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

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1. Introduction

The Miminiska–Fort Hope greenstone belt (MFHGB) of the eastern Uchi domain of the Superior Province contains numerous mafic and ultramafic intrusions (Fig. 1), which appear to be prospective for Ni-Cu-(PGE) mineralization (Sappin et *al.*, 2013). Recent discoveries in the McFaulds Lake greenstone belt (Fig. 1, inset) located further north, in the eastern Oxford-Stull domain, of world-class Cr-(PGE) deposits (e.g., Black Thor, Black Label), significant Ni-Cu-(PGE) deposits (e.g., Eagle's Nest), and Fe-Ti-V occurrences (e.g., Thunderbird, Butler) highlight the mineral potential of this region and justify further investigation within the eastern part of the Uchi domain. The Max, Wabassi Main, Wabassi South, and Oxtoby Lake intrusions (Fig. 1) are four of the most important mafic and ultramafic intrusions in this area. However, they have been little studied and are mostly covered by a thick sequence of glacial till.

This study is part of the "regional characterization of mafic-ultramafic intrusions in the Oxford-Stull and Uchi domains, Superior Province" activity carried out under the high-magnesium ultramafic to mafic systems subproject of the Targeted Geoscience Initiative 4 (TGI-4; Houlé *et al.*, 2012; Houlé and Metsaranta, 2013); an initiative conducted by the Geological Survey of Canada (GSC) in collaboration with provincial governments and academic and industry partners. The main goal of this research activity is to characterize mafic and ultramafic intrusions within the McFaulds Lake and Miminiska-Fort Hope greenstone belts in order to identify the economically most prospective intrusions.

In support to a recent petrological study conducted by Sappin *et al.* (Precambrian Research, in press), the current report presents a summary of petrographic descriptions and mineral compositions of olivine, pyroxene, plagioclase, amphibole, magnetite, and ilmenite in mafic to ultramafic rocks collected from the Max, Wabassi Main, Wabassi South, and Oxtoby Lake intrusions

2. Regional geology

The Max, Wabassi Main, Wabassi South, and Oxtoby Lake (formerly Wabassi North) intrusions are located within the eastern part of the MFHGB (Fig. 1). The geology of this area is not well constrained (see Sappin et *al.*, Precambrian Research, in press). In the vicinity of the intrusions, two metavolcanic rock packages have been recognized, one dominated by massive, brecciated, and commonly variolitic mafic metavolcanic rocks and a second dominated by quartz and/or feldspar porphyritic felsic metavolcanic rocks (Vaillancourt *et al.*, 2011; Fig. 2A), both intercalated with minor metasedimentary rocks. All of the mafic and ultramafic intrusions in the area are mostly undeformed. Planar structures (e.g., schistosity, shear zones) are only locally developed and are usually non-penetrative (Vaillancourt and Bliss, 2010). The Wabassi Main and Wabassi South intrusions are respectively cut by NW-SE and WSW-ENE oriented faults of unknown horizontal displacement and the Wabassi Main and Oxtoby Lake intrusions are crosscut by Proterozoic diabase dikes assigned to the Marathon swarm (Fig. 2). All volcanic, intrusive, and sedimentary rocks have been metamorphosed to upper greenschist to lower amphibolite facies (Vaillancourt *et al.*, 2011), but igneous and sedimentary structures are commonly very well preserved so the "meta" prefix has been omitted for simplicity.

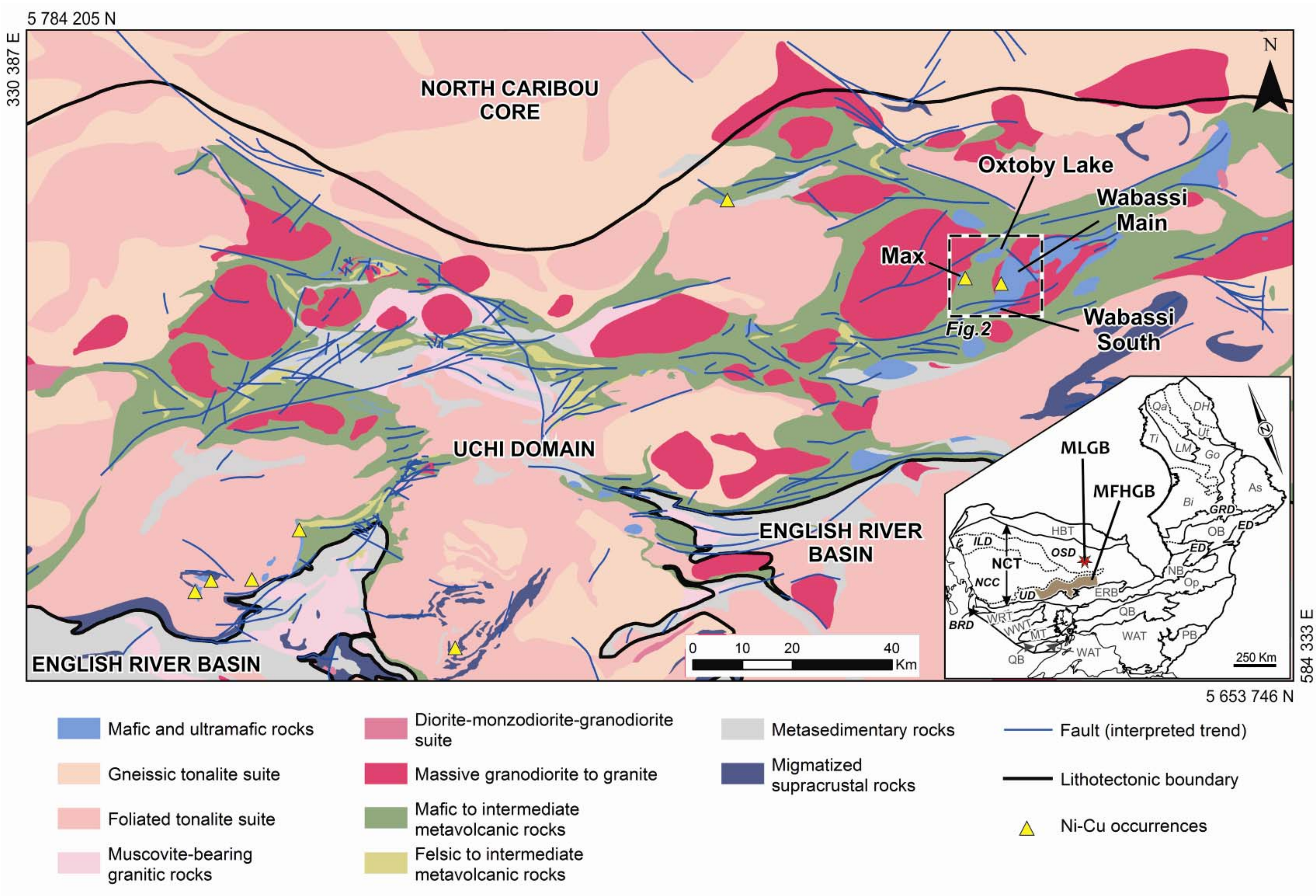
5 784 205 N
330 387 E
NORTH CARIBOU CORE
N
Oxtoby Lake
Wabassi Main
Max
Fig.2
Wabassi South
UCHI DOMAIN
ENGLISH RIVER BASIN
ENGLISH RIVER BASIN
0 10 20 40 Km
MLGB
MFHGB
HBT
ILD
OSD
NCT
NCC
UD
ERB
WRT
WWT
MT
QB
WAT
BRD
Qa
DH
Ut
Ti
LM
Go
Bi
As
GRD
ED
OB
NB
Op
PB
250 Km
584 333 E
5 653 746 N
Mafic and ultramafic rocks
Gneissic tonalite suite
Foliated tonalite suite
Muscovite-bearing granitic rocks
Diorite-monzodiorite-granodiorite suite
Massive granodiorite to granite
Mafic to intermediate metavolcanic rocks
Felsic to intermediate metavolcanic rocks
Metasedimentary rocks
Migmatized supracrustal rocks
Fault (interpreted trend)
Lithotectonic boundary
Ni-Cu occurrences

Figure 1. Simplified geology of the eastern Uchi domain in the Superior Province, general location of the Max, Wabassi Main, Wabassi South, and Oxtoby Lake intrusions, and location of Figure 2. The geology is from Stott and Josey (2009), the lithotectonic boundaries have been modified from Stott (2011) and Percival *et al*. (2012), and the Ni-Cu occurrences have been modified from the Mineral Deposit Inventory (OGS, 2015). Abbreviations: MLGB = McFaulds Lake greenstone belt, MFHGB = Miminiska–Fort Hope greenstone belt, HBT = Hudson Bay terrane, NCT = North Caribou terrane, OSD = Oxford-Stull domain, ILD = Island Lake domain, NCC = North Caribou core, UD = Uchi domain, ERB = English River basin, BRD = Bird River domain, WRT = Winnipeg River terrane, WWT = Western Wabigoon terrane, MT = Marmion terrane, QB = Quetico basin, WAT = Wawa Abitibi terrane, DH = Douglas Harbour, Ut = Utsalik, Qa = Qalluviartuuq, LM = Lac Minto, Ti = Tikkerutuk, Go = Goudalie, Bi = Bienville, As = Ashuanipi, GRD = La Grande Rivière domain, OB = Opinaca basin, ED = Eastmain domain, NB = Nemiscau basin, Op = Opatica, PB = Pontiac basin.

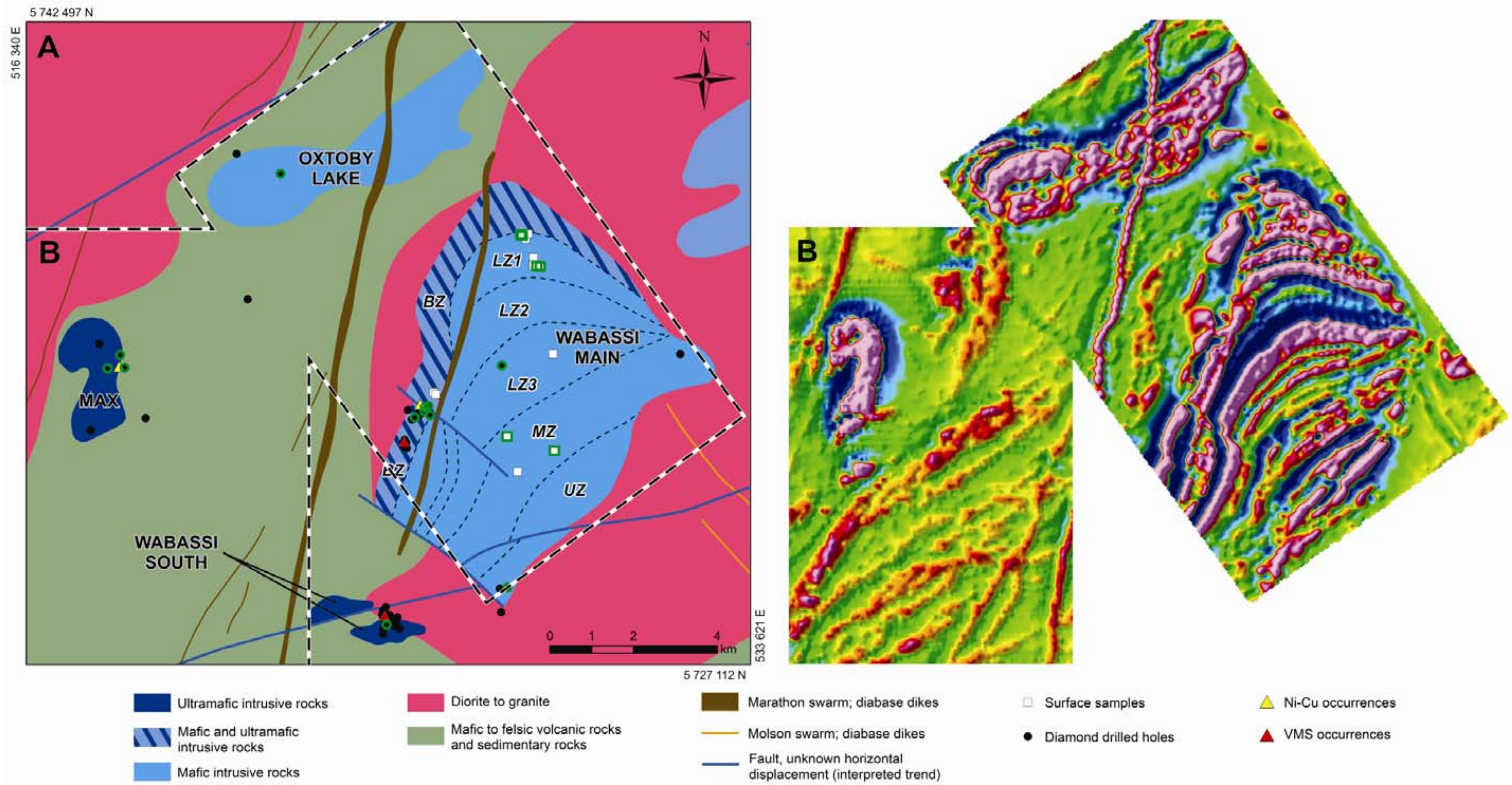

Figure 2. **A.** Simplified geological map of the Max, Wabassi Main, Wabassi South, and Oxtoby Lake intrusions, showing the locations of surface samples and diamond drilled holes (green outlines: selected samples for mineral chemical analysis), mineral occurrences, the stratigraphy of the Wabassi Main intrusion, and the location of Figure 2B (dashed black outline). Modified from Sappin *et al.* (Precambrian Research, in press). **B.** Aeromagnetic map of the study area. Aeromagnetic geophysical datasets are from Northern Shield Resources Inc. Abbreviations: BZ = basal zone, LZ = lower zone, MZ = middle zone, UZ = upper zone.

3. Local geology

The Max intrusion (~1.5 x 3 km^2) is an ultramafic-dominated intrusion with no internal structure (Fig. 2). It is mainly composed of well-preserved harzburgite, lherzolite, and wehrlite, minor olivine pyroxenite, pyroxenite, and plagioclase-bearing pyroxenite (including orthopyroxenite and websterite), and rare mesocratic gabbroic rocks.

The Wabassi Main intrusion (~9 x 11 km^2) is a well-layered mafic-ultramafic intrusion (Fig. 2), as suggested by a well-defined magnetic fabric and field observations. This intrusion is composed of leuco- to melanocratic gabbronorite, norite, and gabbro, leuco- to melanocratic olivine gabbronorite, norite, and gabbro, troctolite with lesser local anorthosite, minor feldspathic lherzolite and harzburgite and mesocratic Fe-Ti oxide-rich ferrogabbroic rocks (up to 50% magnetite), and subordinate non-cumulate meso- to melanocratic amphibole-bearing gabbroic rocks. The Wabassi Main intrusion may be subdivided into four main zones based on their composition, including from northwest to southeast: 1) a basal zone (BZ) characterized by the occurrence of layers of olivine-bearing gabbroic rocks and peridotite; 2) a lower zone (LZ) characterized by the occurrence of layers of olivine-free gabbroic rocks and olivine-bearing gabbroic rocks, with rare trace of apatite and up to 10% Fe-Ti oxides, which has been subdivided into three subzones based upon magnetic fabric (lower zone 1, lower zone 2, and lower zone 3); 3) a middle zone (MZ) composed of layers of gabbroic rocks devoid of olivine with up to 8% of Fe-Ti oxides; and 4) an upper zone (UZ) composed of layers of olivine-free gabbroic rocks and ferrogabbroic rocks, with up to 8% apatite (Fig. 2).

The Wabassi South intrusion (~1.7 x 0.6 km^2 and ~1.2 x 0.6 km^2) is an ultramafic-dominated intrusion with no internal structure (Fig. 2). It is composed of olivine-rich ultramafic lithologies which lack textures typical of ultramafic flows, so are currently interpreted as intrusive.

The Oxtoby Lake intrusion (~7 x 2 km^2) is a mafic-dominated intrusion with no internal structure (Fig. 2). This intrusion is composed of more metamorphosed, mesocratic amphibole-bearing gabbroic rocks.

The Max and Wabassi Main intrusions contain magmatic Ni-Cu-PGE mineralization and the Wabassi Main and Wabassi South intrusions host volcanogenic massive sulfides (VMS) (Fig. 2). In contrast, the gabbroic rocks of the Oxtoby Lake intrusion are not mineralized.

4. Methodology

4.1. Sampling

The present investigation focussed mainly on diamond drill core information, as the area is extensively covered by a thick sequence of glacial till and only sporadic bedrock exposure is present in the Wabassi Main intrusion (Fig. 2). Sixty-one diamond drill holes (DDHs) have been drilled on the property by Northern Shield Resources Inc. between 2008 and 2013 (Table 1), 27 of which have been sampled for this study. Locations and descriptions of individual samples are given in Appendix A.

Table 1. Locations of diamond drill holes drilled on the property by Northern Shield Resources Inc.

Drill hole	Intrusion	Collar		Azimuth	Dip	Length
		UTM East (m)	UTM North (m)			(m)
08MX-01	Max	518586	5734504	280°	-55°	426.72
08MX-02	Max	518586	5734504	270°	-75°	502.92
08MX-03	Max	518084	5734790	270°	-70°	362.70
08MX-04	Max	521628	5735853	270°	-55°	207.26
08MX-05	Max	518690	5734200	270°	-75°	787.35
08MX-06	Max	518290	5734200	90°	-70°	739.07
10MX-07	Max	519190	5732998	270°	-60°	344.60
10MX-08	Max	517880	5732710	320°	-65°	225.00
08WA-04	Wabassi Main	525430	5732280	330°	-65°	347.12
10WA-01	Wabassi Main	527657	5728911	120°	-65°	234.70
10WA-02	Wabassi Main	531967	5734539	145°	-75°	152.40
10WA-03	Wabassi Main	527705	5734265	325°	-50°	268.20
10WA-04	Wabassi Main	525860	5733240	145°	-75°	301.80
10WA-05	Wabassi Main	525860	5733240	325°	-75°	341.40
10WA-06	Wabassi Main	525735	5733145	145°	-65°	216.40
10WA-07	Wabassi Main	525355	5732415	145°	-85°	213.40
10WA-08	Wabassi Main	525978	5733062	290°	-60°	306.00
10WA-09	Wabassi Main	525761	5733141	290°	-60°	192.00
10WA-10	Wabassi Main	525800	5733129	110°	-60°	170.70
10WA-11	Wabassi Main	525948	5733287	280°	-68°	288.00
10WA-12	Wabassi Main	525896	5733172	290°	-65°	253.00
10WA-13	Wabassi Main	525416	5732414	290°	-55°	164.00
11WA-14	Wabassi Main	525715	5733051	107°	-58°	473.00
11WA-15	Wabassi Main	525551	5732968	90°	-50°	194.00
11WA-18	Wabassi Main	527838	5728932	320°	-60°	128.00
12WA-29	Wabassi Main	525620	5733002	220°	-45°	74.00
12WA-30	Wabassi Main	525454	5733191	110°	-60°	236.00
12WA-31	Wabassi Main	525376	5732480	110°	-80°	149.00
12WA-32	Wabassi Main	525346	5732333	290°	-60°	173.00
11WA-16	Wabassi South	524924	5728075	320°	-60°	222.00
11WA-17	Wabassi South	524845	5728289	135°	-56°	326.00
11WA-19	Wabassi South	524967	5728031	315°	-60°	362.00
11WA-20	Wabassi South	524897	5728369	135°	-60°	443.00
12WA-25	Wabassi South	524924	5728078	315°	-45°	149.00
12WA-26	Wabassi South	524906	5728005	315°	-55°	252.00
12WA-27	Wabassi South	525051	5728103	312°	-50°	224.00
12WA-28	Wabassi South	525182	5728095	312°	-55°	341.00
13WA-37	Wabassi South	525022	5728264	149°	-57°	167.00
13WA-38	Wabassi South	525125	5728020	313°	-61°	482.00
13WA-39	Wabassi South	525017	5728150	323°	-51°	179.00
13WA-40	Wabassi South	524865	5727922	24°	-51°	614.00
13WA-41	Wabassi South	525200	5728220	223°	-56°	185.00
13WA-42	Wabassi South	524870	5728227	151°	-62°	251.00
13WA-43	Wabassi South	524864	5728376	147°	-48°	362.00
13WA-44	Wabassi South	524928	5728471	129°	-54°	563.00
13WA-45	Wabassi South	524871	5727824	317°	-50°	356.00
13WA-48	Wabassi South	527684	5728335	300°	-53°	239.00
13WA-49	Wabassi South	525257	5727950	310°	-67°	820.00
08WA-01	Oxtoby Lake	521362	5739350	270°	-55°	14.90
08WA-02	Oxtoby Lake	522415	5738860	300°	-55°	160.62

Table 1. Locations of diamond drill holes drilled on the property by Northern Shield Resources Inc. (continued)

Drill hole	Intrusion	Collar		Azimuth	Dip	Length
		UTM East (m)	UTM North (m)			(m)
10MX-09	Regional	522583	5718301	90°	-70°	152.25
12WA-21	Regional	510058	5718430	210°	-65°	155.00
12WA-22	Regional	510308	5718019	30°	-50°	182.00
12WA-23	Regional	513276	5719079	0°	-55°	52.00
12WA-24	Regional	513276	5719079	0°	-70°	59.00
13WA-33	Regional	528603	5722736	305°	-55°	341.00
13WA-34	Regional	528603	5722736	305°	-45°	119.00
13WA-35	Regional	527377	5721610	324°	-50°	348.00
13WA-36	Regional	516215	5718278	215°	-70°	201.00
13WA-46	Regional	539070	5728299	330°	-58°	284.00
13WA-47	Regional	539215	5728453	330°	-65°	257.00

Note: All the coordinates are in NAD 83, Zone U16.

Seven DDHs drilled by Northern Shield Resources Inc. between 2008 and 2010 intersected the central, eastern, and southern parts of the Max intrusion (Fig. 2). Relevant sections of the most representative core (08MX-02) were relogged during field investigations in 2013 to better identify the main rock types and the field relationships between each of the lithologies in the intrusion and the country rocks. Twenty-nine representative samples from 7 DDHs were selected for detailed petrographic characterization. Eight of these were selected for mineral chemical analysis and 23 were analyzed for whole-rock major, minor, and trace elements. Northern Shield Resources Inc. also assayed 187 specific sections of the cores for a series of 33 elements, including Mg, Fe, Cr, V, and Ti.

Twenty-one DDHs drilled by Northern Shield Resources Inc. between 2008 and 2012, targeting magmatic Ni-Cu-(PGE) mineralization and volcanic-hosted Cu-Zn-Ag mineralization, intersected the Wabassi Main intrusion (Fig. 2). Of these, three cores were relogged in detail during field investigations in 2013 to identify the different lithologies and mineralization styles but also to conduct a more complete transect through the intrusion (from northwest to southeast: 10WA-05, 10WA-03, and 11WA-18). Seventy-five representative samples from 15 DDHs from the basal, lower, and upper zones of the intrusion, and 28 surface samples from several outcrops located in the basal, lower and middle zones (Fig. 2) were selected for detailed petrographic characterization. Of these samples, 12 core samples and 6 grab samples were selected for mineral chemical analysis and 50 core samples and 22 grab samples were analyzed for whole-rock major, minor, and trace elements. Northern Shield Resources Inc. also assayed 994 specific sections of the 21 cores for a series of 33 elements, including Mg, Fe, Cr, V, and Ti.

Another fourteen DDHs drilled by Northern Shield Resources Inc. between 2011 and 2013 intersected the Wabassi South intrusion, in the eastern part of the intrusion (Fig. 2). Sixteen representative samples from 4 of the DDHs were selected for detailed petrographic characterization. One of these was selected for mineral chemical analysis and 7 samples were analyzed for whole-rock major, minor, and trace elements. Northern Shield Resources Inc. also assayed 580 specific sections of 8 of the cores for a series of 33 elements, including Mg, Fe, Cr, V, and Ti.

One hole (08WA-02) drilled by Northern Shield Resources Inc. in 2008 intersected the Oxtoby Lake intrusion, in the western part of the intrusion (Fig. 2). The core was relogged in detail during field investigations in 2013 to identify the main lithologies. Six representative samples from the DDH were selected for detailed petrographic characterization. Three of these were selected for mineral chemical analysis and 6 samples were analyzed for whole-rock major, minor, and trace elements.

Northern Shield Resources Inc. also assayed 17 specific sections of the core for a series of 33 elements, including Mg, Fe, Cr, V, and Ti.

4.2. Mineral analysis

Minerals were analyzed in polished thin sections by wavelength-dispersive X-ray emission spectrometry using a five-spectrometer CAMECA SX-100 electron probe microanalyzer at Université Laval (Québec, Canada). Major and minor element contents of individual grains of olivine, pyroxene, plagioclase, amphibole, magnetite, and ilmenite were determined using an accelerating voltage of 15 kV and a beam current of 20 nA. The counting time was 20 seconds on peaks and 10 seconds on background for olivine, 20 to 15 seconds on peaks and 10 to 7.5 seconds on background for pyroxene and plagioclase, 15 seconds on peaks and 7.5 seconds on background for amphibole, and 20 seconds on peaks and 10 seconds on background for oxides. Trace element contents of magnetite and ilmenite were also measured by electron microprobe, using a method modified from Dupuis and Beaudoin (2011), with an accelerating voltage of 15 kV, a beam current of 100 nA, and a 10 µm beam diameter. The counting time was 40 to 80 seconds on peaks for magnetite and 30 to 60 seconds on peaks for ilmenite. Backgrounds were measured on both sides of the peaks for 15 to 20 seconds at positions free of interferences for both minerals. The accuracy of analyses was verified using simple oxides (GEO Standard Block, from P&H Developments) and minerals (Mineral Standard Mount MINM25-53, from Astimex Scientific Limited; reference samples from Jarosewich *et al.*, 1980) as calibration standards.

5. Results

The main petrological and mineralogical characteristics of the Max, Wabassi Main, Wabassi South, and Oxtoby Lake intrusions are summarized in Table 2.

5.1. Petrographic description

The texture and mineralogy of the different lithofacies in the Max, Wabassi Main, Wabassi South, and Oxtoby Lake intrusions are described below. A summary of the main petrographic observations for individual samples is given in Appendix A.

In the Max intrusion, peridotite and olivine pyroxenite are composed primarily of olivine, orthopyroxene, and clinopyroxene with trace amounts of chromite (commonly altered to magnetite). Metamorphic minerals include serpentine, chlorite, amphibole, talc, magnetite, and ilmenite. Peridotite and olivine pyroxenite display well-preserved cumulate textures with cumulus olivine-chromite and oikocrystic orthopyroxene and clinopyroxene. Pyroxenite, plagioclase-bearing pyroxenite, and gabbroic rocks are composed primarily of amphibole (after pyroxene) and plagioclase, but also contain chlorite, talc, and epidote and trace amounts of quartz, titanite, and ilmenite.

Table 2. Summary of the main petrological and mineralogical characteristics of the Max, Wabassi Main, Wabassi South, and Oxtoby Lake intrusions

	Max		Wabassi Main		Wabassi South	Oxtoby Lake
Location	Miminiska-Fort Hope greenstone belt					
Mafic/Um ratio	Um >>> Mafic		Mafic > Um		Um	Mafic
Internal structure	-		Layered		-	-
Size	1.5 km x 3 km 4 km²		9 km x 11 km 42 km²		1.7 km x 0.6 km and 1.2 km x 0.6 km 1 km²	7 km x 2 km 12 km²
Lithology	Peridotite, minor olivine pyroxenite, pyroxenite, plagioclase-bearing pyroxenite, and gabbroic rocks		Gabbroic rocks (± olivine), anorthosite, minor peridotite		Peridotite	Gabbroic rocks
Igneous mineralogy	Ol, Opx, Cpx?, Pl, Chr		Cpx, Opx, Pl, Ol, Ilm, Mag, Chr, Ap		Ol, Opx, Chr	Pl, Px?, Mag, Ilm, Ap
Mineralization	Ni-Cu-(PGE)		Ni-Cu-(PGE)		VMS	-
	0.3% Ni, 0.2% Cu, 0.3 ppm Pt+Pd (Vaillancourt and Bliss, 2010)		3.6% Cu, 0.2% Ni (Vaillancourt *et al.*, 2011)		217 g/t Ag (Vaillancourt *et al.*, 2011)	-
Mineral Composition	**Mafic**	**Um**	**Mafic**	**Um**	**Um**	**Mafic**
Olivine	-	Mg#$_{80–67}$	Mg#$_{78–19}$	Mg#$_{78–73}$	Mg#$_{82–74}$	-
Orthopyroxene	-	Mg#$_{84-82}$	Mg#$_{84–44}$	Mg#$_{84–77}$	-	-
Clinopyroxene	-	-	Mg#$_{80–56}$	Mg#$_{95–91}$	-	-
Plagioclase	-	-	An$_{96–31}$	An$_{82–61}$	-	An$_{68–47}$
Magnetite	-	No primary Mag	V ≤ 12 380 ppm Ni ≤ 1 713 ppm Cr ≤ 30 714 ppm Ti ≤ 123 685 ppm	No primary Mag	No primary Mag	V ≤ 3 711 ppm Ni ≤ 1 290 ppm Cr ≤ 2 020 ppm Ti ≤ 53 938 ppm
Ilmenite	-	No primary Ilm	V ≤ 5 295 ppm Ni ≤ 684 ppm Cr ≤ 4 187 ppm Mn ≤ 14 614 ppm	No primary Ilm	No primary Ilm	V? Ni? Cr ≤ 90 ppm Mn ≤ 12 990 ppm
Mag/Ilm ratio	-	-	Ilm > Mag	-	-	Mag > Ilm
Parental magma	Basaltic with high-Mg content		Basaltic with high-Mg content		Basaltic with high-Mg content	Basaltic

Abbreviations: Ap = apatite, Chr = chromite, Cpx = clinopyroxene, Ilm = ilmenite, Mag = magnetite, Ol = olivine, Opx = orthopyroxene, PGE = platinum-group element, Pl = plagioclase, Px = pyroxene, Um = ultramafic, VMS = volcanogenic massive sulfide.
Notes: Mg# (Mg number) = 100×Mg/(Mg+Fe2+) in atomic proportions, An (anorthite content) = 100×Ca/(Na+K+Ca) in atomic proportions.

In the Wabassi Main intrusion, peridotite contains mostly olivine, orthopyroxene, clinopyroxene, and plagioclase with trace amounts of chromite/magnetite. Metamorphic minerals include serpentine, chlorite, amphibole, biotite, magnetite, and ilmenite. Peridotite exhibits cumulate textures with cumulus olivine-chromite-plagioclase and oikocrystic orthopyroxene and clinopyroxene. Olivine gabbroic rocks are composed mostly of orthopyroxene, clinopyroxene, plagioclase, and olivine, but also contain magnetite, ilmenite, apatite, amphibole, biotite, chlorite, muscovite, and hercynite. They have cumulate textures with cumulus olivine-orthopyroxene-clinopyroxene-plagioclase, and locally magnetite-ilmenite-apatite. In some samples, cumulus minerals are enclosed by orthopyroxene and clinopyroxene oikocrysts. Gabbroic rocks and anorthosite are generally composed of plagioclase, orthopyroxene, clinopyroxene with accessory Fe-Ti oxides, apatite, and zircon. Metamorphic minerals include amphibole, quartz, epidote, biotite, chlorite, carbonate, muscovite, talc, and garnet. The gabbroic rocks exhibit well-preserved cumulate textures with cumulus orthopyroxene-clinopyroxene-plagioclase and locally magnetite-ilmenite-apatite, and oikocrystic orthopyroxene and clinopyroxene. One sample of norite (10WA-10-146.6) from the basal zone of the Wabassi Main intrusion and a sample of gabbronorite (BR09-01) from the middle zone both exhibit a cumulate texture with cumulus pyroxene enclosed by oikocrystic plagioclase. Amphibole-bearing gabbroic rocks contain amphibole (after pyroxene), plagioclase, and quartz. Accessory and metamorphic minerals include Fe-Ti oxides, zircon, titanite, apatite, biotite, chlorite, carbonate, muscovite, talc, and epidote.

In the Wabassi South intrusion, peridotite is porphyritic with phenocrysts of olivine and orthopyroxene and a matrix composed of serpentine, chromite/magnetite, and ilmenite with various amounts of chlorite, talc, carbonate, quartz, amphibole, and muscovite.

In the Oxtoby Lake intrusion, amphibole-bearing gabbroic rocks are composed of amphibole (after pyroxene) and plagioclase with accessory quartz, chlorite, Fe-Ti oxides, biotite, epidote, carbonate, apatite, and zircon.

5.2. Mineral chemistry

The major element contents of olivine, orthopyroxene, clinopyroxene, plagioclase, and amphibole are given in Appendices B to F. The major and trace element contents of magnetite and ilmenite are given in Appendices G to J; the lower limits of detection (LLD) and values below the LLDs are indicated in these appendices.

Max ultramafic rocks contain olivine ($Mg\#_{80–67}$, where $Mg\#=100\times Mg/(Mg+Fe^{2+})$) and orthopyroxene ($Mg\#_{84–82}$) with intermediate compositions. They also contain Ca-amphibole (based on the classification of Leake *et al.*, 1997) with magnesiohastingsite and minor tremolite, magnesiohornblende, pargasite, and edenite, and rare Mg-Fe-Mn-Li-amphibole (as defined by Leake *et al.*, 1997) with orthorhombic anthophyllite or monoclinic cummingtonite, according to their crystal system. In the Max ultramafic intrusion, magnetite and ilmenite are not primary crystals, thus they were not analyzed.

Wabassi Main ultramafic rocks contain olivine ($Mg\#_{78–73}$), orthopyroxene ($Mg\#_{84–77}$), clinopyroxene ($Mg\#_{95–91}$), and plagioclase ($An_{82–61}$, where $An=100\times Ca/(Na+K+Ca)$ with intermediate compositions. They also contain Ca-amphibole with magnesiohastingsite, magnesiohornblende, and tschermakite, and rare Mg-Fe-Mn-Li-amphibole with orthorhombic anthophyllite or monoclinic cummingtonite. Wabassi Main gabbroic rocks (± olivine) and anorthosite contain olivine ($Mg\#_{78–19}$), orthopyroxene ($Mg\#_{84–44}$), clinopyroxene ($Mg\#_{80–56}$), and plagioclase ($An_{96–37}$) with evolved to intermediate compositions. They contain Ca-amphibole with magnesiohornblende, tschermakite, ferrohornblende, magnesiohastingsite, and actinolite, and a few Mg-Fe-Mn-Li-amphiboles, including orthorhombic anthophyllite or monoclinic cummingtonite and minor orthorhombic ferroanthophyllite or monoclinic grunerite. Magnetite and ilmenite show wide compositional variations. V content of magnetite ranges up to 12 380 ppm, Ni content ranges up to 1713 ppm, Cr content ranges up to 30 714 ppm, and Ti content ranges up to 123 685 ppm. V content of ilmenite ranges up to 5295 ppm, Ni content ranges up to 589 ppm, Cr content ranges up to 4187 ppm, and Mn content ranges up to 11 849 ppm. Wabassi Main hornblende-bearing gabbroic rocks contain plagioclase ($An_{66–31}$) with evolved compositions and Ca-amphibole with magnesiohornblende, ferrotschermakite, and rare ferropargasite. V-Ni-Cr contents of magnetite are lower or equal to the detection limits and Ti content ranges up to 37 781 ppm. Furthermore, V-Cr contents of ilmenite are lower or equal to the detection limits, Ni content ranges up 684 ppm, and Mn content ranges up to 14 614 ppm.

Wabassi South ultramafic rocks contain olivine ($Mg\#_{82–74}$) with intermediate compositions, magnesiohornblende, a Ca-amphibole, and orthorhombic anthophyllite or monoclinic cummingtonite, both Mg-Fe-Mn-Li-amphiboles. In the Wabassi South intrusion, magnetite and ilmenite are not primary crystals, thus they were not analyzed.

Oxtoby Lake hornblende-bearing gabbroic rocks contain plagioclase ($An_{68–47}$) with evolved compositions and Ca-amphibole with magnesiohornblende, tschermakite, and rare actinolite. Magnetite and ilmenite show a limited range of compositional variations. V content of magnetite ranges up to 3711 ppm, Ni content ranges up to 1290 ppm, Cr content ranges up to 2020 ppm, and Ti content ranges up to 53 938 ppm. V content of ilmenite was not determined, Ni content is lower or equal to the detection limit, Cr content ranges up to 90 ppm, and Mn content ranges up to 12 990 ppm.

6. Conclusions

The ultramafic-dominated Max intrusion is mainly composed of peridotite with minor olivine pyroxenite, pyroxenite, plagioclase-bearing pyroxenite, and gabbroic rocks. Peridotite and olivine pyroxenite display cumulate textures with cumulus olivine-chromite and oikocrystic orthopyroxene-clinopyroxene and contain olivine with $Mg\#_{80–67}$, orthopyroxene with $Mg\#_{84–82}$, Ca-amphibole, and rare Mg-Fe-Mn-Li-amphibole. The Wabassi Main intrusion is a layered mafic-dominated intrusion that consists of gabbroic rocks (± olivine) with minor anorthosite and peridotite. Wabassi Main gabbroic rocks (± olivine) have mostly cumulate textures with cumulus olivine-orthopyroxene-clinopyroxene-plagioclase and locally magnetite-ilmenite-apatite, and oikocrystic orthopyroxene-clinopyroxene. They contain olivine with $Mg\#_{78–19}$, orthopyroxene with $Mg\#_{84–44}$, clinopyroxene with $Mg\#_{80–56}$, plagioclase with $An_{96\text{-}31}$, magnetite and ilmenite with wide compositional variations, Ca-amphibole, and rare Mg-Fe-Mn-Li-amphibole. Wabassi Main peridotite exhibits cumulate textures with cumulus olivine-chromite-plagioclase and oikocrystic orthopyroxene-clinopyroxene and contains olivine with $Mg\#_{78–73}$, orthopyroxene with $Mg\#_{84–77}$, clinopyroxene with $Mg\#_{95–91}$, plagioclase with $An_{82\text{-}61}$, Ca-amphibole, and rare Mg-Fe-Mn-Li-amphibole. The ultramafic-dominated Wabassi South intrusion is composed of porphyritic peridotite with olivine with $Mg\#_{82–74}$, Ca-amphibole, and Mg-Fe-Mn-Li-amphibole. The mafic Oxtoby Lake intrusion is composed of more metamorphosed gabbroic rocks with plagioclase with $Mg\#_{68–47}$, magnetite and ilmenite with a limited range of compositional variations, and Ca-amphibole.

The petrographic and mineral chemistry data of the samples from the Max, Wabassi Main, Wabassi South, and Oxtoby Lake intrusions presented in this report are used as geological framework for a more detailed study on the petrogenesis and the emplacement of these intrusions in the eastern part of the MFHGB. The complete results of this study will be published in Sappin *et al.*, (Precambrian Research, in press).

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