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3D Geological and Geophysical Interpretation

Assessment Report

Valentine Property

Otter Rapids, Northeastern Ontario, Canada

NTS: 42I04NE / 42I05SE

Townships: Valentine and Pitt

NioBay Metals Inc.

1100 ave des Canadiens-de-Montreal, Suite 300

Montreal, Quebec, H3B 2S2

Canada

Date: October 28, 2022

Prepared By:

Mira Geoscience Ltd.

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1.0 Summary

Mira Geoscience Ltd. (“Mira”) of Montreal, Quebec, Canada was contracted by NioBay Metals Inc. ("NioBay") of Montreal, Quebec, Canada to write an assessment report for Mira’s 3D geophysical and geological targeting of airborne magnetic data on the Valentine Property (the "Property") which took place over 14 days between August 28th, 2021, and March 25th, 2022. This Report describes the 3D modelling process and associated outcomes and makes recommendations for future exploration. The purpose of this Report is to file a 3D geophysical and geological targeting work for assessment credit.

The Valentine Property is located 3 km north of Otter Rapids, 140 km north of Cochrane and 200 km north of Timmins, northeastern Ontario. The center of the Property is located at 455569 m E, 5565778 m N, Zone 17, WGS 84.

Valentine Property consists of 190 single cell mining claims in Valentine and Pitt townships and NTS Sheets: 42I04NE and 42I05SE. The claims are held 100% by Les Métaux NioBay Inc./NioBay Metals Inc. and are in good standing. The Property is approximately 8.4 km x 5.4 km.

The Valentine Property is located in the northern portion of the Kapuskasing structural province, a NE-trending linear zone of magnetic and gravity anomalies in northern Ontario. The zone is controlled by a series of NE-striking faults that expose Archean crust of high metamorphic grade.

The Property area is predominantly granulite facies Archean garnet-hornblende-feldspar gneiss overlaid by a thick Devonian sedimentary cover. The gneiss is cut by diabase dikes of the Matachewan dike swarm. Kimberlite intrusions occur in the area and were initially identified from indicator mineral sampling and aeromagnetic surveys. Known kimberlites occur predominantly below Devonian sedimentary cover and do not outcrop. The regional unconformity between Archean gneiss and Devonian sedimentary rocks strikes NS through the Property area and dips gently north.

The Property hosts the Valentine Township Carbonatite Complex, a buried carbonatite body with associated niobium (Nb) and phosphorus (P) mineralization (Sage, 1988). The carbonatite complex consists of sövite and silicocarbonatite with associated fenitized wallrock blocks. Sövite (<50% total oxide and silicate minerals) and silicocarbonatite (>50% total oxide and silicate minerals) include up to 20% magnetite. The carbonatite complex is associated with a strong magnetic anomaly approximately 3 x 1 km in plan view with a long axis oriented EW occurring within a variably magnetic intrusive body which boundaries have not yet been precisely identified. Mineralization consists of Nb and P as disseminated pyrochlore and apatite within the carbonatite matrix. The complex occurs beneath 120 to 150 m of overburden and Devonian sedimentary rocks, and the top of the carbonatite is weathered below the unconformity with overlying sedimentary rocks.

The purpose of the work was to develop a property-wide 3D integrated model to capture structure, geology and magnetic susceptibility distribution to support exploration. The modelling was based on a new high resolution aeromagnetic survey acquired in the fall of 2020 by Terraquest Ltd. and available aeromagnetic surveys and geological (surface maps and drill hole database) data sets publicly available and provided by NioBay. The data and mineral system genetic model were reviewed with NioBay to capture their advanced knowledge of the area. The modelling area of interest covers an area of approximately 6 km by 9 km equivalent to the Terraquest airborne survey footprint.

An initial property-wide 2D interpretation was performed to identify structure, geology and magnetic signatures. The initial geological interpretation was then propagated in 3D, evaluated against the magnetic data and model updates were applied where necessary to improve data fit. A 3D lithology-constrained inversion of the magnetic data was then performed to generate a magnetic susceptibility distribution within the lithological model. The resulting model and associated geological interpretation provided a robust base for a discussion of potential target areas favorable to mineralization.

The key features leveraged in this work were abilities to;

- estimate the depth of base of sedimentary cover,
- correct the magnetic data for the effect of the non-magnetic sedimentary cover to enhance magnetic anomalies from the bedrock,
- evaluate and update the 3D geological model geometry and physical property,
- account for the effects of magnetic remanence on specific lithologies, and
- generate magnetic susceptibility distributions through unconstrained and lithology-constrained inversions.

The Valentine Township Carbonatite Complex magnetic anomaly is a singular feature within the Valentine Property area. It has a distinctively high, zoned, broad magnetic response, including overprinting of basement diabase dykes. Other magnetic high anomalies occur in the Property but are interpreted to be associated with kimberlites and basement high gneiss domains. They do not share the extensive, distinctively shaped anomaly observed at the Valentine Township complex. Given the lack of other prospective anomalies, the Valentine Township Carbonatite Complex itself should be considered the priority for further work.

The use of magnetic data for exploration targeting at the Valentine Property depends on the lithological explanation of the observed magnetic anomalies. Two main alternative models can be considered:

- magnetic domains reflect the relative amount of carbonatite to wallrock, or
- magnetic domains reflect separate intrusive phases.

In the first model, the different magnetic domains are due to varying amounts of wallrock relative to carbonatite. The main carbonatite intrusion is interpreted to occur as a series of sheets with intervening panels of wallrock, represented by a moderate magnetic anomaly. Within the main concentration of carbonatite, more stock-like bodies with only minor wallrock content occur as magnetic highs. The carbonatite complex is surrounded by a relatively low magnetic anomaly that is due to fenitized wallrock with only minor carbonatite. Because pyrochlore occurs as an accessory mineral within carbonatite, more carbonatite-rich (and thus magnetic) portions of the complex are the main exploration targets. Portions of the model that had high starting susceptibilities and remained high after the heterogenous inversion, as well as areas where susceptibility increased after heterogenous inversion, represent higher concentrations of carbonatite and should be considered for further exploration.

An alternative model is that more magnetic portions of the complex represent different intrusive phases within the complex. The magnetic low halo is either calcite or dolomite carbonatite with low magnetite content, a silicate intrusive phase, or fenitized wallrock. Moderately magnetic areas represent calcite or dolomite carbonatite, and highly magnetic domains represent late ferrocarbonatite intrusions.

At the Fen Carbonatite Complex (Norway), Nb mineralization occurs within low or moderately magnetic areas interpreted to have formed during an early phase of intrusion. This relationship is consistent with the expected early crystallization of pyrochlore from carbonatite magmas. In this model, the moderately magnetic portions of the complex, interpreted to represent earlier carbonatite intrusions, would be more prospective. In particular, areas near the contacts of low and moderate magnetic susceptibility domains within the complex may represent the walls of carbonatite intrusions, which could have higher concentrations of pyrochlore. Highly magnetic ferrocarbonatite bodies may be more prospective for REE mineralization than for Nb.

Targets were identified based on the 3D heterogenous magnetic susceptibility distribution. Targets were defined based on three criteria: interpreted structures, locations of anomalously high magnetic susceptibility, contacts between high and low susceptibility domains. As discussed above, the Valentine Township Carbonatite Complex is interpreted as a fault-controlled intrusion and the controlling faults may have provided important pathways for fluid ingress and remobilization of mineralization fluids during the coupled intrusion and stress history of the complex. Highly magnetic zones within the complex may represent areas with a higher proportion of carbonatite to wallrock, and are thus considered more prospective. Based on analogous deposits, the internal contacts between high and low susceptibility domains are interpreted to represent internal intrusive contacts that could have provided a locus for concentration of Nb-rich pyrochlore. Together, these three main factors were applied to delineate 7 target areas for further evaluation. Targets were defined based on limited subsurface control and are thus conceptual in nature, but reflect the outcomes of geophysical modelling and evaluation of the integrated geoscience dataset for the project.

The depth and extents of the Valentine Township Carbonatite Complex are not yet known. There is currently only three drill holes from 1967-1969 on the Carbonatite Complex with only hole V-2-3 intersecting significant Nb mineralization. As the Valentine Township Carbonatite Complex is completely under cover, it is recommended to evaluate the relationship between the magnetic response and the carbonatite to better guide exploration. Further work should consist of deep drill holes seeking to evaluate which of the two alternative models discussed in section 9.3 is more prevalent to better understand the mineralization. Drill core should be assayed for niobium, phosphorus and REE, as the carbonatite is likely to host all three commodities. In order to evaluate the targets delineated in this study, it is recommended that a total of 7 drill holes at 800 m each be drilled for a total 5,600 m. The recommended budget is $1,122,800.00.

2.0 Introduction

2.1. Introduction

Mira Geoscience Ltd. (“Mira”) of Montreal, Quebec, Canada was contracted by NioBay Metals Inc. ("NioBay") of Montreal, Quebec, Canada to write an assessment report for Mira’s 3D geophysical and geological targeting of airborne magnetic data on the Valentine Property (the "Property") which took place over 14 days between August 28th, 2021, and March 25th, 2022. This Report describes the 3D modelling process and associated outcomes and makes recommendations for future exploration. The purpose of this Report is to file a 3D geophysical and geological targeting work for assessment credit.

Sources of information for this report include Ministry of Energy, Northern Development and Mines (“MNDM”) assessment files listed in *Appendix 3:* and references listed in section *12.0*. Tenure information was derived from MNDM’s MLAS map viewer website (https://www.mndm.gov.on.ca/en/mines-and-minerals/applications/mlas-map-viewer).

2.2. Terminology

Alnoites is a rock with variable modal abundance of clinopyroxene, phlogopite, melilite and olivine (Mitchell R. , 1996).

Carbonatite: Carbonatites are defined by the International Union of Geological Sciences (IUGS) as igneous magmatic rocks containing more than 50% modal primary carbonates (Le Maitre, 2002). Depending on the predominant carbonate mineral, a carbonatite is referred to as a ‘calcite carbonatite’ (sövite), ‘dolomite carbonatite’ (beforsite) or ‘ankerite carbonatite’.

G9 garnets are peridotite (Ca, Cr)-rich pyrope garnets with lherzolitic origin. They are used in exploration as kimberlite indicator minerals.

Lamprophyre: ultrapotassic mafic igneous rocks which have primary mineralogy consisting of amphibole or biotite, and with feldspar in the groundmass (https://en.wikipedia.org/wiki/Lamprophyre). They primarily occur as dikes, lopoliths, laccoliths, stocks, and small intrusions.

"**Lamprophyre facies**" rocks are characterized by the presence of phenocrysts of mica and/or amphibole together with lesser clinopyroxene and/or melilite set in a groundmass of plagioclase, alkali feldspar, carbonate, monticellite, melilite, mica, amphibole, pyroxene, perovskite, Fe-Ti oxides and glass (Mitchell R. , 1994).

Lherzolite: an ultramafic igneous rock with 40-90% olivine and significant orthopyroxene and lesser amounts of Ca,Cr-rich clinopyroxene (https://en.wikipedia.org/wiki/Lherzolite).

Olivine melilitite a rock with > 10% melilite and > 10% olivine (Woolley, et al., 1996)

Pyrochlore: $(Na,Ca)_2Nb_2O_6(OH,F)$ is a mineral group of the niobium end member of the pyrochlore supergroup (https://en.wikipedia.org/wiki/Pyrochlore). Pyrochlore is typically yellowish or brownish in colour with an octahedral shape. It is commonly found in nepheline syenites and carbonatites. Pyrochlore often contains radioactive uranium and thorium and is an ore mineral for niobium.

MLAS: Ontario’s mining lands are registered and managed online with the Mining Lands Administration System.

MNDM: Ministry of Energy, Northern Development, Mines which is the provincial ministry responsible for managing mining claims (Mining Lands Section) and Ontario Geological Survey.

Melilite: a mineral group with a general formula of $(Ca,Na_2)(Mg,Fe,Al)(Si,Al)_2O_7$.

Melnoites: rocks belonging to the lamprophyre facies including but not restricted to ultramafic lamprophyres (Ontario Geological Survey, 2001). Melilite plus alnoite in ultramafic lamprophyres (Mitchell R. , 1994).

REE: Rare earth elements (REE) are a group of 15 elements referred to as the lanthanide series in the periodic table of elements. Although they are not true REEs, scandium and yttrium are included in this categorization because they exhibit similar properties to the lanthanides and are found in the same ore bodies. REEs are key components in many electronic devices that we use in our daily lives, as well as in a variety of industrial applications.

Silicocarbonatite: A carbonate-rich igneous rock composed of 50 % or more oxide and silicate minerals (Sage, 1988).

Sövite: carbonatite with calcite as the dominant carbonate mineral.

2D: 2-Dimensional space.

3D: 3-Dimensional space.

2.3. Units

The Metric System is the primary system of measure and length used in this Report and is generally expressed in kilometres (km), metres (m) and centimetres (cm); volume is expressed as cubic metres (m^3), mass expressed as metric tonnes (t), area as hectares (ha), and gold and silver concentrations as grams per tonne (g/t). Conversions from the Metric System to the Imperial System are quoted where practical and 1 foot (ft) is equivalent to 0.3048 m. Many of the geologic publications and more recent documents now use the Metric System but older documents almost exclusively refer to the Imperial System. Metals and minerals acronyms in this report conform to mineral industry accepted usage and the reader is directed to www.maden.hacettepe.edu.tr/dmmrt/index.html for a glossary.

The term gram/tonne or g/t is expressed as “gram per tonne” where 1 gram/tonne = 1 ppm (part per million) = 1000 ppb (part per billion). The mineral industry accepted terms Au g/t and g/t Au are substituted for “grams gold per metric tonne” or “g Au/t”. Other abbreviations include ppb = parts per billion; ppm = parts per million; SG = specific gravity.

The magnetic susceptibility is expressed in the international system of units (SI) where it is a dimensionless unit.

The intensity of the magnetic field is expressed in nanotesla (nT) and its directional gradients in “nanotesla per metre” (nT/m).

The acceleration of the gravity field is expressed in milligal (mGal).

Dollars are expressed in Canadian currency (CAD$) unless otherwise noted. Where quoted, Universal Transverse Mercator (UTM) coordinates are provided in the datum of Canada, WGS 1984, Zone 17U North.

3.0 Reliance on Other Experts

This Report was prepared on behalf of NioBay and is directed solely for the development and presentation of data with recommendations to allow NioBay and current or potential partners to reach informed decisions.

The information, conclusions and recommendations contained herein are based on a review of digital data and information supplied to Mira Geoscience by NioBay, as well as various published geological reports, and discussions with representatives from NioBay who are familiar with the Valentine property and the area in general. Mira Geoscience has assumed that the reports and other data listed in the 12.0 References section of this report are substantially accurate and complete.

The dates, titles and authors of all reports that were used as a source of information for this Technical Report are listed in the “References” section of this report and MNDM assessment reports used in this Report are given in Appendix 3: Table A3-1. The dates and authors of these reports also appear in the text of this Report where relevant, indicating the extent of the reliance on these reports.

The author of this Report relied on tenure information derived from MNDM’s MLAS map viewer website; (https://www.mndm.gov.on.ca/en/mines-andminerals/applications/mlas-map-viewer).

4.0 Property Description and Location

4.1. Location

Valentine Property is located 3 km north of Otter Rapids, 140 km north of Cochrane and 200 km north of Timmins, northeastern Ontario (Figure 4-1). The center of the Property is located at 455,569 m E, 5,565,778 m N, UTM Zone 17 North, WGS84.

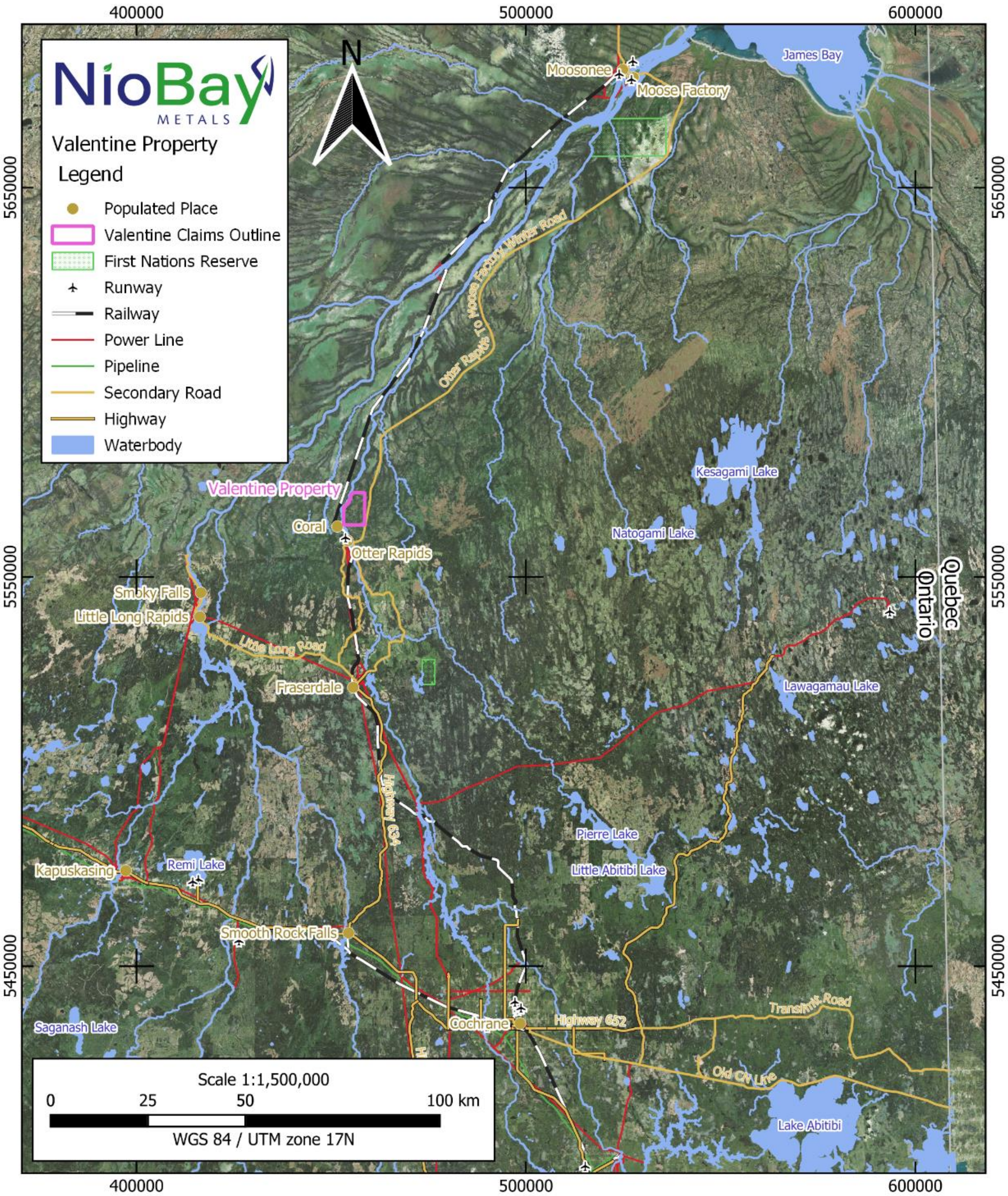

Figure 4-1: Valentine Property location, Otter Rapids, northeastern Ontario.

4.2. Description and Ownership

Valentine Property consists of 190 single cell mining claims in Valentine and Pitt townships and NTS Sheet: 42I04NE (Appendix 2: and Figure 4-2). The claims are held

100% by Les Métaux NioBay Inc./NioBay Metals Inc. and are in good standing. The Property is approximately 8.4 km x 5.4 km.

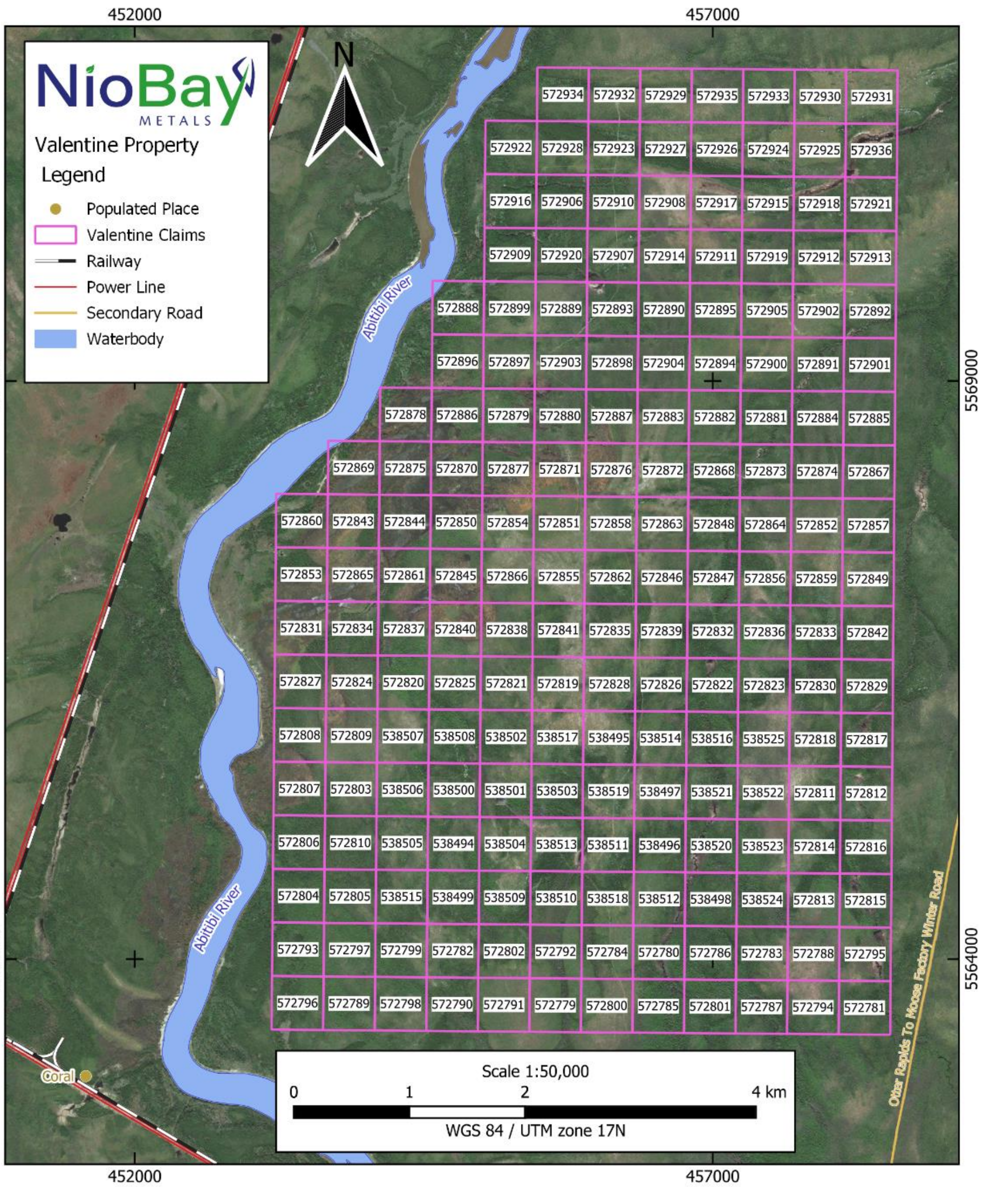

Figure 4-2: Valentine Property claim map.

4.3. Requirements to Retain the Property and Exploration Plan and Permit

In Ontario, to retain a mining claim, companies must submit an assessment file to MNDM's Geoscience Assessment Office showing that they have spent $400/per single cell claim unit on exploration on each claim. One claim unit is equal to 16 hectares. The initial mining claim is issued for a term of 2 years and then renewed every year afterwards.

To the best of the author's knowledge, there is no significant factors and risks that may affect access, title or the right or ability to perform work on the Property.

5.0 Accessibility, Climate, Local Resources, Infrastructure, and Physiography

[*Updated from* (Selway, 2022)]

5.1. Access

The Valentine Property can be accessed by taking Highway 634 north of Smooth Rock Falls to Fraserdale (Figure 4-1). At Fraserdale, there is a gravel road that continues north to Otter Rapids (https://en.wikipedia.org/wiki/Otter_Rapids,_Ontario). In the winter, there is a winter road called the Wetum Road that connects Otter Rapids to Moose Factory on the south shore of James Bay and passes along the east side of the Property.

The Ontario Northland Railway connects Cochrane and Moosonee on the south shore of James Bay and passes through Otter Rapids on the west side of the Property. The train can stop in Otter Rapids upon request. Ontario Northland operates a bus from Cochrane to Fraserdale three times a week.

The Property is in the southern part of the James Bay Lowlands. The Abitibi River is along the western boundary of the Valentine Property and flows north to James Bay.

5.2. Climate and Vegetation

For Kapuskasing, the maximum daily temperature is 23.5°C in July and minimum daily temperature is -24.8°C in January (Canadian Climate Normals website: https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnProv&lstProvince=ON&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=4156&dispBack=0). The average rainfall is 102.8 mm in July and average snowfall is 36.9 mm in February.

In the southern section of the James Bay Lowlands and along rivers, the forests are composed of balsam fir, white and black spruce, trembling aspen, and paper birch (Ecoregions of Canada: http://ecozones.ca/english/region/217.html). Most of the ecoregion is poorly drained, and the dominant vegetation consists of sedge, mosses, and lichens with or without stunted black spruce and tamarack. The ecoregion is underlain by flat-lying, Palaeozoic limestone bedrock of the Hudson Bay Lowland. These lowlands slope gently towards James Bay. Characteristic wildlife includes barren-ground caribou, black bear, wolf, moose, lynx, and snowshoe hare. Bird species include the Canada goose, ruffed grouse, and American black duck.

Drilling can be conducted year-round except for spring thaw in April when it is too muddy in the bush. Geological mapping and outcrop sampling can be conducted mid-May to end of September when there is no snow on the ground. Lakes are free of ice from mid-May to mid-October.

5.3. Physiography

The Valentine Property is located in the southern part of the James Bay Lowlands and is generally swampy with low relief (Sage, 1988).

5.4. Infrastructure and Local Resources

Otter Rapids (also known as White Otter Rapids) has a population of over 1,000 people and is well equipped with a bank, post office, grocery store, fire hall, 10-bed hospital and auditorium (Otter Rapids Generating Station website: https://en.wikipedia.org/wiki/Otter_Rapids_Generating_Station). Otter Rapids has a hydroelectric generating station and dam on the Abitibi River (Figure 5-1).

The closest airport to the Property is the Timmins airport which has service by Air Canada and Porter Airlines to Toronto.

Sources of water on the Property includes Abitibi River and numerous swamps.

The Property's surface rights are owned by the Crown and they are sufficient for future mining operations.

Valentine project is in the exploration stage and does not yet have NI 43-101 compliant resource/reserve or a prefeasibility study; therefore, discussion on potential tailings storage areas, potential waste disposal areas, heap pad leach pad areas and potential processing tailings storage area for mining operations is not relevant.

Figure 5-1: Otter Rapids hydroelectric generating station and dam on the Abitibi River. (Otter Rapids Generating Station, Wikipedia)

6.0 History

[*Updated from* (Selway, 2022)]

6.1. 1964, Ontario Department of Mines – Geological Survey of Canada

In 1964, Ontario Department of Mines and Geological Survey of Canada published aeromagnetic maps 2306G (Coral Rapids area) and 2307G (Ranoke area). The airborne magnetic survey was flown from May 1963 to April 1964. The 2306G map shows an oval magnetic high over the Valentine Township Carbonatite Complex and another smaller magnetic high on the west side of the Abitibi River.

6.2. 1966-1967, Ontario Department of Mines

Bennett et al., (1966) produced P0370 map of the Otter Rapids area and noted the presence of kimberlite and lamprophyre dikes along Abitibi River west of the Valentine Property. This map was later accompanied by Operation Kapuskasing report (MP010, Bennett et al., 1967). Ontario Hydro Electric Commission drilled numerous holes between Otter Rapids and Coral Rapids which intersected lamprophyric and kimberlitic intrusive rocks.

6.3. 1967-1969, Argor Explorations Ltd.

In April 1967, Barringer Research Limited, on behalf of Argor Explorations Ltd., carried out a low-level airborne magnetometer survey at a 200 ft (=60.5 m) ground clearance and 400 ft (=121 m) line spacing including parts of Valentine, Pitt, Hamlet and Kilmer townships in the Coral Rapids area (MNDM assessment report 42I04NE0007). The survey included a smaller area within Valentine township east of the Abitibi River on claims P91422 to P91436 inclusive. The purpose of the survey was to detail the large magnetic high from ODM-GSC Map 2306G and to locate possible alkaline intrusive complexes. The result of this survey was that that the magnetic high in the southwest part of Valentine township is actually two magnetic highs.

In October 1967, Argor Explorations followed up on the aeromagnetic survey with drill hole V-2-1 (MNDM assessment report 42I04NE0013). Drill hole V-2-1 was a vertical hole 654 ft (=199.3 m) deep (Figure 6-1). The hole intersected Middle Devonian Abitibi Formation limestone followed by Lower Devonian Sextant Formation sandstone, siltstone and mudstone followed by an unconformity around 445 ft (=135.6 m). Drill hole V-2-1 intersected (445-517 ft / 135.6-157.6 m) altered ultrabasic or basic rock with chlorite, serpentine, magnetite, hematite and altered carbonatite. The drill hole then intersected carbonatite (517-591 ft = 157.6 – 180.1 m) with dolomite, chalcopyrite, pyrite, secondary calcite, chlorite after biotite and hematite after magnetite. The accessory minerals are zircon, apatite, possible columbite and possible pyrochlore. The best Nb mineralized interval was 0.08 % Nb_2O_5 from 570 to 580 ft (=173.7 to 176.7 m), over 10 ft (=3.0 m) in dolomite carbonatite. The drill hole then intersected pyroxenite/hornblendite interlayered with carbonatite. The pyroxenite contains 10-40% magnetite which has been altered to hematite, 5-8% calcite and trace chalcopyrite, titanite and zircon.

In February 1969, Argor Explorations drilled V-2-2 with a dip of -50° and a length of 2,362 ft (=719.9 m) on the center of the magnetic high anomaly in close approximately to drill hole V-2-1 (Figure 6-1) (MNDM assessment report 42I04NE0012). Drill hole V-2-2 intersected Middle Devonian Abitibi Formation limestone and Lower Devonian Sextant Formation sandstone, siltstone and shale. The unconformity occurs at 634 ft (=193.2 m). Weathered granite and hybrid biotite syenite was intersected from 634-741 ft (=193.2-225.8 m). Carbonatite and hybrid biotite syenite form alternating layers to the end of hole at 2,362 ft (=719.9 m) which was the limit of the drill.

The best intersections for pyrochlore in drill hole V-2-2 was 2,278-2,282.8 ft (=694.3-695.8 m) and 2,288.5-2,289.5 ft (=697.5-697.8 m) in dolomite carbonatite with 10% mica, 5% pale green amphibole needles, 3% magnetite and trace orange apatite. The 0.5-0.8% fine-grained pale cream pyrochlore occurs in bands within the carbonatite. Drill hole V-2-2 had phosphorus mineralization with assays varying from 3.62-7.67 % P_2O_5 (Sage, 1988).

In April 1969, Argor Explorations drilled V-2-3 with a dip of -50° and a length of 2,000 ft (=609.6 m) on the center of the magnetic high anomaly (Figure 6-1) (MNDM assessment report 42I04NE0013). Drill hole V-2-3 intersected Middle Devonian Abitibi Formation limestone and Lower Devonian Sextant Formation sandstone, siltstone and shale. The unconformity occurs at 547.5 ft (=166.9 m). Carbonatite interlayered with syenite and hybrid syenite was intersected 547.5 ft to end of hole at 2,000 ft. Drill hole V-2-3 intersected 0.22% Nb_2O_5 over 257 ft (=78.3 m), 1,738-1,995 ft (=529.7-608 m) (Figure 6-1) in carbonatite. The Nb mineralized assay highlights include:

- 1.18 % Nb_2O_5 and 5.49 % P_2O_5 over 5ft (=1.5 m), 1,810-1,815 ft (=551.7-553.2 m) in dolomite carbonatite with 20% magnetite, 40-50% fibrous amphibole serpentine, 3-4% pyrochlore, 1% zircon. Highly radioactive. High grade pyrochlore/apatite stringers up to 1 inch (=2.54 cm) wide occur in pink dolomite rock. Individual stringers contain up to 10% pale pyrochlore.
- 0.48 % Nb_2O_5 over 10 ft (=3.0 m), 1,920-1,930 ft (=585.2-588.3 m) in dolomite carbonatite with biotite-rich bands/inclusions of hybrid rocks. Overall, this interval contains 15% biotite, 10% apatite, 8-10% fibrous amphibole, trace magnetite, pyrrhotite. Pyrochlore occurs as fine-grained pale honey octahedra in narrow stringers of up to 1-2%.
- 0.46 % Nb_2O_5 over 15 ft (=4.6 m), 1,980-1,995 ft (=603.5-608.1 m) in calcite carbonatite with 8-10% biotite, 8-10% apatite, 5-8% fibrous amphibole, 2-4% magnetite. Brown pyrochlore occurs as 4 inch (=10.16 cm) wide interval at 1%.

Drill hole V-2-3 also intersected phosphorous mineralization:

- 8.65 % P_2O_5 over 10 ft (=3.0 m), 1,000-1,010 ft (=304.8-307.85 m) in pyroxenite with 20% orange apatite
- 8.58 % P_2O_5 over 10 ft (=3.0 m), 1,020-1,030 ft (=310.9-313.9 m) in pyroxenite with 20% orange apatite

- 7.50 % P_2O_5 over 10 ft (=3.0 m), 1,160-1,170 ft (=353.6-356.6 m) in pyroxene lamprophyre with 20% orange apatite

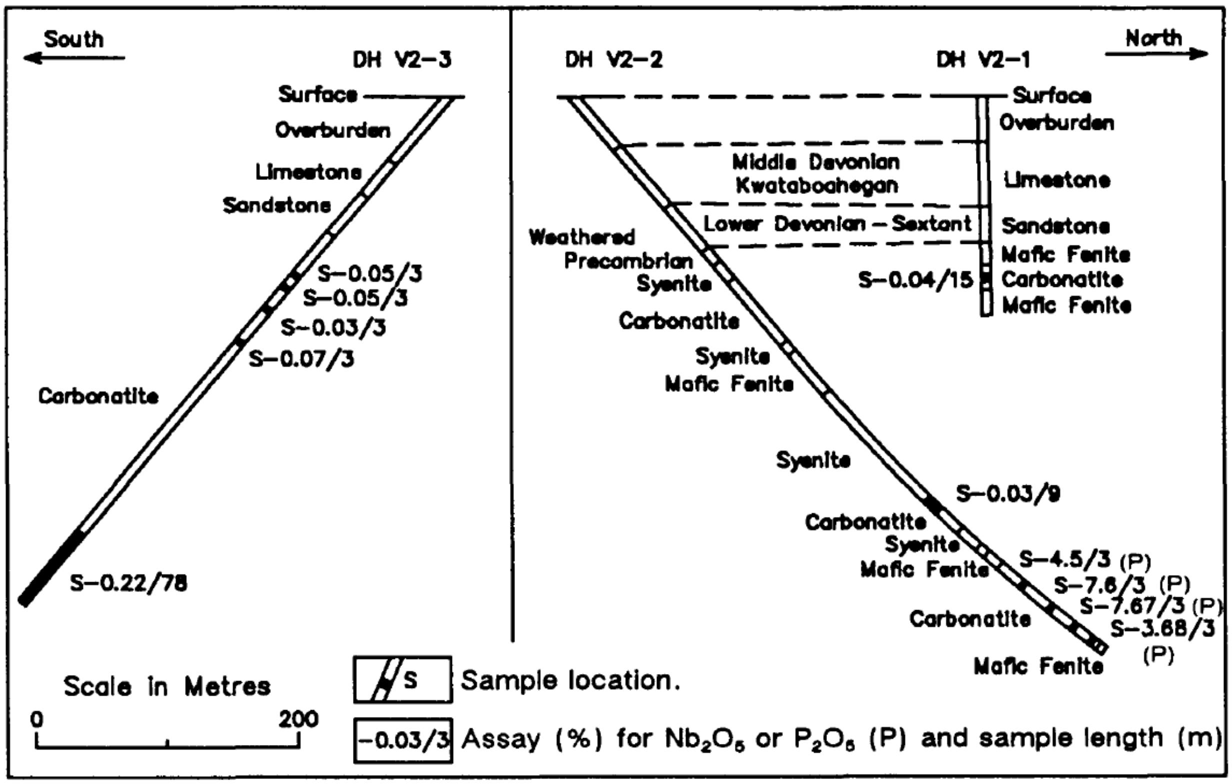

Figure 4. *Sections through diamond drillholes V2-1, V2-2, and V2-3 of Argor Explorations Limited. Data compiled from File 63.2234, Assessment Files Research Office, Ontario Geological Survey, Toronto.*

Figure 6-1: Cross sections of Argor Explorations' drill holes V-2-1, 2 and 3 (Sage, 1988).

6.4. 1982, Selco Mining Corp. Ltd.

In Feb. 1982, Selco Mining Corp. conducted a ground magnetic survey along grid lines with 100 m spacing (MNDM assessment report 42I04NE0002). Grid 42I5-114 was located on claim 608411 northeast of Coral Rapids and Grid 42I5-115 was located on claims 608399 and 608416 immediately east of Coral Rapids. Grid 42I5-114 identified an intense circular anomaly with a source depth of 75-80 m. Grid 42I5115 also identifies a large roughly circular anomaly with a smaller satellite on its northeast shoulder with a depth to source of 100 m.

In Sept. 1982, Selco Mining drilled 42I5-114-1 with a vertical dip and a length of 118.5 m centered on a magnetic anomaly 42I5-114 (MNDM assessment report 42I04NE0003). The drill hole intersected gravel with abundant boulders to 39.7 m and altered bedrock from 39.7-35.7 m. The drill hole intersected kimberlitic breccia from 65.7 to end of hole at 118.5 m. The kimberlitic breccia is magnetic and contains carbonates. The foreign fragments range in size from 40 cm to < 2mm, comprise of 15-20% of the rock and are mudstone, gneissic and limestone. The autoliths vary in size from 1.5 cm to < 5 mm, comprise 65% of the rock and are porphyritic. The groundmass comprises 15-20% of the rock is very fine-grained carbonate, serpentine, magnetite and pale orange garnet.

Selco also drilled 42I5-115-1 with a vertical dip and a length of 152 m on magnetic anomaly 42I5-115 (MNDM assessment report 42I04NE0003). The drill hole intersected 100 m of overburden (clay and boulders) and 5 m of possibly tuff facies of a diatreme. The drill hole then intersected kimberlitic breccia from 105 m to end of hole at 152 m. The kimberlitic breccia is magnetic with foreign fragments varying in size from 5 cm to < 3 mm, comprise 10-15% of the rock and are dominantly gneissic and mudstone. The autoliths vary in size from 2.5 cm to < 5 mm, comprise about 5-60% of the rock and are porphyritic. The autoliths contain carbonate, serpentine, magnetite, fine-grained biotite, pale orange mineral and garnet.

6.5. 2003, Big Red Diamond Corp.

In 2003, Terraquest Ltd. conducted a tri-sensor high sensitivity magnetic and VLF-EM airborne survey on the Valentine property on behalf of Big Red Diamond Company (MNDM assessment report 42I05SE2005). The survey consisted of 67 survey lines with a 60 m terrain clearance, at 50 m spacing and tie lines at 1,000 m spacing covering 3.2 km x 3.2 km block in the southwest corner of Valentine township. The base of operations for the survey was Kapuskasing airport and the survey was flown Dec. 13 and 14, 2003. The total field magnetic survey indicated that there is two large magnetic anomalies and one smaller magnetic anomaly to the north of the eastern most large anomaly. These anomalies represent the Valentine Township Carbonatite Complex.

In December 2003, Big Red Diamond conducted ground total magnetics survey along E-W grid lines with 50 m spacing (MNDM assessment report 42I05SE2004). The survey identified two circular anomalies which were interpreted as shallow pipe-like features. The anomalies located at 454,855E, 5,566,500N at a source depth of 50 m and at 454,940E, 5,566,750N at a source depth of > 90 m (NAD 27). These anomalies are in close proximity to Selco's drill hole 42I5-115-1 which intersected kimberlite breccia.

As a follow up to the 2003 airborne mag survey, in January to April 2005, Big Red Diamond conducted overburden sampling and mineralogy study of heavy minerals on the Valentine Property (MNDM assessment report 2.30132). A helicopter was used to collect a sample in November 2003. The samples were checked for the presence of kimberlite indicator minerals and selected samples were sent for SEM/microprobe analysis. Sample #28E575N located south of the Valentine Township Carbonatite contains eclogitic garnets likely from kimberlite.

6.6. 2006, Baltic Resources Inc.

In February and March 2006, Baltic Resources Inc. drilled 11 holes totaling 951 m. The drill holes were located on both the east and west side of the Abitibi River in the Coral Rapids area (MNDM assessment report 2.31852). Drill holes CR06-1, 2, 3 and 6 were drilled on the east side of the Abitibi River on the northern part of the Valentine Property.

Drill hole CR06-1 has a vertical dip and intersected kimberlitic autolithic breccia from 37.0-94.5 m. Drill hole CR06-2 has a vertical dip and intersected kimberlitic heterolithic breccia from 46.0-71.8 m. Drill hole CR06-3 has a vertical dip and intersected autolithic breccia from 28.0-79.0 m. Drill hole CR06-6 has a vertical dip and intersected porphyritic ultramafic intrusive from 20.0-62.0 m.

In September 2007, selected drill core samples were studied under binocular microscope and thin sections were studied by petrographic microscope to identify the mineralogy and rock types (MNDM assessment report 2.36059).

Drill hole CR06-1 has two rock types: fragmental rock type (39.0-87.0 m) which was classified as very fine-grained massive fragmental olivine melilitites and very fine to fine-grained massive fragmental olivine melilitite breccias. The second rock type is coherent rock type at 94.0 m which was classified as very fine to fine-grained massive coherent alnoite.

Drill hole CR06-2 samples have massive structure and fragmental texture and has been classified as very fine to fine-grained massive fragmental olivine melilitites and very fine to fine-grained massive fragmental olivine melilitites breccias.

The diamond carrying capacity for the samples examined are rated as very low because olivine melilitites and olivine alnoites belonging to the melilitite clan have no economic diamond deposits associated with them (MNDM assessment report 2.36059).

6.1. 2018-2022, NioBay Metals Inc.

In 2018, NioBay first acquired the Valentine property by map staking of 32 claims, which was further enlarged in early 2020 with the addition of 128 new claims.

In November 2020, an airborne high resolution magnetic and VLF-EM survey was flown by Terraquest Ltd (MNDM assessment report 20000020024). The main objective of the survey was to help better define the geological interpretation for future undercover exploration program, as there is thick overburden and no rock outcropping over the property. A total of 1,027.1 line-km were flown with a helicopter affixed with a nose boom magnetometer and an on-board VLF-EM antenna to get high precision data at a 21.5 m mean terrain clearance over 50 m flight lines spacing (Barrie, 2021).

The initial interpretation of the results was performed by J-J Minerals on behalf of NioBay and recommended 6 new drill holes to be drilled on the centers of the magnetic anomalies associated with the Valentine Carbonatite complex (Selway, 2022).

7.0 Geological Setting and Mineralization

7.1. Geological Setting

The Valentine Property is located in the northern portion of the Kapuskasing structural province, a NE-trending linear zone of magnetic and gravity anomalies in northern Ontario. The zone is controlled by a series of NE-striking faults that expose Archean crust of high metamorphic grade (granulite facies). The high-grade rocks occur in a regional block with greenschist facies rocks to the west and east.

The Property area is predominantly underlain by granulite facies Archean garnet-hornblende-feldspar gneiss. The gneiss is cut by diabase dikes of the Matachewan dike swarm. Kimberlite intrusions occur in the area and were initially identified from indicator mineral sampling and aeromagnetic surveys. Known kimberlites occur predominantly below Devonian sedimentary cover and do not outcrop. In drilling, kimberlites consist of autolithic breccias and lapilli in a fine-grained groundmass. Xenoliths consist predominantly of mantle and basement rocks, with local limestone and sandstone fragments that indicate intrusion into Devonian cover rocks.

The regional unconformity between Archean gneiss and Devonian sedimentary rocks strikes NS through the Property area and dips gently north. To the south and west of the Valentine Lake complex, the surface trace of the unconformity turns to strike EW. The change in strike may reflect structural complexity in the underlying basement rocks.

The Property hosts the Valentine Township Carbonatite Complex, a buried carbonatite body with associated niobium (Nb) and phosphorus (P) mineralization (Sage, 1988).

The carbonatite complex consists of sövite and silicocarbonatite with associated fenitized wallrock blocks. Sövite (<50% total oxide and silicate minerals) and silicocarbonatite (>50% total oxide and silicate minerals) include up to 20% magnetite. Mineralization at Valentine Lake consists of Nb and P as disseminated pyrochlore and apatite within the carbonatite matrix. The complex occurs beneath 120 to 150 m of overburden and

Devonian sedimentary rocks, and the top of the carbonatite is weathered below the unconformity with overlying sedimentary rocks.

Blocks of fenitized granitic gneiss occur within the complex, which were historically logged as syenite. Fenitized gneiss consists of pyroxene, plagioclase, biotite, and carbonate, amphibole, apatite, with minor magnetite.

No geochronology samples have been analyzed for the complex. It is interpreted as Late Precambrian, similar to the James Bay carbonatite complex and other carbonatite intrusions in the Kapuskasing Structural Zone (Sage, 1988). The Valentine Township Carbonatite Complex cuts interpreted ~2.5 Ga Matachewan dikes, consistent with a Late Precambrian age.

The drilled portion of the carbonatite is strongly magnetic but occurs within a variably magnetic intrusive body and thus the boundary of the intrusion cannot be precisely identified in plan view. The main magnetic anomaly is approximately 3 x 1 km in plan view with a long axis oriented EW. Diabase dike anomalies that occur on both sides of the complex are cross-cut by low magnetic responses in an approximately 3.5 km by 2.5 km zone around the magnetic anomaly, also with its long axis oriented EW. Due to its elongated shape and complex magnetic fabric, the intrusion was likely emplaced in association with fault reactivation.

7.2. Carbonatite Niobium Deposit Type

The Valentine Property covers the Valentine Township Carbonatite Complex which consists of sövite, silicocarbonate and fenitized country rocks (Sage, 1988).

Carbonatites may contain economic quantities of niobium, tantalum, phosphorus and rare-earth elements. Carbonatites are typically vertical plugs/dikes that are zoned with fenites in the outer zone and carbonate-rich carbonatites in the inner core.

Kimberlite breccias have also been intersected in historic drill holes on the Valentine Property. Kimberlites are the rock type for diamond deposits.

Carbonatite Nb deposits consist of disseminated or vein-hosted pyrochlore, ferrocolumbite, and fersmite within carbonatite complexes and their wallrock. Nb-bearing pyrochlore forms early in the crystallization of carbonatite magma, becoming concentrated in the base or walls of the magma chamber as crystallization progresses. Pyrochlore may then be redistributed by density currents or later hydrothermal alteration.

At carbonatite complexes, the internal variability and heterogeneity of intrusive units generally precludes the mapping of continuous features (Mitchell R. H., 2015). However, relatively continuous bodies that formed due to separate intrusive events may form continuous features that can be mapped. By extension, the magnetic domains present in a carbonatite complex are expected to reflect large-scale bulk variability in the complex due to multiple intrusive phases or broad alteration patterns.

Carbonatites are generally circular to elliptical in plan view. They form as part of zoned complexes reflecting the sequence of intrusion: silicate intrusions are the earliest, followed by calcite carbonatites, dolomite carbonatites, and finally ferrocarbonatites. This relationship can be complicated by the occurrence of multiple zoned pulses within the complex. Carbonatite intrusions are surrounded by fenitized wallrock. The extent of fenitization can vary considerably depending on the chemistry, structure, and rheology of the host rocks. Haloes in siliciclastic or carbonate sedimentary units can be of limited extent (<500 m) while haloes in granitic gneiss wallrock can extend for several kilometers (Elliot, et al., 2018). Fenitizing fluids are highly oxidizing and thus have the potential to oxidize ferromagnetic magnetite into paramagnetic hematite and affect the magnetic response of wall rocks.

The relationship between Nb-enriched portions of intrusive complexes and their geometry is poorly understood. Pyrochlore is expected to crystallize early in the intrusive history and would thus tend to be concentrated in the base or walls of the magma chamber. It may be redistributed by density currents or by later alteration. The fenitized halo around complexes can be enriched in Nb relative to the parent carbonatite as well (Elliot, et al., 2018).

The Fen Carbonatite Complex in Norway is a type locality for several carbonatite lithologies and has associated niobium mineralization. The Fen complex is interpreted to have formed during two main phases. The first phase was emplacement of silicate intrusive rocks (ijolite) and calcite and dolomite carbonatites. The second phase was the emplacement of lamprophyres and ferrocarbonatites with associated fenitization. Niobium mineralization at the Fen complex occurs in a zone near the northern edge of the complex in calcite carbonatite interpreted to have formed during the first phase of emplacement. A geological map of the complex, overlaid by contours of aeromagnetic data, is shown in Figure 7-1.

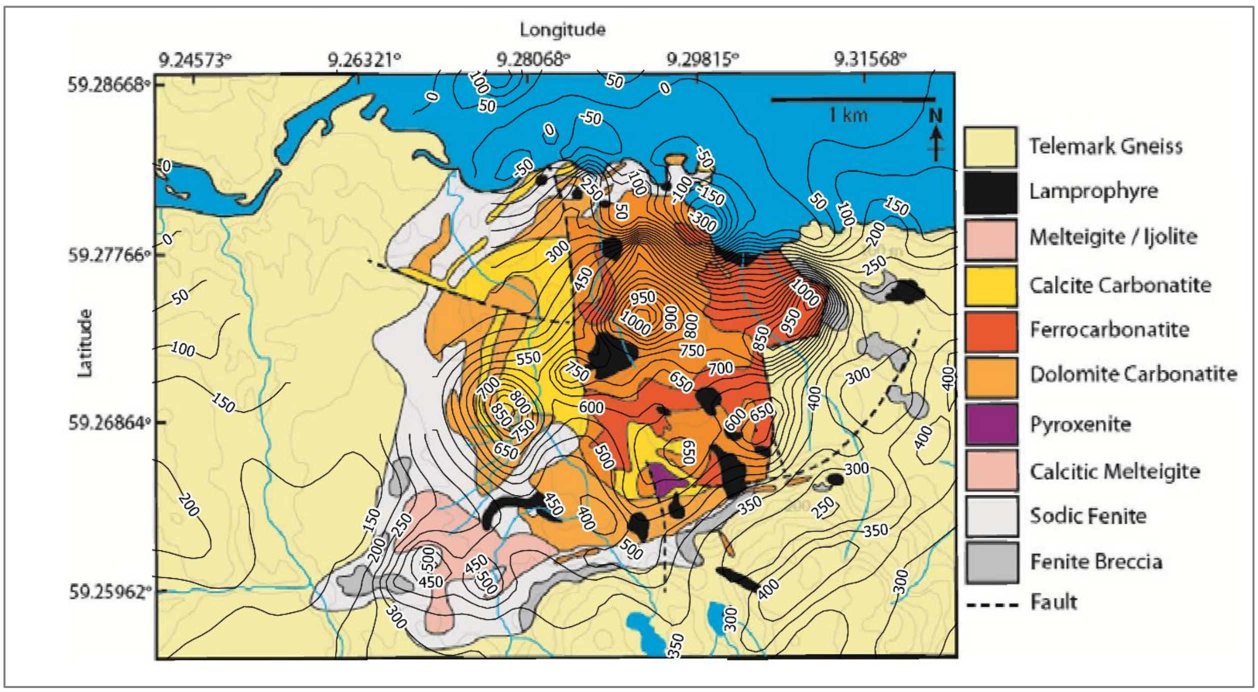

Figure 7-1: The Fen carbonatite complex, Norway. Geological map is after (Elliot, et al., 2018). Black contours lines are compiled airborne magnetic data from (Geological Survey of Norway, 2013).

The magnetic expression of the Fen complex is similar to that of the Valentine Township Carbonatite Complex. It is marked by a broad moderate to high anomaly relative to granitic gneiss country rock. Within the anomaly, spot highs or pods occur and are associated with mapped ferrocarbonatite, lamprophyre, and dolomite carbonatite. The area of known Nb mineralization is in a relative low within the anomaly. The fenitized rock is slightly more magnetic than background values, but is otherwise very similar to the granitic gneiss outside of the complex.

8.0 Modelling and Interpretation

Mira Geoscience completed a geology and magnetic data driven 3D exploration integrated interpretation for structurally controlled mineralization on the Valentine Property in March 2022. The purpose of the work was to develop a property-wide 3D integrated model to capture structure, geology and magnetic susceptibility distribution to support exploration.

The work was implemented with a series of software including:

- SKUA-GOCAD Mining Suite for 3D geoscientific modelling,
- VPmg for 3D magnetic data inversion modelling (see *Appendix 4:*), and
- QGIS for data management and mapping.

The modelling was based on a new high resolution aeromagnetic survey acquired in the fall of 2020 by Terraquest Ltd. (MNDM assessment report 20000020024) and available aeromagnetic surveys and geological (surface maps and drill hole database) data sets publicly available and provided by NioBay. The data and mineral system genetic model were reviewed with NioBay to capture their advanced knowledge of the area. The modelling area of interest (“AOI”) is shown in Figure 8-1 and covers an area of approximately 6 km by 9 km equivalent to the Terraquest airborne survey footprint.

An initial property-wide 2D interpretation was performed to identify structure, geology and magnetic signatures. The initial geological interpretation was then propagated in 3D, evaluated against the magnetic data and model updates were applied where necessary to improve data fit. A 3D lithology-constrained inversion of the magnetic data was then performed to generate a magnetic susceptibility distribution within the modelled lithologies. The resulting model and associated geological interpretation provided a robust base for a discussion of target areas favorable to mineralization.

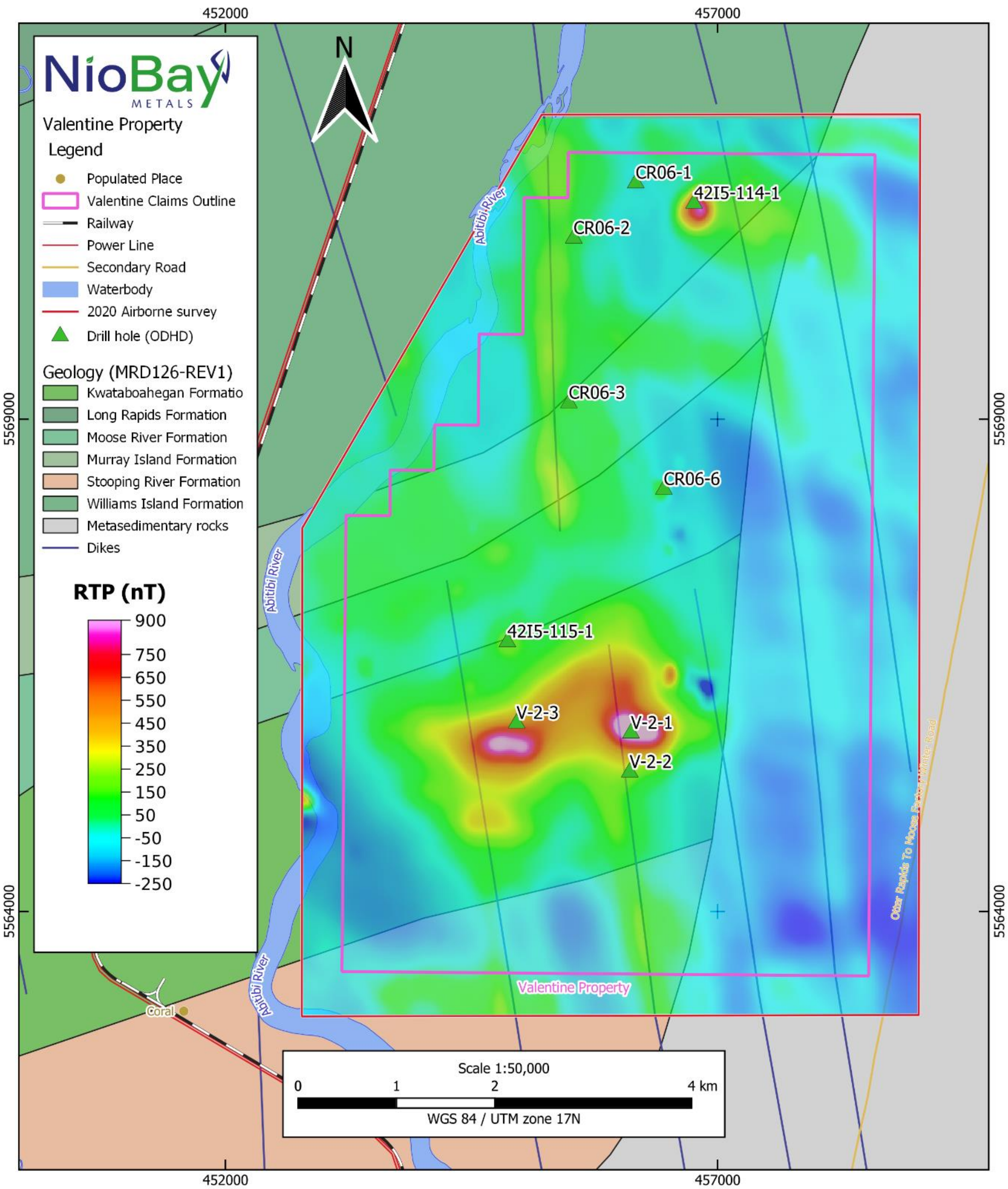

Figure 8-1: Modelling area of interest and input data.

The key features leveraged in this work were abilities to;

- estimate the depth of base of sedimentary cover,
- correct the magnetic data for the effect of the non-magnetic sedimentary cover to enhance magnetic anomalies from the bedrock,
- evaluate and update the 3D geological model geometry and physical property,
- account for the effects of magnetic remanence on specific lithologies, and
- generate magnetic susceptibility distributions through unconstrained and lithology-constrained inversions.

8.1. Data

The modelling and interpretation work relied on a series of geological, drilling and geophysical datasets that are publicly available or were provided by NioBay.

8.1.1. Digital Elevation Model

The publicly available 30 m resolution Shuttle Radar Topography Mission (SRTM) data was retrieved over the property area and stitched to the high-resolution 12.5 m Digital Elevation Model (DEM) from the 2020 Terraquest aeromagnetic survey (Barrie, 2021) to extend coverage beyond the survey footprint.

8.1.2. Geological Data

Several geological maps and compilations from the Ontario Geological Survey (OGS) were used to establish a conceptual model and the regional-scale lithological unit geometry:

- Bennett, G., Brown, D.D., and George, P.T., 1968. Coral Rapids-Cochrane sheet, geological compilation series, Cochrane District, M2161, scale 1:253,440.
- Ontario Geological Survey, 1997. Quaternary geology, seamless coverage of the province of Ontario: Ontario Geological Survey, Data Set 14 (EDS014-REV).

- Ontario Geological Survey 2011. 1:250,000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release–Data 126 - Revision 1 (MRD126-REV1).

All maps exhibit varying levels of information within the Property with dataset MRD126-REV1 providing the most recent overall compilation with a better insight into the regional geological context (see Figure 8-1).

Detailed information specific to the Valentine Township Carbonatite Complex was available through:

Sage, R.P., 1988. Geology of Carbonatite - Alkalic Rock Complexes in Ontario: Valentine Township Carbonatite Complex, District of Cochrane; Ontario Geological Survey, Study 39 (S039), 37p.

8.1.3. Drilling Data

The historical collars, surveys, lithology logs were provided by NioBay containing 4 holes from 1967 and 1969 exploration campaigns (see section 6.3). Additional drill holes were also retrieved from the Ontario Drill Hole Database (ODHD). Collar locations, hole surveys and log intervals were reviewed on import and the resulting drill hole database collar locations are shown in Figure 8-1.

The ODHD collar locations do not seem to match the locations shown in the historical reports in respect to the targeted magnetic anomaly. Moreover, collar locations for holes V2-1 and V2-2 appeared swapped compared to a cross-section in the Valentine Township Carbonatite Complex study S039 (Sage, 1988) shown in Figure 6-1. Moreover, the MNDM assessment reports 42I04NE0012 (p22) and 42I04NE0013 (p23) both confirm the collar locations shown in study S039.

The updated drill holes are shown in Figure 8-2. More sensible locations have been achieved by swapping the collar locations for holes V2-1 and V2-2, and converting all ODHD locations coordinates from NAD27 to NAD83 datum. Some uncertainty remains as re-located holes appear on the edge of the magnetic anomaly they while targeted its centre.

The drilling data was thus used as general reference but not explicitly in the modelling.

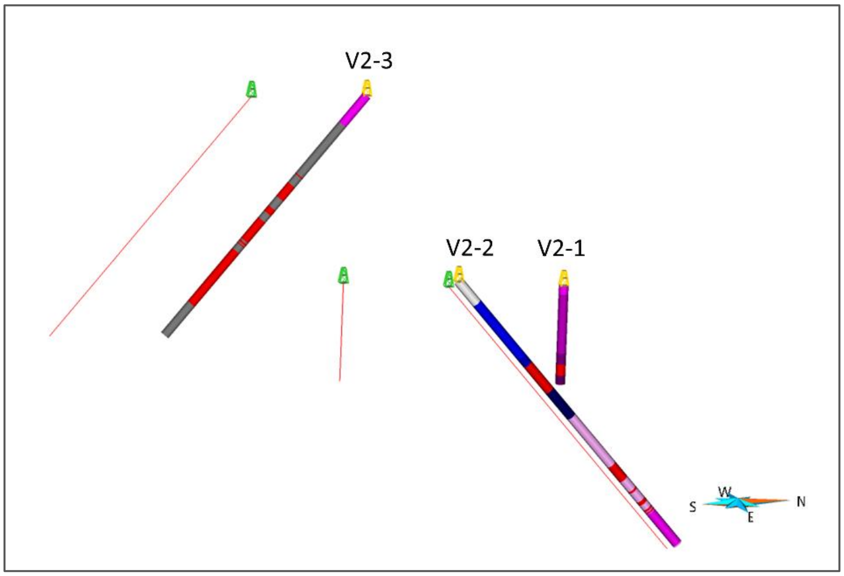

Figure 8-2: Plunging view to the west-northwest of original ODHD drill locations with green derricks and updated drill holes with yellow derrick and lithology logs. Hole labels based on updated locations.

8.1.4. Magnetic Data

Three magnetic datasets were used for this work;

- the Natural Resources Canada (NRCAN) 200 m aeromagnetic compilation (Natural Resources Canada, 2022),
- the 1993 OGS Coral Rapids survey (Ontario Geological Survey, 2002), and
- the 2020 Terraquest high-resolution magnetic and VLF-EM airborne survey (Barrie, 2021),

The NRCAN and OGS datasets were both used to help with the interpretation of regional structures while the Terraquest data were at the centre of the main interpretation work.

All magnetic datasets are shown in Figure 8-3. The Terraquest data were processed to minimize flight lines artefacts and all magnetic datasets were used to generate a series of filtered data grids to help with interpretation. The data grids were processed using Fourier filters to produce the reduced-to-pole (RTP), first vertical derivative (1VD), second vertical derivative (2VD), analytic signal (AS), total horizontal derivative (HDT), EW and NS horizontal derivatives (HDX and HDY), tilt angle (TA), and analytic signal of tilt angle (ASTA) maps.

The latest version of the country wide NRCAN 200 m aeromagnetic compilation retrieved consisted of merged grids combining data from adjoining high-resolution aeromagnetic surveys. The compilation residual magnetic anomaly is levelled to a magnetic datum 305 m above ground thus reducing its sensitivity to and resolution of small magnetic sources.

The 1993 OGS Coral Rapids survey (OGS GDS1213-REV) was flown with a 150 m line spacing and 75 m ground clearance, thus providing 40 m resolution data grids offering higher level of details in the surroundings of the property area.

The 2020 Terraquest high-resolution helicopter-borne magnetic and VLF-EM survey was flown with a 50 m line spacing and a mean ground clearance of 21.5 m, thus providing 12.5 m resolution data grids offering the highest level of details.

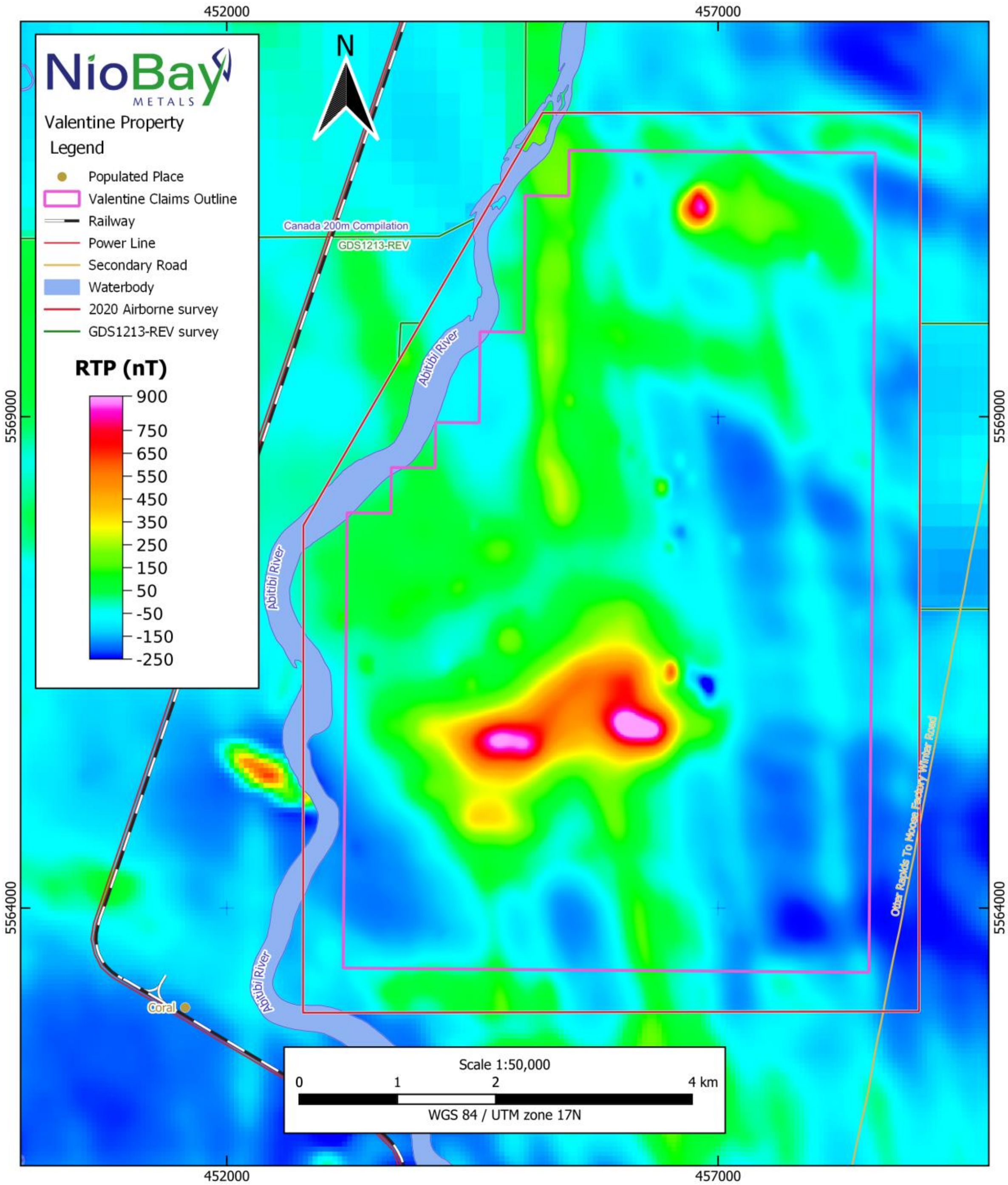

Figure 8-3: NRCAN 200m aeromagnetic compilation (Natural Resources Canada, 2022) , 1993 OGS Coral Rapid survey (Ontario Geological Survey, 1993), and 2020 high-resolution Terraquest survey (Barrie, 2021) RTP of residual magnetic data grids.

The ambient magnetic field parameters at the time of the Terraquest survey acquisition in November of 2020 were used for all magnetic data processing and modelling. The parameters were estimated from the International Geomagnetic Reference Field IGRF2020 and are shown below in Table 8-1.

Table 8-1: 2020 Terraquest survey IGRF ambient magnetic field parameters.

<table>
<tr><th>Model</th><th colspan="4">IGRF2020</th></tr>
<tr><td>Latitude (WGS84)</td><td>50.2417° N</td><td rowspan="2">Declination</td><td rowspan="2">Inclination</td><td rowspan="2">Total Field</td></tr>
<tr><td>Longitude (WGS84)</td><td>80.5746° W</td></tr>
<tr><td>Date</td><td>2020-Nov-05</td><td>-10.6144°</td><td>74.3345°</td><td>56,225.1 nT</td></tr>
</table>

8.1.5. VLF-EM Data

The 2020 Terraquest high-resolution helicopter-borne magnetic and VLF-EM survey acquired VLF-EM data for two stations:

- Cutler, Maine, USA (NAA)
- LaMoure, North Dakota, USA (NML)

VLF-EM total field amplitude, in-phase and quadrature data were generated. The general survey parameters are detailed in section 8.1.4. The VLF total field amplitude for LaMoure is shown in Figure 8-4.

VLF-EM has a limited depth of penetration which can only represent conductivity variations near surface. This data is thus of limited use as the Valentine Property lacks outcropping bedrock and is overlaid by a thick quaternary cover. VLF-EM was not used for interpretation.

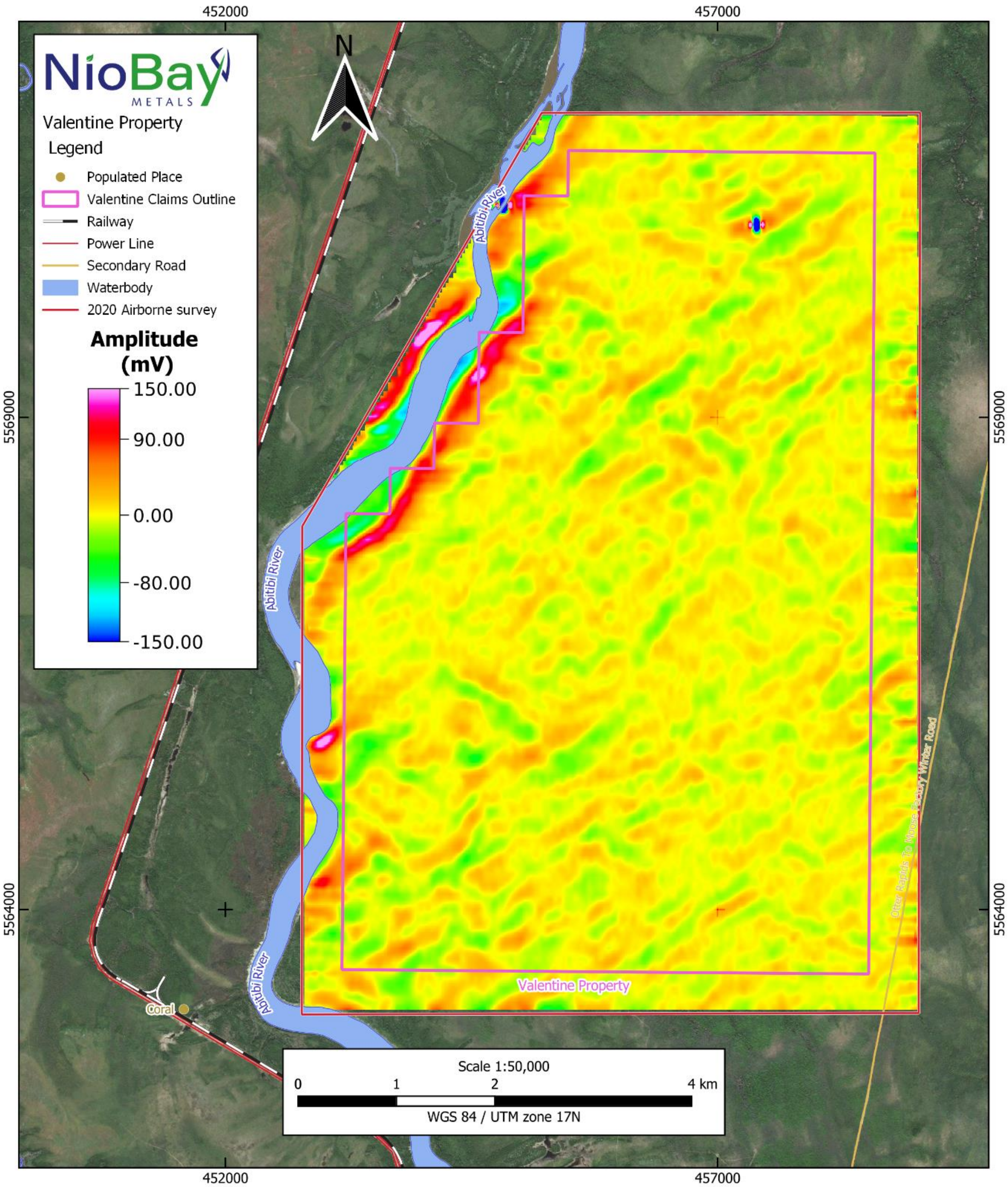

Figure 8-4: 2020 high-resolution Terraquest (Barrie, 2021) high-pass filtered VLF total field amplitude data grid for LaMoure (NML).

8.1.6. Gravity Data

Regional gravity data were available from the Gravity anomaly point data of Canada from the Canadian Geodetic Survey, acquired between 1944 and 2018, and distributed by Natural Resources Canada (Natural Resources Canada, 2022). Fully processed compiled data, including free air and complete Bouguer data, were retrieved as station (point) and gridded data, and are shown in Figure 8-5. The coarse 2 km resolution of this data is not suitable for the integrated interpretation process, so gravity was used to help with understanding the regional trends and structures.

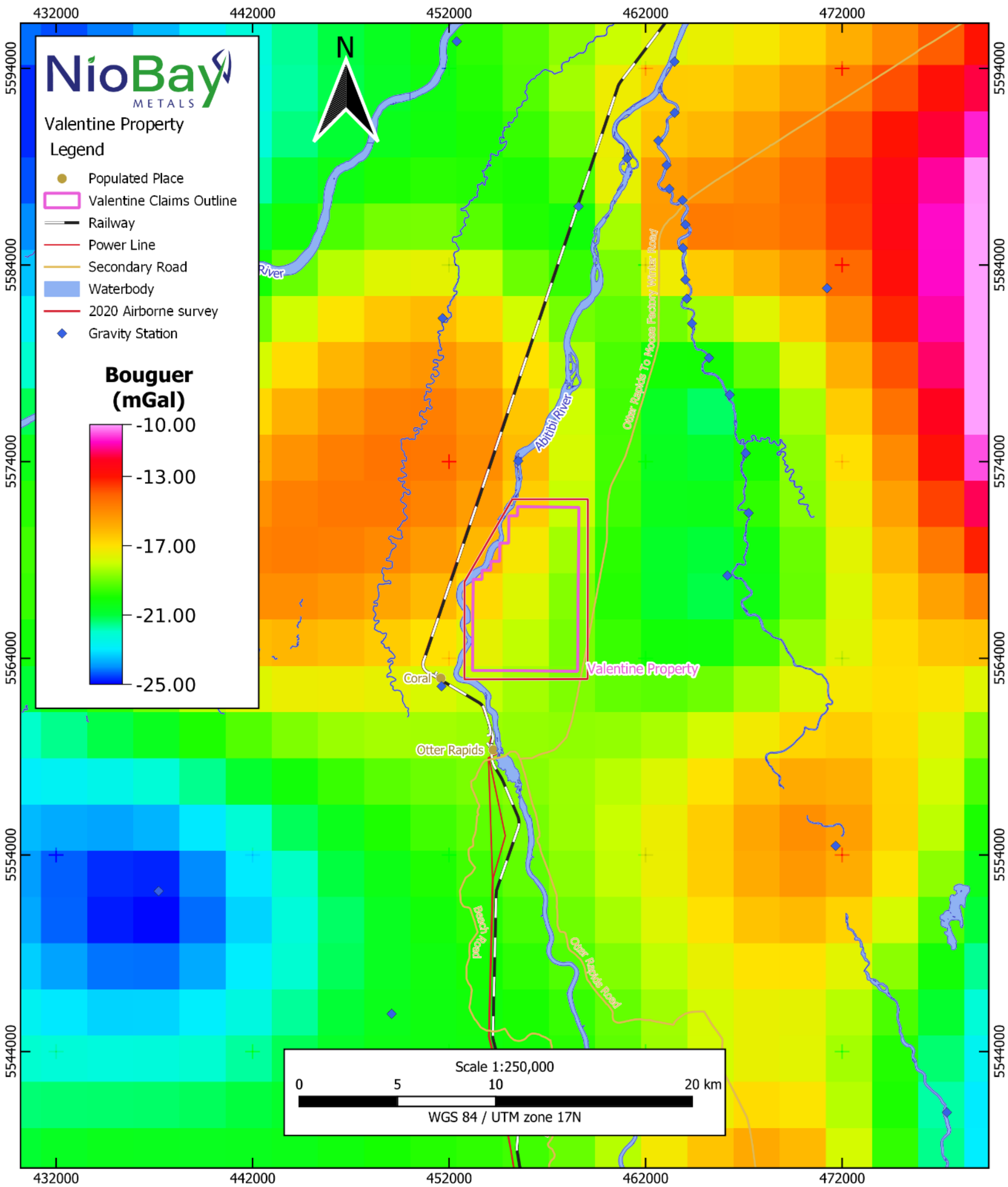

Figure 8-5: NRCAN gravity stations and 2 km resolution Bouguer anomaly grid.

8.2. Preliminary Modelling

The integrated interpretation sought to identify specific relationships between geology, rock properties and magnetic data to build a unique petrophysical model consistent with all inputs. Preliminary modelling work took place to:

- estimate the depth of non-magnetic cover for the entire property, and
- generate an initial 3D magnetic susceptibility distribution model through an unconstrained inversion to avoid any geological bias.

8.2.1. Depth of non-magnetic cover modelling

The depth of non-magnetic cover has been estimated over the entire property based on the observation that all magnetic sources are located within the basement rocks and not in the overlaying sediments. A depth to source analysis of the magnetic data provided a series of points located in space representing the top of magnetic sources. A base of non-magnetic cover surface was then fitted through these points and the base of overburden pierce points from historical drilling to generate a cover depth map shown in Figure 8-6.

The resulting depth map further supported detailed interpretation as it allowed for the removal of the smoothing effect associated with the of non-magnetic cover. An enhanced magnetic map of the 1st vertical derivative (1VD) of the reduced to the pole data (RTP) shown in Figure 8-7 was produced to support geological contact and structure interpretation.

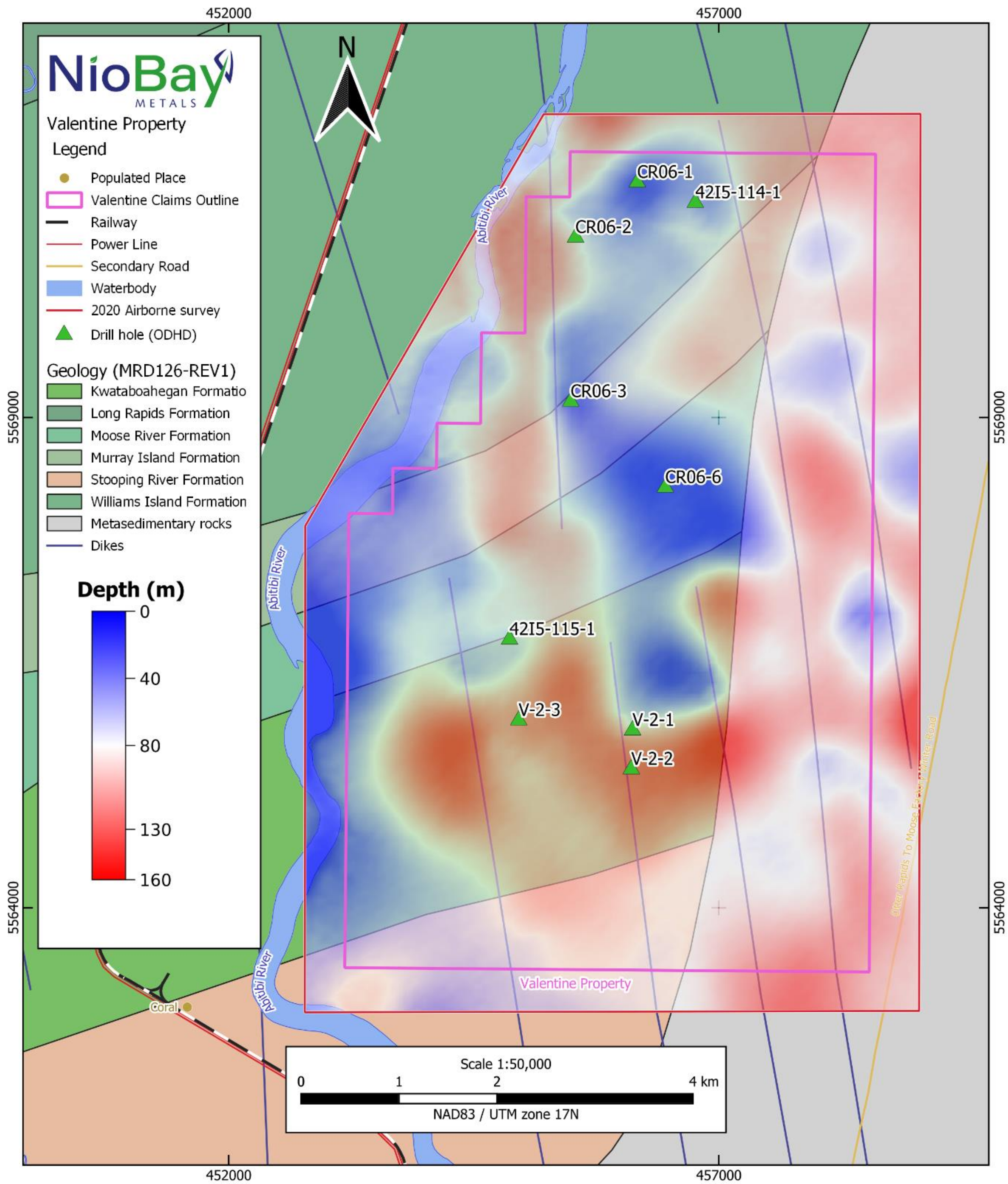

Figure 8-6: Depth of non-magnetic cover map.

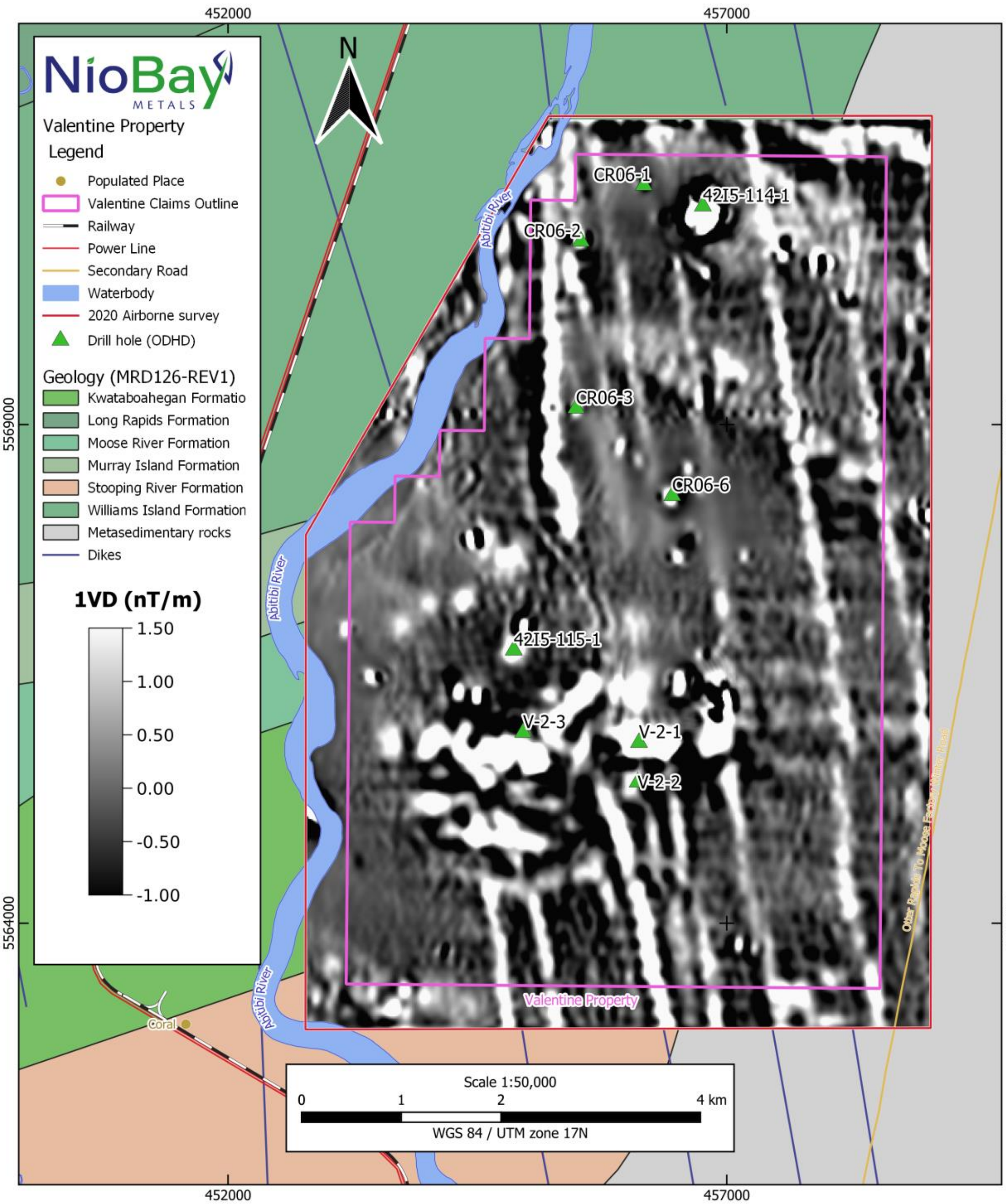

Figure 8-7: Cover corrected 1VD of RTP data map.

8.2.2. Unconstrained magnetic modelling

A 3D magnetic susceptibility model was generated from the unconstrained inversion of the 2020 Terraquest magnetic data.

Regional magnetic trends from sources located within and around the Property area were estimated with a coarse resolution 3D unconstrained inversion of the regional NRCAN 200 m aeromagnetic compilation data that generated a 3D magnetic susceptibility model. The regional unconstrained 3D magnetic susceptibility model at a 500 m resolution is shown in Figure 8-8.

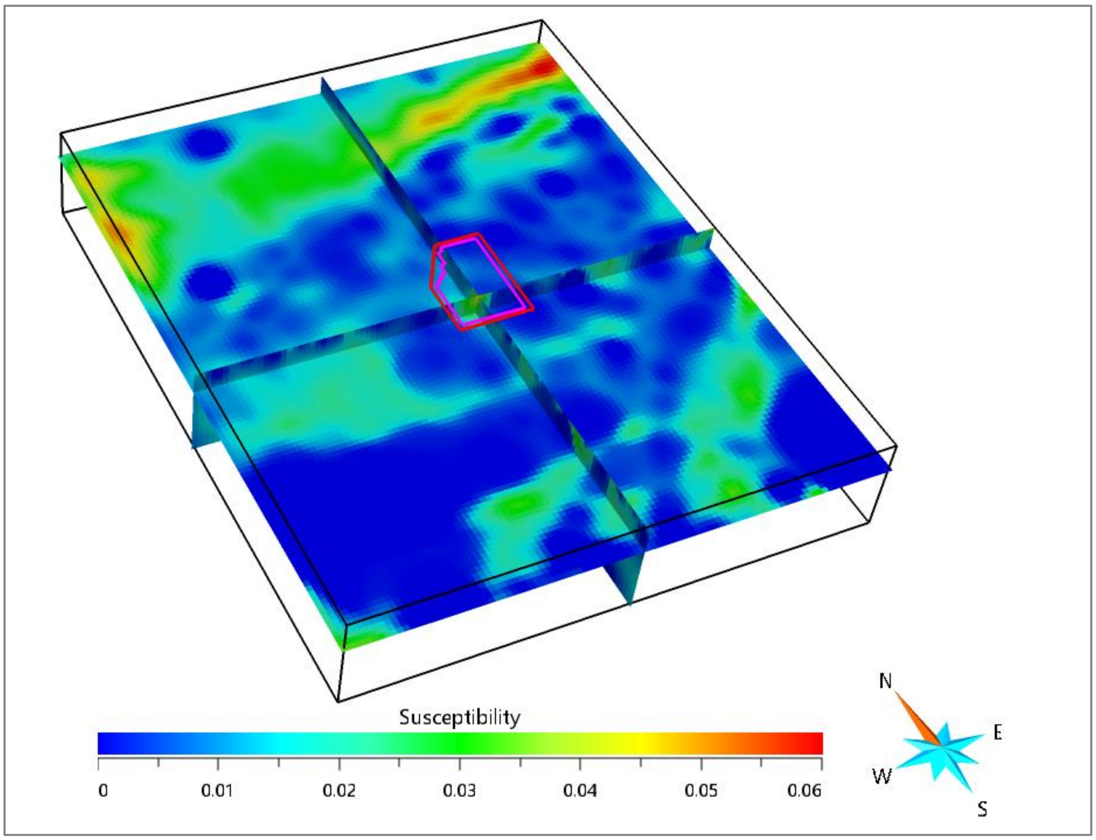

Figure 8-8: Plunging view looking north-northeast of the regional unconstrained magnetic susceptibility model. The Valentine Property outline is shown in purple and the 2020 Terraquest survey outline in red.

The local, or Property-wide, 50 m resolution model was incised into the coarser regional model to account for regional trends from sources located within and around the Property. The inversion completed with a 6.93 nT root mean squared (RMS) data misfit indicating a good data fit and the model is shown in Figure 8-9.

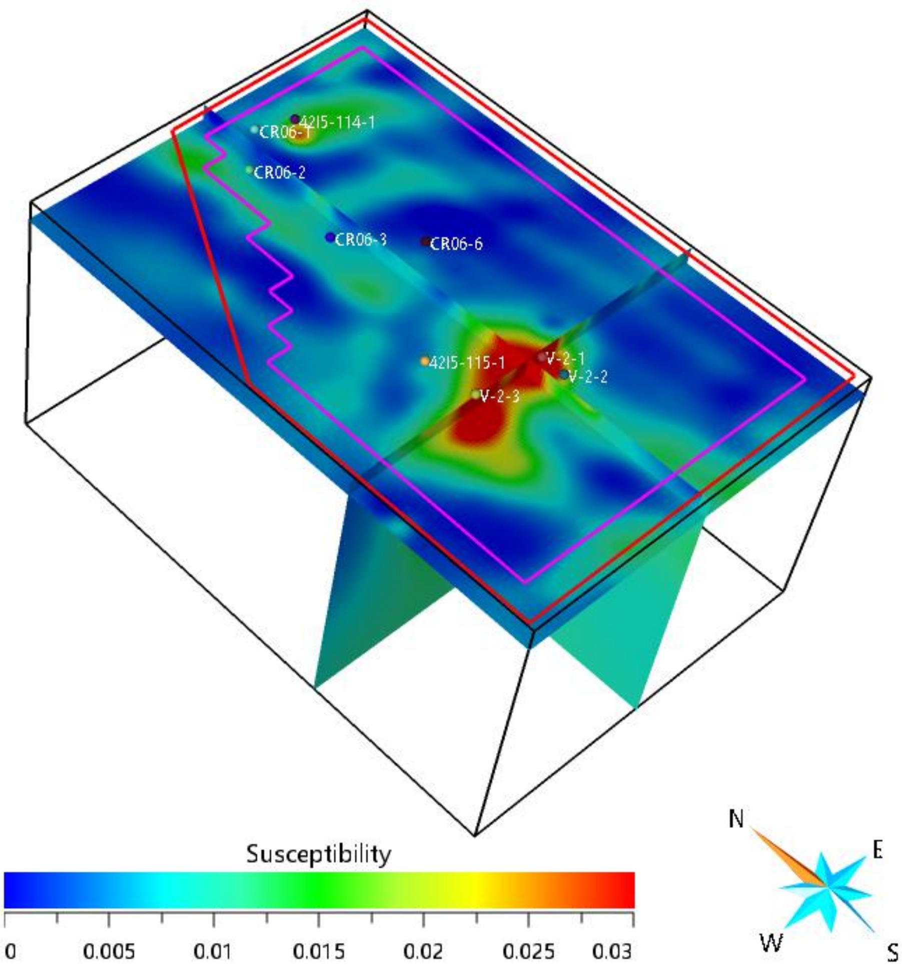

Figure 8-9: Plunging view looking northeast of the Property scale unconstrained magnetic susceptibility model. The Valentine Property outline is shown in purple and the 2020 Terraquest survey outline in red.

8.3.3D Integrated Interpretation

Magnetic data were interpreted, along with existing geological maps and an unconstrained magnetic susceptibility inversion, to establish the structural framework and magnetic domains shown in Figure 8-10.

Magnetic data were interpreted in detail to establish major geological domains. Potential structural breaks were identified and used to interpret a fault network. The interpreted domains and faults were used to construct an initial 2D geological map of the area of interest. The unconstrained magnetic inversion was used to estimate structure and contact dips where possible. Existing geological maps were reviewed and used to place identified geophysical domains into their geological context.

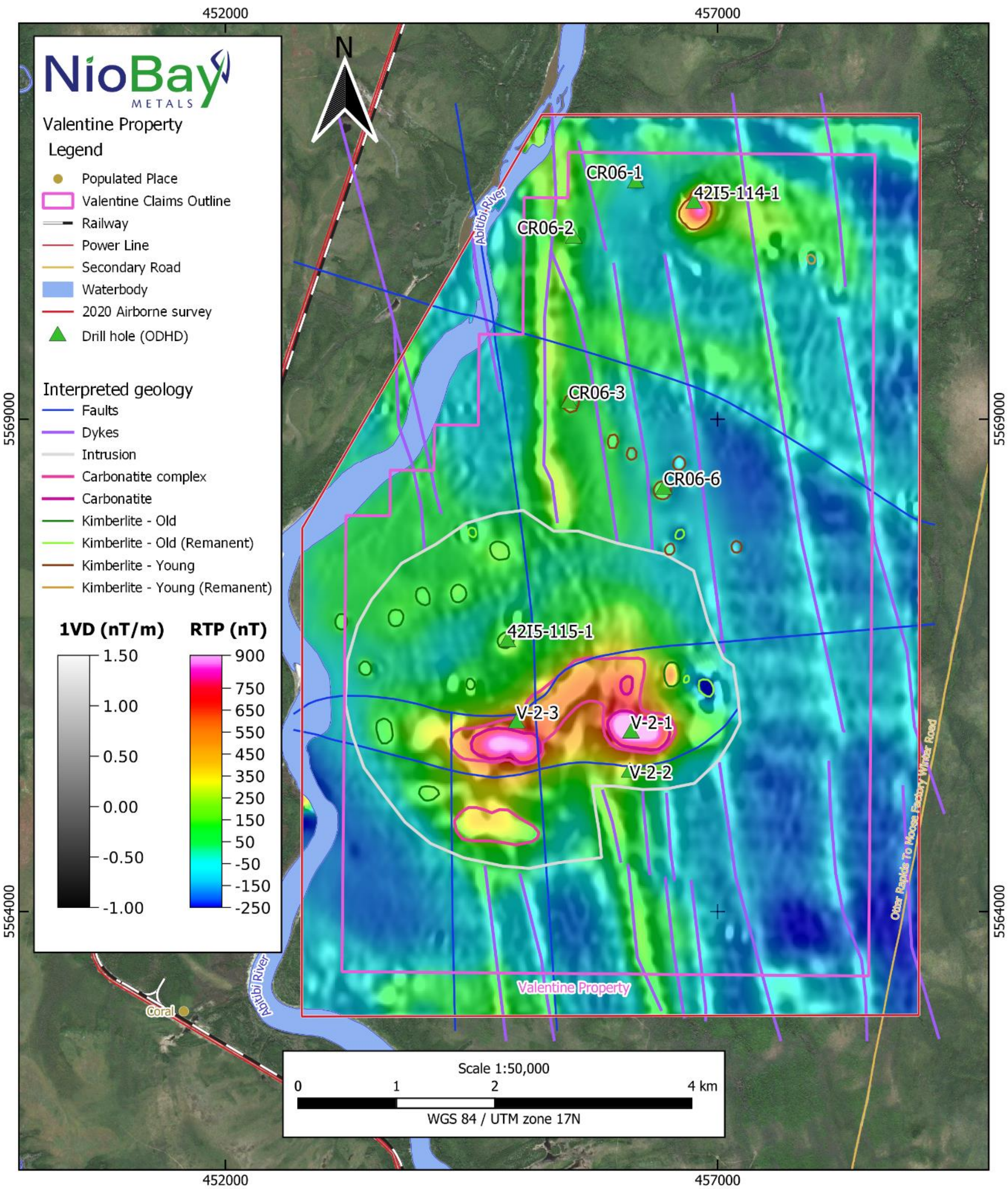

Figure 8-10: Interpreted geology and structures.

8.3.1. Fault interpretation

2D magnetic data were interpreted with reference to available geological maps to produce a 3D structural framework for interpretation and modelling. The resulting fault traces are shown in Figure 8-10.

Three NS-oriented faults cut the AOI. One terminates against an EW fault and two continue through the AOI and cross EW faults. An EW fault is interpreted north of the Valentine Township Carbonatite Complex magnetic high anomaly. A subsidiary structure splays off it south of the magnetic high anomaly and terminates against an interpreted NS structure at the eastern side of the anomaly. An NW-SE oriented fault occurs in the northern portion of the AOI and appears to be related to layering in gneiss. The Valentine Township Carbonatite Complex occurs at the zone of intersection between EW structures and NS structures, and the magnetic anomaly associated with the complex is bound to the west and east by NS structures.

The EW-trending faults are interpreted to be related to layering in the basement gneiss and have probably been reactivated. NS-trending faults are interpreted to be younger and were possibly reactivated as well. It is difficult to discern much structure or structural history from the available data. The AOI is not a heavily faulted area, although the Valentine Township Carbonatite Complex appears to be hosted within a zone of structural complexity at the intersection between a relatively extensive EW-oriented regional structure and a series of NS-oriented structures.

8.3.2. Geological Interpretation

Major lithological domains were identified based on the magnetic maps for the AOI. Basement gneisses were divided into high and low magnetic domains. The contact between the two domains occurs north of the Valentine Township Carbonatite Complex was interpreted as a faulted lithological contact. High magnetic gneiss occurs north of the contact and low magnetic gneiss occurs to the south. The contact dips nearly vertically based on unconstrained magnetic inversion and forward modelling.

The Valentine Township Carbonatite Complex is centered at the interpreted intersection between NS and EW-trending structures. It has an elongated sigmoidal shape that probably reflects fault control on the magnetic phase of the complex. The external intrusion outline may be more extensive and rounder based on overprinting of diabase dikes in the AOI. This domain was not separated for the purposes of magnetic modelling due to its unknown lithology and lack of magnetic response.

Diabase dikes occur throughout the AOI. They are represented by high magnetic anomalies with continuous NNW-SSE strikes. The dikes have a periodic spacing of 500-1,000 m. Dike centerlines were traced and used to define vertically dipping surfaces representing the median plane of each dike. The dikes were assigned a thickness of 75 m based on the magnetic maps.

Kimberlites were divided into several domains based on their magnetic response and interpreted geological history to define four domains: pre-Paleozoic and not remanent, pre-Paleozoic and remanent, post-Paleozoic and not remanent, and post-Paleozoic and remanent. Remanent kimberlites are represented by spot magnetic lows and coincident highs in the analytic signal.

8.3.1. Accounting for Magnetic Remanence

Remanent magnetization or residual magnetism is the permanent magnetism of a rock, resulting from the orientation of the Earth's magnetic field at the time the rock was formed. Most often residual magnetism is negligeable in regard to the current ambient magnetic field thus is assumed to be non-existent by standard inversion algorithms. When remanent magnetization happens to be equal or greater than the strength of the current ambient magnetic field, the shape of magnetic anomalies is altered. Their inversion will produce a model affected by remanence artefacts and exhibiting sub-optimal magnetic feature geometries in the vicinity the remanent anomaly location.

Analysis of the magnetic grids and of the preliminary modelling results highlighted magnetic remanence artefacts associated with some of the kimberlitic intrusions that exhibit reversely polarized magnetic anomalies.

This phenomenon is best described by the anomaly associated with the kimberlitic intrusion just east of the Valentine Township Carbonatite Complex as shown in Figure 8-11. An anomalous magnetic low is observed in the residual anomaly data (a) and the 1VD data but shows as a positive anomaly in the AS data (c) thus confirming the remanent nature of the source of this magnetic anomaly. Without remanence, the anomalies for all three data types show a positive as seen over the carbonatite magnetic high in the carbonatite complex. Similar signatures were identified and mapped through the property.

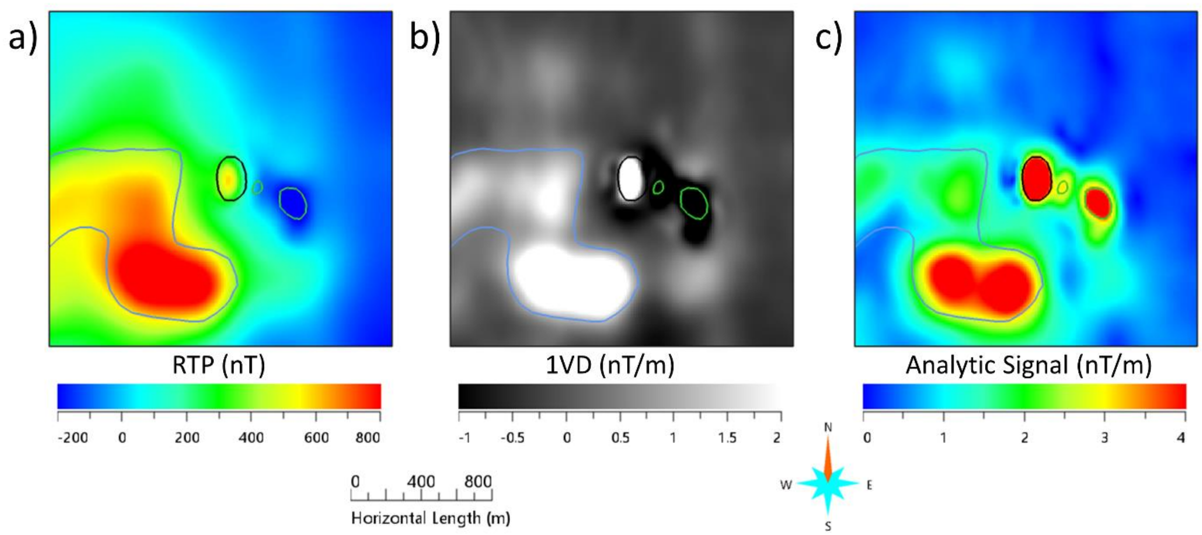

Figure 8-11: Plan view of a) RTP magnetic data, b) 1VD of RTP and c) Analytic Signal of RTP. Lithology outlines; Carbonatite complex in teal blue, kimberlite intrusion in black, remanent kimberlite intrusion in green.

Further investigation consisted in evaluating, through a series of forward models and magnetic remanence inversions, the optimal magnetic remanence parameters consisting of:

- the Koenigsberger ratio that is the proportion of remanent magnetization relative to induced magnetization in natural rocks,
- the remanent magnetization inclination, and
- the remanent magnetization declination.

The estimated magnetic remanence parameters are detailed in Table 8-2 and were explicitly taken into account thorough all subsequent lithology constrained modelling. The effect of explicitly representing remanent bodies greatly improves the magnetic data fit as shown on Figure 8-12 where the forward modeled magnetic response of a kimberlite located to the east of the complex is shown with or without taking its remanence into account

Table 8-2: Estimated magnetic remanence parameters of remanent kimberlitic intrusions.

Koenigsberger ratio (Q)	Remanence inclination	Remanence declination
Q = 2.8	Dec_{Rem} = 180°	Inc_{Rem} = -52°

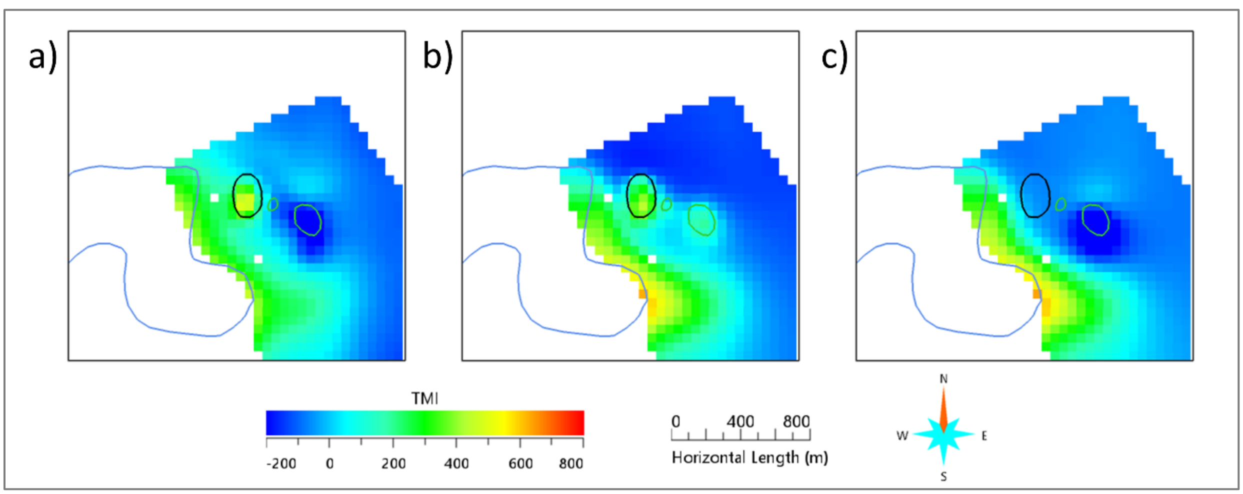

Figure 8-12: Plan view of a) observed magnetic data, and forward modelled magnetic data b) without and c) with magnetic remanence taken into account. Lithology outlines; Carbonatite complex in teal blue, kimberlite intrusion in black, remanent kimberlite intrusion in green.

8.3.2. Physical Property Estimates

Magnetic susceptibility from literature and general estimates were evaluated within the domains established from geological mapping and drill logs and optimized through homogeneous (bulk) property inversion of magnetic data onto the interpreted geological model. The values used for each modelled lithological unit are summarized in Table 8-3.

Table 8-3: Magnetic susceptibility of the modeled geological domains. Units are mSI.

Lithology	Starting Value
Sedimentary cover	0.0
Low magnetic gneiss	1.0
High magnetic gneiss	3.0
Old kimberlitic intrusion	22.0
Old kimberlitic intrusion (remanent)	45.0 (Q=2.8, Dec_{Rem}=180°, Inc_{Rem}=-52°)
Young kimberlitic intrusion	15.0
Young kimberlitic intrusion (remanent)	45.0 (Q=2.8, Dec_{Rem}=180°, Inc_{Rem}=-52°)
Dike	12.0
Carbonatite complex	30.0
Carbonatite part 1	63.0
Carbonatite part 2	64.5
Carbonatite part 3	60.0
Magnetic remanence parameters: Q, Dec_{Rem}, and Inc_{Rem}	

8.3.3. 3D Integrated Model

The SKUA-GOCAD software was used to model geological surfaces and outlines reflecting the geological interpretation. The modelled geological surfaces and outlines were used to divide a 25 x 25 x 25 m grid into regions for each lithology. The modelled lithologies are shown in Figure 8-13 and summarized in Table 8-3.

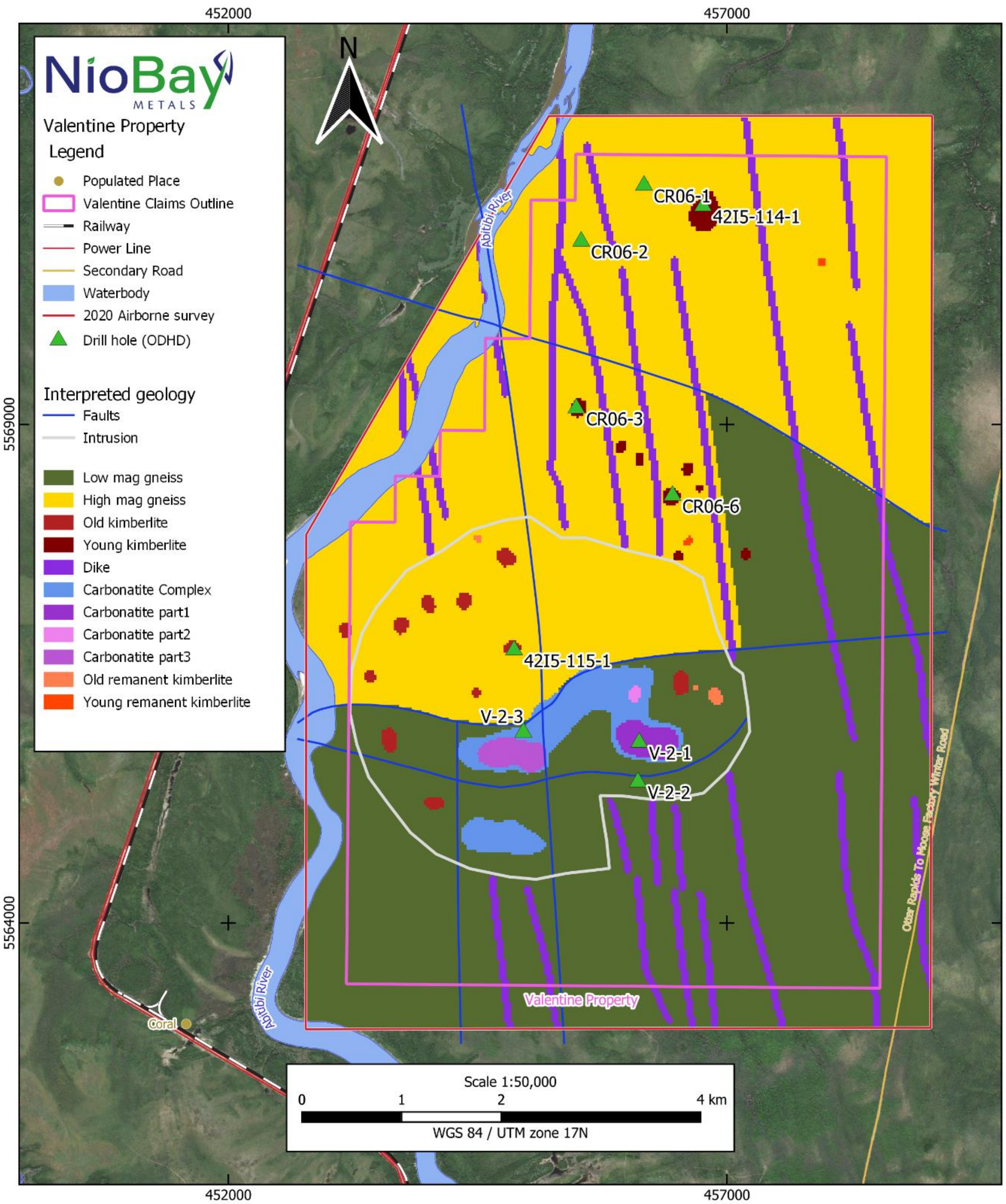

Figure 8-13: Plan view of lithology block model at -87.5 masl of elevation.

8.3.4. Geology-Constrained Magnetic Inversion

At this stage, the geometry of the geological model remained unchanged and only the magnetic susceptibility distribution was updated through the inversion process.

The homogeneous susceptibilities of the starting model were adjusted through a series of homogeneous inversions and interpretation decisions as part of the previously described exploratory modelling process and are summarized in Table 8-3. Upper and lower bounds were kept open to accommodate the larger range of magnetic susceptibilities observed within the modelled domains. The starting susceptibility model, its computed and residual response maps are shown in Figure 8-14, Figure 8-15 and Figure 8-16, respectively. Forward modelling resulted in a RMS misfit of 98.80 nT indicating a poor fit despite the model capturing the main geological trends.

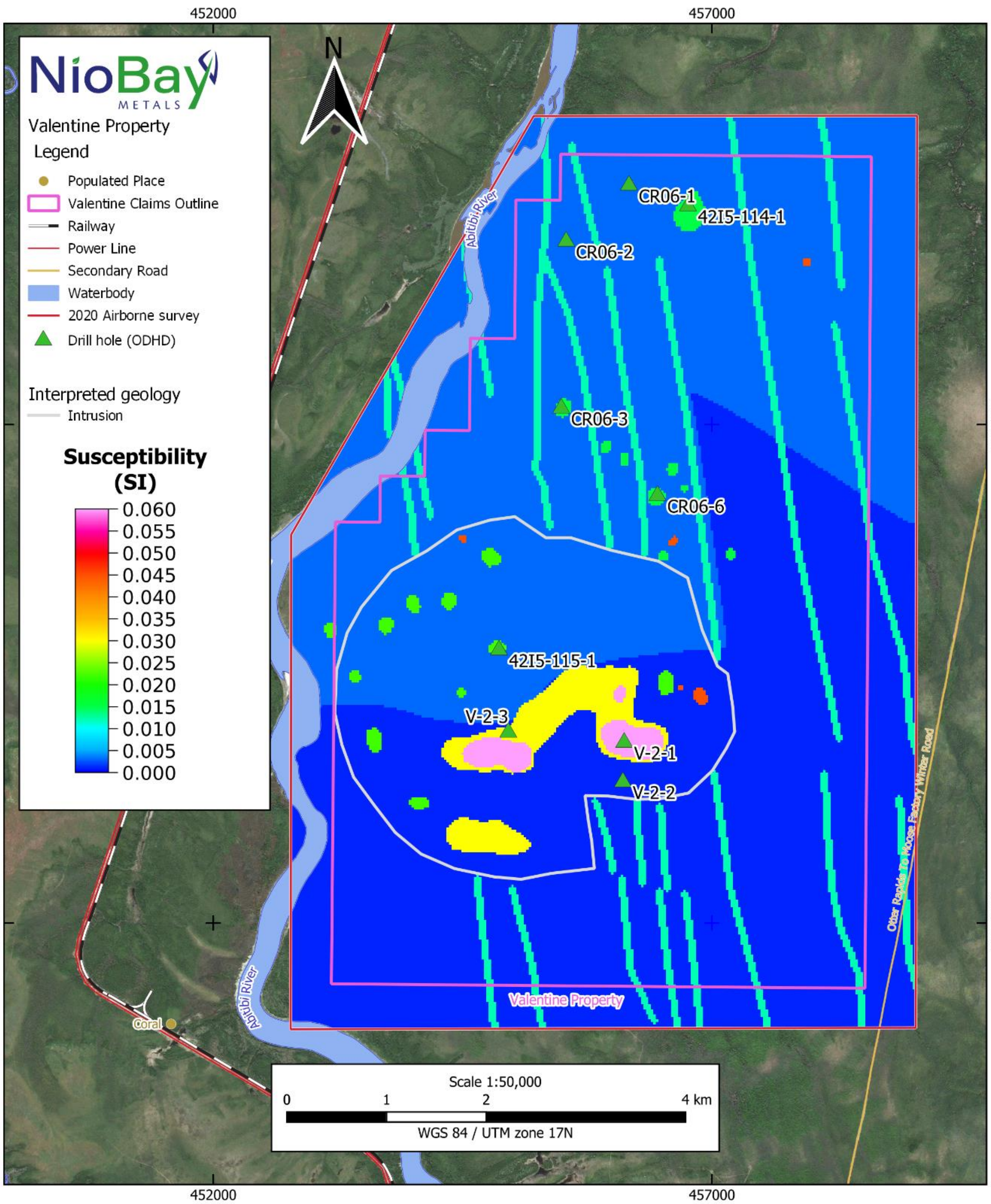

Figure 8-14: Constant elevation slice at -87.5 masl through the initial homogeneous susceptibility model. Survey outline is shown in red.

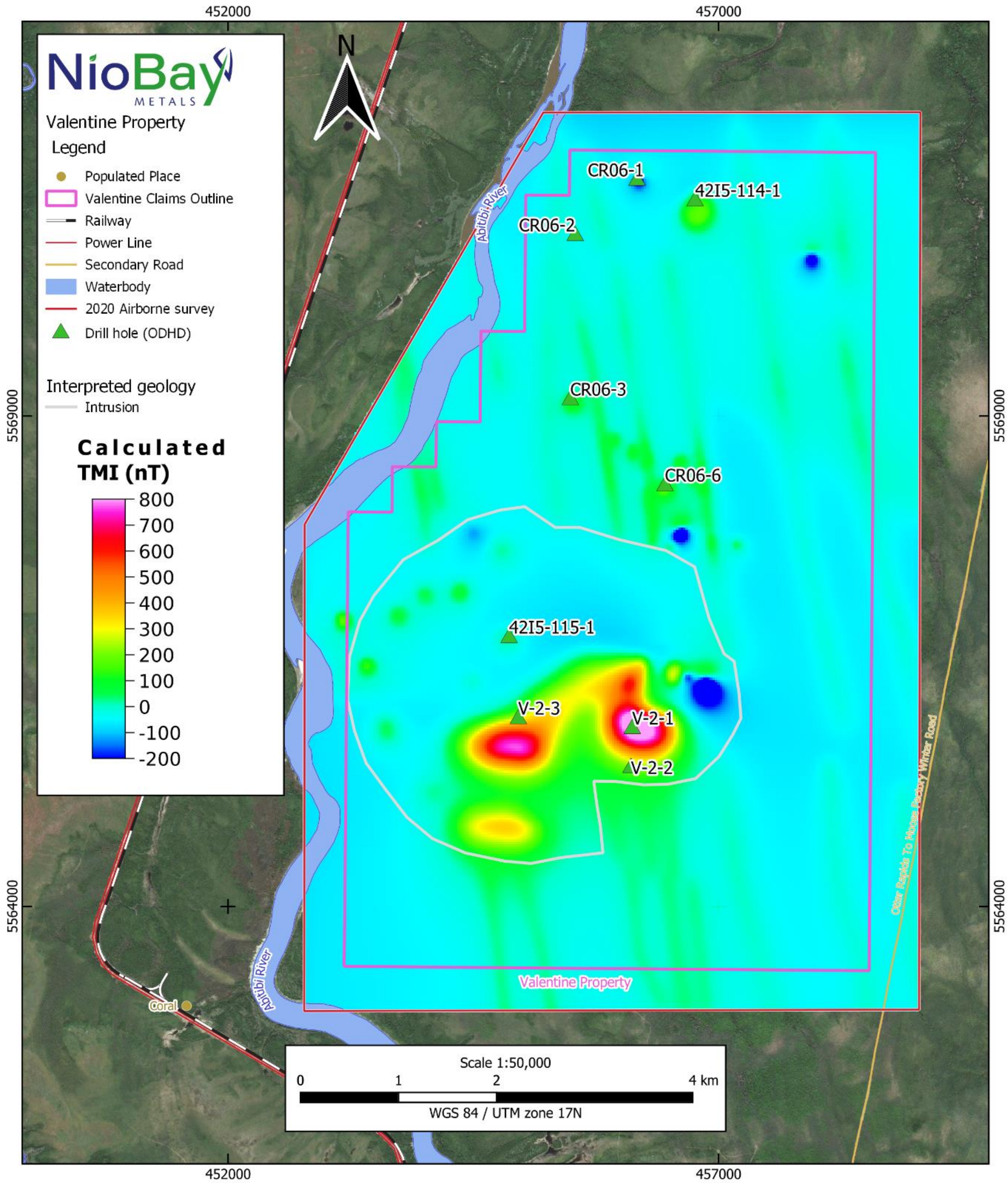

Figure 8-15: Calculated response for starting lithological model. RMS misfit between calculated and observed magnetic response is 98.80 nT.

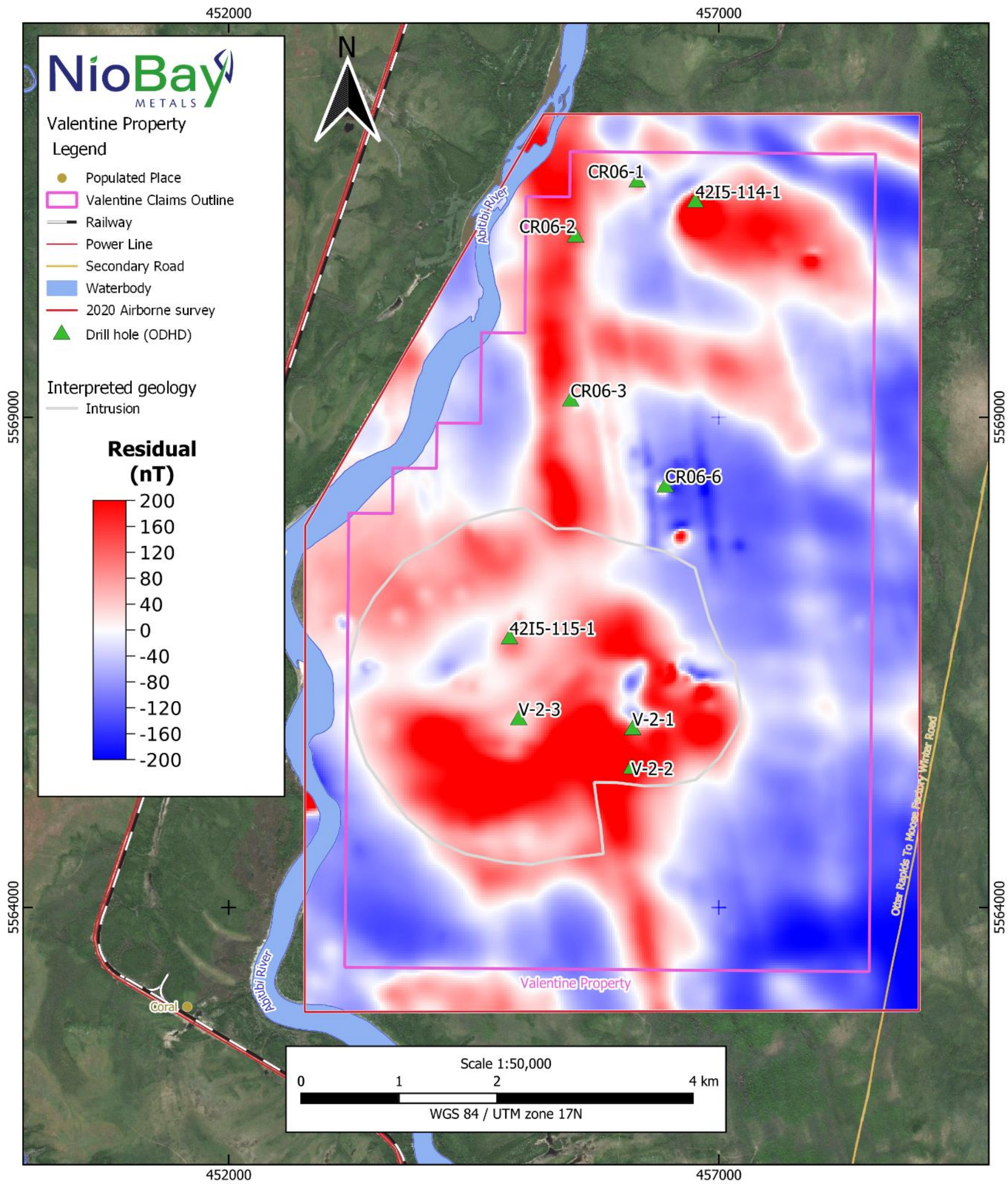

Figure 8-16: Residual response for starting lithological model. RMS misfit between calculated and observed magnetic response is 98.80 nT.

Heterogeneous susceptibilities were then introduced in the model and their 2D or lateral distribution was optimized through an inversion. Due to the significant susceptibility contrasts within the various represented lithological domains and their overlapping susceptibility ranges, their susceptibility bounds were not used to limit changes with the exception of the sedimentary cover that remained fixed. The sedimentary cover domain was kept homogeneous as most of the geophysical contributions to the magnetic data were deemed to be associated with the underlying lithologies, and also to keep the strong susceptibility contrast located at its base.

The inverted susceptibility model, its computed and residual response maps are shown in Figure 8-17, Figure 8-18 and Figure 8-19, respectively. Inversion resulted in a RMS misfit of 7.9 nT indicating of a good fit of the inverted model. The initial magnetic susceptibility model is shown in Figure 8-14 and the inverted model in Figure 8-17.

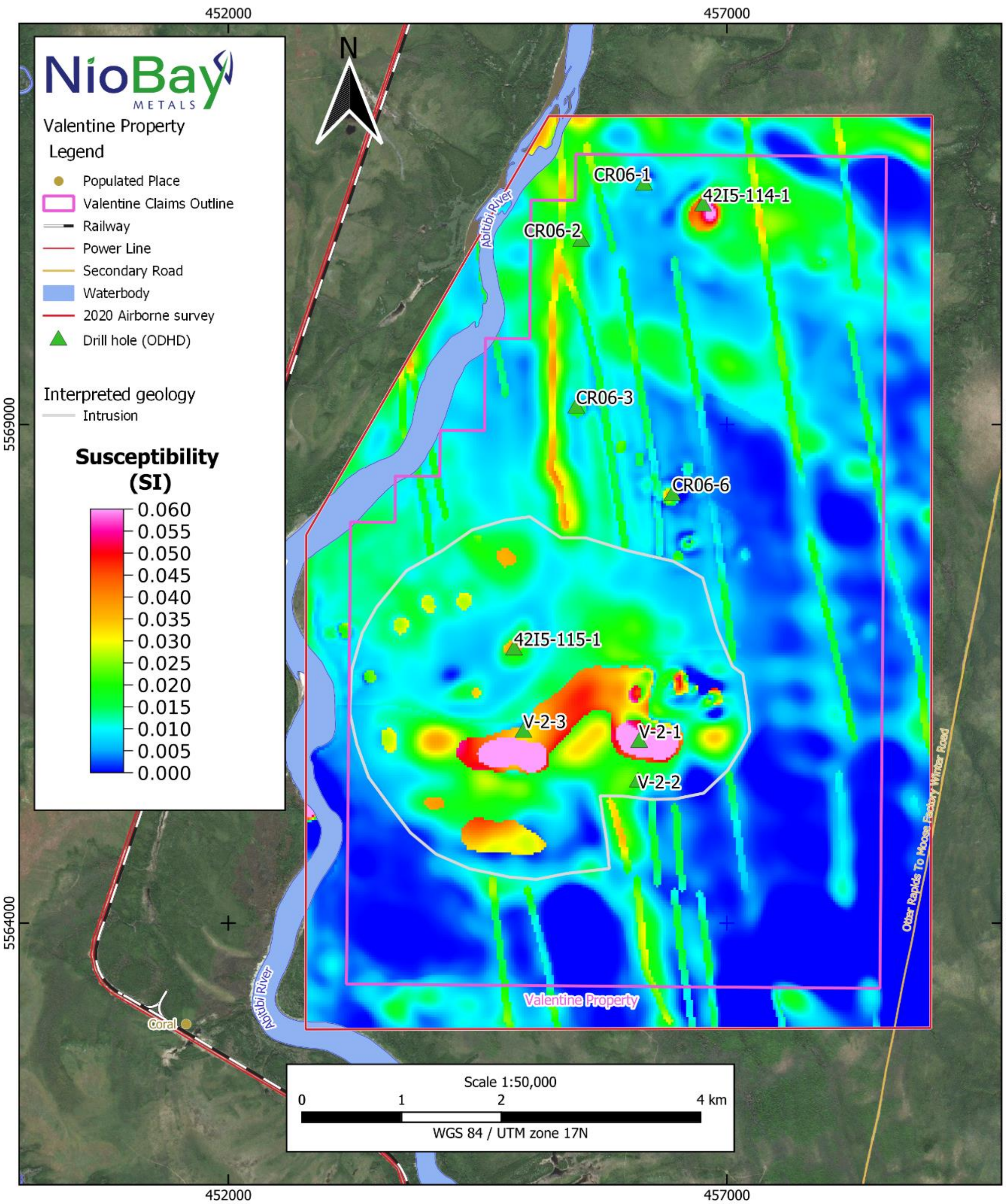

Figure 8-17: Constant elevation slice at -87.5 masl through the inverted heterogeneous susceptibility model. Property outline is shown in red.

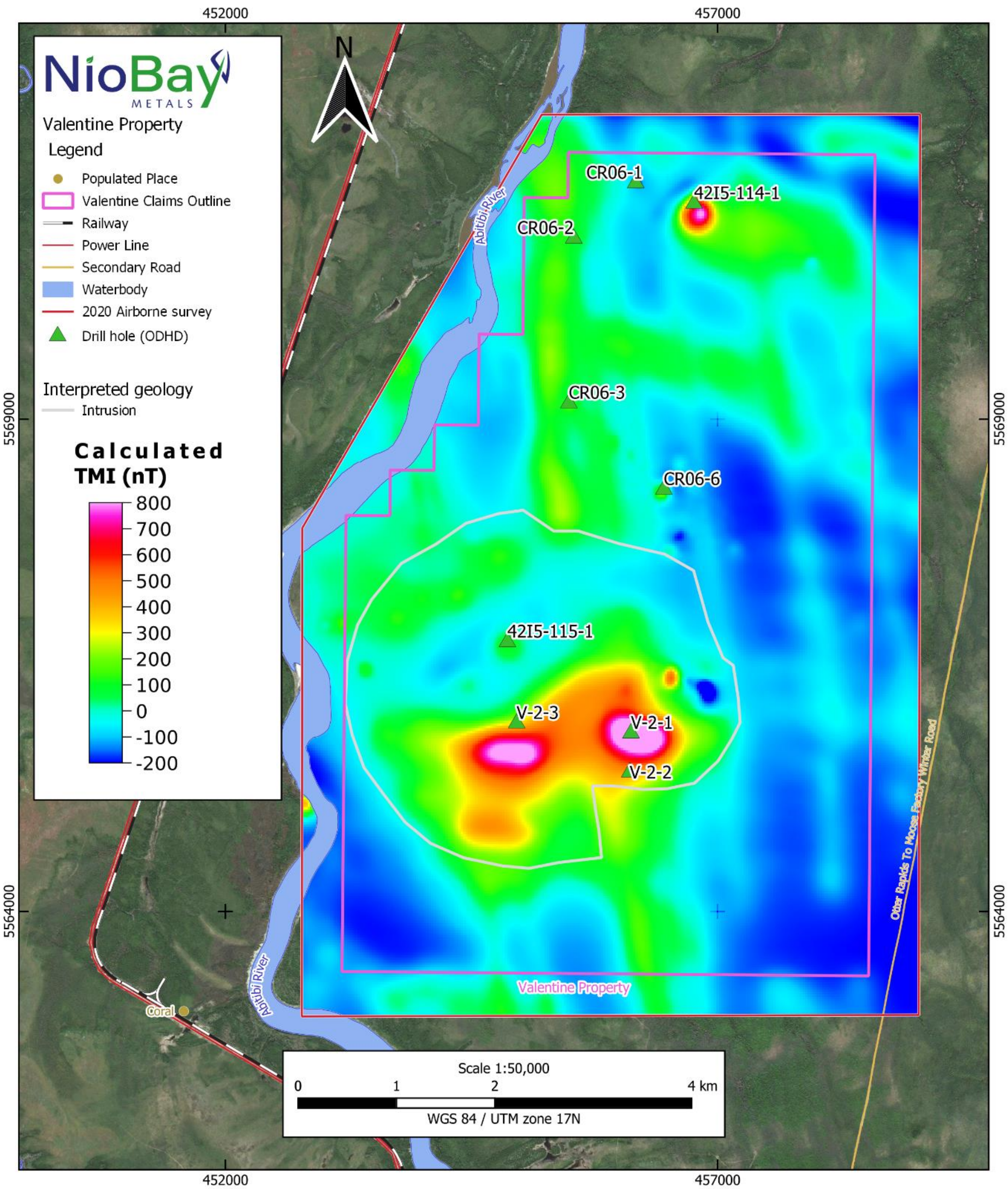

Figure 8-18: Calculated response for inverted lithological model. RMS misfit between calculated and observed magnetic response is 7.9 nT.

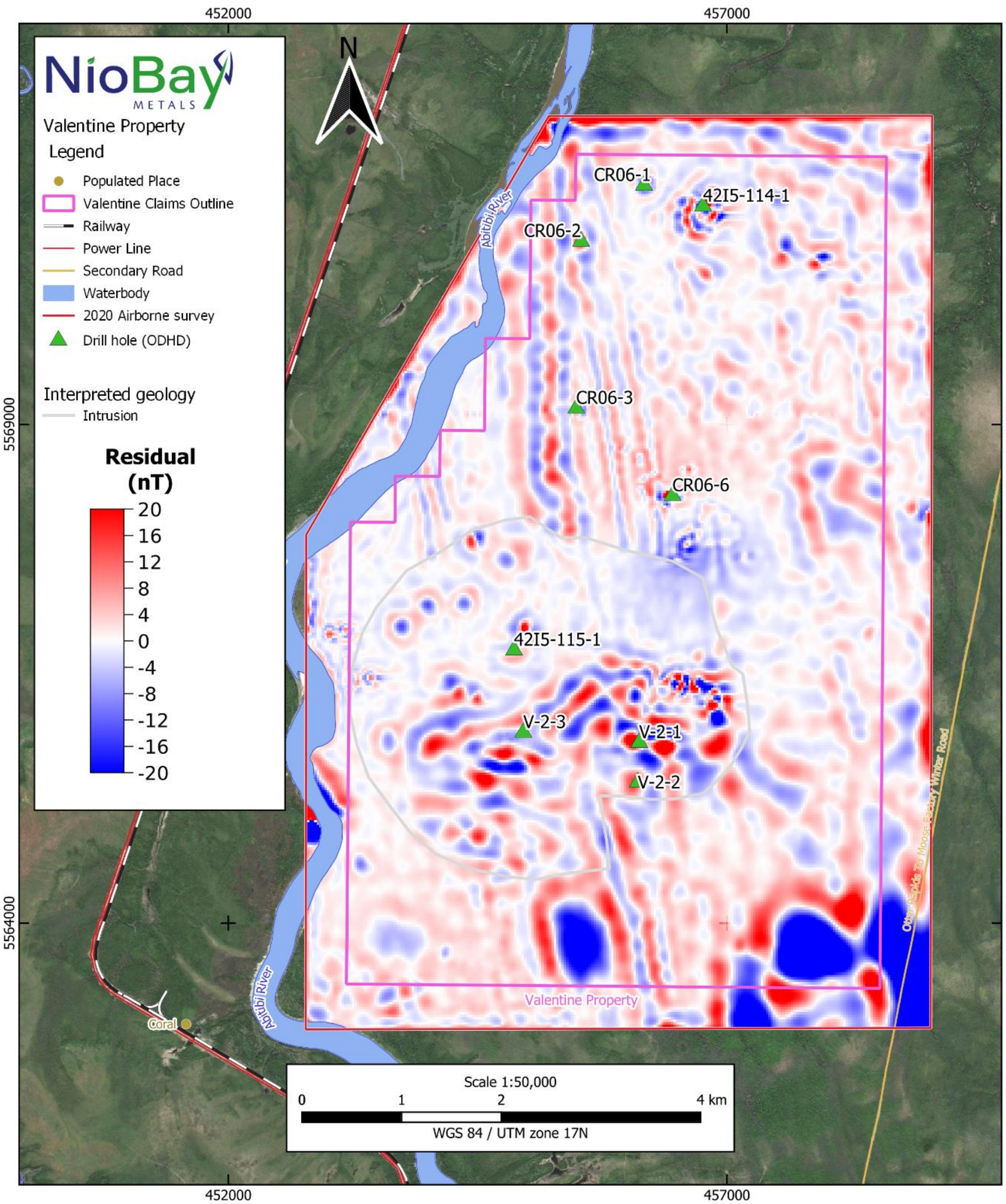

Figure 8-19: Residual response for inverted lithological model. RMS misfit between calculated and observed magnetic response is 7.9 nT.

9.0 Integrated Model Evaluation

A 2D lithological and structural model was constructed based on 2D magnetic data, 3D unconstrained magnetic inversion, and geological mapping for the Valentine project. Furthermore, a 3D geological model was built from a series constrained geophysical models seeking to evaluate relationships between lithology, magnetic susceptibility and magnetic data.

The Valentine Township Carbonatite Complex magnetic anomaly is a singular feature within the Property area. It has a distinctively high, zoned, broad magnetic response, including overprinting of basement diabase dykes. Other magnetic high anomalies occur in the Property but are interpreted to be associated with kimberlites and basement high gneiss domains. They do not share the extensive, distinctively shaped anomaly observed at the Valentine Lake complex. Given the lack of other prospective anomalies, the Valentine Township Carbonatite Complex itself should be considered the priority for further work. For this project, discussion of integrated interpretation will focus on the relationship between magnetic response in the 2D data and 3D heterogenous inversion model and mineralization on the Valentine Property.

9.1. Magnetic anomaly

The Valentine Township Carbonatite Complex magnetic anomaly can be divided into several main domains based on magnetic response.

A relatively low magnetic response extends around the main moderate-high zone for around 1 km. This zone could represent a more extensive intrusive body with relatively low magnetite content, a zone of mixed wallrock and intrusive with a low bulk magnetic response, or a zone of fenitized wallrock.

A moderate to high magnetic domain forms a discrete irregular body within this halo. The domain is an irregular elongated shape approximately 500 m wide and forming a sinuous path around 3 km long, with a long axis oriented EW. Within the moderate to high domain zone, several very high magnetic domains form ovoid EW-oriented bodies. Additional satellite moderately magnetic domains occur to the south, east, and southwest of the main trend.

9.2. Relationship between magnetic response and lithology

Further work is required to characterize the relationship between magnetic response within the carbonatite complex and mineralization, if such a relationship exists. Based on currently available data, the known portion of the Valentine Township Carbonatite Complex is predominantly highly to moderately magnetic. Based on descriptions of thin sections and drill core, no consistent relationship between carbonatite mineralogical phase (silicocarbonatite vs sövite) and magnetic response is expected. This is consistent with descriptions of other carbonatites, where only broad-scale changes in lithology can be consistently mapped or expected to form domains in geophysical data.

The observed magnetic domains within the Valentine Township Carbonatite Complex are due to some combination of changes in magnetite content or phase (i.e.: more or less disseminated magnetite). Changes in magnetite content could be due to primary lithology or alteration. Primary lithological changes could be due to different phases of intrusion or different relative amounts of wallrock to intrusive. Different phases of the intrusion may reflect an earlier silicate-carbonatite phase, with an expected moderate magnetic response, followed by a more strongly magnetic ferrocarbonatite phase. In all core logs at the Valentine Property, significant intervals of fenitized wallrock are logged, and thus the drilled carbonatite may be more like a series of sheets or dykes rather than a single intrusive mass. Increased wallrock content is expected to result in decreased magnetite content and thus magnetic response, due to low primary magnetite content in gneisses and through fenitization and associated magnetite destruction.

9.3. Discussion

The use of magnetic data for exploration targeting at the Valentine Property depends on the lithological explanation of the observed magnetic anomalies. Two main alternatives can be considered:

- magnetic domains reflect the relative amount of carbonatite to wallrock, or
- magnetic domains reflect separate intrusive phases.

In the first model, the different magnetic domains are due to varying amounts of wallrock relative to carbonatite. The main carbonatite intrusion is interpreted to occur as a series of sheets with intervening panels of wallrock, represented by a moderate magnetic anomaly. Within the main concentration of carbonatite, more stock-like bodies with only minor wallrock content occur as magnetic highs. The carbonatite complex is surrounded by a relatively low magnetic anomaly that is due to fenitized wallrock with only minor carbonatite. Because pyrochlore occurs as an accessory mineral within carbonatite, more carbonatite-rich (and thus magnetic) portions of the complex are the main exploration targets. Portions of the model that had high starting susceptibilities and remained high after the heterogenous inversion, as well as areas where susceptibility increased after heterogenous inversion, represent higher concentrations of carbonatite and should be considered for further exploration.

An alternative model is that more magnetic portions of the complex represent different intrusive phases within the complex. The magnetic low halo is either calcite or dolomite carbonatite with low magnetite content, a silicate intrusive phase, or fenitized wallrock. Moderately magnetic areas represent calcite or dolomite carbonatite, and highly magnetic domains represent late ferrocarbonatite intrusions.

At the Fen Carbonatite Complex (see *7.2 Carbonatite Niobium Deposit Type*), Nb mineralization occurs within low or moderately magnetic areas interpreted to have formed during an early phase of intrusion. This relationship is consistent with the expected early crystallization of pyrochlore from carbonatite magmas. In this model, the moderately magnetic portions of the complex, interpreted to represent earlier carbonatite intrusions, would be more prospective. In particular, areas near the contacts of low and moderate magnetic susceptibility domains within the complex may represent the walls of carbonatite intrusions, which could have higher concentrations of pyrochlore. Highly magnetic ferrocarbonatite bodies may be more prospective for REE mineralization than for Nb.

9.4. Targets

Targets were identified based on the 3D heterogenous magnetic susceptibility distribution. Targets were defined based on three criteria: interpreted structures, locations of anomalously high magnetic susceptibility, contacts between high and low susceptibility domains. As discussed above, the Valentine Township Carbonatite Complex is interpreted as a fault-controlled intrusion and the controlling faults may have provided important pathways for fluid ingress and remobilization of mineralization fluids during the coupled intrusion and stress history of the complex. Highly magnetic zones within the complex may represent areas with a higher proportion of carbonatite to wallrock, and are thus considered more prospective. Based on analogous deposits, the internal contacts between high and low susceptibility domains are interpreted to represent internal intrusive contacts that could have provided a locus for concentration of Nb-rich pyrochlore. Together, these three main factors were applied to delineate 7 target areas for further evaluation. The targets are shown in Figure 9-1. Targets were defined based on limited subsurface control and are thus conceptual in nature, but reflect the outcomes of geophysical modelling and evaluation of the integrated geoscience dataset for the project.

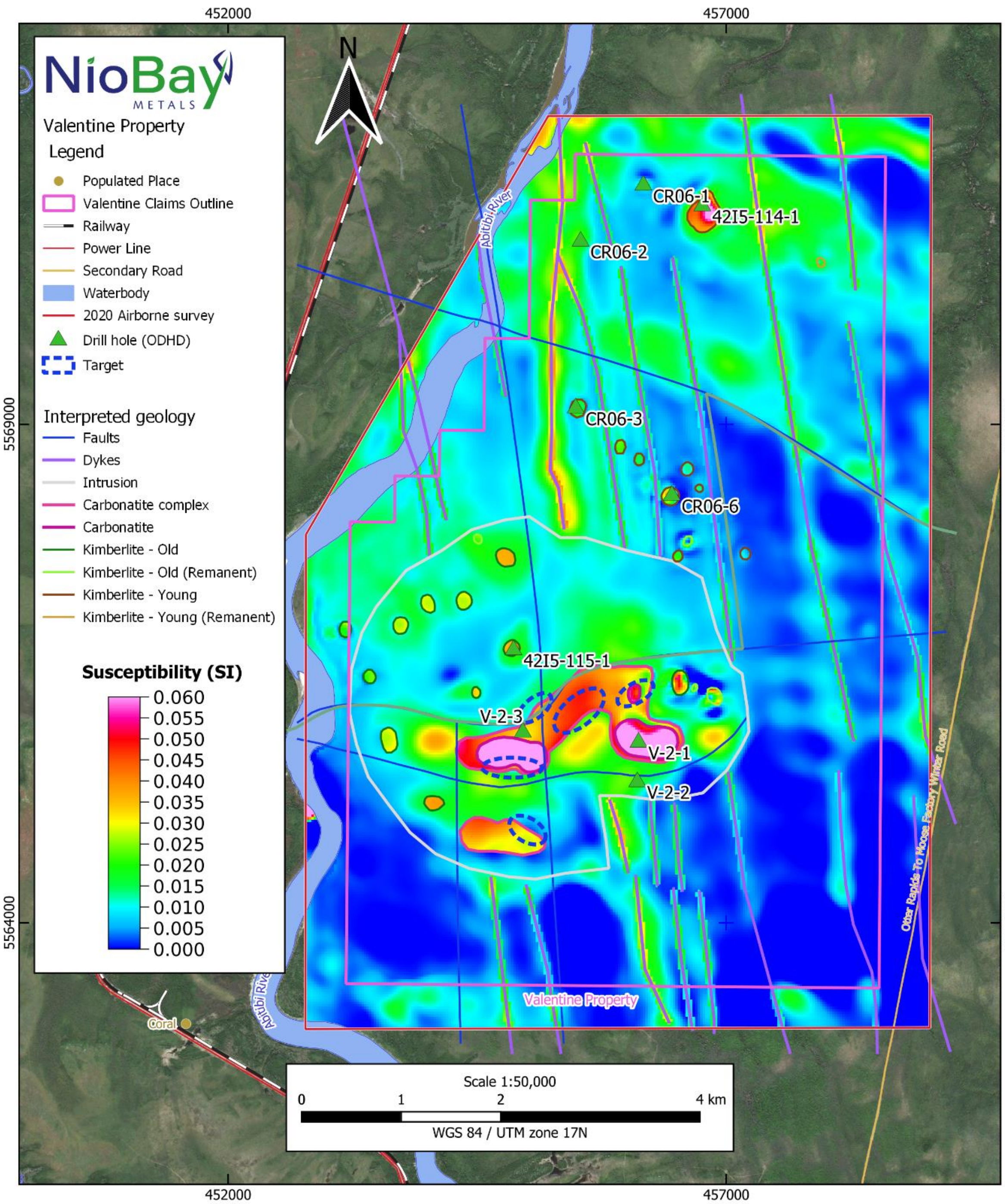

Figure 9-1: Constrained magnetic inversion with interpreted structures and targets defined in this study.

10.0 Conclusion

A 3D lithological and structural model for the Valentine project area was constructed based on available mapping, drilling data, and airborne magnetic surveys. Sedimentary cover thickness was estimated from magnetic data and used to refine the interpretation. The resulting fault and geology model was used to constrain a magnetic inversion that generated magnetic susceptibility distributions within the modelled lithologies. The resulting model provides a robust base for further undercover exploration for pyrochlore mineralization. The 3D heterogenous susceptibility model can be used to target high magnetic domains and contacts between high and low magnetic domains that are interpreted to represent potential Nb mineralization. The integrated interpretation and modelling work successfully established a geologically realistic 3D magnetic susceptibility model that was used to delineate potential target zones for follow up drilling.

11.0 Recommendations

The depth and extents of the Valentine Township Carbonatite Complex are not yet known. There is currently only three drill holes from 1967-1969 on the Carbonatite Complex with only hole V-2-3 intersecting significant Nb mineralization. As the Valentine Township Carbonatite Complex is completely under cover, it is recommended to evaluate the relationship between the magnetic response and the carbonatite to better guide exploration. Further work should consist of deep drill holes seeking to evaluate which of the two alternative models discussed in section 9.3 is more prevalent to better understand the mineralization. Drill core should be assayed for niobium, phosphorus and REE, as the carbonatite is likely to host all three commodities. In order to evaluate the targets delineated in this study, it is recommended that a total of 7 drill holes at 800 m each be drilled at locations detailed in Table 11-1 and shown in Figure 11-1 for a total 5,600 m.

Table 11-1: Proposed drill holes.

Hole No	Easting (m)	Northing (m)	Length (m)	Azimuth (°N)	Dip (°)
ddh_1	455,000	5,565,650	800	0	-50
ddh_2	455,000	5,565,150	800	0	-50
ddh_3	455,000	5,564,700	800	0	-50
ddh_4	454,700	5,565,150	800	0	-50
ddh_5	455,525	5,565,900	800	315	-50
ddh_6	455,775	5,566,060	800	315	-50
ddh_7	455,775	5,566,060	800	55	-50

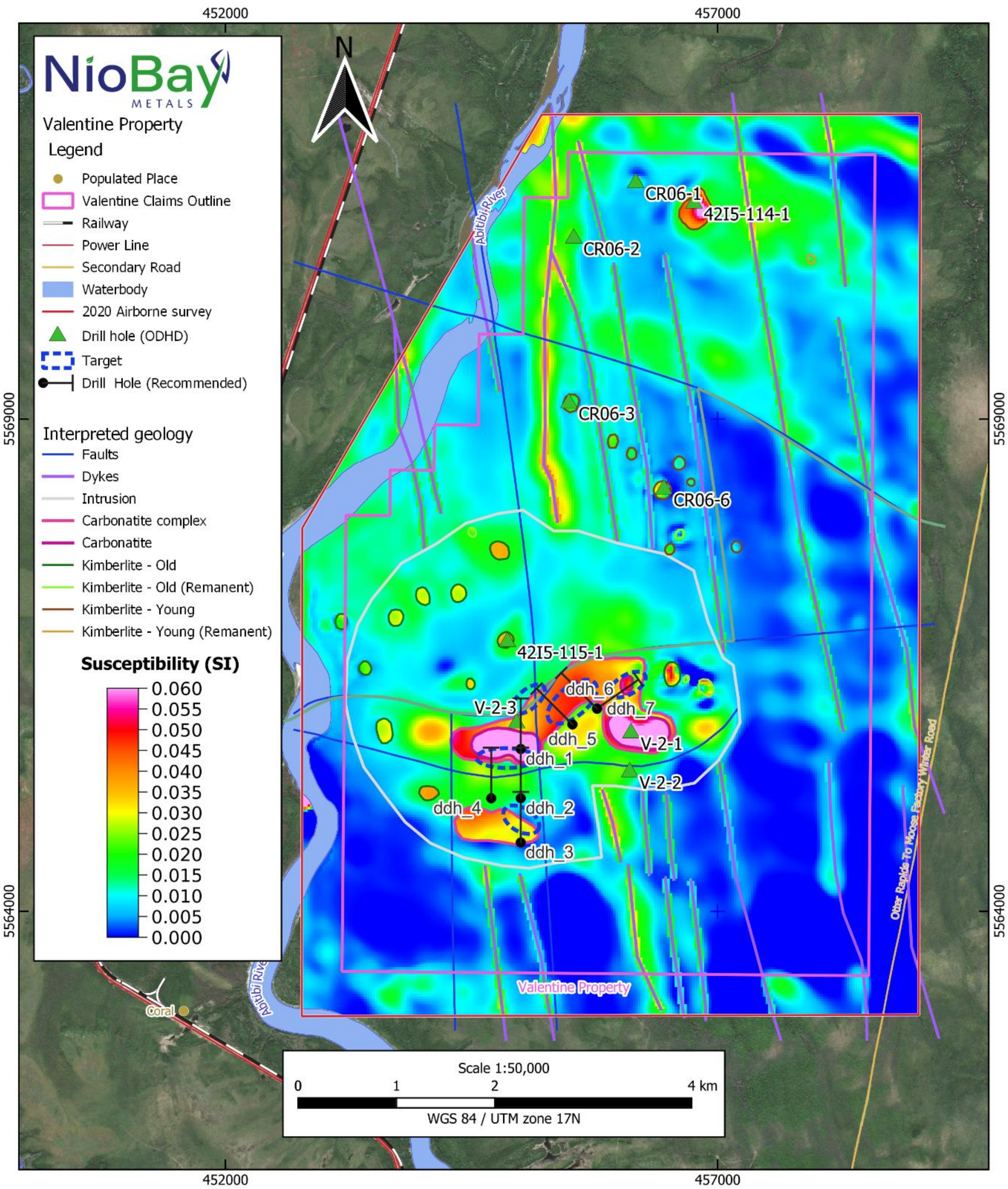

Figure 11-1: Recommend drill holes locations over the constrained magnetic inversion with interpreted structures and targets defined in this study.

11.1. Proposed Budget

It is recommended that 7 drill holes at 800 m each be drilled for a total of 5,600 m. The recommended budget is $1,122,800.00 (Table 11-2).

Table 11-2: Estimated budget for recommended drill program on the Valentine Property.

Item	Unit	No of Unit	Rate	Total
Drilling	m	5600	$150.00	$840,000.00
Mobilization/demobilization drill	task	2	$5,000.00	$10,000.00
Senior geologist -core logger	day	35	$800.00	$28,000.00
Core cutter	day	35	$500.00	$17,500.00
Assays	sample	2240	$70.00	$156,800.00
Truck rental	week	5	$1,000.00	$5,000.00
Meals	day	70	$50.00	$3,500.00
Accommodations	day	70	$120.00	$8,400.00
Project management	day	35	$800.00	$28,000.00
QA/QC of assays	day	18	$800.00	$14,400.00
Write assessment report	day	14	$800	$11,200.00
			Total	**$1,122,800.00**

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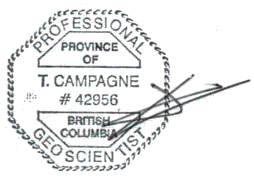
13.0 Statement of Authorship

This Report, titled "3D Geological and Geophysical Interpretation Assessment Report, Valentine Property, Otter Rapids, Northeastern Ontario, Canada", and dated October 28, 2022October 28, 2022, was prepared and signed by the following authors:

I reviewed and approved the Report,



2022-10-28

Thomas Campagne
Senior Geophysicist, P.Geo, M.Sc.
Practice #: 1002908
October 28, 2022
Vancouver, BC

Shaun O’Connor
Senior Geologist, P.Geo, M.Sc.
Upper Tantallon, NS

Appendix 1: Certificate of Qualifications

Thomas Campagne, M.Sc, P.Geo

To accompany the report titled: **3D Geological and Geophysical Interpretation Assessment Report, Valentine Property, Otter Rapids, Northeastern Ontario, Canada**, dated effective October 28, 2022 (the Assessment Report).

I, Thomas Campagne, M.Sc, P.Geo., residing in Vancouver, British Columbia, Canada, do hereby certify that:

1) I am a Geoscientist for Mira Geoscience Limited, with an office at Suite 880, 409 Granville Street, Vancouver, British Columbia, V6C 1T2 Canada;
2) I graduated with a bachelor's degree in Earth, Universe and Environmental Sciences from the University of Strasbourg, France in 2006. I received a Master's degree in Geophysics from the School and Observatory of Earth Sciences (EOST), Strasbourg, France in 2008. I have practiced my profession continuously since 2008. I have fourteen years of experience working as a geophysicist in the natural resource exploration industry.
3) I am a Professional Geoscientist registered with Engineers and Geoscientists BC (EGBC), registration number 42956. EGBC has a defined and enforceable Code of Ethics which Thomas Campagne agrees to abide by.
4) I have personally reviewed the Assessment Report and approve of its contents.
5) I am independent of NioBay Metals Inc. holding no shares or other beneficial interest.
6) As of the effective date of the Assessment Report, to the best of my knowledge, information and belief, the Assessment Report contains all the scientific and technical information that is required to be disclosed to ensure the Assessment Report is not misleading.

Vancouver, B.C. Canada
October 28, 2022

(Signed and Sealed) "Thomas Campagne"

2022-10-28

Thomas Campagne, M.Sc., P. Geo.
Senior Geophysicist
Mira Geoscience Limited

Shaun O'Connor, M.Sc, P.Geo

To accompany the report titled: **3D Geological and Geophysical Interpretation Assessment Report, Valentine Property, Otter Rapids, Northeastern Ontario, Canada**, dated effective October 28, 2022 (the Assessment Report).

I, Shaun O'Connor, P.Geo., M.Sc, residing in Upper Tantallon, Nova Scotia, Canada, do hereby certify that:

1) I am a Geoscientist for Mira Geoscience Limited, with an office at Suite 880, 409 Granville Street, Vancouver, British Columbia, V6C 1T2 Canada;
2) I graduated with a bachelor's degree in Earth Sciences from Carleton University, Ottawa, ON in 2010. I completed a master's degree in geology at Queen's University, Kingston, ON in 2015. I have practiced my profession continuously since graduation and have 10 years of experience in mineral exploration and geological modelling.
3) I am a Professional Geoscientist registered with Geoscientists Nova Scotia registration number 261. The Association of Professional Geoscientists of Nova Scotia has a defined and enforceable Code of Ethics which I have agreed to abide by.
4) I have personally reviewed the Assessment Report and approve of its contents.
5) I am independent of NioBay Metals Inc. holding no shares or other beneficial interest.
6) As of the effective date of the Assessment Report, to the best of my knowledge, information and belief, the Assessment Report contains all the scientific and technical information that is required to be disclosed to ensure the Assessment Report is not misleading.

Upper Tantallon, N.S. Canada

THE ASSOCIATION OF PROFESSIONAL GEOSCIENTISTS OF NOVA SCOTIA est 1997 0261

Signature:

Date: 10/28/22

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Senior Geologist
Mira Geoscience Limited

Appendix 2: NioBay Metals Inc.'s cell claims for the Valentine Property

Table A2-1: Property claim table.

#	TOWNSHIP	TENURE ID	CELL ID	TENURE TYPE	ANNIVERSARY DATE	WORK REQUIRED
1	VALENTINE	538494	42I04J079	SCMC	2023-01-08	$ 400.00
2	VALENTINE	538495	42I04I022	SCMC	2023-01-08	$ 400.00
3	VALENTINE	538496	42I04I063	SCMC	2023-01-08	$ 400.00
4	VALENTINE	538497	42I04I043	SCMC	2023-01-08	$ 400.00
5	PITT-VALENTINE	538498	42I04I084	SCMC	2023-01-08	$ 400.00
6	PITT-VALENTINE	538499	42I04J099	SCMC	2023-01-08	$ 400.00
7	VALENTINE	538500	42I04J059	SCMC	2023-01-08	$ 400.00
8	VALENTINE	538501	42I04J060	SCMC	2023-01-08	$ 400.00
9	VALENTINE	538502	42I04J040	SCMC	2023-01-08	$ 400.00
10	VALENTINE	538503	42I04I041	SCMC	2023-01-08	$ 400.00
11	VALENTINE	538504	42I04J080	SCMC	2023-01-08	$ 400.00
12	VALENTINE	538505	42I04J078	SCMC	2023-01-08	$ 400.00
13	VALENTINE	538506	42I04J058	SCMC	2023-01-08	$ 400.00
14	VALENTINE	538507	42I04J038	SCMC	2023-01-08	$ 400.00
15	VALENTINE	538508	42I04J039	SCMC	2023-01-08	$ 400.00
16	PITT-VALENTINE	538509	42I04J100	SCMC	2023-01-08	$ 400.00
17	PITT-VALENTINE	538510	42I04I081	SCMC	2023-01-08	$ 400.00
18	VALENTINE	538511	42I04I062	SCMC	2023-01-08	$ 400.00
19	PITT-VALENTINE	538512	42I04I083	SCMC	2023-01-08	$ 400.00
20	VALENTINE	538513	42I04I061	SCMC	2023-01-08	$ 400.00
21	VALENTINE	538514	42I04I023	SCMC	2023-01-08	$ 400.00
22	PITT-VALENTINE	538515	42I04J098	SCMC	2023-01-08	$ 400.00
23	VALENTINE	538516	42I04I024	SCMC	2023-01-08	$ 400.00
24	VALENTINE	538517	42I04I021	SCMC	2023-01-08	$ 400.00
25	PITT-VALENTINE	538518	42I04I082	SCMC	2023-01-08	$ 400.00
26	VALENTINE	538519	42I04I042	SCMC	2023-01-08	$ 400.00
27	VALENTINE	538520	42I04I064	SCMC	2023-01-08	$ 400.00
28	VALENTINE	538521	42I04I044	SCMC	2023-01-08	$ 400.00
29	VALENTINE	538522	42I04I045	SCMC	2023-01-08	$ 400.00
30	VALENTINE	538523	42I04I065	SCMC	2023-01-08	$ 400.00
31	PITT-VALENTINE	538524	42I04I085	SCMC	2023-01-08	$ 400.00
32	VALENTINE	538525	42I04I025	SCMC	2023-01-08	$ 400.00
33	PITT	572779	42I04I121	SCMC	2023-01-30	$ 400.00
34	PITT	572780	42I04I103	SCMC	2023-01-30	$ 400.00
35	PITT	572781	42I04I127	SCMC	2023-01-30	$ 400.00
36	PITT	572782	42I04J119	SCMC	2023-01-30	$ 400.00
37	PITT	572783	42I04I105	SCMC	2023-01-30	$ 400.00

#	TOWNSHIP	TENURE ID	CELL ID	TENURE TYPE	ANNIVERSARY DATE	WORK REQUIRED
38	PITT	572784	42I04I102	SCMC	2023-01-30	$ 400.00
39	PITT	572785	42I04I123	SCMC	2023-01-30	$ 400.00
40	PITT	572786	42I04I104	SCMC	2023-01-30	$ 400.00
41	PITT	572787	42I04I125	SCMC	2023-01-30	$ 400.00
42	PITT	572788	42I04I106	SCMC	2023-01-30	$ 400.00
43	PITT	572789	42I04J137	SCMC	2023-01-30	$ 400.00
44	PITT	572790	42I04J139	SCMC	2023-01-30	$ 400.00
45	PITT	572791	42I04J140	SCMC	2023-01-30	$ 400.00
46	PITT	572792	42I04I101	SCMC	2023-01-30	$ 400.00
47	PITT	572793	42I04J116	SCMC	2023-01-30	$ 400.00
48	PITT	572794	42I04I126	SCMC	2023-01-30	$ 400.00
49	PITT	572795	42I04I107	SCMC	2023-01-30	$ 400.00
50	PITT	572796	42I04J136	SCMC	2023-01-30	$ 400.00
51	PITT	572797	42I04J117	SCMC	2023-01-30	$ 400.00
52	PITT	572798	42I04J138	SCMC	2023-01-30	$ 400.00
53	PITT	572799	42I04J118	SCMC	2023-01-30	$ 400.00
54	PITT	572800	42I04I122	SCMC	2023-01-30	$ 400.00
55	PITT	572801	42I04I124	SCMC	2023-01-30	$ 400.00
56	PITT	572802	42I04J120	SCMC	2023-01-30	$ 400.00
57	VALENTINE	572803	42I04J057	SCMC	2023-01-30	$ 400.00
58	PITT-VALENTINE	572804	42I04J096	SCMC	2023-01-30	$ 400.00
59	PITT-VALENTINE	572805	42I04J097	SCMC	2023-01-30	$ 400.00
60	VALENTINE	572806	42I04J076	SCMC	2023-01-30	$ 400.00
61	VALENTINE	572807	42I04J056	SCMC	2023-01-30	$ 400.00
62	VALENTINE	572808	42I04J036	SCMC	2023-01-30	$ 400.00
63	VALENTINE	572809	42I04J037	SCMC	2023-01-30	$ 400.00
64	VALENTINE	572810	42I04J077	SCMC	2023-01-30	$ 400.00
65	VALENTINE	572811	42I04I046	SCMC	2023-01-30	$ 400.00
66	VALENTINE	572812	42I04I047	SCMC	2023-01-30	$ 400.00
67	PITT-VALENTINE	572813	42I04I086	SCMC	2023-01-30	$ 400.00
68	VALENTINE	572814	42I04I066	SCMC	2023-01-30	$ 400.00
69	PITT-VALENTINE	572815	42I04I087	SCMC	2023-01-30	$ 400.00
70	VALENTINE	572816	42I04I067	SCMC	2023-01-30	$ 400.00
71	VALENTINE	572817	42I04I027	SCMC	2023-01-30	$ 400.00
72	VALENTINE	572818	42I04I026	SCMC	2023-01-30	$ 400.00
73	VALENTINE	572819	42I04I001	SCMC	2023-01-30	$ 400.00
74	VALENTINE	572820	42I04J018	SCMC	2023-01-30	$ 400.00
75	VALENTINE	572821	42I04J020	SCMC	2023-01-30	$ 400.00
76	VALENTINE	572822	42I04I004	SCMC	2023-01-30	$ 400.00
77	VALENTINE	572823	42I04I005	SCMC	2023-01-30	$ 400.00
78	VALENTINE	572824	42I04J017	SCMC	2023-01-30	$ 400.00
79	VALENTINE	572825	42I04J019	SCMC	2023-01-30	$ 400.00

#	TOWNSHIP	TENURE ID	CELL ID	TENURE TYPE	ANNIVERSARY DATE	WORK REQUIRED
80	VALENTINE	572826	42I04I003	SCMC	2023-01-30	$ 400.00
81	VALENTINE	572827	42I04J016	SCMC	2023-01-30	$ 400.00
82	VALENTINE	572828	42I04I002	SCMC	2023-01-30	$ 400.00
83	VALENTINE	572829	42I04I007	SCMC	2023-01-30	$ 400.00
84	VALENTINE	572830	42I04I006	SCMC	2023-01-30	$ 400.00
85	VALENTINE	572831	42I05B396	SCMC	2023-01-30	$ 400.00
86	VALENTINE	572832	42I05A384	SCMC	2023-01-30	$ 400.00
87	VALENTINE	572833	42I05A386	SCMC	2023-01-30	$ 400.00
88	VALENTINE	572834	42I05B397	SCMC	2023-01-30	$ 400.00
89	VALENTINE	572835	42I05A382	SCMC	2023-01-30	$ 400.00
90	VALENTINE	572836	42I05A385	SCMC	2023-01-30	$ 400.00
91	VALENTINE	572837	42I05B398	SCMC	2023-01-30	$ 400.00
92	VALENTINE	572838	42I05B400	SCMC	2023-01-30	$ 400.00
93	VALENTINE	572839	42I05A383	SCMC	2023-01-30	$ 400.00
94	VALENTINE	572840	42I05B399	SCMC	2023-01-30	$ 400.00
95	VALENTINE	572841	42I05A381	SCMC	2023-01-30	$ 400.00
96	VALENTINE	572842	42I05A387	SCMC	2023-01-30	$ 400.00
97	VALENTINE	572843	42I05B357	SCMC	2023-01-30	$ 400.00
98	VALENTINE	572844	42I05B358	SCMC	2023-01-30	$ 400.00
99	VALENTINE	572845	42I05B379	SCMC	2023-01-30	$ 400.00
100	VALENTINE	572846	42I05A363	SCMC	2023-01-30	$ 400.00
101	VALENTINE	572847	42I05A364	SCMC	2023-01-30	$ 400.00
102	VALENTINE	572848	42I05A344	SCMC	2023-01-30	$ 400.00
103	VALENTINE	572849	42I05A367	SCMC	2023-01-30	$ 400.00
104	VALENTINE	572850	42I05B359	SCMC	2023-01-30	$ 400.00
105	VALENTINE	572851	42I05A341	SCMC	2023-01-30	$ 400.00
106	VALENTINE	572852	42I05A346	SCMC	2023-01-30	$ 400.00
107	VALENTINE	572853	42I05B376	SCMC	2023-01-30	$ 400.00
108	VALENTINE	572854	42I05B360	SCMC	2023-01-30	$ 400.00
109	VALENTINE	572855	42I05A361	SCMC	2023-01-30	$ 400.00
110	VALENTINE	572856	42I05A365	SCMC	2023-01-30	$ 400.00
111	VALENTINE	572857	42I05A347	SCMC	2023-01-30	$ 400.00
112	VALENTINE	572858	42I05A342	SCMC	2023-01-30	$ 400.00
113	VALENTINE	572859	42I05A366	SCMC	2023-01-30	$ 400.00
114	VALENTINE	572860	42I05B356	SCMC	2023-01-30	$ 400.00
115	VALENTINE	572861	42I05B378	SCMC	2023-01-30	$ 400.00
116	VALENTINE	572862	42I05A362	SCMC	2023-01-30	$ 400.00
117	VALENTINE	572863	42I05A343	SCMC	2023-01-30	$ 400.00
118	VALENTINE	572864	42I05A345	SCMC	2023-01-30	$ 400.00
119	VALENTINE	572865	42I05B377	SCMC	2023-01-30	$ 400.00
120	VALENTINE	572866	42I05B380	SCMC	2023-01-30	$ 400.00
121	VALENTINE	572867	42I05A327	SCMC	2023-01-30	$ 400.00

#	TOWNSHIP	TENURE ID	CELL ID	TENURE TYPE	ANNIVERSARY DATE	WORK REQUIRED
122	VALENTINE	572868	42I05A324	SCMC	2023-01-30	$ 400.00
123	VALENTINE	572869	42I05B337	SCMC	2023-01-30	$ 400.00
124	VALENTINE	572870	42I05B339	SCMC	2023-01-30	$ 400.00
125	VALENTINE	572871	42I05A321	SCMC	2023-01-30	$ 400.00
126	VALENTINE	572872	42I05A323	SCMC	2023-01-30	$ 400.00
127	VALENTINE	572873	42I05A325	SCMC	2023-01-30	$ 400.00
128	VALENTINE	572874	42I05A326	SCMC	2023-01-30	$ 400.00
129	VALENTINE	572875	42I05B338	SCMC	2023-01-30	$ 400.00
130	VALENTINE	572876	42I05A322	SCMC	2023-01-30	$ 400.00
131	VALENTINE	572877	42I05B340	SCMC	2023-01-30	$ 400.00
132	VALENTINE	572878	42I05B318	SCMC	2023-01-30	$ 400.00
133	VALENTINE	572879	42I05B320	SCMC	2023-01-30	$ 400.00
134	VALENTINE	572880	42I05A301	SCMC	2023-01-30	$ 400.00
135	VALENTINE	572881	42I05A305	SCMC	2023-01-30	$ 400.00
136	VALENTINE	572882	42I05A304	SCMC	2023-01-30	$ 400.00
137	VALENTINE	572883	42I05A303	SCMC	2023-01-30	$ 400.00
138	VALENTINE	572884	42I05A306	SCMC	2023-01-30	$ 400.00
139	VALENTINE	572885	42I05A307	SCMC	2023-01-30	$ 400.00
140	VALENTINE	572886	42I05B319	SCMC	2023-01-30	$ 400.00
141	VALENTINE	572887	42I05A302	SCMC	2023-01-30	$ 400.00
142	VALENTINE	572888	42I05B279	SCMC	2023-01-30	$ 400.00
143	VALENTINE	572889	42I05A261	SCMC	2023-01-30	$ 400.00
144	VALENTINE	572890	42I05A263	SCMC	2023-01-30	$ 400.00
145	VALENTINE	572891	42I05A286	SCMC	2023-01-30	$ 400.00
146	VALENTINE	572892	42I05A267	SCMC	2023-01-30	$ 400.00
147	VALENTINE	572893	42I05A262	SCMC	2023-01-30	$ 400.00
148	VALENTINE	572894	42I05A284	SCMC	2023-01-30	$ 400.00
149	VALENTINE	572895	42I05A264	SCMC	2023-01-30	$ 400.00
150	VALENTINE	572896	42I05B299	SCMC	2023-01-30	$ 400.00
151	VALENTINE	572897	42I05B300	SCMC	2023-01-30	$ 400.00
152	VALENTINE	572898	42I05A282	SCMC	2023-01-30	$ 400.00
153	VALENTINE	572899	42I05B280	SCMC	2023-01-30	$ 400.00
154	VALENTINE	572900	42I05A285	SCMC	2023-01-30	$ 400.00
155	VALENTINE	572901	42I05A287	SCMC	2023-01-30	$ 400.00
156	VALENTINE	572902	42I05A266	SCMC	2023-01-30	$ 400.00
157	VALENTINE	572903	42I05A281	SCMC	2023-01-30	$ 400.00
158	VALENTINE	572904	42I05A283	SCMC	2023-01-30	$ 400.00
159	VALENTINE	572905	42I05A265	SCMC	2023-01-30	$ 400.00
160	VALENTINE	572906	42I05A221	SCMC	2023-01-30	$ 400.00
161	VALENTINE	572907	42I05A242	SCMC	2023-01-30	$ 400.00
162	VALENTINE	572908	42I05A223	SCMC	2023-01-30	$ 400.00
163	VALENTINE	572909	42I05B260	SCMC	2023-01-30	$ 400.00

#	TOWNSHIP	TENURE ID	CELL ID	TENURE TYPE	ANNIVERSARY DATE	WORK REQUIRED
164	VALENTINE	572910	42I05A222	SCMC	2023-01-30	$ 400.00
165	VALENTINE	572911	42I05A244	SCMC	2023-01-30	$ 400.00
166	VALENTINE	572912	42I05A246	SCMC	2023-01-30	$ 400.00
167	VALENTINE	572913	42I05A247	SCMC	2023-01-30	$ 400.00
168	VALENTINE	572914	42I05A243	SCMC	2023-01-30	$ 400.00
169	VALENTINE	572915	42I05A225	SCMC	2023-01-30	$ 400.00
170	VALENTINE	572916	42I05B240	SCMC	2023-01-30	$ 400.00
171	VALENTINE	572917	42I05A224	SCMC	2023-01-30	$ 400.00
172	VALENTINE	572918	42I05A226	SCMC	2023-01-30	$ 400.00
173	VALENTINE	572919	42I05A245	SCMC	2023-01-30	$ 400.00
174	VALENTINE	572920	42I05A241	SCMC	2023-01-30	$ 400.00
175	VALENTINE	572921	42I05A227	SCMC	2023-01-30	$ 400.00
176	VALENTINE	572922	42I05B220	SCMC	2023-01-30	$ 400.00
177	VALENTINE	572923	42I05A202	SCMC	2023-01-30	$ 400.00
178	VALENTINE	572924	42I05A205	SCMC	2023-01-30	$ 400.00
179	VALENTINE	572925	42I05A206	SCMC	2023-01-30	$ 400.00
180	VALENTINE	572926	42I05A204	SCMC	2023-01-30	$ 400.00
181	VALENTINE	572927	42I05A203	SCMC	2023-01-30	$ 400.00
182	VALENTINE	572928	42I05A201	SCMC	2023-01-30	$ 400.00
183	VALENTINE	572929	42I05A183	SCMC	2023-01-30	$ 400.00
184	VALENTINE	572930	42I05A186	SCMC	2023-01-30	$ 400.00
185	VALENTINE	572931	42I05A187	SCMC	2023-01-30	$ 400.00
186	VALENTINE	572932	42I05A182	SCMC	2023-01-30	$ 400.00
187	VALENTINE	572933	42I05A185	SCMC	2023-01-30	$ 400.00
188	VALENTINE	572934	42I05A181	SCMC	2023-01-30	$ 400.00
189	VALENTINE	572935	42I05A184	SCMC	2023-01-30	$ 400.00
190	VALENTINE	572936	42I05A207	SCMC	2023-01-30	$ 400.00

SCMC - Single Cell Mining Claim

Appendix 3: Assessment files used in this report

Table A3-1: Assessment files used in this report on Valentine Property.

Assessment Report Number	Year Of Report	Year Of Work	Company	Type Of Work
42I04NE0007	1967	1967	Argor Explorations Ltd.	airborne mag survey, 400 ft (=121 m) spacing
42I04NE0013	1969	1967, 1969	Argor Explorations Ltd.	drill hole V-2-1 / 199.3 m; hole V-2-3 / 609.6 m
42I04NE0012	1969	1969	Argor Explorations Ltd.	drill hole V-2-2 / 719.9 m
42I04NE0002	1982	1982	Selco Mining Corp. Ltd.	ground mag survey, 100 m spacing
42I04NE0003	1984	1982	Selco Mining Corp. Ltd.	drill hole 42I5-114-1 / 118.5 m; drill hole 42I5-115-1 / 152 m
42I05SE2005	2003	2003	Big Red Diamond Corp.	airborne mag and VLF-EM survey, 50 m spacing
42I05SE2004	2003	2003	Big Red Diamond Corp.	ground mag survey, 50 m spacing
2.30132	2005	2003 and 2005	Big Red Diamond Corp.	overburden sampling, mineralogy study, 12 samples
2.31852	2006	2006	Baltic Resources Inc.	11 drill holes totalling 951 m of which 4 drill holes are on the Property (CR06-1, CR06-2, CR06-3 & CR06-6)
2.36059	2007	2007	Baltic Resources Inc.	petrographic study of drill core; 12 samples CR06-01, 3 samples CR06-02
20000020024	2022	2020	NioBay Metals Inc.	Airborne Mag/VLF-EM survey, 50 m spacing

Appendix 4: VPmg software

1. VPmg software overview

VPmg is a gravity, gravity gradient, magnetic, and magnetic gradient 3D modelling and inversion program developed by Fullagar Geophysics Pty Ltd (Fullagar et al, 2000; 2004; Fullagar & Pears, 2007; Fullagar et al, 2008) until its acquisition by Mira Geoscience in 2015 who has since continued its development.

In VPmg, the models are geological (categorical) insofar as each volume of the subsurface is assigned to a rock unit. The shape and property (density or susceptibility) of each unit can change during inversion, but its geological (or topological) identity is preserved. Geological contacts can be fixed (where pierced by a drill hole for example), bounded, or free to move during inversion. Bounds can be imposed on each unit's properties, and density or susceptibility measurements (on drill core samples or from downhole logs) are honoured during property inversion.

VPmg represents the sub-surface as a set of tightly-packed vertical rectangular prisms, which in plan view appear as a regular mesh or grid. Prism tops honour surface topography, and in its simplest form, internal contacts representing geological boundaries divide each prism into (usually elongated) cells. The vertical dimension of cells is arbitrary, implying that the vertical position of the geological boundaries is not "quantised" by vertical discretization. The internal contacts represent geological boundaries that collectively define the shape of geological units. The geological units can either be homogeneous, i.e., uniform in density or susceptibility, or fully heterogeneous. When considering property inversion, a geological unit can be discretized in different ways. In the first instance, the property of each vertical prism segment of a geological unit can be allowed to vary independently, thereby introducing a lateral property variation within the unit. Full 3D property variation is achieved by introducing vertical sub-celling within the selected units.

VPmg offers considerable flexibility during interpretation. The model complexity ranges from conventional (uniform density) terrain models, to discrete bodies in a uniform background, to layered stratigraphy on basement, to complex 3D models. Regional effects can be handled by constructing a regional model, based on a relatively large rectangular mesh. The regional model is in turn embedded in a uniform half-space. A local model, comprised of smaller prisms, can be embedded in a regional model. The local model parameters can be adjusted by inversion until the gravity, gravity gradient, TMI, or magnetic gradient data within the local model area are satisfied.

VPmg offers a variety of inversion styles: homogeneous unit property, contact geometry, and heterogeneous property. During property inversion, model contacts (geometry) are fixed. During contact geometry inversion, geological boundaries are altered while physical properties remain fixed. The user is able to easily switch from one inversion style to another.

GOCAD Mining Suite utilities developed by Mira Geoscience facilitate communication of model and data information to and from VPmg, and expedite assignment of drillhole constraints.

2. VPmg model parameterisation and inversion styles

In VPmg, the Earth is represented as a close packing of vertical prisms, each of which is divided into cells by horizontal boundaries that coincide with geological contacts (Figure A4-1). The tops of the prisms coincide with the topography. A rock type and a rock property (density or susceptibility) are assigned to every cell. For rank green fields, the same rock type is assigned to every cell, and the starting model degenerates into a homogeneous half-space for unconstrained inversion.

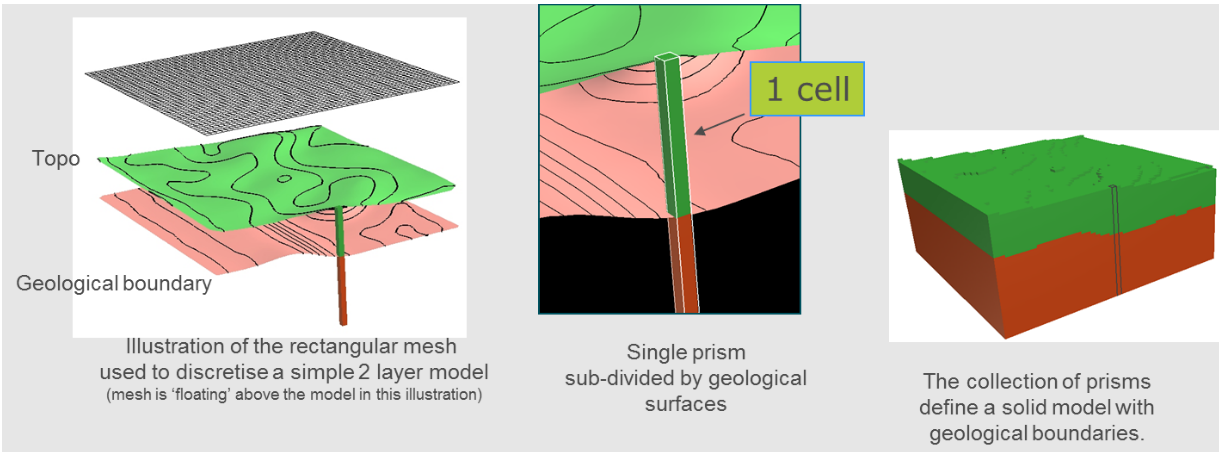

Figure A4-1: Illustration of VPmg model parameterisation for a simple 2 layer model comprising cover and basement.

Although a layered model is illustrated in Figure A4-1, this style of model parameterisation does not enforce a constant stratigraphy in all prisms and therefore supports full 3D geological complexities.

VPmg model parameterisation permits a wide variety of starting model options and 3 general inversion styles: homogeneous unit inversion, geometry inversion and heterogeneous property inversion. These inversion styles are illustrated schematically in Figure A4-2.

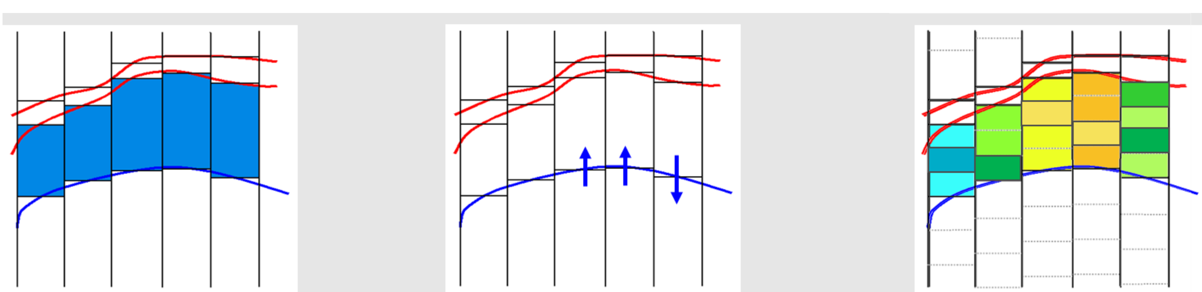

Figure A4-2: Schematic illustrations of VPmg inversion styles; homogeneous unit inversion (left), geometry inversion (centre) and heterogeneous property inversion (right).

Various inversion options are elaborated upon below.

Homogeneous unit property inversion

For a homogeneous unit property inversion, the starting model is comprised of geological units with uniform density or susceptibility. Inversion optimises the density or susceptibility of one or more units to improve the data fit to the entire data set. Upper and lower property bounds for each unit can be imposed during inversion.

Geometry inversion

Geometry inversion adjusts the elevation of geological boundaries. Geological boundaries can be designated as free or fixed (e.g. pierce by a drill hole), or could be bounded above (e.g. by the end of drill hole). If drillhole information is used to fix a geological boundary, changes to the model in the vicinity of the drill hole are also suppressed (as a measure to preserve consistency with the drill hole away the actual drillhole intersection).

Geometry inversion facilitates a variety of applications such as depth to basement modelling and refining the geological boundaries of a complex geological model. In the absence of a geological model, geometry inversion can assist, be implemented during preliminary interpretations by using a simple body (e.g. ellipsoid or rectangular slab) and geometry inversion will adjust the conceptual starting model to fit the data.

Heterogeneous unit property inversion

Geological domains can be discretized internally and heterogeneous unit property inversion can be performed. VPmg domains are intrinsically discretized laterally (by the vertical prism boundaries), and users can specify whether geological domains are also discretized vertically for heterogeneous property inversion. Vertical discretization is typically specified to be either a constants cell size, or a cell size expanding with depth. The vertical discretization settings can be different for each geological domain.

Heterogeneous unit inversion adjusts the property (density or susceptibility) variations within one or more geological domains (subject to imposed upper and lower property bounds) to produce a model with an improved fit between the observed and computed gravity and magnetic responses.

During inversion, cells can be designated as fixed if their property has been defined by downhole logging or core measurements. If drill hole physical property measurements are used as hard constraints, changes to the model in the neighbourhood of hard constraints are also suppressed (as for geometry inversion).

Individual weights can also be assigned to individual cells. For example, depth weighting constraints can be set to compensate for heightened sensitivity of model cells closer to the survey measurements.

Geologically unconstrained property inversion

Although VPmg is well-suited to geologically constrained inversion, in the absence of a geological model, unconstrained density or susceptibility inversion can be executed.

VPmg offers two styles of unconstrained property inversion; full 3D density or susceptibility inversion and apparent density or susceptibility inversion (both of which are heterogeneous property inversions). The VPmg apparent density and apparent susceptibility models comprise the 2D grid of tightly packed vertical prisms (elongated cells) with great depth extent (see Figure A4-1 but with no vertical divisions). A VPmg 3D unconstrained inversion adopts a similar model structure, but each vertical prism is divided into cells. For both these models, the same rock type identifier is simply assigned to every cell.

Apparent density and susceptibility inversions can be executed faster than full 3D unconstrained inversions. In the absence of a regional geological model, apparent density and susceptibility models provide an efficient means for explaining the regional scale potential field response. VPmg can literally incise a local geological model into the regional apparent density or susceptibility model during potential field modelling.

Geologically unconstrained geometry inversion

A style of unconstrained geometry inversion is also permitted using a scheme known as "geobody" inversion. Geobody inversion considers a simple 3 layered starting model. The middle layer is initially set to zero thickness and assigned a starting depth and density or susceptibility (upper and lower layers are generally assumed to be 0 SI or 0 g/cc). VPmg geometry inversion increases the thickness of the geobody to produce a volume of material that provides an improved fit with the observed data. This inversion style is illustrated schematically in Figure A4-3.

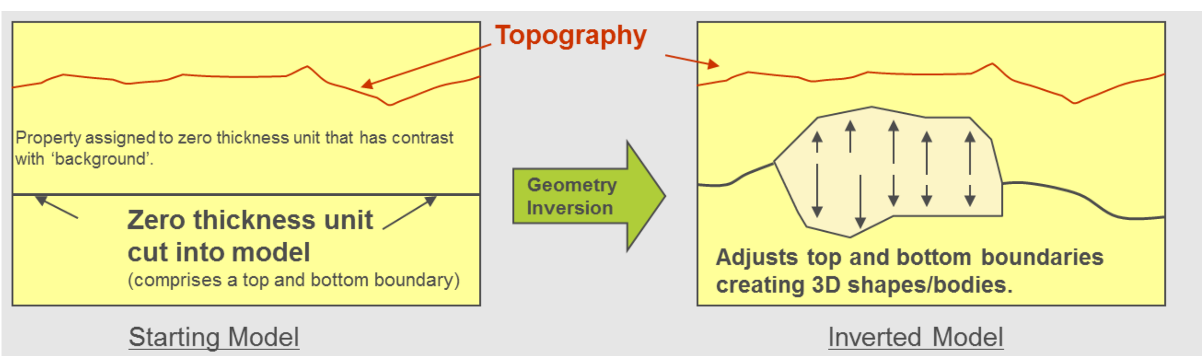

Figure A4-3: Schematic sections depicting the mechanics of a VPmg geobody style

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