Natural Resources Canada | Ressources naturelles Canada

Marginal Notes

GEOPHYSICAL IMAGERY

Remnant magnetic intensity images (OGS, in press), at a scale of 1:200 000, are displayed in the surround of the map. Interpretation of the geology displayed on the map is largely based on this data, other airborne magnetic survey data (e.g., derivatives of the remnant magnetic field) and gravity gradiometer data (OGS–GSC 2011). Some contacts are interpreted from raster geophysical data present in the assessment files and from proprietary company data.

Note that many of the geological contacts displayed on the map are based on projected drilling intersections, but their interpreted extensions are mainly inferred from geophysical data.

Faults displayed on the map are mostly aeromagnetic discontinuities that are interpreted to represent offsets of geological units by faulting. The faults interpreted from the geophysical data may or may not be supported by geological observations.

GEOLOGY

Compiled outcrop locations should be verified and used with caution as the data are mainly compiled from older geological maps and locations could not be verified in many instances.

Where mineral abbreviations are shown on the map face, they represent noteworthy metamorphic and/or alteration minerals, and do not represent an exhaustive list of mineral species at each station. The presence of these minerals is shown in order to highlight occurrences of mineralization and/or unique mineralogy.

CENOZOIC

Apart from the limited number of outcrop exposures that are shown on the geological map, all Precambrian rocks in the area are overlain by non-indurated to weakly indurated surficial deposits. These include marine, glacial, glaciofluvial and glaciolacustrine deposits as well as more recent bog, fen, lake and river deposits. These surficial deposits are not shown on the geological map. The reader is referred to the recent work conducted by the Ontario Geological Survey on the surficial geology of the area summarized in Gao and Crabtree (2016).

PALEOZOIC

The eastern half of the study area covered by the 3 maps in this series (OGS Maps P.3804, P.3805, P.3806 and GSC Open Files OF8200, OF8201, OF8202, respectively) is overlain by Silurian and Ordovician sedimentary rocks. An approximation of the location of the Archean–Paleozoic unconformity is shown on the map based on the work of Armstrong (2011) and Ratcliffe and Armstrong (2013). Contacts between the various lithostratigraphic units within the Paleozoic are not shown.

Silurian rocks consist of the Severn River Formation. Ordovician rocks consist, from youngest to oldest, of the Red Head Rapids Formation, the Churchill River Group and the Bad Cache Rapids Group. Details on the character of these lithostratigraphic units can be found in Armstrong (2011) and Ratcliffe and Armstrong (2013).

Outcrop exposures of Paleozoic rocks are shown on the map and in the compilation of drill-hole data, and are coded as DPz, CPz, Pz, for Paleozoic rock in drill core, compiled Paleozoic outcrop, and observed Paleozoic outcrop, respectively. Outcrop locations coded as "Pz" are from Armstrong (2011) and Ratcliffe and Armstrong (2013) so as to distinguish them from older, possibly less accurately located data from older maps.

PROTEROZOIC

Kimberlites (unit 21)
The Kyle Lake "Kimberlites" were emplaced between *circa* 1123 ± 20 and 1076.2 ± 3.8 Ma (Heaman, Kjaarsgard and Creaser 2004). Descriptions of the Kyle Lake Kimberlites are given in Sage (2000), but rock types present in the "kimberlites" are not well constrained from the descriptions in Sage (2000) or from the assessment reports filed with the Ministry of Northern Development and Mines.

It should also be noted that the locations of diamond-drill holes containing rocks of unit 21 are not well constrained. Drill logs obtained from companies and/or the assessment files do not specify the datum used for the location data. For the purposes of this map, locations of diamond-drill holes, assume that they are all located in UTM Zone 16 North American Datum 1983 (NAD83). Map users should verify location data for drill holes containing diamond-bearing unit 21 if it is critical for their intended usage of the data portrayed on the geological map.

Mafic Dikes (unit 20)
Linear positive or negative magnetic anomalies are interpreted to represent mafic dikes of Proterozoic age. Minor occurrences are noted in drill core and outcrop. Four major dike swarms are present: the Mackenzie dike swarm, emplaced at *circa* 1276 Ma (unit 20a); the Pickle Crow dike swarm, emplaced at *circa* 1878 Ma (unit 20b); the Marathon dike swarm, emplaced between *circa* 2126 and 2101 Ma (unit 20c); and the Matachewan dike swarm, emplaced at *circa* 2454 Ma (unit 20d). Mafic dikes that cannot be reliably assigned to a particular swarm are designated as unit 20e. Ages and most locations of the various dikes shown on the geological map are based on or modified from Stott and Josey (2009).

ARCHEAN

Intrusive Rocks (units 12 to 19)
Typically felsic to intermediate plutonic suites consist predominantly of rocks of granitic to dioritic composition but they also may contain volumetrically minor components of mafic and ultramafic rocks, usually as enclaves. These enclaves of mafic and ultramafic rocks are typically too small to be displayed on the geological map.

Plutonic rocks assigned to the late-tectonic to posttectonic intrusive suites (units 17, 18, 19) are thought to postdate most Neoarchean deformation based on dominantly nontectonically foliated texture. Rocks of these suites are also commonly observed to crosscut foliations in the rocks that they intruded.

Rocks of the syenite suite (unit 18) were not observed in outcrop or in diamond-drill core, but are included based on the compilation map of Buse et al. (2009), and are likely correlative with the Wapikopa pluton (*circa* 2698 Ma).

In contrast, plutons assigned to the syntectonic and/or synvolcanic suites (units 12, 13, 14, 15, 16) are tectonically foliated intrusive and metamorphosed intrusive rocks. Unit 14 is likely synvolcanic based on geochronology. Other units do not have known volcanic equivalents. Units 13 and 14, and inferred older portions of unit 12, may have been emplaced prior to regional tectonism.

Unit 13 is defined as a separate unit, as age constraints in the central map area suggest that a body of tonalite, *circa* 2773 Ma, exists to the northwest of units 9 to 11. The extent of this unit is poorly known and speculative. Units 12 and 13 comprise very similar rock types and both may represent several distinct generations of granodiorite- to tonalite-dominated bodies that are characterized by low magnetic susceptibility.

Mafic and Ultramafic Intrusive Rocks (units 6 to 11)
These map units encompass Neoarchean or Mesoarchean metamorphosed, intrusive rocks of anorthositic to dunitic composition, including oxide dominated rocks, namely chromitite (a rock dominated by the mineral chromite) and magnetitite (a rock dominated by the mineral magnetite).They have been subdivided into 3 subsuites (units 9, 10 and 11) based on rock type, geological relationships, regional distribution and mineralization styles. Variably deformed, ultramafic rocks are typically serpentinized or talc-carbonate altered. Rocks of unit 9 host all known magmatic chromite and nickel-copper-PGE-enriched sulphide deposits in the map area. Rocks of unit 11 may have intruded rocks of unit 10 and unit 9.

The Mesoarchean Highbank-Fishtrap intrusive complex (unit 8; *circa* 2809 Ma) consists of a deformed, layered, mafic rock-dominated intrusive complex, informally subdivided into a western Fishtrap Lake intrusion and an eastern Highbank Lake intrusion. It is a predominantly hornblende-bearing gabbro to anorthosite with rare pyroxenite and is locally magnetite-rich, locally apatite-rich and locally olivine-bearing. Some magnetite-rich horizons are vanadium- and titanium-enriched.

Mafic and ultramafic rocks of uncertain age and/or tectonic affinity are assigned to units 6 and 7. These may correlate with units 8, 9, 10 or 11, but field, geochemical or isotopic age constraints do not permit assignment to these units based on knowledge at the time of cartographic preparation.

Mesoarchean and Neoarchean Metasedimentary and Metavolcanic Rocks (units 1 to 5)
Unit 5 consists of chemical metasedimentary rocks, predominantly banded iron formation. Unit 4 consists of metamorphosed clastic metasedimentary rocks (units 4a to 4f) and their gneissic equivalents (unit 4g). Metavolcanic rocks have been subdivided into 3 main groupings: felsic to intermediate metavolcanic rocks (unit 3) that are considered to be metamorphosed equivalents of a compositional range from andesite to rhyolite; mafic metavolcanic rocks (unit 2) that are considered to be metamorphosed equivalents of a compositional range from basalt or basaltic andesite; and ultramafic metavolcanic rocks (unit 1) that represent metamorphosed volcanic rocks with MgO content over 18% or their assumed equivalents as determined by visual or petrographic observations.

Canada

REFERENCES

Armstrong, D.K. 2011. Re-evaluating the hydrocarbon resource potential of the Hudson Platform: Interim results from northern Ontario; *in* Summary of Field Work and Other Activities 2011, Ontario Geological Survey, Open File Report 6270, p.27-1 to 27-11.

Buse, S., Smar, L., Stott, G.M. and McIlraith, S.J. 2009. Precambrian geology of the Winisk Lake area; Ontario Geological Survey, Preliminary Map P.3607, scale 1:100 000.

Gao, C. and Crabtree, D.C. 2016. Results of regional till and modern alluvium sampling in the McFaulds Lake ("Ring of Fire") area, northern Ontario; Ontario Geological Survey, Open File Report 6309, 164p.

Heaman, L.M., Kjarsgaard, B.A. and Creaser, R.A. 2004. The temporal evolution of North American kimberlites; Lithos, v.76, p.377-397.

Ontario Geological Survey–Geological Survey of Canada 2011. Ontario airborne geophysical surveys, gravity gradiometer and magnetic data, grid and profile data (ASCII and Geosoft® formats) and vector data, McFaulds Lake area; Ontario Geological Survey, Geophysical Data Set 1068.

Ontario Geological Survey, in press. Magnetic supergrids, Ontario airborne geophysical surveys; magnetic data, grid data; Ontario Geological Survey, Geophysical Data Set 1037—Revised.

Ratcliffe, L.M. and Armstrong, D.K. 2013. The Hudson Platform Project: 2013 field work and drill-core correlations, western Moose River Basin; *in* Summary of Field Work and Other Activities 2013, Ontario Geological Survey, Open File Report 6290, p.36-1 to 36-19.

Sage, R.P. 2000. Kimberlites of the Attawapiskat area, James Bay Lowlands, northern Ontario; Ontario Geological Survey, Open File Report 6019, 341p.

Stott, G.M. and Josey, S.D. 2009. Post-Archean mafic (diabase) dikes and other intrusions of northwestern Ontario, north of latitude 49°30'; Ontario Geological Survey, Miscellaneous Release—Data 241.

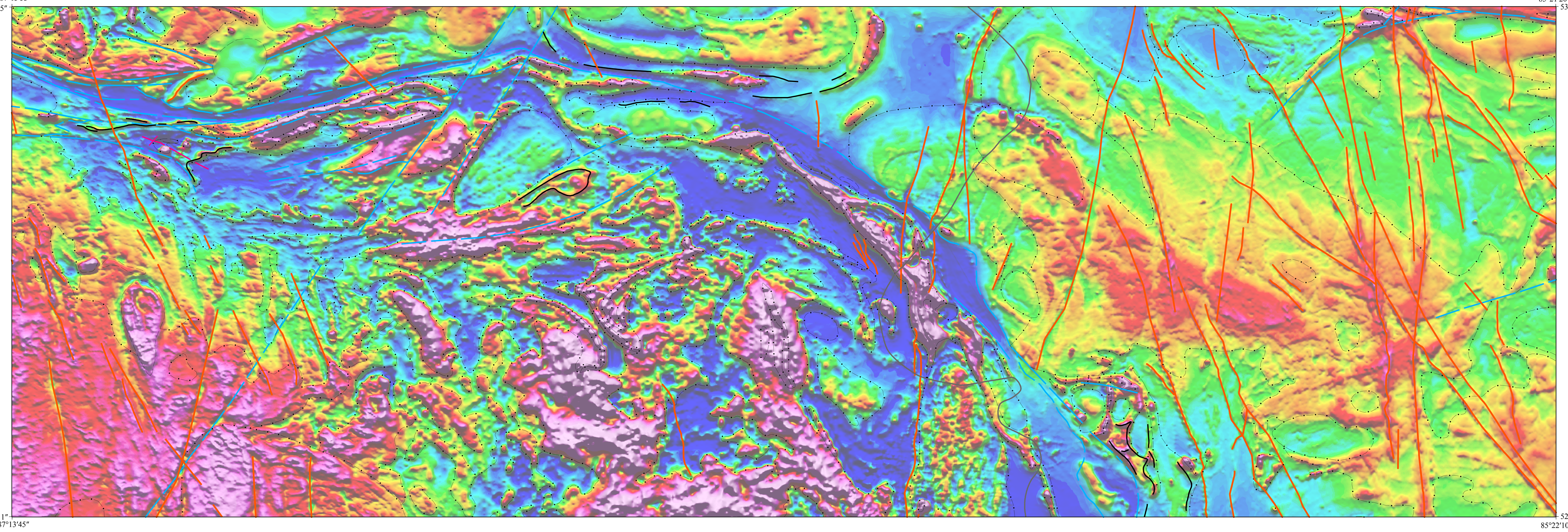


Figure 1. Remnant magnetic intensity image of the area, at 1:200 000 scale, showing interpreted geophysical contacts, dikes, geophysically defined faults and the Archean–Paleozoic unconformity. Symbology is the same as on the map face. Aeromagnetic data are from OGS (in press).

Table 1. Summary of mineral occurrences displayed on the map. Data *modified from t*he OGS Mineral Deposit Inventory (MDI) database (OGS 2016). Additional information can be found in OGS MRD 343 (Metsaranta and Houlé 2017).

Number	Name	MDI Identifier	Main Commodity	Interpreted Deposit Type	Easting (m)	Northing (m)	MDI Status
1	G1 (G1-09-01)	MDI000000001733	Zn	VMS-style base metal	515396	5903947	Occurrence
2	G3 (G3-09-01)	MDI000000001735	Zn	VMS-style base metal	520344	5904487	Occurrence
3	Northern Star Eagle (TME-08-02)	MDI000000000861	Zn	VMS-style base metal	520799	5902803	Occurrence
4	5.01	MDI000000000912	Zn	VMS-style base metal	522360	5901486	Prospect
5	MacDonald Mines DDH BM-04-01	MDI000000000272	Zn	VMS-style base metal	548241	5898281	Discretionary occurrence
6	Sanderson Property (BM9b-04)	MDI000000000271	V	Magmatic Fe-Ti-V	548799	5896596	Occurrence
7	MacDonald DDH BM-04-03	MDI000000000710	Cu	VMS-style base metal	549393	5897463	Discretionary occurrence
8	Caribou Property (CO-08-04)	MDI000000000957	Zn	VMS-style base metal	547422	5880017	Occurrence
9	Kyle No. 3	MDI43F04NW00001	Diamond	Kimberlite-hosted diamond	580990	5894039	Prospect
10	Kyle No. 2	MDI43F03NW00001	Diamond	Kimberlite-hosted diamond	603000	5892500	Occurrence

Abbreviations: DDH - diamond-drill hole; VMS - volcanogenic massive sulphide.

Table 2. Summary of new and compiled geochronology data for the map area (*see* "Sources of Information" for details). Eastings and northings are provided in NAD 83, Zone 16. For drill-core samples, locations are projected vertically to surface from their location along the trace of the drill hole. Additional information can be found in OGS MRD 343 (Metsaranta and Houlé 2017).

Number	Sample Type	Easting (m)	Northing (m)	Map Unit	Rock Type	Age (Ma)	Inherited Zircon Ages (if present) (Ma)	Interpretation	Mineral	Method	Source
1	DC	493258	5900458	3	Felsic metavolcanic rock	2757±1.0		Volcanism	zircon	ID-TIMS	This study, Kamo (2014)
2	OC	497750	5899227	7	Gabbro	2732.9±0.6		Crystallization age	zircon	ID-TIMS	This study, McNicoll et al., unpublished data
3	COMP	498300	5900858	3 or 4	Siltstone	<2714±8		Maximum age of deposition	zircon	SHRIMP	Buse et al. (2009)
4	COMP	498300	5900858	3 or 4	Resedimented intermediate tuff	<2719±2		Maximum age of deposition	zircon	ID-TIMS	Buse et al. (2009)
5	OC	505621	5888284	12	Foliated biotite tonalite	<2703.8±1.4	2703.8±1.4, 2708.7±1.0, 2718±3	Maximum age of crystallization	zircon	ID-TIMS	This study, Kamo (2016)
6	DC	522419	5902070	3	Felsic metavolcanic rock	2737±3		Volcanism	zircon	LA-ICP-MS	This study, Davis (2013)
7	DC	525005	5892109	12 or 3	Felsic to intermediate dike	2711±6.0		Crystallization age, minimum age of metavolcanic rocks it intrudes	zircon	LA-ICP-MS	This study, Davis (2014)
8	DC	535169	5882447	18	Quartz monzonite	2698±6		Crystallization age	zircon	LA-ICP-MS	This study, Petrus (2013)
9	DC	579185	5872967	12	Foliated quartz diorite dike	2661±5		Crystallization age	zircon	LA-ICP-MS	This study, Petrus (2013)

Abbreviations: COMP - compiled data; DC - drill-core sample; ID-TIMS - isotope dilution thermal ionization mass spectrometry; LA-ICP-MS - laser ablation inductively coupled plasma mass spectrometry; OC - outcrop sample; SHRIMP - sensitive high-resolution ion microprobe.

SOURCES OF INFORMATION

Base map information derived from the Land Information Ontario Data Warehouse, Land Information Ontario, Ontario Ministry of Natural Resources and Forestry, scale 1:100 000, with modifications by staff of the Ministry of Northern Development and Mines.

Assessment Files and Activity Reports-Mineral Exploration online databases, OGSEarth, Mines and Minerals Division, Ministry of Northern Development and Mines: http://www.mndm.gov.on.ca/en/mines-and-minerals/applications/ogsearth.

Some diamond-drill core information was compiled from proprietary company data contributions. The authors gratefully acknowledge Northern Shield Resources Inc., Melkior Resources Inc., Noront Resources Ltd., KWG Resources Inc., MacDonald Mines Ltd., Fancamp Exploration Ltd., Probe Metals Inc., Bold Ventures Inc., White Pine Resources Inc. and Metalex Ventures Inc. for access to drilling data not available in the assessment files.

Mapping conducted using Universal Transverse Mercator (UTM) co-ordinates in North American Datum 1983 (NAD83), Zone 16.

Compiled geology, geochronology and geophysical interpretation derived from:

Bostock, H.H. 1962. Geology, Lansdowne House, Ontario; Geological Survey of Canada; Preliminary Map 4-1962, scale 1:253 440.

Buse, S., Smar, L., Stott, G.M. and McIlraith, S.J. 2009. Precambrian geology of the Winisk Lake area; Ontario Geological Survey, Preliminary Map P.3607, scale 1:100 000.

Crabtree, D.C. and Gleeson, C.F. 2003. Results of the "Spider 3" regional kimberlite indicator mineral and geochemistry survey carried out in the vicinity of the upper Attawapiskat and Ekwan rivers, northern Ontario; Ontario Geological Survey, Open File Report 6097, 127p.

Davis, D.W. 2013. LA-ICPMS geochronology of Archean zircon from northwest Ontario; unpublished report for the Ontario Geological Survey by the Jack Satterly Geochronology Laboratory, University of Toronto, 11p.

——— 2014. LA-ICPMS geochronology of rocks from northwest Ontario; unpublished report for the Ontario Geological Survey by the Jack Satterly Geochronology Laboratory, University of Toronto, 24p.

Gao, C. and Crabtree, D.C. 2016. Results of regional till and modern alluvium sampling in the McFaulds Lake ("Ring of Fire") area, northern Ontario; Ontario Geological Survey, Open File Report 6309, 164p.

Heaman, L.M., Kjarsgaard, B.A. and Creaser, R.A. 2004. The temporal evolution of North American kimberlites; Lithos, v.76, p.377-397.

Kamo, S.L. 2011. Report on U-Pb CA-ID-TIMS geochronology on volcanic and plutonic rocks, Grenville and Superior provinces, Ontario; unpublished report for the Ontario Geological Survey by the Jack Satterly Geochronology Laboratory, University of Toronto, 26p.

——— 2013. Report on U-Pb geochronology (CA-ID-TIMS and LA-ICPMS) of rocks from the Grenville and Superior provinces of Ontario, Parts 1 and 2; unpublished report for the Ontario Geological Survey by the Jack Satterly Geochronology Laboratory, University of Toronto, 11p.

——— 2013. Preliminary report on U-Pb ID-TIMS geochronology of rocks from the Grenville and Superior provinces of Ontario; unpublished report for the Ontario Geological Survey by the Jack Satterly Geochronology Laboratory, University of Toronto, 36p.

——— 2014. Report on U-Pb CA-ID-TIMS geochronology on volcanic and plutonic rocks, Superior and Grenville provinces, Ontario; unpublished report prepared for the Ontario Geological Survey, Jack Satterly Geochronology Laboratory, University of Toronto, 27p.

——— 2016. Results summary for two foliated biotite tonalite samples for Riku Metsaranta (analyses performed Fall 2014); unpublished report for the Ontario Geological Survey by the Jack Satterly Geochronology Laboratory, University of Toronto, 4p.

Lahti, H.R. 2008. Updated technical report on the McFaulds Lake project, Porcupine Mining Division, James Bay Lowland, Ontario, Canada, for UC Resources Limited and Spider Resources Inc. by Deep Search Exploration Technologies Inc., August 30, 2008; Technical Report under NI 43-101, filed September 4, 2008, with SEDAR®, 96p.

Metsaranta, R.T. and Houlé, M.G. 2017. Geochronology, mineral deposit, drill-core relogging and drill-core compilation data from the Winiskisis Channel, McFaulds Lake and Highbank Lake areas, "Ring of Fire" region, northern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 343.

Ontario Geological Survey, in press. Magnetic supergrids, Ontario airborne geophysical surveys; magnetic data, grid data; Ontario Geological Survey, Geophysical Data Set 1037—Revised.

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

Ontario Geological Survey–Geological Survey of Canada 2011. Ontario airborne geophysical surveys, gravity gradiometer and magnetic data, grid and profile data (ASCII and Geosoft® formats) and vector data, McFaulds Lake area; Ontario Geological Survey, Geophysical Data Set 1068.

Petrus, J, 2013. Final report on U-Pb Geochronology; unpublished report for the Ontario Geological Survey by the Mineral Exploration Research Centre, Department of Earth Sciences, Laurentian University, 12p.

Rayner, N. and Stott, G.M. 2005. Discrimination of Archean domains in the Sachigo Subprovince: A progress report on the geochronology; *in* Summary of Field Work and Other Activities 2005, Ontario Geological Survey, Open File Report 6172, p.10-1 to 10-21.

Sage, R.P. 2000. Kimberlites of the Attawapiskat area, James Bay Lowlands, northern Ontario; Ontario Geological Survey, Open File Report 6019, 341p.

Stott, G.M. 2008. Precambrian geology of the Hudson Bay and James Bay lowlands region interpreted from aeromagnetic data—east sheet; Ontario Geological Survey, Preliminary Map P.3598—Revised, scale 1:500 000.

Stott, G.M., Corkery, M.T., Percival, J.A., Simard, M. and Goutier, J. 2010. A revised terrane subdivision of the Superior Province; *in* Summary of Field Work and Other Activities 2010, Ontario Geological Survey, Open File Report 6260, p.20-1 to 20-10.

Stott, G.M. and Josey, S.D. 2009. Post-Archean mafic (diabase) dikes and other intrusions of northwestern Ontario, north of latitude 49°30′; Ontario Geological Survey, Miscellaneous Release—Data 241.

———2009. Regional geology and mineral deposits of northern Ontario, north of latitude 49°30′; Ontario Geological Survey, Miscellaneous Release—Data 265.

Stott, G.M., Josey, S.D., Rainsford, D.R.B. and McIlraith, S.J. 2008. Precambrian geology and aeromagnetic data of the Hudson Bay and James Bay lowlands region with Precambrian basement depth estimates and related tables of geochronology and diamond-drill hole data; Ontario Geological Survey, Miscellaneous Release—Data 233.

Thurston, P.C. and Carter, M.W. 1969. Operation Fort Hope: Attawapiskat River sheet, districts of Kenora (Patricia Portion) and Thunder Bay; Ontario Department of Mines and Northern Affairs, Preliminary Map P.563, scale 1:126 720.

Thurston, P.C., Sage, R.P. and Siragusa, G.M. 1971. Operation Winisk Lake: Winiskisis Channel sheet, District of Kenora (Patricia Portion); Ontario Department of Mines, Preliminary Map P.714, scale 1:126 720.

——— 1971. Operation Winisk Lake: Winisk Lake sheet, District of Kenora (Patricia Portion); Ontario Department of Mines, Preliminary Map P.716, scale 1:126 720.

Geology is not tied to surveyed lines.

Magnetic declination for the centre of the map area, approximately 8°4.74′W in 2017, with an annual change of 2.0′ eastward.

Metric conversation factor 1 foot equals 0.3048 m.

LEGEND[abcdefh]

PHANEROZOIC

CENOZOIC

QUATERNARY

RECENT
Bog, fen, lake and river deposits

PLEISTOCENE
Marine, glacial, glaciofluvial, glaciolacustrine deposits

UNCONFORMITY

PALEOZOIC

Pz Paleozoic rock

UNCONFORMITY

PRECAMBRIAN

PROTEROZOIC

21 **Kyle Lake "Kimberlites" (*circa* 1123±20 to 1076.2±3.8 Ma)**
Unsubdivided, altered ultramafic alkalic rocks. Locally diamondiferous.

20 **Mafic Dike Swarms**
20a Mackenzie dike swarm (*circa* 1276 Ma)
20b Pickle Crow dike swarm (*circa* 1878 Ma)
20c Marathon dike swarm (*circa* 2126 to 2101 Ma)
20d Matachewan dike swarm (*circa* 2454 Ma)
20e Unsubdivided

INTRUSIVE CONTACT

ARCHEAN

Felsic to Intermediate Intrusive Rocks

Late-Tectonic to Posttectonic Suites

19 **Two Mica Granite Suite (no age constraints)**
Granite to granodiorite, medium grained to pegmatitic, generally massive to weakly foliated. Unit typically occurs as minor sills and dikes in diamond-drill core. Commonly biotite-, muscovite- and/or garnet-bearing.
19c Granite and/or alkali feldspar granite
19g Biotite bearing
19j Muscovite bearing
19k Garnet bearing
19l Xenolith bearing
19p Pegmatitic dike or sill[g]

18 **Syenite Suite**
Medium- to very coarse-grained, hornblende-bearing syenitoid rocks. Locally apatite bearing.

17 **Weakly Foliated Granodiorite to Granite (<*circa* 2704 Ma)**
Granite to granodiorite, fine grained to pegmatitic, massive to weakly foliated, typically biotite bearing, leucocratic to mesocratic. Occurs as thin sills and dikes but also as map-scale plutons. Typically low magnetic susceptibility, although locally magnetite bearing.
17b Granodiorite[g]
17c Granite and/or alkali feldspar granite
17l Xenolith bearing
17n Alkali feldspar phyric
17p Pegmatitic dike or sill
17q Fine-grained dike or sill
17r Graphic texture

INTRUSIVE CONTACT

Syntectonic and/or Synvolcanic Suites

16 **Alkali Feldspar Megacrystic Granodiorite to Granite Suite**
Granodiorite to quartz monzonite, typically medium- to coarse-grained, locally pegmatitic. Characterized by coarse-grained potassium feldspar phenocrysts. Typically biotite- and hornblende-bearing, commonly magnetite-bearing.
16b Granodiorite[g]
16d Monzonite and/or quartz monzonite
16g Biotite bearing
16h Hornblende bearing
16i Magnetite bearing
16n Alkali feldspar phyric

INTRUSIVE CONTACT

15 **Hornblende-Magnetite Tonalite-Granodiorite-Diorite Suite (*circa* 2728 Ma)**
Granodiorite to tonalite, rare porphyritic diorite. Typically medium- to coarse-grained and porphyritic. Foliated, biotite-, hornblende- and magnetite-bearing. Commonly contains elongate xenoliths and autoliths.
15a Tonalite
15b Granodiorite
15c Granite and/or feldspar granite[g]
15d Monzonite and/or quartz monzonite
15f Diorite and/or quartz diorite[g]
15g Biotite bearing
15h Hornblende bearing
15i Magnetite bearing
15l Xenolith bearing
15n Alkali feldspar phyric[g]
15o Plagioclase phyric

INTRUSIVE CONTACT

14 **Synvolcanic Tonalite to Granodiorite Suite (*circa* 2734 Ma)**
Tonalite, granodiorite and granite. Foliated, commonly characterized by round quartz phenocrysts, likely synvolcanic. Biotite bearing, locally hornblende bearing, locally magnetite bearing.
14a Tonalite
14b Granodiorite[g]
14c Granite and/or alkali feldspar granite[g]
14g Biotite bearing
14r Graphic texture[g]
14s Strongly foliated

INTRUSIVE CONTACT

13 **Foliated Tonalite Suite (*circa* 2773 Ma)**
Tonalite to granodiorite, biotite bearing, foliated, medium grained, locally plagioclase porphyritic, typically characterized by low magnetic susceptibility.
13a Tonalite
13b Granodiorite
13g Biotite bearing
13h Hornblende bearing
13l Xenolith bearing
13n Alkali feldspar phyric
13o Plagioclase phyric[g]

12 **Foliated Tonalite to Granodiorite (various age constraints)**
Tonalite to granodiorite, typically moderately foliated, locally gneissic, biotite bearing. Various age constraints, ranging from Mesoarchean to Neoarchean. Typically interpreted to underlie areas of low magnetic signature on total magnetic field maps. Some areas coded as 12 on the maps may also be posttectonic.
12a Tonalite
12b Granodiorite
12g Biotite bearing
12h Hornblende bearing
12l Xenolith bearing[g]
12n Alkali feldspar phyric[g]
12s Strongly foliated or gneissic

NEOARCHEAN

Mafic and Ultramafic Intrusive Rocks

Ring of Fire Intrusive Suite (*circa* 2734 Ma) (units 9 to 11)

11 **Mafic Intrusive Rocks**
Melagabbro to anorthosite. Layered, locally magnetite- and ilmenite-rich, locally apatite bearing. Includes numerous vanadium- and titanium-enriched oxide-bearing horizons. Locally observed to crosscut unit 10.
11b Gabbro[g]
11d Leucogabbro[g]
11e Anorthosite[g]
11f Quartz gabbro[g]
11h Magnetite bearing [g]
11n Schistose[g]

INTRUSIVE CONTACT

10 **Mafic Intrusive Rocks**
Gabbro to anorthosite, typically nonmagnetic, layered. In gradational contact with unit 9 where the contact is not faulted.
10a Gabbro
10b Leucogabbro
10d Anorthosite[g]

GRADATIONAL IGNEOUS CONTACT

9 **Ultramafic Intrusive Rocks**
Dunite to pyroxenite, commonly broadly layered. Hosts several nickel-copper–PGE and chromite occurrences and deposits.
9b Peridotite[g]
9d Pyroxenite (foliated)[g]
9f Chromitite[g]
9g Semimassive chromitite[g]
9h Layered chromitite[g]
9i Chromite bearing (generally a few percent disseminated oxide)[g]
9l Talc-carbonate schist[g]

MESOARCHEAN

Highbank-Fishtrap Intrusive Complex (*circa* 2809 Ma)

8 **Mafic Intrusive Rocks[g]**
Deformed, layered, hornblende gabbro to anorthosite, locally pyroxenite, locally apatite bearing, minor iron, titanium- and vanadium-enriched oxide-rich layers.
8a Melagabbro to pyroxenite[g]
8b Gabbro[g]
8d Leucogabbro[g]
8e Anorthosite[g]

GEOPHYSICAL MODIFIERS
8l Area of lower magnetic response in unit 8[g]
8m Area of higher magnetic response in unit 8[g]

NEOARCHEAN OR MESOARCHEAN

Unsubdivided Mafic and Ultramafic Intrusive Rocks

7 **Mafic Intrusive Rocks**
7a Melagabbro to pyroxenite
7b Gabbro
7d Leucogabbro
7f Quartz gabbro[g]

6 **Ultramafic Intrusive Rocks**
6a Dunite

Mesoarchean and Neoarchean Metasedimentary and Metavolcanic Rocks

5 **Chemical Metasedimentary Rocks**
5a Oxide iron formation
5b Chert[g]
5c Marble[g]
5d Sulphide iron formation[g]

4 **Clastic Metasedimentary Rocks**
4a Sandstone
4b Siltstone
4d Graphitic and/or sulphidic mudstone
4f Schistose
4g Gneissic to migmatitic[g]

3 **Felsic to Intermediate Metavolcanic Rocks**
3a Massive flow[g]
3c Vesicular and/or amygdaloidal flows[g]
3d Tuff, lapilli-tuff
3h Schistose

2 **Mafic Metavolcanic Rocks**
2a Massive flow
2b Pillowed flow
2c Vesicular and/or amygdaloidal flows
2g Amphibolitized
2h Schistose

1 **Ultramafic Metavolcanic Rocks[g]**

[a] This is a common legend and applies to the 3 maps (OGS Maps P.3804, P.3805 and P.3806; and corresponding GSC Open Files 8200, 8201, 8202, respectively) in this series as well as a more detailed compilation of data that is included with OGS MRD 343 (Metsaranta and Houlé 2017). Not all codes or rock units are present on each map.

[b] This legend is a field legend, although some data have been verified by geochemical or petrographic studies. All Precambrian rocks have been subjected to regional metamorphism; many nonmetamorphic terms are used for the sake of brevity and where the protolith is established or assumed.

[c] The order of Precambrian map units in the legend does not strictly imply relative age relationships. This is in part because the contact relationships between various units are not well constrained. In some cases, the nature of contacts between units is more speculative.

[d] The letter "C" preceding a code refers to data compiled and interpreted from geological maps listed under "Sources of Information". In many cases the map unit shown is based on both geophysical interpretation and the original map coding. Codes containing a hyphen, for example, "C2-15", indicate a compiled outcrop where a previously interpreted geology differs markedly from observations from this study. In these cases, the first number is the original map coding, and the second is the observation or reinterpretation based on this study. Note that the location of compiled outcrops may be less precise than those mapped by the authors.

[e] The letter "G" preceding a code refers to geology interpreted from the aeromagnetic and/or gravity geophysical surveys listed under "Sources of Information". Where multiple map units follow the letter G, for example, "G2,3,4", there is either uncertainty in which map unit is present, or multiple map units may be present that cannot be differentiated at the scale of the map. In cases where a hyphen separates the map units, for example, "G2-7", it indicates a situation where the map unit is uncertain, but where it is thought to be one map unit or the other, but not a mixture of the two.

[f] The letter "D" preceding a code refers to data derived from examination of diamond-drill core by the authors. The letters "DC" preceding a code refers to diamond-drill hole data based on compilation; not all compiled data is shown on the map face because of cartographic constraints. More detailed information for the displayed compiled and re-examined diamond-drill core locations, including collar information, compiled rock types, drill-hole traces, is included in OGS MRD 343 (Metsaranta and Houlé 2017).

[g] Unit absent on this map (Winiskisis Channel area).

[h] Letter codes were applied only to outcrop stations. Additional details about specific rock types and modifiers noted during drilling data compilation and relogging are present in OGS MRD 343 (Metsaranta and Houlé 2017).

SYMBOLS

Outcrop	Elongation lineation, unknown generation
Approximate western limit of Paleozoic rocks	Mineral lineation, unknown generation
Geological contact, interpreted	Fold axis lineation, unknown generation (M-asymmetry, Z-asymmetry)
Geological contact, interpreted from geophysical data	Shear (ductile), dextral displacement, unknown generation (vertical, trend only)
Fault, geophysically interpreted	Shear (ductile), unknown horizontal displacement, unknown generation (trend only)
Antiform, unknown generation, inclined axial plane, interpreted	Glacial striae, direction of ice movement known
Axial fold plane, M-asymmetry, unknown generation (vertical, trend only)	Younging direction of a pillowed mafic flow, interpreted
Axial fold plane, S-asymmetry, unknown generation (trend only)	Diamond-drill hole[a]
Crenulation cleavage, unknown generation, trend only (M-asymmetry, unknown asymmetry)	Compiled diamond-drill hole location
Cleavage, unknown generation (inclined)	Compiled overburden drill-hole location
Compositional layering, unknown generation (inclined)	9:2661 Location of isotopic age determination (in Ma) (first number corresponds with Table 2)
Compositional layering and parallel foliation, unknown generation (inclined)	Zn Mineral occurrence, with commodity
Foliation, unknown generation (inclined, vertical, trend only)	5 Mineral occurrence (number corresponds with Table 1)
Igneous contact, dike (inclined, trend only)	Adminstrative boundary (provincial park)

[a] Examined by the lead author during this study; additional data can be found in OGS MRD 343 (Metsaranta and Houlé 2017).

ABBREVIATIONS

amp	amphibole	mag	magnetite
bt	biotite	oam	orthoamphibole (likely anthophyllite)
c	carbonate	qtz	quartz vein
chl	chlorite	ser	sericite
ep	epidote	slf	silicification
grt	garnet	srp	serpentine
gru	grunerite	st	staurolite
hem	hematite	tlc	talc
kfs	potassium feldspar		

MINERALIZATION

cpy	chalcopyrite
cr	chromite
Cu	copper
dm	diamond
mag	magnetite
po	pyrrhotite
py	pyrite
SM	sulphide mineralization
sp	sphalerite
V	vanadium
Zn	zinc

Ontario

Ontario Geological Survey
MAP P.3804

Geological Survey of Canada
OPEN FILE 8200

PRECAMBRIAN GEOLOGY

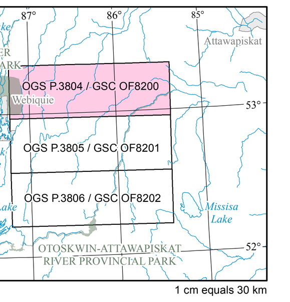
WINISKISIS CHANNEL AREA "RING OF FIRE" REGION, ONTARIO NORTHERN SHEET

Scale 1:100 000

1000 m 0 1 2 km

NTS References: 43 C/13, 14; 43 D/14, 15, 16; 43 E/1, 2, 3, 6, 7, 8; 43 F/3, 4, 5, 6

This map is published with the permission of the Director, Ontario Geological Survey.



Location Map 1 cm equals 30 km

TGI Ore Systems

This map is produced as part of the Targeted Geoscience Initiative (TGI) of the Geological Survey of Canada and is a contribution of the Lands and Minerals Sector of Natural Resources Canada.

ACKNOWLEDGMENTS

The authors would like to acknowledge the contribution of various exploration companies and their corporate and field personnel who have aided this project directly and indirectly through allowing access to geological databases, providing geological insights and discussions, and providing logistical support. In particular we would like to thank the support of these individual and their affiliated company at the time the work was conducted: D. Hoy and M. Tuchscherer (Freewest Resources), A. Mitchell, R. Fink, R. Weston, D. Shinkle, D. Slaney and R. Kruse (Cliffs Natural Resources); R. Weston, R. MacNally, E. Mosley, M. Downey, J. Brett, B. MacLachlan, J. Atkinson and J. Niemi (Noront Resources); M. Flanagan and P. Smith (Fancamp Exploration); M. Lavigne (KWG Resources); Q. Yarie, J. McKinnon, C. Sherba, C. Hunt and J. Masters (MacDonald Mines); D. Palmer (Probe Metals), J. Voisin (UC Resources); D. Clarke (Canterra Minerals); N. Hansen, E. Hébert and I. Lawyer (Melkior Resources); C. Vaillancourt and I. Bliss (Northern Shield Resources); J. Burns and N. Novak (Spider Resources); N. Brewster (Billiken Management); M. Kilbourne (White Pine Resources); and T. Boyd (Tribute Minerals).

Valuable discussions, insights and contributions to the understanding of the geology of the McFaulds Lake project area were also greatly appreciated from J. Franklin, M. Lesher, G. Stott, A.-A. Sappin, J. Mungall, L. Hulbert, P. Hollings, H. Carson, B. Kuzmich, J. Laarman, C. Spath, N. Farhangi and K. Mehrmanesh.

Thanks are extended also to E. Jacob, J. Whitehead, T. Spence, L. Wabasse and C. McKay for their assistance while the authors carried out field work based in Webequie, and to V. Bécu for her GSC internal review of the map.

CREDITS

Geological mapping and compilation by R.T. Metsaranta and M.G. Houlé, 2010, 2011, 2012, 2013, 2014.

Field assistance was provided by James Nopper, Jean-Francois Beausoleil and Cedric Mayer.

Preparation of geophysical imagery by D.R.B. Rainsford. Pierre Keating (Geological Survey of Canada) also provided geophysically imagery used for the interpretation of the geological map.

New geochronology data were provided by V. McNicoll (Geological Survey of Canada), S. Kamo, M. Hamilton, D. Davis (Jack Satterly Geochronology Laboratory, University of Toronto), J. Petrus and R. Lodge (Laurentian University), as listed in the "Sources of Information".

Digital drafting by R.T. Metsaranta, M.G. Houlé and S. Evers.

Cartographic production by R. Corcoran.

Editing by M.A. Rutka and R.M Easton.

Corresponding and additional digital data related to information portrayed on the map are available from the following Ontario Geological Survey publication:

Metsaranta, R.T. and Houlé, M.G. 2017. Geochronology, mineral deposit, drill-core relogging and drill-core compilation data from the Winiskisis Channel, McFaulds Lake and Highbank Lake areas, "Ring of Fire" region, northern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 343.

Issued 2017.

Information from this publication may be quoted if credit is given. It is recommended that reference to this map be made in the following form:

Metsaranta, R.T. and Houlé, M.G. 2017. Precambrian geology of the Winiskisis Channel area, "Ring of Fire" region, Ontario—northern sheet; Ontario Geological Survey, Preliminary Map P.3804; Geological Survey of Canada, Open File 8200, scale 1:100 000. doi: 10.4590/299708

OPEN FILE
DOSSIER PUBLIC
8200
GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA
2017

Publications in this series have not been edited; they are released as submitted by the author.

Les publications de cette série ne sont pas révisées; elles sont publiées telles que soumises par l'auteur.

doi:10.4095/299708

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