRO#42B01NE0036, 34p.

Evans, A.M. 1993. Ore geology and industrial minerals, third edition; Blackwell Science Ltd., Malden, Massachusetts, 389p.

Grant, J.C. 2012. Geophysical report for Rogue Resources Inc. on the Nat River iron project, Keith, Kenogaming and Penhorwood townships, Porcupine Mining Division, Northeastern Ontario; Timmins Resident Geologist Office, AFRO#2.51964, 19p.

Hallé, L. 1984. Quinterra Resources Inc. internal report: Geology of Nat River property; Timmins Resident Geologist Office, assessment file T-2814, AFRO#63.4501, 24p.

Hastie, E.C.G., Lafrance, B. and Kontak, D.J. 2015. Observations on the Kenty and Rundle deposits, Swayze greenstone belt; *in* Summary of Field Work and Other Activities, Ontario Geological Survey, Open File Report, 6313, p.1-9 to 9-9.

Hutteri, H.P. 1988. Reverse circulation overburden drilling report on the Fredrick House Lake property, German, Evelyn and Dundonald Townships, for Kangeld Resources Ltd. p.137. (OGS AFRI file - 42A10NW0563).

International Norvalie Mines Ltd. 1971. Diamond drilling and core donation; Timmins Resident Geologist Office, core library, assessment file T-0429, 11p.

Jackson, S.L. and Fyon, A.J. 1991. The western Abitibi Subprovince in Ontario; *in* Geology of Ontario, Ontario Geological Survey , Special Volume 4, part 1, p. 404-482.

Karvinen, W.O. 1989. Brightwest Resources Report - (OGS AFRI file 42A10SW0100).

Lee, H.A. 1979a. Data base map, Pamour, NTS 42A/NW; Ontario Geological Survey, Northern Ontario Engineering Geology Terrain Study, Map 5026, scale 1:100 000.

Lee, H.A. 1979b. Data base map, Iroquois Falls, NTS 42A/NE; Ontario Geological Survey, Northern Ontario Engineering Geology Terrain Study, Map 5027, scale 1:100 000.

Linekar, H. 1967. Titanium-silver property; Timmins Resident Geologist Office, donated file T-5361, 7p.

Low, J.H. 1960. Report on a geomagnetic survey of the Nat River group of Kukatush Mining Corporation, Penhorwood and Kenogaming townships, Ontario; Timmins Resident Geologist Office, assessment file T-669, 10p.

MacNeil, K.A. and Averill, S.A. 1996. BHP Minerals Canada Ltd. Matheson Township properties, Ontario, reverse circulation overburden drilling and heavy mineral geochemical sampling, p.189. (OGS AFRI file 42A10SW0065).

MacRae, W. 2008. Matamec Exploration Inc.–Diamond drill report on Matheson Joint Venture property, Matheson Township, Ontario. (OGS file 20005659.pdf).

Middleton, R.S., Forslund, N.R. and Laarman, J. 2015. 2015 report on diamond drilling at the Sugar Zone property, Dayohessarah Lake area, White River, Ontario; Timmins Resident Geologist Office, assessment file WP Hambleton.24, AFRO#2.55984, 175p.

Milne, V.G. 1972. Geology of the Kukatush–Sewell Lake area, District of Sudbury; Ontario Division of Mines, Geological Report 97, 116p.

Montgomery, J.K. 2010. Report on the 2010 diamond drilling of the Penhorwood property, Porcupine Mining Division, northeastern Ontario; Timmins Resident Geologist Office, assessment file T-6194, AFRO#2.46685, 170p.

Morin, D.C. 1991. Project – gold occurrence and project – zinc property, Penhorwood Township, Porcupine Mining Division; Timmins Resident Geologist Office, assessment file T-2726, AFRO#63.5980, 15p.

Ontario Geological Survey 2015. Mineral Deposit Inventory; Ontario Geological Survey, Mineral Deposit Inventory (May 2015 update), online database.

Ontario Geological Survey 2016. Mineral Deposit Inventory; Ontario Geological Survey, Mineral Deposit Inventory (February 2016 update), online database.

Préfontaine, S. 2014. Review of the stratigraphic episodes associated with the Bartlett, Halliday and Shaw domes, Abitibi greenstone belt; *in* Summary of Field Work and Other Activities 2014, Ontario Geological Survey, Open File Report 6300, p.6-1 to 6-15.

Rhys, D. 2015. Gold deposit structure, with applications to exploration and mining; Structural geology short course, October 17 and 18, 2015, Timmins, Ontario.

Stott, G.M. 1999. Precambrian geology of the Dayohessarah Lake area, White River, Ontario; Ontario Geological Survey, Open File Report 5984, 59p.

van Hees, E.H., Shelton, K.L., Ross, L.M., Cousens, B.L., Falck, H. Robb, M.E. and Canam, T.W. 1989. Metasedimentary influence on metavolcanic-rock–hosted greenstone gold deposits: Geochemistry of the Giant mine, Yellowknife, Northwest Territories, Canada; Geology, v.27, no.1, p.71-74.

van Hees, E.H. 2000. The formation of high-grade gold deposits in the Abitibi greenstone belt and its relation to regional metamorphism; unpublished PhD Thesis, University of Michigan, Ann Arbor, Michigan, 314p.

Waychison, W. 2005. Report on the 2004 Exploration Program Drill Holes MT04-21 through MT04-23, Claims P528352 through P528354 inclusive, Matheson Twp., Ontario for the Porcupine Joint Venture.

Wu, Q. and Lin, S. 2015. Deformation of the Swayze greenstone belt: Insights from structural geology and uranium-lead geochronology; *in* Summary of Field Work and Other Activities, Ontario Geological Survey, Open File Report, 6313, p.10-1 to 10-8.

This page left blank intentionally.

Ontario

Ontario Geological Survey
Regional Resident Geologist Program

Timmins Regional Resident Geologist (Sault Ste. Marie District)—2015

by

A. Pace and J. Walmsley

2016

CONTENTS

Sault Ste. Marie District—2015

Tables

Figures

Timmins Regional Resident Geologist (Sault Ste. Marie District)—2015

A. Pace[1] and J. Walmsley[2]

[1]District Geologist, Sault Ste. Marie District, Resident Geologist Program, Ontario Geological Survey

[2]District Geological Assistant, Sault Ste. Marie District, Resident Geologist Program, Ontario Geological Survey

INTRODUCTION

Mineral production from the Sault Ste. Marie District during 2015 consisted of gold production from 3 producing gold mines and bedrock aggregate extraction from several established quarries. A total of 45 individuals and companies are known to have performed mineral exploration and prospecting in the district during the year. As of December 31, 2015, a total of 10 027 claim units were active and a total of $3 783 680 of assessment work was completed in the Sault Ste. Marie District. Gold, base metals, uranium and rare earth metals were the major commodities targeted by exploration. Details on exploration activity can be found in the following text and by reference to Table 6.

MINING ACTIVITY

Gold production in the Sault Ste. Marie District came from 3 mines in 2015. Production statistics and descriptions of the individual mining operations are presented below. Historical gold production for the Wawa area is presented in Table 4. Mineral deposits not being mined in the Sault Ste. Marie District are listed in Tables 14 and 15.

Wesdome Gold Mines Ltd.

Wesdome Gold Mines Ltd. owns and operates the Eagle River Mine Complex in Wawa, Ontario. The Complex consists of the Eagle River Mine and the open pit Mishi Mine, both of which feed a common mill located on the Eagle River Mine property. The mines are within the Mishibishu Lake greenstone belt. Total gold production from both mines in 2015 amounted to 50 712 ounces.

In 2015, the company finished developing a 4 year production guidance and mine plan for the Eagle River Complex that spans the years 2016 to 2019. The plan includes (Wesdome Gold Mines Ltd., press release, September 15, 2015)

- doubling its Mishi open pit production to approximately 20 000 ounces per year,
- mill upgrades, bringing the mill capacity up to 1500 tonnes per day from 900 to 1000 tonnes per day, and
- construction of a new tailings management facility with an operating life of at least 10 years to accommodate higher levels of mill throughput and to provide a modern facility for tailings management

EAGLE RIVER MINE

The Eagle River Mine is located approximately 7 km north of the north shore of Lake Superior and 50 km west of the town of Wawa and has been in production since 1996. For the year ending 2015, 41 132 ounces of gold was produced from 173 189 tonnes of ore milled. The average recovered grade was 7.8 g/t gold (Wesdome Gold Mines Inc., press release, January 18, 2016). Ore reserves at the Eagle River Mine are shown in Table 1. Current and past production from the Eagle River Mine is shown in Table 3.

Most of the development at the Eagle River Mine in 2015 focussed on the 300 Zone, which consists of the 300 West Zone and the 300 East Zone, and which is located approximately 300 m north of and parallel to the No. 8 Zone (the mine's main producing structure). Drifting and diamond drilling identified 4 new lenses of mineralization. The company describes these lenses as being zones of subvertical quartz veins, opening up at depth with consistent high grades.

Two of the 4 lenses are within the 300 West Zone on the 750 m and 872 m levels. The 300 West Zone started production in the third quarter of 2015.

The 2 other lenses are within the 300 East Zone. Exploration of this zone continues in order to determine its economic viability (Wesdome Gold Mines Inc., press release, November 30, 2015).

Table 1. Eagle River Mine ore reserves, 2015.

Category	Tonnes	Grade (g/t gold)	Contained Ounces
Proven	165000	10.0	53 000
Probable	846 000	9.1	247 000
Total	1 011 000	9.2	300 000

MISHI MINE

The Mishi Mine is situated 2 km northwest of the Eagle River mill. Commercial production began on January 1, 2012, but was suspended in June of 2013 to allow the company to work through the stockpile and allow for mill upgrades. Gold production resumed in the first quarter of 2015, and for the year ending 2015, the mine produced 9580 ounces of gold from 132 942 tonnes milled. Processed ore was from both ore stockpiles and new run of mine ore. The average recovered grade was 2.6 g/t gold (Wesdome Gold Mines Ltd., press release, January 18, 2016). Ore reserves at Mishi Mine are shown in Table 2. Current and past production from the Mishi Mine are shown in Table 3.

The company completed shallow definition drilling, designed to confirm extensions of the mineralization. The drilling program consisted of 89 holes totalling 9915 m over a 1.3 km strike length (Wesdome Gold Mines Ltd., press release, August 18, 2015). Results from the drilling program confirmed continuity both west and east along strike of the Mishi Mine gold deposit and provide the basis for a new resource definition and mine planning (Wesdome Gold Mines Ltd., press release, January 12, 2016).

Table 2. Mishi Mine ore reserves, 2015.

Category	Tonnes	Grade (g/t gold)	Contained Ounces
Proven	157 000	2.2	11 000
Probable	1 728 000	2.2	120 000
Total	1 885 000	2.2	131 000

Table 3. Combined historical and current gold production from the Wesdome Gold Mines Ltd. – Wawa operations.

Mine	Year	Tonnes Milled	Recovered Grade(g/t gold)	Ounces
Eagle River	1990	60 857	4.93	9946
	1995	28 571	10.56	9700
	1996	162 075	12.38	64 523
	1997	156 294	8.97	45 070
	1998	199 464	11.79	75 629
	1999	163 156	9.1	47 749
	2000	229 262	7.03	51 843
	2001	246 012	8.6	68 074
	2002	281 603	8.17	73 938
	2003	241 926	9.1	70 781
	2004	246 012	8.34	65 977
	2005	198 217	8.33	53 062
	2006	135 100	10.05	43 669
	2007	76 676	13.07	32 299
	2008	118 961	12.98	49 660
	2009	132 004	14.32	60 753
	2010	155 554	7.34	36 712
	2011	178 786	5.27	28 200
	2012	155 000	6.35	31 600
	2013	125 000	10.7	42 850
	2014	123 375	12.1	48 190
	2015	173 189	7.8	41 132
	Total	3 587 094	9.42	1 051 357
Edwards	1997–2002	389 550	11.15	139 692
Mishi	2002	20 000	4.41	2838
	2003	28 090	3.61	3256
	2004	43 947	3.6	5086
	2007	43 458	3.14	4382
	2012	67 200	2.47	5300
	2013	19 748	3.4	2139
	2014	67 149	2.1	4567
	2015	132 942	2.6	9580
	Total	422 534	3.17	37 148
	Combined Total	4 399 178	7.91	1 228 197

Table 4. Historical gold production in the Wawa area to the end of 2015.

Mine	Township	Years of Production	Tons Milled	Production (oz. gold)	Grade (oz./ton)
Alden–Goudreau	Cowie	1937, 1940, 1943, 1945	13 479	3220	0.24
Centennial	Naveau	1939–1940	8612	610	0.07
Cline	Jacobson	1938–1940, 1947–1948	331 842	63 328	0.19
Darwin/Grace	McMurray	1902–1903, 1907–1908, 1910, 1923, 1925, 1930, 1935, 1937, 1940, 1943–1944	45 528	15 191	0.33
Deep Lake	McMurray	1936–1938, 1943	2790	1633	0.59
Eagle River	Point Isacor	1995–2015	3 587 094	1 051 357	0.27
Edwards	Jacobson	1938	1537	485	0.32
		1997–2002	389 550	139 692	0.327
Holdsworth prospect	Corbiere	1933	60	10	0.17
Island Gold	Finan	2007–2015	1 808 373	341 776	0.20
Kremzar	Finan	1988–1990	392 858	37 678	0.10
Magino/Algoma Summit	Finan	1930–1940, 1988–1992	>768 679	113 228	0.15
Magnacon	Mishibishu Lake	1989–1990	165 000	15 356	0.09
Minto (includes Jubilee and Cooper)	McMurray	1929–1942	184 600	37 678	0.20
Mishi	Mishibishu Lake	2002–2007, 2012–2015	422 534	37 148	0.09
Murphy/Algold/Amherst	Abotossaway	1926–1932, 1936–1938, 1940	23 211	2450	0.10
Norwalk/Manxman	Naveau	1904, 1910	820	60	0.07
Parkhill	McMurray	1902, 1929, 1930–1938, 1940–1944	125 778	54 301	0.43
Ranson	Rabazo	1939	774	156	0.20
Renabie	Leeson	1947–1970, 1981–1991	5 583 895	1 100 000	0.20
Smith/Van Sickle	McMurray	1935–1936	9228	536	0.06
Stanley	McMurray	1936	1963	84	0.04
Surluga	McMurray	1968–1969, 1988–1989	87 460	8898	0.10
		Total	**13 955 665**	**3 024 875**	**0.197**

Richmont Mines Ltd.

ISLAND GOLD MINE

The Island Gold Mine property is located in Finan Township, 80 km northeast of Wawa and 10 km southeast of Dubreuilville. Ore reserves at Island Gold Mine are shown in Table 5. Ore from the mine is processed at Richmont's onsite Kremzar mill which has an operating capacity of 850 tonnes per day. Since commercial production began in October 2007, the mine has produced more than 300 000 ounces of gold. Access to the underground operations is via a ramp.

Gold production for the year ending 2015 was 55 040 ounces from 242 137 tonnes of ore milled, at an average recovered grade of 7.31 g/t. (Richmont Gold Mines Ltd., press release, January 12, 2016).

Activities at the Island Gold Mine in 2015 included ramp and ore development accomplished by advancing the main access ramp to a target vertical depth of 740 m, and by drifting at the 620 m level, which has been extended to the east and has been used to complete its 2015 definition and delineation and exploration drilling program.

The company filed a National Instrument 43-101 Technical Report containing a Preliminary Economic Assessment (PEA) for a portion of the deeper resources of the Island Gold Mine. The measured and indicated resources of the Island Gold Mine, as of December 31, 2015, were estimated to be 733 500 tonnes at 9.29 g/t gold, for a total of 219 050 ounces of gold, and the inferred resources were estimated to be 3 547 500 tonnes at 8.79 g/t gold, for a total of 1 002 750 ounces of gold. Measured and indicated mineral resources of 438 000 tonnes grading 10.95 g/t, for a total of 154 200 ounces of gold, have been established for the lower zones of the Island Gold Mine. The inferred mineral resources total 3 178 000 tonnes grading 9.00 g/t, for a total of 919 950 ounces of gold in the lower zones of Island Gold mine, mostly in the C Zone (Richmont Mines Ltd., NI 43-101 Technical Report, December 11, 2015).

The company began an extensive diamond-drilling exploration program on the property. The program consists of 23 000 m of deep, directional drilling and 20 000 m of surface drilling. According to the December 21, 2015, press release, the overall objectives of the Island Gold exploration diamond-drilling programs are

- to test the potential above the 860 m level to extend mine life,
- to test the down-plunge extension of the deposit between the 860 m and 1500 m levels,
- to test the east-west lateral extension beyond the known deposit, and
- to test other, high-priority gold targets on the Island Gold property.

Table 5. Island gold mine ore reserves, 2015.

Category	Tonnes	Grade (g/t gold)	Contained Ounces
Proven and Probable	2 115 500	8.26	561 700
Measured and Indicated	348 500	6.40	71 700
Inferred Resources	2 815 000	8.49	768 050

QUARRYING ACTIVITY

Trap rock, stone and aggregate production continued from a number of quarries within the Sault Ste. Marie District. The production of aggregate material consists primarily of sand and gravel. Products derived from these aggregate resources are used in both road construction (to make concrete and asphalt) and building construction industries.

Ontario Trap Rock

Ontario Trap Rock (a division of R.W. Tomlinson Ltd.) continued quarrying crushed bedrock aggregate from Nipissing gabbro at their operation located 3 km east of the town of Bruce Mines in Plummer Additional Township.

The company produces approximately 800 000 to 1 000 000 tonnes of high-quality aggregate from this facility yearly. The main product produced from the trap rock operation is high-quality aggregate used for rail ballast, asphalt and road construction in both Canada and the United States.

The operating season begins in March and normally ends in November, and fills 27 to 30 fulltime positions, hired from the Lake Huron area. About 90% of the aggregate product is transported by ship from Ontario Trap Rock's deep-water port on Lake Huron. Tandem trucks are loaded with product in the quarry and driven to the port. At the port, product falls through a gate into an underground cement container

which dispenses the aggregate onto a conveyor belt that automatically loads the lake freighters at the dock. The remaining 10% of the product is transported by rail and truck.

There are 7 sizes of product that are crushed at the trap rock operation. These include, in inches, 5, 2.5, 1, 5/8, 3/8, 1/4 and sand or silt.

EXPLORATION ACTIVITY

A summary of exploration activity in the Sault Ste. Marie District is reported in Table 6. Locations for the activities are shown on Figures 1 and 2.

Table 6. Exploration activity in the Sault Ste. Marie District in 2015, keyed to Figures 1 and 2.

Abbreviations

AEM	Airborne electromagnetic survey	PFS	Preliminary Feasibility Study
AMAG	Airborne magnetic survey	Pr	Prospecting
DD	Diamond drilling	Rcalc	Resource calculation
GL	Geological survey	Samp	Sampling (other than bulk)
IP	Induced polarization survey	Strp	Stripping
MAG	Ground magnetic survey	Tr	Trenching
Met	Metallurgical testing	UG	Underground exploration/development
NEA	Natural Environment Assessment	VLF	Very low frequency survey

No.	Company/Individual Property Name	Township/Area	Exploration Activity
1	Argonaut Gold Inc. (Claim 4276606)	Finan	VLF
2	Argonaut Gold Inc. (Magino Property)	Riggs, Jacobson	DD, Rcalc
3	ARW Exploration Ltd.	Procter	Pr
4	Attwell, B.J.	Gapp	Pr
5	Augustine Ventures Inc., Wawa GP Inc. (Wawa Gold Project)	McMurray	Samp, DD, AMAG, IP
6	Batson, B.C.E.	West	Pr
7	Canoe Mining Ventures Corporation (Iron Lake Gold Project)	Abbie Lake area; Keating, Keating Additional Townships	DD
8	Clement, G.R, Racicot, F.C	McMurray	Pr
9	Clement, G.R	Rabazo	Pr
10	Clement, J.A.	Rabazo	Pr
11	Conquest Resources Ltd. (Smith Lake Project)	Rennie	Pr
12	Dan Patrie Exploration Ltd.	Chesley	Samp
13	Dewdney, P.N.	Jackson	Pr
14	First Minerals Exploration Ltd.	Meath	Pr
15	First Minerals Exploration Ltd.	Riggs	Pr
16	First Minerals Exploration Ltd.	Stover	Pr
17	Gagne, Michael and Yvon (Montgomery Copper Property)	Montgomery	Tr
18	Gibson, J.M.	Pukaskwa River area	Pr
19	Hicks, C.R., Lucuik, G., Ralph, J.G	Jollineau	Samp, Pr
20	International Montoro Resources Inc. (Serpent River Property)	Joubin, Gaiashk	DD
21	JD Exploration Inc. (Sharpsand River Project)	Rioux	Pr, Samp

No.	Company/Individual Property Name	Township/Area	Exploration Activity
22	Kehoe, C. (Claim 4250351)	Scriven, Bracci	Pr
23	La Ronge Gold Corp. (Old Cabin Project)	Jacobson	Pr, Samp
24	Laurin, R.M.	Hembruff	Pr
25	Loney, T.	Vankoughnet	Pr
26	O'Connor, T.	Ryan, Kincaid	Pr
27	O'Connor, T.	Ryan	Samp
28	Parent, S.P.	Norberg	Pr, Samp
29	Pele Mountain Resources (Eco Ridge Project)	Joubin	Met
30	Ralph, J.G.	Jessiman	Pr
31	Ralph, J.G.	Maeck	Pr
32	Red Pine Exploration Inc. (Wawa Gold Project)	McMurray	DD, Samp, AMAG, IP
33	Richmont Mines Inc. (Island Gold Property)	Finan	DD, Rcalc
34	Roy, G.	Gunterman	Pr
35	RT Minerals Corp. (Ballard Project)	Bruyere	Pr
36	Skead Holdings Ltd.	Gunterman	Samp
37	Skead Holdings Ltd.	Hughes	Samp
38	Superior Copper Corp. (The Superior Project)	Ryan, Kincaid	DD
39	Trelawney Mining and Exploration Inc. (Abbie Lake area)	Mishibishu Lake area	Pr
40	Trelawney Mining and Exploration Inc. (Mishibishu Lake Property)	Mishibishu Lake area	GL, Pr, DD
41	Tremblay, M.	West	Pr
42	Tremblay, M. (Wishart Ore Project)	Wishart	Pr, Samp
43	Weber, K.R, Dewdney, P.N.	Jackson	Pr
44	Wesdome Gold Mines Ltd. (Mishi Pit)	Mishibishu Lake area	DD
45	Wesdome Gold Mines Ltd. (Eagle River Mine, 300 and 7 Zone)	Point Isacor	UG, DD, Rcalc

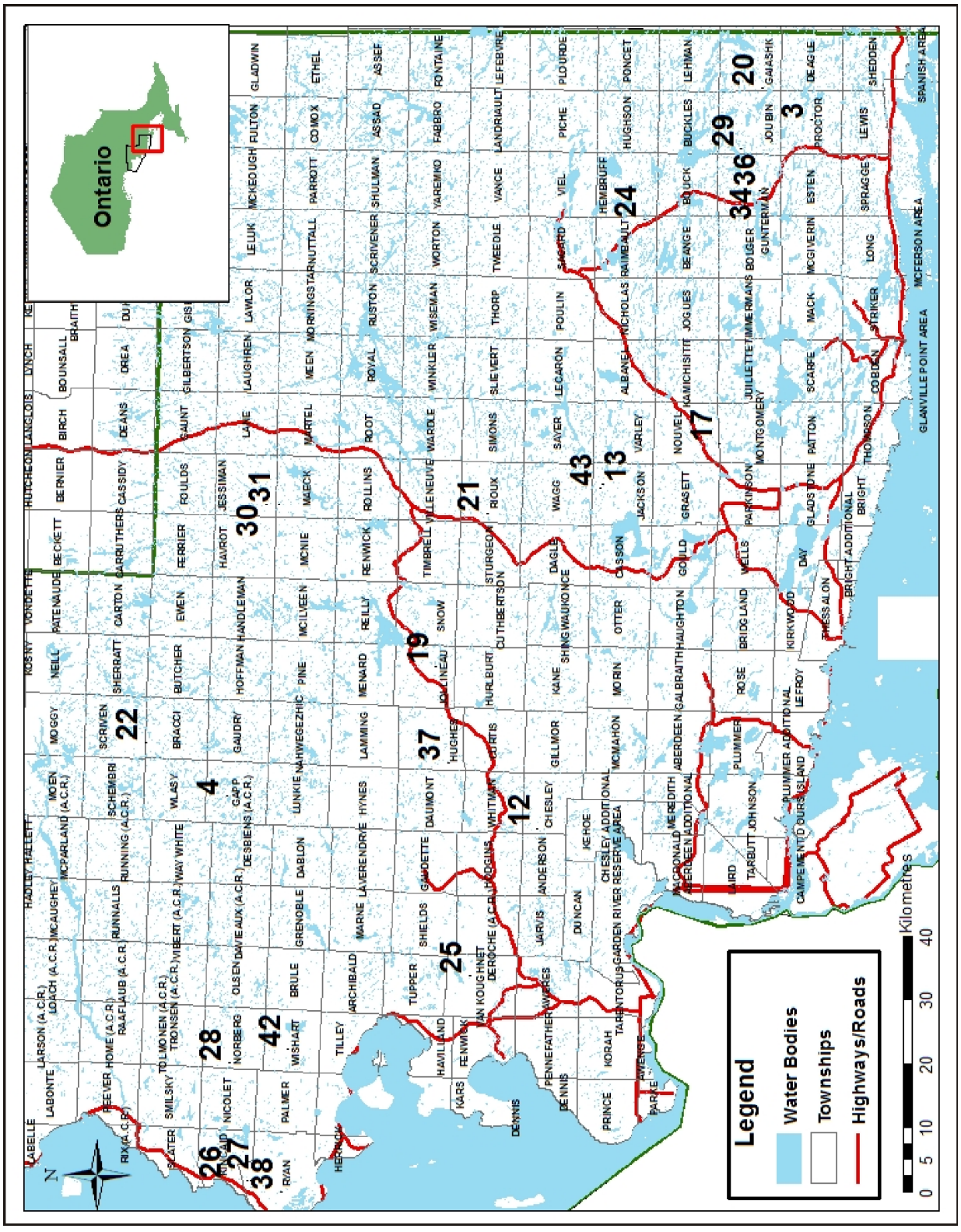


Figure 1. Exploration activity in the southern part of the Sault Ste. Marie District, 2015 (numbers keyed to Table 6).

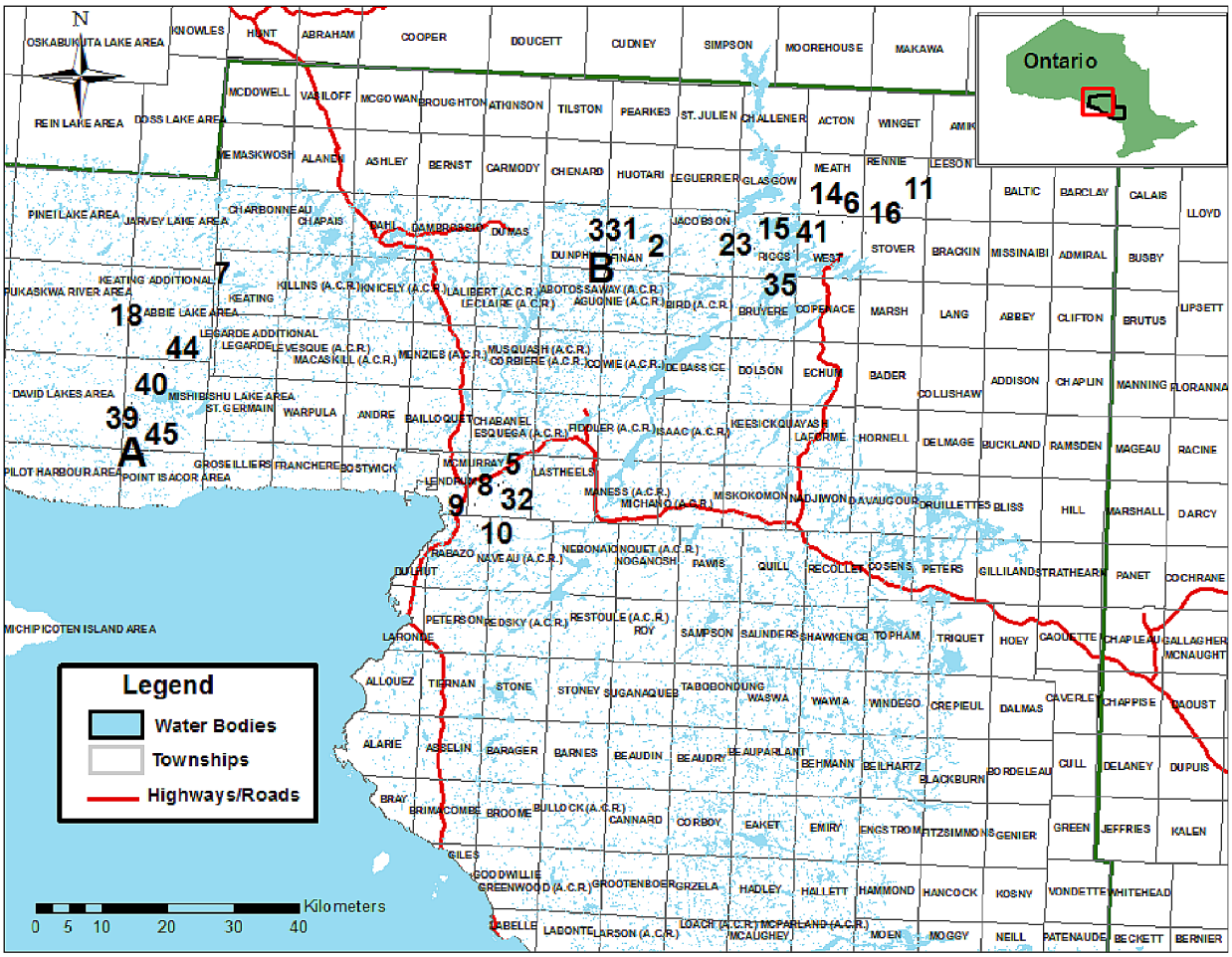


Figure 2. Exploration activity in the northern part of the Sault Ste. Marie District, 2015 (numbers keyed to Table 6). Letters indicate the location of current producing gold mines: A, Wesdome Gold Mines Ltd., Eagle River Mine Complex; and B, Richmont Gold Mines, Island Gold Mine.

ADVANCED EXPLORATION

Argonaut Gold Inc. – Magino Gold Project

In 2015, Argonaut Gold Inc. completed a twelve-hole, 4067 m diamond-drill program on ground acquired from Richmont Mines Ltd. that is situated adjacent to the Magino deposit. The purpose of the drilling program was to explore mineralization along the eastern projection of the Magino deposit. The drilling extended the Magino deposit for over 250 m eastward along strike. An updated resource and preliminary economic assessment includes the extension of the deposit (Argonaut Gold Inc., press release, June 15, 2015). The updated prefeasibility study for the Magino deposit built upon a preliminary feasibility technical report completed in January of 2014. Table 7 summarizes the updated prefeasibility study mineral resource estimate.

Table 7. Updated prefeasibility study mineral resource estimate of the Magino gold project.

Resource Category	Cutoff Grade (g/t gold)	Grade (g/t gold)	Tonnes	Contained Gold (ounces)
Indicated	0.25	0.88	143.8	4 069 000
Inferred	0.25	0.76	43.3	1 058 000
Probable	0.34	0.89	105.4	3 019 000

(Argonaut Gold Inc., press release, January 18, 2016)

EXPLORATION

International Montoro Resources Inc.

SERPENT RIVER PROPERTY—PECORS MAGNETIC ANOMALY

The Serpent River property consists of 10 claims covering 1840 hectares and is located 13 km east of Elliot Lake, Ontario. International Montoro Resources Inc., through their past exploration programs, determined that uranium mineralization occurs in the quartz-pebble conglomerates underlying the property. Significant rare earth element values accompany the uranium mineralization. The uranium mineralization is typical of that in the past-producing mines of the Elliot Lake camp (www.montororesources.com).

In 2009 and 2010, work completed by the Ontario Geological Survey, identified a strong, geophysical magnetic high on the Serpent River property and a lake sediment geochemical copper-nickel anomaly proximal to the magnetic high. The company labelled the geophysical anomaly the Pecors Magnetic Anomaly and believed it could represent a contact nickel-copper-platinum group element (PGE) style of mineralization located at the Archean–Proterozoic boundary.

In 2015 the company completed a diamond-drilling program consisting of 2 diamond-drill holes (PDH-1 and PDH-2) to investigate the Pecors Magnetic Anomaly. PDH-1 drilled to a depth of 1005 m and intersected a thick, medium- to coarse-grained gabbro hosting 2 distinct zones of disseminated sulphides. Assay results returned 2 significant intersections: 0.33 g/t total precious metals (TPM = platinum, palladium, gold), 0.11% Cu and 0.04% Ni over 12 m and 0.47 g/t TPM, 0.17% Cu and 0.06% Ni over 3 m (International Montoro Resources Inc., press release, May 26, 2015). Diamond-drill hole PDH-2 drilled to a depth of 1317 m and intersected gabbro from 650 m to 1206 m. Assays returned from this hole included 0.09 ppm Au, 0.12 ppm Pt, 0.08 ppm Pd, 1410 ppm Cu and 147 ppm Ni over 1 m (International Montoro Resources Inc., press release, October 20, 2015).

The company followed up the diamond drilling by contracting Crone Geophysics and Exploration Ltd. to conduct a down-hole survey using a 3-D Borehole Pulse EM System. The survey probed the entire length of drill hole PDH-2 (1317 m) (International Montoro Resources Inc., press release, August 20, 2015). The results of the down-hole survey defined 2 distinct conductive anomalies at depths from 580 m to 590 m and from 975 m to 1021 m (International Montoro Resources Inc., press release, October 20, 2015).

Pele Mountain Resources Inc.

ECO RIDGE MINE RARE EARTHS AND URANIUM PROJECT

Pele Mountain Resources Inc. continues to focus on the development of its Eco Ridge Mine Rare Earths and Uranium Project in Elliot Lake, Ontario. The company decided to advance its monazite recycling strategy as a means to kick-start the development of a sustainable, low cost, early-to-market, Canadian-based rare earth supply chain centred in Elliot Lake (Pele Mountain Resources Inc., press release, February 17, 2015). Although the company advanced the Eco Ridge Mine Rare Earth and Uranium Project in the last decade, market conditions have not supported the high capital expenditure required to commence a mining project from a bedrock source. The decline in rare earth and uranium prices since 2011, along with the bear market in resources stocks contributed to the company's strategic pivot toward monazite recycling. The company plans to source monazite from mineral sands mine tailings in countries that embrace sustainable mining practices and are allied trading partners with Canada. Their objective is to recycle the monazite to produce mixed rare earth concentrates that will be separated into high-purity, individual rare earth oxides that can be used in downstream, value-added processing and manufacturing (Pele Mountain Resources Inc., press release, February 17, 2015).

Pele Mountain Resources Inc. entered into a memorandum of understanding with Sheng Kang Ning Mining Investment Co. Ltd., to jointly pursue the development of a rare earth processing facility at the Eco Ridge property in Elliot Lake. Sheng Kang Ning Mining Investment Co. Ltd. possess proprietary technologies for environmentally sustainable, low cost, rare earth processing and have the expertise and experience to design, build and operate rare earth processing facilities (Pele Mountain Resources Inc., press release, March 30, 2015).

Pele Mountain Resources Inc. changed the name of its operating subsidiary that holds its Eco Ridge property from First Canadian Uranium Inc. to Eco Ridge Development Corporation (ERDC). The rebranding is intended to reflect growing international interest in project development at the Eco Ridge Property (Pele Mountain Resources Inc., press release, December 10, 2015).

Red Pine Exploration Inc.

WAWA GOLD PROJECT

The Wawa Gold Project property is located 2 km east of the town of Wawa, Ontario. The property lies entirely within McMurray Township and is accessed off Highway 101 by a gravel road that once led to the past-producing Jubilee and Surluga mines. The property consists of 172 patented, leased and unpatented mining claims, totalling 2326 hectares. Historically, the Wawa Gold Project property hosted 8 producing mines or developed prospect, with gold production exceeding 120 000 ounces. A summary of the mineral resources is shown in Table 8. (Red Pine Exploration Inc., press release, January 6, 2015.)

Red Pine's exploration work in 2015 further defined an open pit and underground gold resource on the Surluga deposit. As well, the company discovered 5 near surface gold deposits to the west and east of the Surluga deposit. This suggests that the Surluga deposit may be part of a much broader gold system, which Red Pine refers to as the Wawa Gold Corridor.

The Wawa Gold Corridor contains at least 6 zones of gold mineralization: from west to east they are the Hornblende Shear Zone, the William Gold Zone, the Jubilee Shear Zone (containing the Surluga deposit), the Minto Shear Zone, the Sunrise Shear Zone and the Mickelson Shear Zone. The Wawa Gold Corridor is about 1.5 to 2.0 km wide and the gold zones remain open along strike and to depth. The company contracted SRK Consulting (Canada) Inc. to calculate open pit and underground resources.

Table 8. Mineral resources statement, Wawa Gold Project.

Inferred Resources	Cut-off Grade (g/t gold)	Quantity (t)	Grade (g/t gold)	Contained Gold (ounces)
Pit constrained	0.40	10 239 000	2.05	676 000
Outside pit	0.40	8 630 000	1.07	298 000
Constrained				
Underground	2.50	955 000	3.73	114 000
Total	0.50	19 824 000	1.71	1 088 000

(Red Pine Exploration Inc., press release, May 26, 2015)

Red Pine reports that the Hornblende Shear Zone and the William Gold Zone have similar grades and thicknesses to the Surluga deposit. In addition, gold mineralization not associated with strongly sheared rock occurs between the zones of shear-hosted gold. This new type of gold mineralization is characterized by weakly to moderately sheared rock and strong hydrothermal replacement in which gold is associated with finely disseminated sulphides. (Red Pine Exploration Inc., Press Release, January 21, 2016.)

Superior Copper Corporation

SUPERIOR COPPER PROJECT

The Superior Copper Project consists of a number of discontiguous properties located approximately 85 km north of Sault Ste. Marie, Ontario, in Ryan Township. The properties are hosted in the western portion of the Batchawana greenstone belt, which comprises Archean metavolcanic and mid-Proterozoic Keweenawan rocks. The property is spatially associated with prominent structural features related to the Lake Superior Mid-Continental Rift.

Early in 2015, the company completed 5 diamond-drill holes totalling 3385 m. The program tested geophysical targets. Drill hole SPC-15-03 intersected 14.17 m grading 0.282% Cu and tested an induced polarization anomaly spatially associated with a high-grade copper mineralization (Superior Copper Corporation, press release, May 4, 2015).

In November, a five-hole, 3500 m diamond-drilling program commenced to test a new structural and alteration model developed after a thorough review of available exploration data and reconnaissance mapping carried out during the summer (Superior Copper Corporation, press release, November 16, 2015). Superior Copper suspended the drilling program after the completion of 3 diamond-drill holes. The drilling intersected multiple zones of open-space quartz-carbonate veins consistent with the model; however, no significant assays were returned. The company plans to consider options to better delineate more favorable zones of copper mineralization. (Superior Copper Corporation, press release, January 16, 2016.)

SAULT STE. MARIE DISTRICT STAFF ACTIVITIES

The Sault Ste. Marie District Geologist office is staffed by A. Pace, District Geologist, and J. Walmsley, District Geological Assistant, with assistance from C. Keilty, who worked as a summer experience student. R. McMillan resigned his position as District Geological Assistant in June of 2015 and C. Keilty accepted an acting assignment in this position for the months of July and August. K. Zambusi accepted a 3 month contract as the District Geological Assistant from September to November 2015. J. Walmsley filled the position of District Geological Assistant in December 2015.

During 2015, the office devoted a great amount of time on an ongoing project developing standards to catalogue data that pertains to the Sault Ste. Marie District. Researching, scanning, and cataloging mine plans and donated assessment files is the priority. The goal is to capture relevant data into a searchable database that can assist clients and staff more efficiently.

During the year, the Sault Ste. Marie District Geologist office completed 40 property visits, provided 4 field trips, and updated a total of 5 Mineral Deposits Inventory (MDI) records. Assessment files received in 2015 are listed in Table 9. A. Pace attended the Prospectors and Developers Association of Canada (PDAC) convention in Toronto, Ontario, in March. While at the meeting, A. Pace participated in a short course titled "Structural geology of gold and copper deposits, with emphasis on ores in continental margin tectonic settings", staffed the Ontario Pavilion, and networked with various prospectors and junior exploration companies active in the Sault Ste. Marie District.

In May 2015, A. Pace attended the 61st annual meeting of the Institute on Lake Superior Geology (ILSG) in Dryden, Ontario. This included 2 days of technical sessions and participating in 2 field trips. The ILSG is an annual event that provides a forum for professionals and students to exchange geological ideas and scientific data in order to promote a better understanding of the geology of the Lake Superior region. A. Pace attended the Big Event Mining and Supply Show in Timmins, Ontario, and gave a presentation titled "Mining and Exploration Activities in Northeastern Ontario". A. Pace, in conjunction with Argonaut Gold Mines Ltd., led a field trip for the Sault and District Prospectors Association to the Magino Mine Project in Dubreuilville, Ontario.

In June 2015, A. Pace provided a field trip on the Huronian stratigraphy and geology of the Elliot Lake area to members of the Elliot Lake Geology Group. A total of 75 participants attended the two-day field trip. A. Pace also provided a field trip on the Keweenawan Rocks of the Mamainse Point Area to 25 undergraduate students from Lake Superior State University.

In July 2015, A. Pace, along with A. Wilson, began to prepare field trips in the Wawa area for an upcoming Institute on Lake Superior Geology Conference to be held in Wawa, Ontario, in 2017. This involved selecting a venue for the technical sessions and determining what field trips will be of interest to delegates.

In October 2015, A. Pace also provided a field trip on the Keweenawan Rocks of the Mamainse Point Area to staff of the Thunder Bay North Resident Geologist Office. A. Pace prepared and described drill core of the Mamainse Point stratigraphy and provided drill core samples to the curator of the Earth Science Museum at the University of Waterloo. A. Pace provided assistance to the Northeast Regional Manager, Resident Geologist Program, in the competition process for filling the permanent position of District Geological Assistant.

In November 2015, A. Pace attended the northeastern annual Resident Geologist Program meeting in Timmins, Ontario, as well as the Ontario Geological Survey Branch meeting in Sudbury, Ontario. A. Pace provided a presentation to the Sault and District Prospectors Association on how to use the various applications and tools that are available to download data from the Ministry of Northern Development and Mines Web site. A. Pace was tasked to compile and edit the Resident Geologist Program's Recommendations for Exploration publication, which was released in 2016.

In December 2015, A. Pace compiled and standardized a spreadsheet of all thesis work completed in the Sault Ste. Marie district. J. Walmsley commenced his role as the District Geological Assistant.

Table 9. Assessment files received in the Sault Ste. Marie District in 2015.

Abbreviations

Assay..... Assaying
Bulk ..... Bulk sampling
DD ..... Diamond drilling
DDH ..... Diamond-drill hole(s)
EM..... Ground electromagnetic survey
GL ..... Geological survey
GM ..... Ground magnetic survey
GRA ..... Ground radiometric survey
IP ..... Induced polarization survey
Lc ..... Line cutting
Mag ..... Ground magnetic survey
Map ..... Geological Mapping
PEA ..... Preliminary Economic Assessment Report
Pr ..... Prospecting
PStrip..... Overburden stripping
Rept ..... Report
Samp..... Sampling (other than bulk)
Str ..... Stripping
TEM ..... Time domain electromagnetic survey
Tr ..... Trenching
VLFEM ..... Very low frequency electromagnetic survey
VTEM ..... Versatile time domain electromagnetic survey

Township or Area	Company Name	Year	Type of Work	AFRO Number	Resident Geologist Office File Designation
Bracci and Scriven	Carl Kehoe	2014	Assay, Pr	2.55400	SSMP Bracci-03
Kincaid and Ryan	Thomas O'Connor	2013–2014	Assay, Pr, Samp	2.55547	SSMP Kincaid-26
Abbie Lake	Canoe Mining Ventures	2014	DD	2.55393	WP-Abbie Lake-47
Mishibishu Lake	Trelawney Mining and Exploration Inc.	2014	Map	2.55664	WP Mishibishu Lake-93
Mishibishu Lake	Trelawney Mining and Exploration Inc.	2014–2015	DDH	2.55665	WP Mishibishu Lake-94
Montgomery	Michael and Yvon Gagne	2014	Tr	2.55541	SSMP Montgomery-30
Rioux	JD Exploration Inc.	2014–2015	GM, Samp, Assay	2.55701	Rioux-0012
Chelsey	Dan Patrie Exploration LTD	2015	Samp	2.55796	SSMP Chesley-03
Ryan	Superior Copper Corp.	2014–2015	DD	2.55695	SSMP Ryan-49
McMurray	Red Pine Exploration/Augustine Ventures	2014–2015	IP	2.55771	WP McMurray-106
Gunterman	Skead Holdings	2014–2015	Assay	2.55834	SSMP Gunterman-21
McMurray	Red Pine Exploration/Augustine Ventures	2014–2015	DD	2.55850	WP McMurray-107
Hughes	Skead Holdings	2011–2015	Samp, Assay	2.55833	SSMP Hughes-15
Jacobson	La Ronge Gold Corp.	2014–2015	Samp, Assay	2.55870	WP Jacobson.119
Point Isacor	Wesdome Gold Mines Ltd.	2013–2014	DD	2.55916	WP Point Isacor-31
Finan	Prodigy Gold Inc.	2015	VLFEM	2.55936	WP Finan-93
Ryan	Thomas O'Connor	2013–2015	Rept	2.55992	SSMP Ryan-50
Wishart	Mike Tremblay	2013–2014	Pr, Assay	2.55887	SSMP Wishart-10
Abbie Lake, Keating, Killins	C Level III Inc.	2011–2013	Rept	N/A	WP-Keating-05
Buckles, Bouck	Scott Wilson RPA for Denison Mines Corp.	2007	Rept	N/A	SSMP Buckles-18
Bouck, Buckles, Beange, Gunterman, Joubin	Watts, Griffis and McOuat Ltd. For Appia Energy Corp.	2007–2013	Rept	N/A	SSMP Bouck-10
Joubin	Pele Mountain Resources Inc.	2011–2012	PEA	N/A	SSMP Joubin-31
Bruyere	Lakeland Resources Inc.	2011–2013	Rept	N/A	WP Bruyere-32
Cowie	Zara Resources Inc.	2011–2013	Rept	N/A	WP Cowie-11
Finan	Argonaut Gold Inc.	2013	Rept	N/A	WP Finan-94
Finan, Jacobson	Richmont Mines Inc.	2013	Rept	N/A	WP Finan-95
Jacobson	Strike Minerals Inc.	2013	Rept	N/A	WP Jacobson.120
Gaiashk	International Montoro Resources Inc.	2007	Rept	N/A	SSMP Gaiashk-27
McMurray	Augustine Ventures Inc.	2011	Rept	N/A	WP McMurray-108

Note: *The Resident Geologist Office File Designation incorporates the name of the township in which the assessment work was performed.*

PROPERTY EXAMINATIONS

The Kristina Property

LOCATION

The Kristina property (UTM Zone 16, 721639E 5196571N) is in the southwestern corner of Laverendrye Township. Primary access to the property is via Highway 17 north from Sault Ste. Marie to Highway 556 at Heyden, then Highway 556 east for approximately 40 km to Regional Road 532 and north on Regional Road 532 from Searchmont through Wabos for approximately 20 km to the Kristina property.

EXPLORATION HISTORY

The Kristina property consists of 17 contiguous patented mining claims (12 with surface and mining rights and 4 with mining rights only), joined to 7 contiguous, unpatented mining claims. All parcels are located in the southwest corner of Laverendrye Township. The patented and unpatented mining claims are held by B. Poland.

Table 10 summarizes the exploration history of the property. The history of exploration activity was compiled from the assessment files filed for Jollineau Township, located in the Sault Ste. Marie District Geologist Office.

Table 10. History of exploration activity conducted on the Kristina property from 1901 to 1957.

Company	Work Done	Date	Results
Superior Copper Co. Ltd.	Mine development operations	1901–1907	Development of 6 shafts: • No. 6 shaft: main shaft was 400 feet deep, and 490 feet of drifting on the vein on the 100 foot level, 240 feet on the 200 foot level, 120 feet on the 300 foot level and 25 feet on the 400 foot level. • Shafts No. 1 to No. 5 are 100 feet or less in depth and each has only a very limited amount of lateral work. A 50 ton concentrate mill was erected near No. 6 shaft with copper output from 1903 to 1907 producing 652 000 pounds of copper valued at $38 698.
Kristina Copper Mine Ltd.	Prospectus report, diamond drilling	1950–1952	1952 diamond drilling: 31 holes totalling 10 636 feet, best assay: • 7.95% copper over 3 feet • 4.75% copper over 5 feet • 6.80% copper over 5 feet • 3.40% copper over 5 feet • 2.32% copper over 15 feet
Supercrest Copper Mines Ltd.	Geological mapping, geophysics, diamond drilling, ore reserve estimate	1952–1957	1956 diamond drilling: 34 holes totalling 11 382 feet, no assays returned from diamond drilling. Estimate of ore reserve based on Probable and Possible estimates from shafts No. 4 and No. 6: Tonnage: 369 391 tonnes at a grade of 1.95% copper (non-NI 43-101 compliant)

PROPERTY GEOLOGY

Information about the geology of the property is very limited. Neither the Ontario Geologicial Survey or the Geological Survey of Canada have ever mapped the area in any detail. The only detailed geological map of the Kristina property was completed by Supercrest Copper Mines Ltd. in 1956. The map (Figure 3) is part of a geological report that was submitted for assessment and is on file in the Sault Ste. Marie District Geologist Office.

The area is underlain by granitic rocks of the Archean Algoma Plutonic Domain, which is cut by a series of northwest-trending mafic intrusions. The mineral showing is documented in the Mineral Deposit Inventory (MDI) database as MDI41K16NE00002 (Ontario Geological Survey 2015a). A total of 6 southeast-trending shafts were developed on the property.

Staff of the Sault Ste. Marie District Geologist Office visited the property to investigate the reported copper mineralization. The field visit was spent examining a recently exposed section in the No. 1 shaft area. The area was stripped by B. Poland, exposing approximately 122 m of mineralized quartz veining in the No. 1 shaft area (UTM Zone 16, 720983E 5197156N). A massive, equigranular granitic rock of the Algoma Plutonic Domain hosts the mineralized quartz veining. The granitic rock is medium- to coarse-grained, light pink and composed of quartz, plagioclase, amphibole and biotite. The coarse-grained portions exhibit a foliation as evidenced by the alignment of biotite and amphibole crystals. The granitic rock is cut by an a east-trending, coarse-grained but foliated mafic dike that also exhibits a stretching lineation. Both the granitic rock and the mafic dike are cut by a north-northwest trending diabase dike. The contacts of the diabase dike exhibit iron-gossan staining and carbonate alteration. Parallel to the diabase dike is a white sugary-textured quartz vein that strikes 160/70SW (Figure 4A). The mineralization occurs in fractures, with associated quartz veining hosted within the granitic rock and diabase dike.

Staff of the Sault Ste. Marie District Geologist office collected 7 grab samples during this visit and submitted them to the OGS Geoscience Laboratories for analysis. Table 11 contains the analytical results for 5 of those samples. The two other samples, 005-Kristina-2015 (UTM Zone 16, 720952E 5197179N) and 007-Kristina-2015 (UTM Zone 16, 720964E 5197202N), which were taken from the mineralized quartz vein at the No. 1 shaft, are not included in this table because they were analyzed only for copper. They returned significantly anomalous copper results of more than 15 000 ppm each.

In the area of the No. 1 shaft, the District Geologist identified a quartz-porphyry unit (Figure 4B) that is highly siliceous, porphyritic and reddish in colour. This felsic unit is in close proximity to a shear-hosted quartz vein and intrudes the granite. A sample (006-Kristina-2015) of the quartz porphyry was collected and sent for geochemical analysis, the results of which are listed in Table 11.

Limited bedrock exposure in the vicinity of shafts Nos. 2 through 6 prevents meaningful description of the geology in those areas.

CONCLUSION AND RECOMMENDATION

The Kristina property copper occurrence resembles a vein-type copper showing.

Fracturing observed in the No. 1 shaft area controlled the development of copper mineralization. The mineralized trend is parallel to the strike of the fractures and not the strike of the quartz veining. The elevated potassium and sodium values (Table 11) obtained from samples along the mineralized shear zone provide evidence of hydrothermal alteration. Felsic quartz-porphyry dikes, along with a series of northwest-trending mafic intrusive rocks, were encountered on the property, close to the mineralized shear zone. These rock units may have intruded pre-existing fault zones that contributed to the fractures observed on the property. The close proximity to Late Proterozoic intrusive and extrusive rocks to the west would warrant further investigation as to the timing of the northwest-trending mafic intrusive rocks and felsic porphyry and whether they are associated with the mineralization.

The 6 shafts sunk on the property follow the southeast trend of the observed quartz veins which strike approximately 160°. The trend of the mineralization is parallel to fracturing and not the strike of the quartz veining. Further work should investigate if the observed fracturing is related regional fault structures.

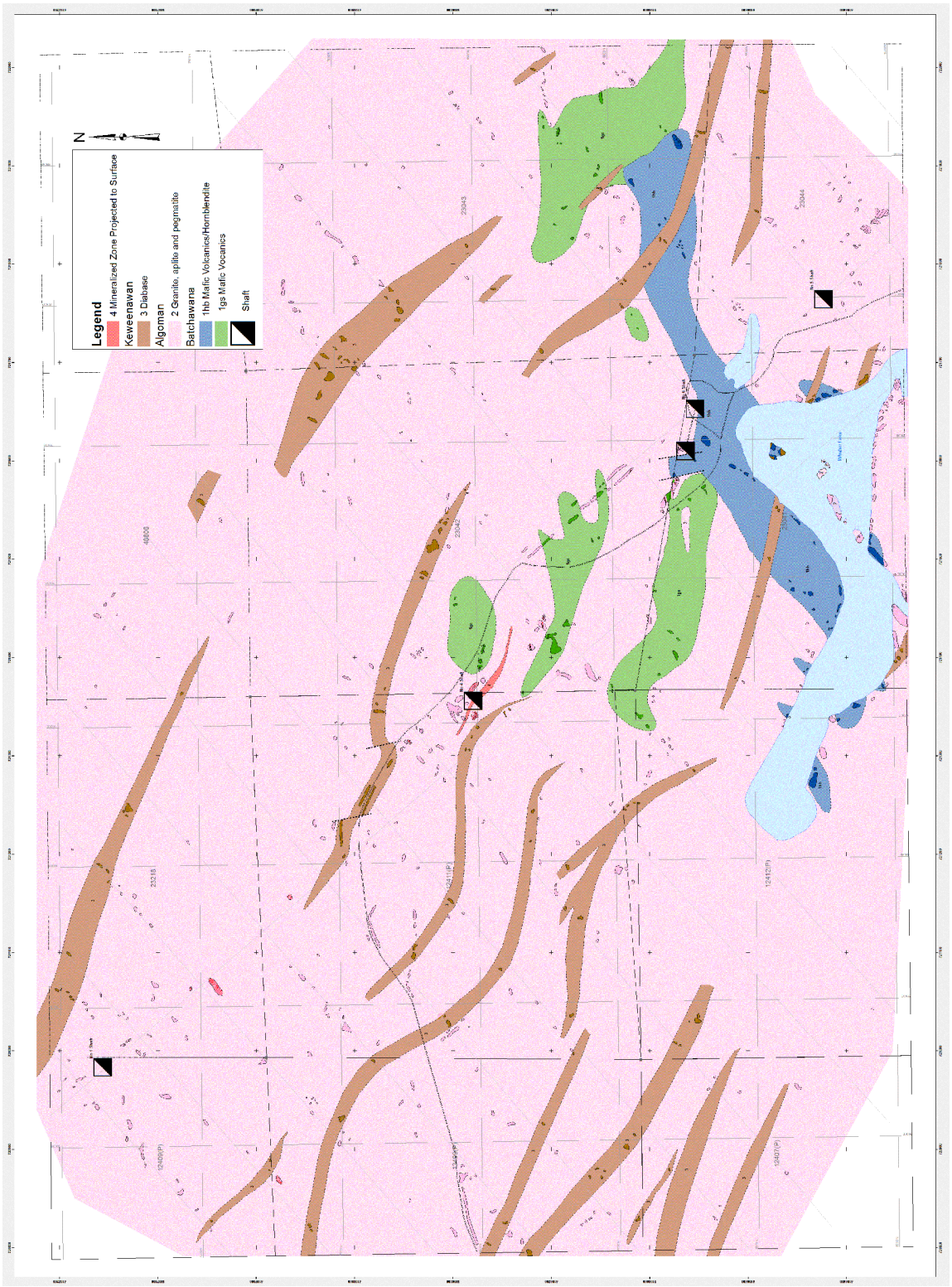


Figure 3. Map illustrating the property geology and shaft locations of the Kristina property (*modified after* Supercrest Copper Mines 1956).

Figure 4. A) Shear-hosted mineralized quartz veining exposed from stripping completed at the No. 1 shaft on the Kristina property. B) A siliceous, quartz-porphyry rock exposure in the area of the No. 1 shaft on the Kristina property. Hammer (40 cm long) for scale.

Table 11. Geochemical data for samples taken during a property visit to the Kristina property. All analyses were performed at the OGS Geoscience Laboratories, Sudbury. UTM coordinates are in NAD 83, Zone 16.

Northing	721874	721902	721914	720962	720952
Easting	5296393	5196382	5196364	5197183	5197179
Sample	**001-Kristina-2015**	**002-Kristina-2015**	**003-Kristina-2015**	**004-Kristina-2015**	**006-Kristina-2015**
Trace Elements					
Al	666 148	65 763	20 178	16 201	71 066
Ba	68	84	9	5	29
Be	1	1	<1	<1	2
Bi	9.51	14.06	11.3	0.47	0.47
Ca	61 194	48 034	83	320	1100
Cd	<1	<1	<1	<1	<1
Co	41	32	1	99	2
Cr	54	68	65	57	20
Cs	1.443	1.478	0.08	0.054	0.377
Cu	236	1264	188	4992	28
Fe	88 483	>95 000	3531	30 622	5945
Ga	36.2	31.82	2.8	8.41	15.63
K	4450	5659	358	325	2483
Li	11	17	<1	4	2
Mg	14 787	24 241	125	9739	1139
Mn	719	871	7	115	25
Mo	2	2	4	4	5
Na	516	2329	690	500	>31000
Nb	11.055	10.354	0.052	1.638	10.346
Ni	19	24	<2	11	<2
P	675	613	<30	150	48
Pb	22	19	<15	<15	16
Rb	40.28	39.45	1.72	2.94	16.38
S	2258	1444	203	9008	249
Sb	0.24	0.08	1.1	0.05	0.04

Northing **Easting**	721874 5296393	721902 5196382	721914 5196364	720962 5197183	720952 5197179
Sample	**001-Kristina-2015**	**002-Kristina-2015**	**003-Kristina-2015**	**004-Kristina-2015**	**006-Kristina-2015**
Sc	54	51	<1	1	2
Sn	9.67	6.68	0.56	0.68	2.23
Sr	746	556	2	<2	32
Ta	0.581	0.603	0.007	0.161	1.755
Th	1.875	1.808	0.019	0.286	17.612
Ti	8653	8303	21	441	310
Tl	0.244	0.206	0.01	0.021	0.053
U	5.467	4.043	0.075	10.928	10.86
V	414	364	4	26	3
W	<6	<6	<6	<6	<6
Y	59	52	<1	2	9
Zn	27	45	<5	15	<5
Zr	120	118	6	9	90
Total REE + Y + Sc	223.38	204.14	1.72	8.05	52.07
FeO	4.42	7.18	0.19	2.62	0.32
CO_2	0.042	0.026	0.023	0.023	0.069
S	0.211	0.168	0.020	1.126	0.069
Major Elements					
Al_2O_3	13.37	12.86	3.64	2.94	14.00
BaO	0.01	0.01	0.004	0.004	0.01
CaO	9.584	6.848	0.024	0.056	0.182
Cr_2O_3	0.01	0.01	0.01	0.01	0.002
Fe_2O_3	12.45	13.25	0.50	4.23	0.81
K_2O	0.54	0.69	0.04	0.04	0.43
MgO	2.54	3.99	0.06	1.61	0.18
MnO	0.095	0.117	0.014	0.021	0.012
Na_2O	0.03	0.28	0.03	0.02	7.04
P_2O_5	0.166	0.150	0.002	0.033	0.011
SiO_2	56.89	57.42	96.58	88.88	77.63

Note: *All major elements, CO_2, S, FeO are in weight percent. All trace elements and Total REE+Sc+Y are in ppm. Abbreviation: REE, rare earth elements.*

The Bussineau Property

LOCATION

The Bussineau property (UTM Zone 17, 298944E 5189976N) is located in the southeastern corner of Jollineau Township. To access the property follow Highway 17 north from Sault Ste. Marie to Highway 556 at Heyden. Then take Highway 556 east approximately 20 km to the intersection with the Ranger Lake Rd. Travel along the Ranger Lake road approximately 40 km to a gravel road entrance on the south. The property is approximately 4 km south on this gravel road.

EXPLORATION HISTORY

Table 12 summarizes the exploration history of the property compiled from the assessment files for Jollineau Township located in the Sault Ste. Marie District Geologist Office.

Table 12. History of exploration activity conducted on the Bussineau property from 1926 to 1968.

Company/Prospector	Work Done	Date	Results
Agnus Bussineau/ The Ranger Lake Mining Company Ltd.	Staking, prospecting, shaft development and exploratory work	1926–1927	A shaft was sunk to a depth of 30 feet, along with several trenching across the vein. Work discontinued in 1927.
Sault Lead-Zinc Mines Ltd.	Mapping, sampling and diamond drilling	1947–1948	Diamond drilling: 10 holes totalling 1701.5 feet. All holes intersected varying amounts of galena and sphalerite mineralization but none of the assays of the intersection are available.
W. J. Warren/Briar-Court Mines Ltd.	Diamond drilling, magnetometer survey	1965–1968	Diamond drilling: 3 holes totaling 305 feet, no assays reported; magnetometer survey over the southeast portion of the property, with several anomalies of interest uncovered. An additional 4 drill holes totaling 1502 feet with no assays reported.

PROPERTY GEOLOGY

The Bussineau property, consisting of 2 single-unit unpatented mining claims held by prospectors C. Hicks, G. Lucuik and J. Ralph, is located in the southeast portion of Jollineau Township. The staff of the Sault Ste. Marie District geologist office visited the property in 2015 to investigate the silver, lead and zinc mineralization.

The mineral showing is documented in the Mineral Deposit Inventory (MDI) database as MDI41J13SE00014 (Ontario Geological Survey 2015). Two grab samples, collected by Angus Bussineau in the late 1920s and submitted to the Provincial Assay Office for analysis, returned the following results: (Hurst 1928)

- 127.2 oz/ton Ag and 42.47% Pb
- 42.70 oz/ton Ag and 56.70% Pb

Neither the Ontario Geologicial Survey or the Geological Survey of Canada had ever mapped the area in any detail. In the past, prospecting focused on a mineralized vein hosted by a sheared mafic intrusion that lies within a massive granitic rock (Figure 5A). The current claim holders exposed approximately 30 m of veining in an area of historic trenching activity. The vein strikes 140°/80°SW and is composed of quartz, carbonate, galena, sphalerite, pyrite and chalcopyrite mineralization hosted within a northwest-trending shear zone. The sulphide minerals, in particular galena, sphalerite and chalcopyrite, are concentrated along the margins of and within the quartz-carbonate vein. Irregularly oriented quartz veining and shear fabrics observed in the mafic dike are believed to be related to the extensive shearing and fracturing observed on the property (Figure 5B). The massive granitic rock, which has been intruded by the mafic dike, exhibits shear fractures and is light pink to reddish in colour.

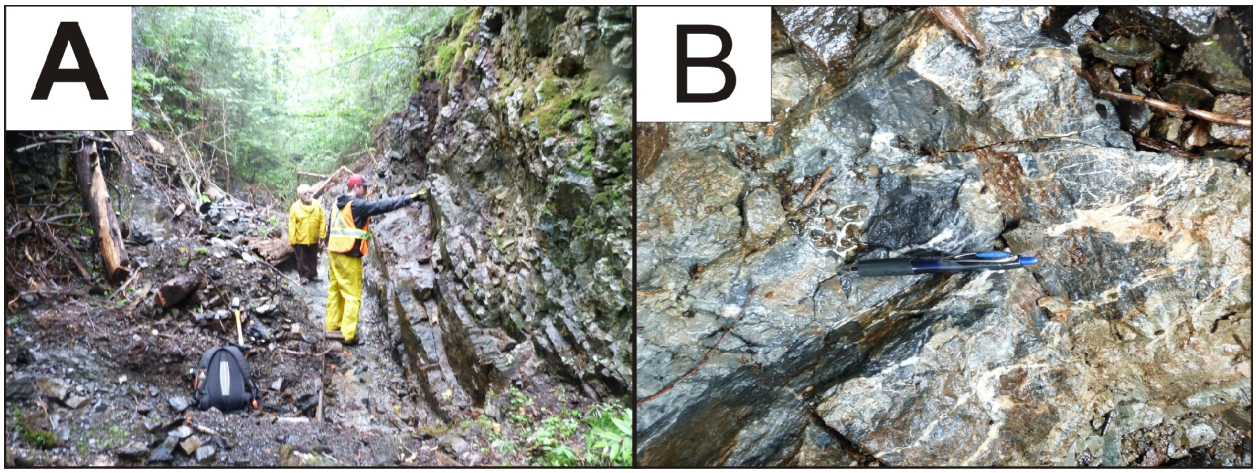


Figure 5. A) Shear-hosted mineralized quartz vein exposed from historical trenching at the Bussineau property. B) The altered mafic intrusion with irregularly oriented quartz-carbonate veining pervasively throughout.

Staff collected grab samples during the property visit and submitted 3 of them to the OGS Geoscience Laboratories in Sudbury, Ontario, for whole rock and trace element analysis. Results of the analysis are shown in Table 13. All 3 samples were representative of the shear-hosted quartz-carbonate vein in the altered mafic intrusion.

Significant assay results from this analysis include

- Sample 001-Jollineau-2015: 3 oz/ton Ag, 0.14% Cu, more than 6100 ppm Pb, and > 2900 ppm Zn
- Sample 002-Jollineau-2015: 0.6 oz/ton Ag, 3649 ppm Pb, and 3779 ppm Zn
- Sample 004-Jollineau-2015: 0.1 oz/ton Ag, 1363 ppm Pb, and 7834 ppm Zn

The elevated levels of CO_2, K, Na, Ag, Cu, Zn, Pb, As, Sb and Sn (*see* Table 12) in the samples may be the result of hydrothermal alteration, which would explain the mineralization identified in the quartz-carbonate vein.

Table 13. Geochemical data for samples taken during a property visit to the Bussineau property. All analyses were performed at the OGS Geoscience Laboratories, Sudbury.

Sample	001-Jollineau-2015	002-Jollineau-2015	004-Jollineau-2015
Ag	3.0	0.6	0.1
Trace Elements			
Al	9809	63 278	28 835
Ba	23	230	216
Be	0.29	2.56	1.30
Bi	18.84	3.77	0.73
Ca	12 112	63 292	>100 000
Cd	>140	22	44
Co	32.27	28.10	18.52
Cr	67	425	69
Cs	0.359	13.943	3.715
Cu	1395	144	50
Fe	74 208	28 801	58 108
Ga	9.53	14.70	7.70

Sample	001-Jollineau-2015	002-Jollineau-2015	004-Jollineau-2015
K	2254	32 003	8919
Li	15	15	14
Mg	6522	14 992	45 631
Mn	973	3043	4782
Mo	27	2.25	18.54
Na	<500	759	<500
Nb	2.243	65.449	10.569
Ni	78	64.2	41.9
P	40	921	363
Pb	>6100	3649	1363
Rb	10.71	194.84	69.66
S	>16 000	5455	11 517
Sb	>28	>28	>28
Sc	4.0	22.5	12.7
Sn	>14	>14	11.71
Sr	56	142	158
Ta	0.141	5.614	0.738
Th	1.212	11.832	1.759
Ti	490	6715	2878
Tl	0.331	1.659	0.744
U	18	2	0.427
V	34	154	93
W	38	<6	31
Y	1.91	18.57	11.09
Zn	>2900	3779	7834
Zr	35	169	43
Total REE+Y+Sc	35.43	216.47	78.04
FeO	8.43	3.02	6.76
CO_2	2.779	8.611	23.652
S	21.695	0.388	0.857
Major Elements			
Al_2O_3	Nr	11.96	5.45
BaO	Nr	0.02	0.02
CaO	Nr	9.259	18.185
Cr_2O_3	Nr	0.06	0.01
Fe_2O_3	Nr	4.16	8.59
K_2O	Nr	3.41	0.95
MgO	Nr	2.45	7.54
MnO	Nr	0.351	0.561
Na_2O	Nr	0.09	0.05
P_2O_5	Nr	0.198	0.076
SiO_2	Nr	52.66	30.39
TiO_2	Nr	1.09	0.47

Note: *All major elements, CO_2, S, FeO are in weight percent; all trace elements and Total REE+Sc+Y , in ppm; Ag, in oz/ton.*

Abbreviations: Nr, not reported; REE, rare earth elements.

CONCLUSION AND RECOMMENDATION

The Bussineau property is characterized as a quartz-carbonate vein lying within a northeast-trending shear zone that is hosted within an altered mafic intrusion. The shear zone may have developed as a result of regional faulting in the area. The quartz veining associated with the shear zone consists of anomalous Ag, Zn, CO_2, K, Na, Cu, Pb, As, Sb and Sn. Further work would be warranted to prospect the area for similar zones and to delineate the extent of the existing zone.

RECOMMENDATIONS FOR EXPLORATION

A Possible Volcanogenic Massive Sulphide Target in the Batchawana Greenstone Belt

LOCATION

The Percy Lake area (UTM Zone 17, 287329E 5247441N) is located in the northeastern section of the Batchawana greenstone belt, approximately 100 km north-northeast of Sault Ste. Marie, Ontario, 100 km southeast of Wawa, and 60 km south-southwest of Chapleau. The area is in Moggy and Moen townships. Primary access to the area is via the Sheppard Morse Road, which extends south-southwest from a junction approximately 200 m east of the junction of Provincial Highways 101 and 129, near Chapleau. The Toll Creek Road forks east from the Sheppard Morse Road at kilometre 40 and extends south and then west along the south edge of the Percy Lake area.

REGIONAL GEOLOGY OF THE BATCHAWANA GREENSTONE BELT

The Batchawana greenstone belt (BGB) lies approximately 70 km north of Sault Ste. Marie, Ontario, and occurs within the Abitibi and Wawa subprovinces (Card 1990). The northern part of the BGB is part of both the Kapuskasing Structural Zone (KPS) and the Wawa Subprovince, while the supracrustal rocks of the southern part of the area are considered to be part of the Abitibi Subprovince. The BGB is bounded to the northwest and to the east by the Ramsey Gneiss Domain, to the south by the Algoma Plutonic Domain, and to the north by the Chapleau Gneiss Domain. The Montreal River Fault, which truncates the Chapleau Gneiss Domain to the north from the supracrustal rocks of the Batchawana greenstone belt to the south, has been described as a probable extension of the Ivanhoe Lake Fault of the KPS (Percival and West 1994). The Batchawana greenstone belt evolved from 2730 and 2670 Ma, and is subdivided into the metavolcanic Griffin and Dismal assemblages and the metasedimentary Wart assemblage (Grunsky 1991). The western part of the greenstone belt is overlain by Keweenawan metavolcanic rocks. Within the greenstone belt are several small, posttectonic, internal plutons that range in age from 2678 to 2668 Ma (Figure 6).

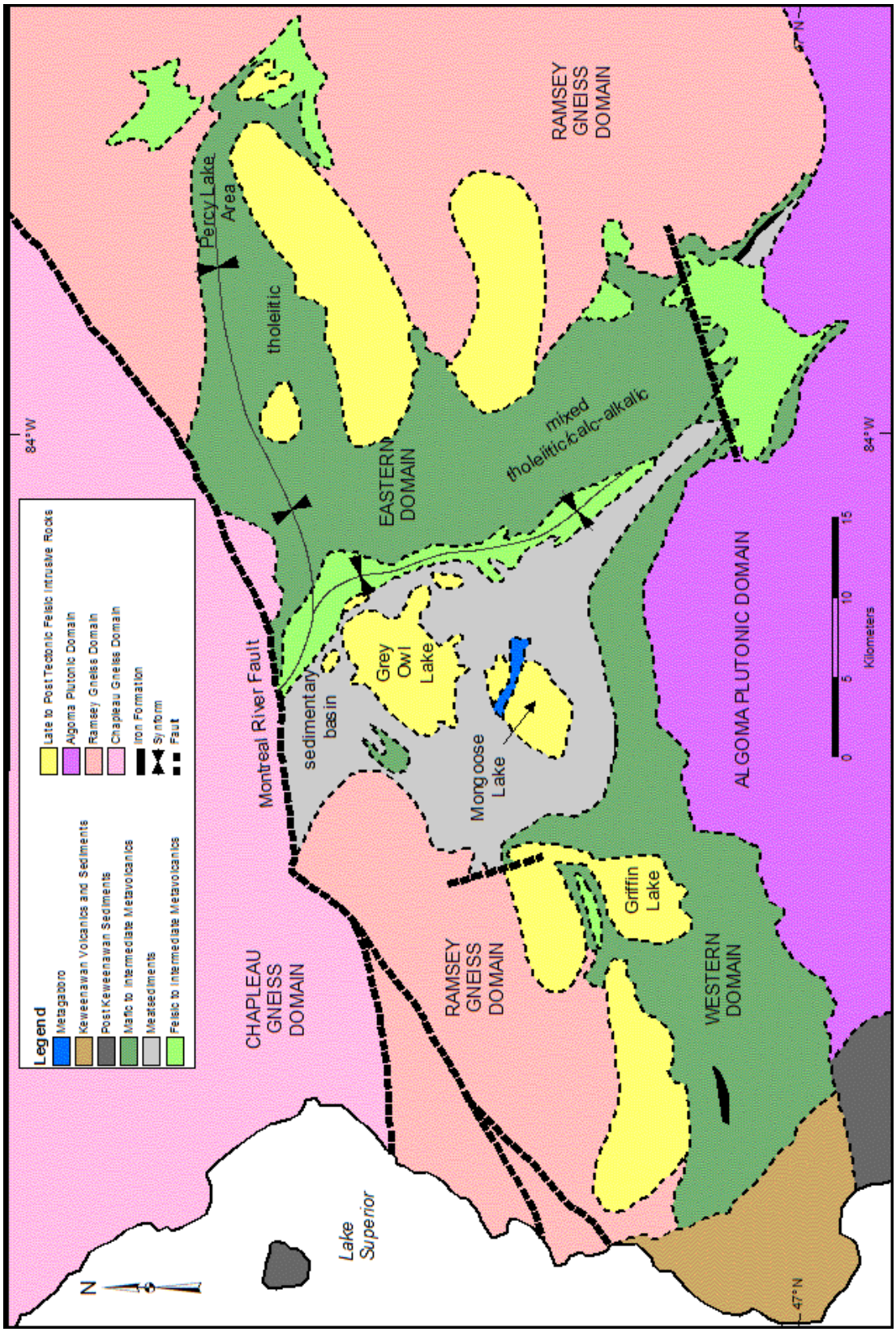


Figure 6. Regional geology map of the Batchawana greenstone belt illustrating the location of the Percy Lake area in the mafic to intermediate rocks of the Dismal assemblage (*modified from* Grunsky 1991).

THE PERCY LAKE AREA

The Percy Lake area lies within the Dismal assemblage (2720 to 2698 Ma) of the Batchawana greenstone belt. Unlike the Griffin assemblage, which is composed mainly of tholeiitic basalts, the Dismal assemblage consists of a tholeiitic-calc-alkalic sequence of mafic and felsic metavolcanic rocks and interflow sedimentary rocks. Base metal occurrences are more common in the Dismal assemblage than in the Griffin assemblage.

Prior to 1995, geological mapping and exploration in the area had been limited, largely because of accessibility. Wilson (1983) mapped the area as mafic to intermediate metavolcanic rocks. The area is now more accessible because of recent logging activity, which has also increased the amount of exposed outcrop. A series of exploration programs conducted by Avalon Ventures Inc. in 1995 and Vault Minerals Ltd. in 2006 showed the geology of the area to be more complex than was interpreted by Wilson (1983).

In the summer of 2015 the staff of the Sault Ste. Marie District Geologist office investigated several outcrop exposures within the Percy Lake area. The outcrops expose fine- to medium-grained mafic to intermediate metavolcanic rocks and intermediate to felsic metavolcanic rocks. The mafic to intermediate rocks are typically well foliated and chloritic; pillow structures are occasionally recognized. The felsic to intermediate metavolcanic rocks are typically well-foliated, beige in colour and quartz and/or plagioclase porphyritic (Figure 7A). Sericite alteration is evident. A series of irregularly oriented quartz veins are boudinaged, stretched and folded as result of intense deformation (Figure 7B). Intense deformation is evidenced by a strong foliation and a stretching lineation, along with isoclinal and parasitic folding (Figure 7C). The only mineralization identified on the surface of the outcrops were patches of iron gossan staining associated with variable chloritization, sericitization and silicification (Figure 7D).

Numerous northwest-trending diabase dikes cut the area. The diabase dikes are medium- to coarse-grained, weakly to strongly magnetic and are not foliated. The dikes are more resistant to weathering than the metavolcanic rocks. Grunsky (1982) identified a regional scale syncline west of the Percy Lake area. The syncline trends east-northeast and was interpreted by Wilson (1983) to extend to the Percy Lake area.

In 1996, mapping and exploration work completed by Avalon Ventures Ltd. identified finely disseminated sulphide mineralization, predominantly pyrite and pyrrhotite, in outcrop (Bain 1996). Six grab samples collected over an exposed width of 0.5 m averaged 1.01% Cu, 7.38% Zn, 1.19% Pb and 33.7 g/t Ag. One sample in particular returned 0.48% Cu, 0.96% Zn, 0.79% Pb and 22.1 g/t Ag (sample location: Zone 17, 287405E 5247664N).

In 2006, as follow up to the work completed by Avalon Ventures ltd., Vault Minerals Inc. completed the only diamond drilling in the area. Drilling intersected a succession of mafic volcanic flows and tuffs, feldspar porphyritic flows, crystal tuff, synvolcanic intrusions, and several exhalite-type horizons (Lengyel 2006). The exhalite horizons consist of chert ± magnetite ± pyrrhotite ± pyrite with trace amounts of disseminated to stringer, medium to dark sphalerite, galena and chalcopyrite that are syngenetic in appearance (Lengyel 2006).

The drilling program also intersected numerous quartz, calcite and feldspar fracture veins containing sphalerite, galena and chalcopyrite. Analysis of these veins produced the most significant assay values, with the highest grade consisting of 2.77% Zn, 6.53% Pb over 1.0 m (UTM Zone, 17 288794E 5249659N). These fracture veins may reflect a structural control that developed as a result of the surrounding synvolcanic intrusions or during the development of the Kapuskasing Structural Zone.

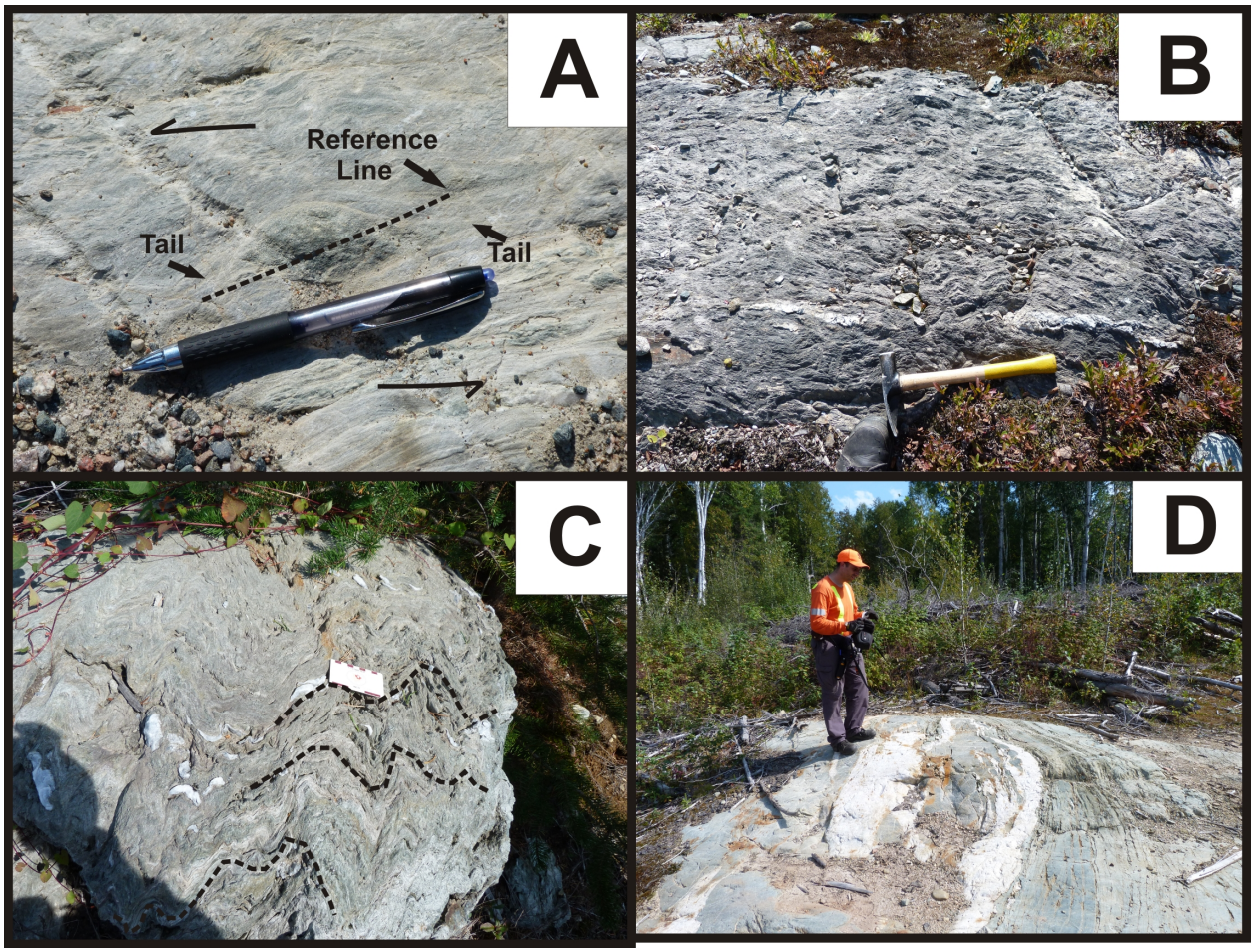


Figure 7. A) Rotated ʒ-type chloritic porphyroclast in the felsic metavolcanic rocks, displaying a sinistral sense of shear and consistent with the asymmetry of the shear fabric. B) Intense shear fabric of irregularly oriented veins that are boudinaged and stretched within the felsic metavolcanic rocks. C) Drag folding (outlined by the dashed lines) observed in the mafic metavolcanic rocks. D) Highly deformed mafic metavolcanic rocks displaying iron-gossan staining and irregularly oriented quartz veins that are boudinaged and stretched as a result of intense shearing that is quite pervasive throughout the outcrop.

GEOCHEMISTRY

Staff of the Sault Ste. Marie District office collected 10 grab samples from outcrops in the Percy Lake area and submitted them to the OGS Geoscience Laboratories in Sudbury, Ontario, for whole rock and trace element analysis. All 10 samples are representative of mafic to felsic metavolcanic rocks found in the Percy Lake area. Figure 8A shows all samples plotted on a silica versus total alkalis discrimination diagram of Le Bas et al. (1986). Four samples fall in or very close to the basalt field, 1 sample in the "andesite" field and 5 samples in the dacite field.

Figures (8C, D, E, F) show the samples plotted on rare earth element (REE) and multi-element plots (chrondrite-normalized and primitive mantle-normalized), using the normalizing factors of McDonough and Sun (1995). The 4 basaltic rock samples display flat to light REE-depleted patterns, with small positive or negative europium anomalies, suggesting that plagioclase fractionation was not a significant process in the magma chamber prior to eruption of these basaltic rocks. The basaltic rocks display negative niobium-tantalum anomalies and varied large ion lithophile element (LILE) (cesium, rubidium, barium, potassium, lead) enrichment typical of a metasomatized mantle source. The andesitic and dacitic

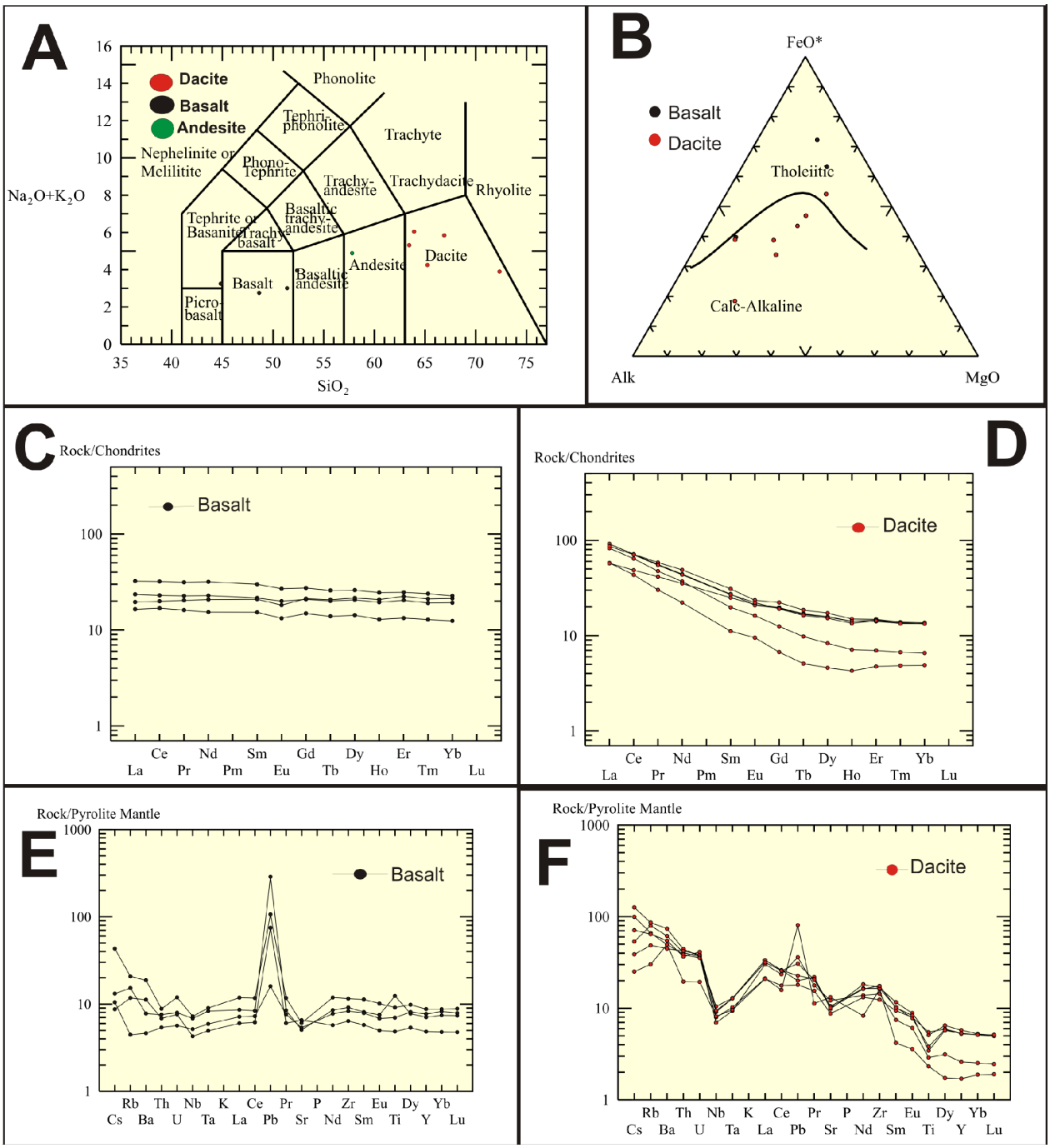


Figure 8. Rare earth element (REE) and multi-element plots of samples collected by staff of the Sault Ste. Marie District Geologist office. A) Silica versus total alkalis discrimination diagram of Le Bas et al. (1986). B) AFM diagram of Irvine and Baragar (1971). C) Rare earth element plot, normalized to chondritic and primitive-mantle values, using the normalizing factors of McDonough and Sun (1995) for basalts. D) Rare earth element plot, normalized to chondritic and primitive-mantle values, using the normalizing factors of McDonough and Sun (1995) for dacites. E) Rare earth element and extended trace element plot, normalized to chondritic and primitive-mantle values, using the normalizing factors of McDonough and Sun (1995) for basalts. F) Rare earth element and extended trace element plot, normalized to chondritic and primitive-mantle values, using the normalizing factors of McDonough and Sun (1995) for dacites.

rocks display increasing light REE contents with increasing silica content but with flat, relatively low heavy REE contents. There are no pronounced negative europium or strontium anomalies, suggesting that plagioclase fractionation was not a significant process. Plotting all 10 samples on an AFM diagram of Irvine and Baragar (1971) (Figure 8B) demonstrates a tholeiitic to calc-alkalic trend, suggesting that the metavolcanic rocks were possibly derived from a more evolved and fractionated source that is typically more conducive to a volcanogenic massive sulphide (VMS)-type setting.

Significant anomalies in the area have been identified in a lake sediment geochemical survey of the Batchawana greenstone belt done by the Ontario Geological Survey (Hamilton, Fortescue and Hardy 1995). The survey identified approximately 40 samples, out of 933 obtained from the area, with anomalous zinc ranging from 215 ppm to 900 ppm along with significant anomalies of cadmium and copper. The anomalies are located in catchments that are part of the Percy Creek, Tool Creek and Cow River watersheds, suggesting that their source may be in the immediate vicinity of the Percy Lake drainage basin (Hamilton, Fortescue, and Hardy 1995) (Figure 9).

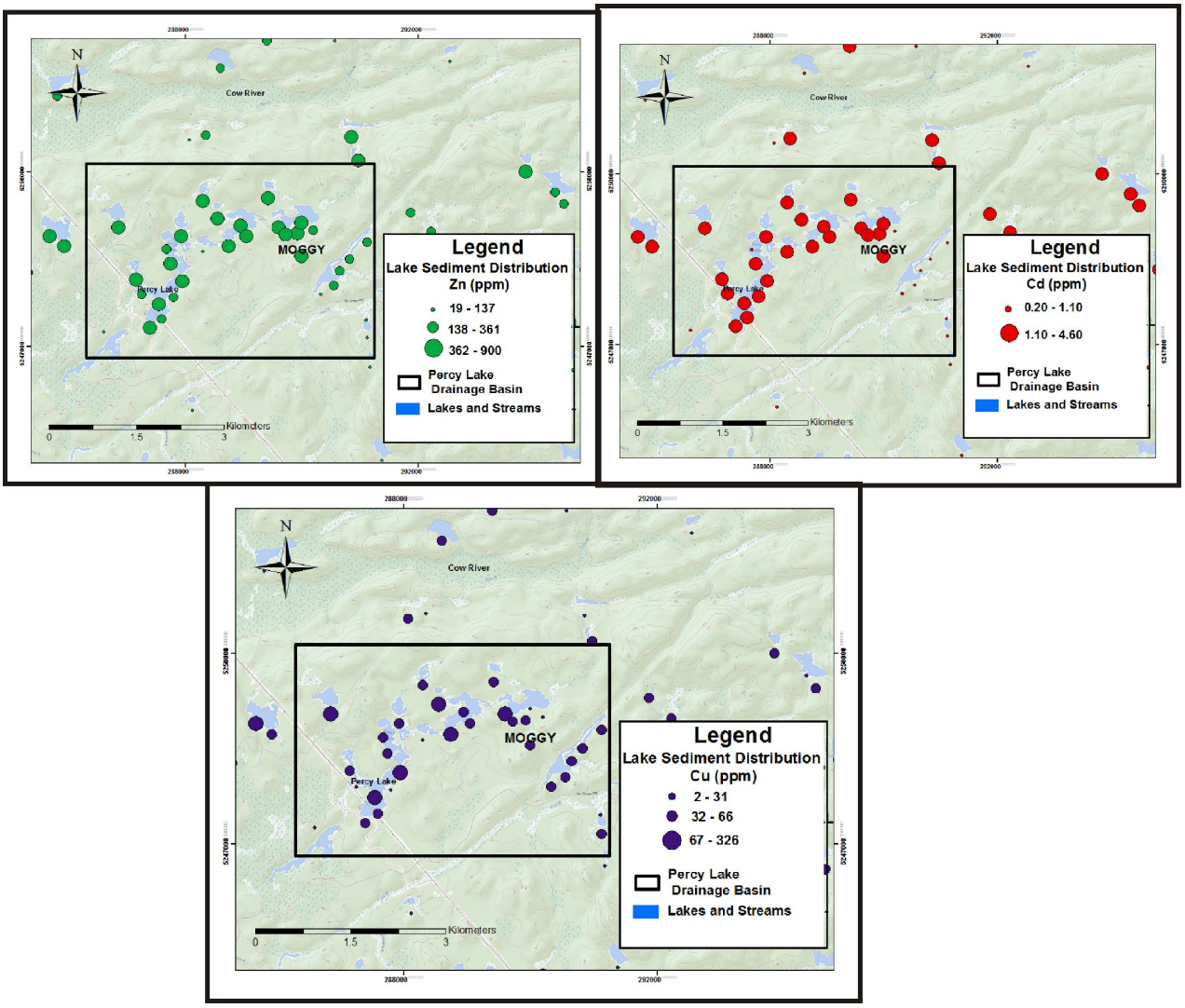


Figure 9. Results of a lake sediment geochemical survey of the Batchawana greenstone belt conducted by the Ontario Geological Survey, showing the location of zinc, cadmium and copper anomalies (Hamilton, Fortescue and Hardey 1995).

CONCLUSION

The Percy Lake area is the northeast part of the Batchewana greenstone belt, an area that has received limited government mapping and mineral exploration by industry. Hamilton, Fortescue and Hardy (1995) completed a lake sediment geochemistry survey that included the Percy Lake area and revealed some strong base metal lake sediment geochemical anomalies. Significant zinc, cadmium and copper anomalies suggest the underlying stratigraphy is favourable for the location of Archean volcanogenic massive sulphide deposits. The following are recommendations that could assist in further exploration within the area.

1. Conduct further geological mapping and an extensive lithogeochemical survey. Geological mapping should focus on developing a better understanding of the strong structural deformation observed on many of the outcrops during the 2015 field visit by the staff of the Sault Ste. Marie District Geologist office. The deformation consists of folding and boudinaged structures.
2. Conduct further lake and stream sediment geochemical surveys, especially in the Percy Creek, Toll Creek and Cow River watersheds, which may help point towards the source of the zinc, copper and cadmium anomalies discovered by Hamilton, Forescue and Hardy (1995).

Table 14. Mineral deposits not being mined in the Sault Ste. Marie District in 2015.

Abbreviations

AF ..... Assessment Files
AR ..... Annual Report
CAMH..... Canadian and American Mines Handbook
CMH..... Canadian Mines Handbook
GDIF ..... Geoscience Data Inventory Folio
GR ..... Geological Report
MDC..... Mineral Deposit Circular [No.15–]
[formerly Mineral Resources Circular, No.1-14]
MDIR ..... Mineral Deposit Inventory record
MP ..... Miscellaneous Paper
MRC……..Mineral Resource Circular
OBM……..Ontario Bureau of Mines
ODM..... Ontario Department of Mines
OFR ..... Open File Report
OGS……..……..Ontario Geological Survey
SMDR..... Source Mineral Deposit Records
SSMP..... Sault Ste. Marie Plans

Deposit Name/ NTS	Commodity	Tonnage-Grade Estimates and/or Dimensions	Reserve References	Status	AMIS site #
Pater Mine Spragge Tp. 41J/02NE	Cu, Au, Ag	Total production was 70 460 264 lbs Cu. Est. 2 000 621 ton @ 1.8% Cu.	MRC 12, p.65. GR 76, p.90-94.	Past Producer 1960–1968	07955
Bar-Fin Mine Thompson Tp. 41J/03NE	Cu	Production of 120 000 lbs of Cu from 1500 tons of ore. 1.82% over 3 feet and 9.27% over 1.9 feet.	MRC 12, p.67 GR 17, p.62-63	Past Producer 1906	07968
Bald Dome prospect Plummer Add. Tp. 41J/05SW	Cu	80 – 100 feet true width averaging 0.25% Cu, diamond-drill core.	MRC 12, p.52 AF 0014	showing	07885
Bruce Mines Plummer Add. Tp. 41J/05SW	Cu, Ag	40 000 ton @ 1.8% Cu above 155-foot level Bruce Mines Taylor site.	MDC 12	Past Producer 1915–1921	07888 - 07891
Campbell–Dukes prospect Plummer Add. Tp. 41J/05SW	Cu	33 000 ton @ 1.2% Cu in a 230 by 8 by 220 foot block	MRC 12, p.54 AF 0014	Past Producer 1956	07883
Rock Lake Mine Aberdeen Tp. 41J/05NE	Cu, Ag	1 524 000 lbs Cu from 43 300 tons of ore	MDC 12, p.14	Past Producer 1899–1903	07781
Havilah Mine – Ophir Mine Galbraith Tp. 41J/05NE	Au, Ag, Cu	1 main vein, 2 – 150 foot shafts, 1 – 183 foot adit In 1911, 1030 oz Au and 214 oz Ag from 6589 tons ore milled.	MRC 13, p.18 OBM 1893, AR v.3, p.37-45	Past Producer 1892–1894, 1900, 1910 and 1911	07851

Deposit Name/ NTS	Commodity	Tonnage-Grade Estimates and/or Dimensions	Reserve References	Status	AMIS site #
Steinberg Mine Plummer Add. Tp. 41J/05SW	Cu	124 000 T @ 1.1% Cu (drill indicated) for a length of 200 feet to a depth of 200 feet.	OGS 1969, MRC 12, p.56-57 AF Plummer -0014-0017.	Past Producer 1919	07884
Stobie Mine –Rainbow Mine Johnson Tp. 41J/05SW	Cu, Ni, Au	9 tons of ore shipped from 100 foot level, 280 feet of lateral work. Shaft is 160 feet depth.	MRC 12, p.34-35. MRC 2, p.74. AF Index plan	Past Producer 1899–1901	08013
Bilton Option Patton Tp. 41J/06SE	Cu	95 160 tons @ 1.72% Cu over a width of 7.3 feet to a depth of 200 feet.	ODM 1953, GR 17, p.55-58 AF	Past Producer Pre 1956	08093
Boyea Lake Adit and East Zones Montgomery Tp. 41J/06NE	Cu	50 000 tons @ 2.5 to 3% Cu 135 150 tons @2.32% Cu across 7 feet over 1068 feet. 75 000 tons @ 1.0% Cu across 20 feet over a length of 300 feet.	Sudbury Contact Mines AR 1971 MRC 12, p.43-44 AF	Past Producer Pre-1942	08060
Crownbridge (Cannon) prospect Kamichisitit Tp. 41J/06NE	Cu	415 000 tons @ 1.8% Cu over a width of 6.5 feet.	MRC 12, p.94 AF	Past Producer 1966–1967	08018
Glagoma Mine Gladstone Tp. 41J/06SE	Cu	In 1917, 2 shafts sunk to 250 feet	MRC 12, p.25-26 OGS 1963, GR 17 p.52-55	Past Producer 1917 and 1962	07865
Goulding Mine Cobden Tp. 41J/06SE	Cu	In 1962, 26.3 dry tons shipped @ 1.45% and 222.5 dry tons shipped @ 1.34%.	MRC 12, p.19 OGS 1964, GR 20, p.62-65	Past Producer 1962	07823
North Montgomery – Grand Portage Mine Gould Tp. 41J/06NW	Cu	No production or reserve data found.	OGS 1969, MRC 12, p.27-28. OGS 1899, AR v.8, pt.1, p.37-38. SMDR 00463 or MDIR A0229	Past Producer 1899	07871
Milgate (Abbican) prospect Nouvel Tp. 41J/06NE	Cu	105 750 tons @ 1.08% Cu (drill indicated) A Zone L-600 by W-10 by D-235 feet	OGS 1969, MRC 12, p.97. ODM 1957, MRC 2, p.71.	1936–1955, 1956 Development work.	08076
Principle Strategic Minerals prospect Gladstone Tp. 41 J/06SE	Cu	112 300 tons containing 3 128 196 lbs. Cu	MRC 12, p.26, GR 17, p.50-51. AF	Pre 1957	07864
Sheba prospect Nouvel Tp. 41J/06NE	Cu	L-1000 feet by W-3 feet on surface @ 0.59% Cu, weighted diamond drill assays.	MRC 12, p.98	1956–1957 Development work.	08077
Twin Lakes prospect Esten Tp. 41J/07SE	Cu	Probable - 76 900 tons @ 1.73% Cu over 8 foot width, drill indicated.	MRC 12, p.23 AF Esten 0010-D1	1957 Trenching and diamond drilling	07841
Bi-Ore Mine Sagard Tp. 41J/10NW	Cu	2726 tons of concentrate containing 1 647 079 lbs. of Cu.	ODM 1951, AR. v.60, pt.2, p.2. MRC 12, p.70-71	Past Producer 1947–1949	07931
Cheney Mine Gould Tp. 41J/11SW	Cu	39 405 tons @ 3.97% Cu (drill indicated) 3500 tons mined in 1967.	MRC 12, p.26-27 ODM, 1929, v.38, pt.7, p.10-15	Past Producer 1966–1967	07874

Deposit Name/ NTS	Commodity	Tonnage-Grade Estimates and/or Dimensions	Reserve References	Status	AMIS site #
Copper Prince Mine Kamichisitit Tp. 41J/11SE	Cu, Au	4 shoots 310 by 6.3 feet averages 3% Cu 60 by 9.7 feet averages 1.9% Cu 45 by 6.6 feet averages 2.3% Cu 110 by 9.6 feet averages 0.9% Cu Weighted average of 4 diamond-drill holes, 2.7% Cu over 7 feet and 0.03 oz/ton Au.	MRC 12, p.93-94 GR 178, p.66-67 SMDR File 00823 MP 57, p.87	1928–1929 Diamond drilling, trenching and grabs. 1973 mining operations suspended after shipping small quantity of Cu concentrate.	08019
Jardun Mine Jarvis Tp. 41K/09NE	Pb, Zn, Ag, Cu, Au	No.1 and 4 zone reserves are 20 000 tons averaging 7.25% Pb, Zn and 1.52 oz/ton Ag. No. 3 zone reserve estimate is 19 367 tons averaging 9.56% Pb and Zn with 1.10 oz/ton Ag.	MRC 12, p.32-33 AR v.67, pt.2. p.108-109.	Past producer 1954–1957	08007
Kerr Scott (Algoma Galena) Deroche Tp. 41K/09NE	Pb, Zn, Ag, Au	1859 tons of hand-cobbed ore recovered. Deposit reserves have not been calculated.	MRC 12, p.21-22 AR v.49, pt.1, p.223 ODM 1928 v.37, pt.3, p.72-73	Past Producer 1939	07833
Goulais River, Doughty, Eagle Mine, Tribag, Edwards. Vankoughnet Tp. 41K/16SW	Cu, Ag	250 000 ton @ 2.35% Cu, 0.26 oz/ton Ag in 3 zones (drill-indicated).	GDIF #75, OBM 1905, v.14, pt.1 AR 1970, MP 46, p.92-93 AR 1973, MP 57, p.86.	Past Producer 1900	07974
Kristina Mine (Supercrest) (Superior) LaVerendrye Tp. 41K/16NE	Cu	369 350 tons @ 1.95% Cu in No.4 and No.6 shaft zones. No.6 Shaft Zone, 10 000 tons @ 4% Cu and 200 000 tons @ 2.53 % Cu.	MRC 12, p.75 MRC 1, p.43 OBM, v.11, 1902, p.274 OBM, v.17, 1908, p.79	Past Producer 1903–1907 1952–1957: 22 000 ft of diamond drilling.	08040
Prace–Sill Lake Mine Vankoughnet Tp. 41K/16SW	Pb, Zn, Ag	20 000-60 000 tons @ 12 oz/ton Ag, and 20 000 tons @ 41.65 oz/ton Ag and 33.7% Pb over 1.13 ft width.	AF SSMP Vankoughnet 16, 17.	Past Producer 1975, 1979, 1981, 1983–84 and 1985–1987	07976
Caputo–Just (Caputo-Thompson, Ontex) Wishart Tp. 41N/01SW	Cu	475 tons @ 1.18 % Cu recovered from 3 zones	MRC 12, p.78 MP 25, p.5	Past Producer 1968	07985
Coppercorp Mine Ryan Tp. 41N/02SW	Cu, Ag, Au	1.02 million tons @ 1.16% Cu production.	MRC 12, p.45-46 ODM 1953, AR 62, pt.4, p.18-24 AF – Montreal Mining Co. SSMP-0012 AF SSMP Ryan 15, p.30 AF SSMP Ryan – 37 (cd). 2.47257, p.3.	Past Producer 1965–72	07937, 07938, 07939, 08061
Glenrock (Rockdale) Palmer Tp. 41N/02SE	Co, Au, Cu	Several zones – main zone L-250 by W-3.5 feet (drill indicated) 1953, 11 diamond-drill holes, failed to show continuity with depth, best assay 16% Co.	MRC 12 p.103 MRC 10 p.20	Glenrock 1952 Rockdale 1958	08081
Jogran prospect Ryan Tp. 41N/02SE	Cu, Mo	Reserve est. 18 M tons @0.19% Cu and 0.05% MoS_2	MRC 12, p.60-61 MRC 7, p.11 AF RYAN SSMP -15, p.30	1965/66: diamond drilling	07924
Mamainse Mine Ryan Tp. (A.McDonell Location-west of Ryan Tp.) 41N/02SW	Cu	Vein L-1500 by W-13 feet 3 shafts sunk to depth 60, 280, and 320 feet. No production recorded.	MRC 12, p.57 AR. v.62, pt.4, p.23 MRC 2, p.79	Past Producer 1882–1884	08050

Deposit Name/ NTS	Commodity	Tonnage-Grade Estimates and/or Dimensions	Reserve References	Status	AMIS site #
Maricona prospect (Rankin Location-Point Aux Mines) Slater Tp. 41N/02NE	Cu	295 405 tons @ 1.17% Cu (1098 by 345 by 8.1 feet)	MRC 12, p.58 AF Rankin Mnrl 1964, 0013-A1 AF Rankin Mnrl 1956, 0012 AF Rankin Mnrl 1949, 0017A	Past Producer 1865/66 and 1949, 1955/56	07902 Same as 07899
Pancake Lake (Richards) Kincaid Tp. 41N/02SE	Cu	310 by 21.5 by 310 feet @ 0.76% Cu developed prospect.	MRC 12, p.38	1952 intermittent until 1964	08026
Tribag Mine Nicolet Tp. 41N/02SE	Cu, W, Ag, Au	4 Zones (Breton, West, East and South) Reserve est. 2004 : Breton, 40 M tons @ 0.2% Cu above 300 m. East Breccia, 125 M tons @ 0.13% Cu and 0.04% MoS_2 West Breccia, 0.1 M tons @ 0.6 – 1.0% Cu.	MRC 12, p.80 AF SSMP Ryan -15, p.30	Past Producer 1967–1973 Production from Breton and West Breccia Zones	08068
Goulais River Nahwegezhic Tp. 41O/04SW	Fe	Algoma Ore Division Iron Range: 25-40% total iron. Estimated reserves 30 480 000 tons of iron pellets in Cowie Lake Section. McPhail deposit (southern extension): 31% total iron, est. Reserves 5 080 000 tons of iron pellets.	MRC 11, p.41-42 OGS GR 192, p.49-56	1910–1944 Development work 1963–1966 diamond drilling, trenching, metallurgical studies.	08065

Note: *This table contains tonnage and grade estimate, referred to as "reserves" (indicated, possible, probable), which were determined at various times by methods largely unreported. Unless specifically indicated, it must be assumed that these estimates are not in compliance with the reporting standards required by National Instrument 43-101. AMIS = Abandoned Mine Information System.*

Table 15. Mineral deposits not being mined in the Wawa area in 2015.

Abbreviations

CMH.....Canadian Mines Handbook
GR.....Geological Report
NM.....The Northern Miner
NM.....The Northern Miner
OFR.....Open File Report
RGF.....Resident Geologist Files

Deposit Name/ Township	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References	Status
Alden-Goudreau (past producer) Cowie Township	Au	170 000 tons @ 0.50 oz/t Au	Michipicoten Forest Resources and Cedar Falls Forest Resources	CMH 1937–43	Diamond drilling 2011
Betty Lake Iron Range Knicely Township	Fe	1 570 140 tonnes @ 39.5% Fe	Essar Steel Algoma Inc.	RGF	Inactive. Bulk sampled 1999
Big Lake Iron Range Corbiere Township	Fe	302 150 tons per 100 feet @ 36.6% Fe	Michipicoten Forest Resources and Cedar Falls Forest Resources	GR 153	Last active exploration 1955
Braminco prospect Brackin Township	Au	100 000 tons @ 0.15 oz/t (#21 Vein); 23 000 tons @ 0.31 oz/t (#7 Vein); 5000 tons @ 0.26 oz/t (B Vein)	Conquest Resources Limited	RGF	Last explored 2004
Cline Gold Mine (past producer) Jacobson Township	Au	204 000 tons @ 0.221 oz/t Au (88-60 Zone)	Cline Mining Corporation	NI 43-101 Rpt. 30/11/2009	Diamond drilling 2008
Edwards Mine (past producer) Jacobson Township	Au	96 000 tonnes @ 11.3 g/t Au (at the end of 2000)	Strike Minerals Ltd.	RGF	Dewatering and diamond drilling 2011

Deposit Name/ Township	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References	Status
Ego Mines Claims Abotossaway Township	Au, Cu	7 mineralized zones; W-8 zone hosts 442 080 tonnes @ 2.6 g/t Au, 1.91% Cu	Richmont Mines Inc.	OFR 5587	Inactive
Goudreau Zone Finan Township	Au	Indicated resource: 220 667 t @ 12.0 g/t Au (85 262 ounces); Inferred resource: 169 027 t @ 10.3 g/t Au (55 730 ounces)	Richmont Mines Inc.	RGF	Diamond drilling 2010
G.W. Macleod Mine (past producer) McMurray Township	Fe	18 700 000 tonnes (blocked out) @ 31% Fe	Essar Steel Algoma Inc.	OFR 5990	Mine closed in 1998.
Josephine–Bartlett Iron Range Corbiere Township	Fe	7 555 788 tonnes @ 58.36% Fe	Essar Steel Algoma Inc.	OFR 5578	Diamond drilled 1946.
Josephine Mine (past producer) Corbiere Township	Fe	3 965 00 tons @ 51.65% Fe, 14.92% Si, 1.88% S	Canada Iron Inc.	RGF	Mine cave-in in 1946. Inactive.
Jubilee–Surluga property (past producer) McMurray Township	Au	Inferred resource: 32 200 000 tonnes @1.14 g/t Au	Augustine Ventures Inc.	NI 43-101 Rpt 21/11/2011	Past producers (8) 1902–1991. Diamond drilling 2011.
Kremzar Mine (past producer) Finan Township	Au	229 777 tonnes @ 7.65 g/t Au	Richmont Mines Inc.	RGF	Active exploration 2000
Lakemount property Esquega Townships	Ni, Cu	Inferred resource: 3 048 000 tonnes @ 0.35% Ni, 0.20% Cu, 0.13 g/t Pt, 0.09 g/t Pd	First Development Holdings Corporation	NI 43-101 Rpt. Platinum Group Metals 21/01/2005	Diamond drilling 2003–2004
Lochalsh Zone (past producer) Finan Township	Au	Probable reserves: 185 450 t @ 5.6 g/t Au (33 161 ounces); Indicated resource: 252 755 t @ 5.3 g/t Au (42 875 ounces); Inferred resource: 210 160 t @ 6.4 g/t Au (43 083 ounces)	Richmont Mines Inc.	RGF	Diamond drilling 2010
Lucy Iron Range (past-producer) Chabanel Township	Fe	13 780 000 tonnes @ 33.2% Fe	Essar Steel Algoma Inc.	RGF	Mine closed 1970.
Magino Mine (past producer) Finan Township	Au	Indicated resource: 67 555 000 t @ 1.00 g/t Au (2 176 300 ounces @ 0.35 g/t cut-off) Inferrred resource: 54 242 000 t @ 0.99 g/t Au (1 721 200 ounces @ 0.35 g/t cutoff)	Prodigy Gold Incorporated	NI 43-101 Rpt. 2/11/2011	Diamond drilling 2011
Magnacon Mine (past producer) Mishibishu Lake area	Au	1.47 million tons aver. 0.19 oz/t Au (drill indicated). Past producer 1990, 19 397 oz from 163 366 tons	Wesdome Gold Mines Ltd.	CMH, 1997–98, p.204	Underground exploration 2004. Drifting westward toward Mishi Mine.
Magpie Iron Range (past producer) Leclaire Township	Fe	332 400 tonnes @ 36% Fe	Essar Steel Algoma Inc.	RGF	Mine closed 1921. Underground mine.

Deposit Name/ Township	Commodity	Tonnage-Grade Estimates and/or Dimensions	Ownership References	Reserve References	Status
Markes occurrence Jacobson Township	Au	65 000 tonnes @ 5.75 g/t Au	Pele Mountain Resources Inc.	RGF	Diamond drilling 2010
Mishi deposit Mishibishu Lake area	Au	Open pit measured+indicated resource: 5 169 200 t @ 2.14 g/t Au; inferred resource 764 100 t @ 2.42 g/t Au Underground measured+indicated resource: 567 100 t @ 4.52 g/t Au; inferred resource: 437 600 t @5.78 g/t Au	Wesdome Gold Mines Ltd.	NI 43-101 Rpt 12/01/2011	Diamond drilling, dewatering 2011. Commercial production January 2012
Murphy–Algold–Amherst gold mine (past-producer) Abotossaway Township	Au	248 800 tons @ 0.305 oz/t Au	Lake Shore Gold Corp.	RGF	Diamond drilling 2003.
Nudulama prospect Leeson Township	Au	579 325 T @ 0.194 opT Au	GoldTrain Resources Inc.	RGF	Inactive
No.8 Zone Finan Township	Au	90 700 tonnes @ 6.9 g/t Au	Richmont Mines Inc.	RGF	Exploration 1997
Pine Zone Finan Township	Au	70 000 tonnes @ 6.4 g/t Au	Richmont Mines Inc.	RGF	Inactive
Ranson Mine Rabazo Township	Au	30 300 tonnes @ 12.4 g/t Au	N/A	RGF	Diamond drilling 2001
Renabie Mine (past producer) Leeson Township	Au	1 million tonnes @ 0.2 g/t Au. Past producer 1 100 000 oz Au	N/A	RGF	Rehabilitated
Ruth Iron Range (past-producer) Chabanel Township	Fe	34 608 000 tonnes @ 30.9% Fe	Essar Steel Algoma Inc.	RGF	Diamond drilling 1967 by Algoma Ore Company Ltd.
Shenango gold mine Hawkins Township	Au	37 440 tonnes @ 4.3 g/t Au	Canadian Orebodies Inc.	RGF	Inactive
Shihan VMS property Meath and Rennie townships	Zn, Pb, Cu	Indicated: 199 699 tonnes @ 3.81% Zn, 0.21% Pb, 0.09% Cu, 91.82 g/t Ag, 0.30 g/t, 0.30 g/t Au Inferred: 44 362 tonnes @ 4.30% Zn, 0.20% Pb, 0.09% Cu, 72.82 g/t Ag, 0.21 g/t, 0.30 g/t Au	Goldpath Resources Corp.	NI 43-101 Rpt 14/11/2011	Inactive
Sir James Dunn Mine (past-producer) Chabanel Township	Fe	65 454 545 tonnes @ 34% Fe, 7% SiO2	Essar Steel Algoma Inc.	RGF	Inactive.
Surluga Mine (past producer) McMurray Township	Au	385 000 tons @ 0.21 opT Au	Augustine Ventures Inc.	NI 43-101 Rpt 21/11/2011	Diamond drilling 2011

OGS ACTIVITIES

Details of activities completed during the year by the staff of the Earth Resources and Geoscience Mapping Section, Ontario Geological Survey, are provided in *Summary of Field Work and Other Activities 2015* (Ontario Geological Survey 2015b). Field work activities completed in Sault Ste. Marie District include:

- Geology and Mineral Potential of Rennie and Leeson Townships, Michipicoten Greenstone Belt; by L. Robichaud, J.A. McDivitt and B.E. Trevisan.
- Characterization of Gold Mineralization in the Missanabie–Renabie District of the Wawa Gold Camp; by J.A. McDivitt, B. Lafrance, D.J. Kontak and L. Robichaud.
- Mineralogical and Geochemical Studies of Rocks from the Pecors Magnetic Anomaly East of Elliot Lake, Southern Province; by R. M. Easton.

REGIONAL LAND USE GEOLOGIST ACTIVITIES—NORTHEAST REGION

Land Use Planning Activities

The activities of the Regional Land Use Geologist are described *in* "Regional Land Use Geologist Activities—Northeast Region" in the Timmins District report of this volume.

MINERAL DEPOSIT COMPILATION GEOLOGIST—NORTHEASTERN ONTARIO

The activities of the Mineral Deposit Compilation Geologist are described in "Mineral Deposit Compilation Geologist—Northeastern Ontario" in the Timmins District report of this volume.

ACKNOWLEDGMENTS

Information on past activities reported in the text is from assessment files and other files of the Sault Ste. Marie District Geologist office unless otherwise noted. Information on current mining and exploration activities was provided by individual prospectors and exploration and mining company personnel, compiled from assessment files and obtained from public information sources.

REFERENCES

Bain, D. 1996. Report on the economic potential for Cu-Pb-Zn carried out on the Percy Lake property; Avalon Ventures Ltd., Assessment File, SSMP Moggy-06.

Card, K.D. 1990. A review of the Superior Province of the Canadian Shield, a product of Archean accretion; Precambrian Research, v.48, p.99-156.

Grunsky, C.E. 1982. Batchawana Synoptic Project; Summary of Field Work; Ontario Geological Survey, Miscellaneous Paper 106, p.36-40.

Grunsky, C.E. 1991. Geology of the Batchawana area, District of Algoma; Ontario Geological Survey, Open File Report 5791, 214p.

Hamilton, S.M., Fortescue, J.A.C. and Hardy, A.S. 1995. A zinc-cadmium-copper anomaly: Preliminary results of the Cow River Geochemical Mapping Project, Batchawana greenstone belt; Ontario Geological Survey, Open File Report 5917, 31p.

Hurst, M.E. 1928. Prospects in the Upper Garden River area, Bussineau property; Ontario Department of Mines, Annual Report v.37, pt.3, p.62-65.

Irvine, T.N. and Baragar, W.R.A. 1971. A guide to chemical classification of the common volcanic rocks; Canadian Journal of Earth Sciences, v.9, p.523-548.

Le Bas, M.J., LeMaitre, R.W., Streckeisen, A. and Zanettin, B. 1986. A chemical classification of volcanic rocks based on the total alkali-silica diagram; Journal of Petrology, v. 27, p.745-750.

Lengyel, P.W.J. 2006. Report on the 2006 diamond drilling program carried out on the Percy Lake property; Vault Minerals Inc., Assessment File SSMP Moggy-05.

McDonough, W.F. and Sun, S-s. 1995. The composition of the Earth; Chemical Geology, v.120, p.223-253.

Ontario Geological Survey 2015a. Mineral Deposit Inventory—2015; Ontario Geological Survey, Mineral Deposit Inventory, online database.

Ontario Geological Survey 2015b. Summary of Field Work and Other Activities; Open File Report 6313, 488p.

Percival, J.A., West G.F. 1994. The Kapuskasing uplift: A geological and geophysical synthesis; Canadian Journal of Earth Sciences, v.31, p.1256-1280.

Supercrest Copper Mines Ltd. 1956. Surface geological plan; Sault Ste. Marie District Geologist's office, assessment file, AFRI Laverendrye-0011-A1.

Wilson, B.C. 1983. Geology of the Rotunda Lake–Percy Lake area, Districts of Algoma and Sudbury; Ontario Geological Survey, Report 229. 32p.

Metric Conversion Table

Conversion from SI to Imperial			Conversion from Imperial to SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
		LENGTH			
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
		AREA			
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
		VOLUME			
1 cm^3	0.061 023	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.307 951	cubic yards	1 cubic yard	0.764 554 86	m^3
		CAPACITY			
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
		MASS			
1 g	0.035 273 962	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 747	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 622 6	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton(short)	**907.184 74**	kg
1 t	1.102 311 3	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 9**	t
		CONCENTRATION			
1 g/t	0.029 166 6	ounce (troy) / ton (short)	1 ounce (troy) / ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights / ton (short)	1 pennyweight / ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

	Multiplied by	
1 ounce (troy) per ton (short)	31.103 477	grams per ton (short)
1 gram per ton (short)	0.032 151	ounces (troy) per ton (short)
1 ounce (troy) per ton (short)	20.0	pennyweights per ton (short)
1 pennyweight per ton (short)	0.05	ounces (troy) per ton (short)

*Note: Conversion factors in **bold** type are exact. The conversion factors have been taken from or have been derived from factors given in the* Metric Practice Guide for the Canadian Mining and Metallurgical Industries*, published by the Mining Association of Canada in co-operation with the Coal Association of Canada.*

ISSN 1484-947X (print)
ISBN 978-1-4606-7405-5 (print)

ISSN 1916-6192 (online)
ISBN 978-1-4606-7406-2 (PDF)