Newfoundland Labrador

Natural Resources

Mines

KIMBERLITE-INDICATOR MINERAL ANALYSIS OF ESKER SAMPLES, WESTERN LABRADOR

D. Brushett and S. Amor

Open File LAB/1620

St. John's, Newfoundland
July, 2013

NOTE

DISCLAIMER

Recommended citation:
Brushett, D. and Amor, S.
2013: Kimberlite-indicator mineral analysis of esker samples, western Labrador. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Open File LAB/1620, 58 pages.

Cover: View of esker looking southeast, Menihek Lakes, western Labrador.

Newfoundland Labrador

Natural Resources

Mines

KIMBERLITE-INDICATOR MINERAL ANALYSIS OF ESKER SAMPLES, WESTERN LABRADOR

D. Brushett and S. Amor

Open File LAB/1620

St. John's, Newfoundland
July, 2013

CONTENTS

FIGURES

Page

FIGURES

Page

PLATES

ABSTRACT

The discovery of economic concentrations of diamonds in kimberlites of the Superior Province, in Québec and Ontario, prompted the Geological Survey of Newfoundland and Labrador to conduct a reconnaissance, regional-scale field program in western Labrador in 2012. The survey area encompassed four 1: 250 000 NTS map areas (23G, 23H, 23I and 23J).

Examination of heavy mineral concentrations from 154 samples of esker sand and gravel collected over rocks of the Archean Ashuanipi Complex (Superior Province) and the Proterozoic Labrador Trough (Kaniapiskau Supergroup) and Grenville Province from Western Labrador have not revealed indications of the presence of kimberlites. There is evidence of the presence of other types of mineralization; these indications include:

- *Sedimentary or volcanosedimentary barite mineralization, possibly accompanied by base-metal sulphides, in mid-Paleoproterozoic metasediments of the Sims Group, Labrador Trough, centred in NTS map area 23G/16.*

- *Magmatic Ni–Cu mineralization, possibly rather minor, in rocks of the Ashuanipi Complex in NTS map areas 23J/02 or 23J/03.*

- *Minor pyritic Au–Cu mineralization, probably hosted in paragneiss of the Ashuanipi Complex, in NTS map area 23J/07.*

- *'Low-chromium' (cumulus, as opposed to kimberlitic) diopside indicating magmatic Ni–Cu mineralization, in Grenvillian metamorphosed mafic intrusive rocks in NTS map areas 23G/01 and 23H/11.*

- *Cu mineralization of unknown type in Labrador Trough supracrustal rocks in NTS map areas 23G/08 and 23G/09.*

- *Magmatic Ni–Cu mineralization in gabbroic rocks of the Montagnais suite (Labrador Trough).*

The composition of the eskers shows a close, although indirect, relationship with that of the underlying bedrock and it is concluded that the paucity of kimberlite indicator minerals is due to the absence of kimberlites in the eskers' catchment area, and not because the sampling method failed to detect them.

INTRODUCTION

Following the discovery of diamonds in the Archean Slave Craton in the Northwest Territories (*i.e.*, the Lac de Gras region) in the early 1990s, diamond exploration has expanded to other cratons in North America (Pell, 1997). One of the most important geological constraints on the location of diamond deposits is their association with Archean cratons, typically those tectonically stable for the last 1.5 Ga (Morris and Kaszycki, 1995). The Superior Craton is the largest Archean craton (~2.7 Ga), constituting most of eastern Canada and host to numerous occurrences of diamond-bearing kimberlite and other associated rocks (such as lamproite) that have risen from deep within the lithosphere (Van Rythoven *et al.*, 2011). Recent exploration in the Superior Craton has led to several diamond discoveries in the Otish Mountains (*e.g.*, Lynx, Renard, and Hibou), James Bay (Wemendji), and Temiscaminque regions of Québec (Moorhead *et al.*, 2000; Van Rythoven *et al.*, 2011) and the Wawa, Attawapiskat and Kirkland Lake regions of Ontario (McClenaghan *et al.*, 2002; Figure 1a).

To date, no diamonds have been found in Labrador, although kimberlite has been identified in northern Labrador (Wilton *et al.*, 2002). In eastern Labrador, a kimberlite and lamproite sediment and bedrock sampling program was conducted by the Geological Survey of Newfoundland and Labrador in the mid 1990s (Ryan and McConnell, 1995). River, stream and beach sediment was collected from reworked glaciofluvial and glaciomarine deposits, in areas underlain by the Archean Nain Province and reworked Archean crust of the Makkovik Province. Samples were analyzed for kimberlite and lamproite minerals; no indication of either was found (Ryan and McConnell, 1995). The discovery of diamonds in western Greenland (Jensen and Secher, 2004), once contiguous with the Canadian Shield of Labrador, has provided further impetus for diamond exploration in Labrador.

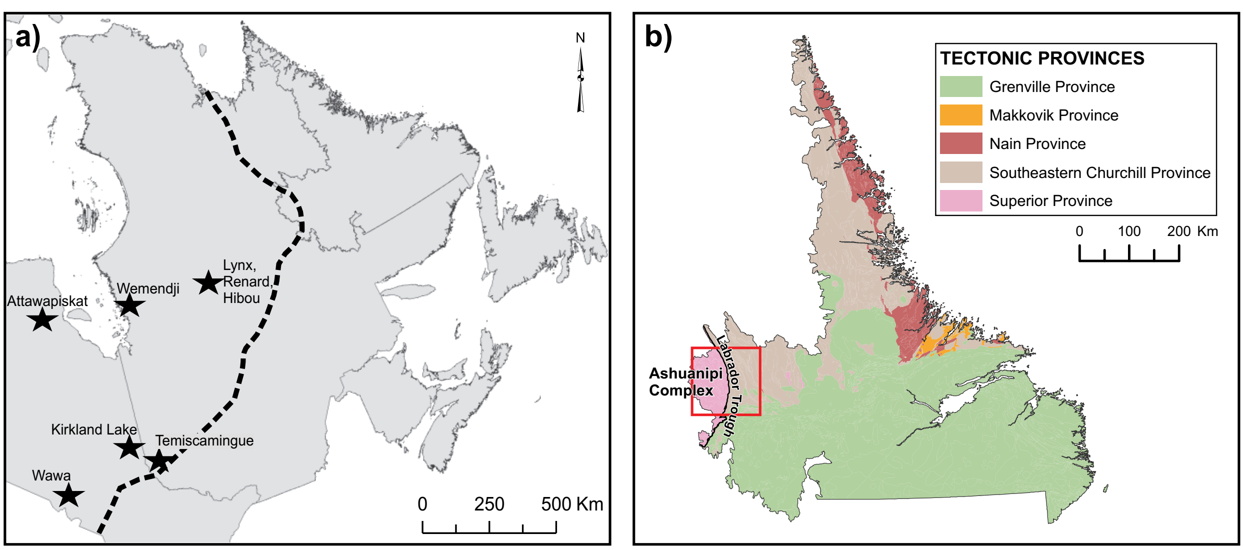

Figure 1. *a) Map showing eastern Superior Craton with kimberlite occurrences mentioned in the text indicated (black stars). The thick dashed line shows the approximate boundary of the Superior Craton. b) Map of Labrador showing study area (red box) and tectonic provinces (taken from Wardle* et al., *1997).*

The project focuses on western Labrador, particularly the Archean Ashuanipi Complex of the Superior Province, the easternmost extension of the Superior Craton (Figure 1b). Given the favourable geological context, and exploration elsewhere across the Canadian Shield in areas underlain by Archean cratons, a reconnaissance, regional-scale sampling program was conducted as an initial appraisal of the area during the summer of 2012. The objective was to collect sand and gravel samples from esker deposits to be analyzed for kimberlite indicator minerals (KIMs) as a means of identifying potential areas for diamond exploration.

DIAMOND EXPLORATION IN GLACIATED TERRAIN

KIMBERLITE AND KIMBERLITE-INDICATOR MINERALS

Diamond exploration in glaciated terrain, in Canada, focuses on the search for indications of kimberlite, the primary host rock for diamonds. Kimberlites are usually linear pipe-like bodies and, as exposed at the bedrock surface, they are small (few hundred metres across) circular point sources. They are relatively soft rocks that have been preferentially eroded by preglacial weathering and glacial scouring to deeper levels than the surrounding bedrock surface, and subsequently buried by glacial sediments, or covered by lakes.

Kimberlite hosts a suite of heavy minerals, which have unique geochemical and physical characteristics that yields discrete dispersal trains in glacial sediments. Cr-pyrope garnet, eclogitic pyrope-almandine garnet, Mg-ilmenite, Cr-diopside, Cr-spinel, Mg-olivine, and enstatite are the most common KIMs (McClenaghan *et al.*, 1997). Most of these kimberlite indicator minerals are found in few rocks other than kimberlite (with the exception of Mg-olivine, which is common in other kinds of ultramafic rocks) and are used to identify kimberlite pipes and evaluate their diamond potential. KIMs are so source-specific that only a few grains are needed in glacial sediments to recognize the presence of kimberlite. They are coarse grained, visually distinctive, dense (specific gravity > 3.2), relatively resistant to weathering and generally able to survive long-distance glacial transport (McClenaghan and Kjarsgaard, 2007). Because of these properties, the KIM dispersal trains tend to be tens of kilometres long, longer than the heavy-mineral geochemical signatures of base-metal dispersal trains in till that are generally only hundreds of metres long (Averill, 2001).

GLACIAL PROCESSES

Success in tracing indicator minerals back to their source depends on the proper identification of the surficial sediment types collected, and an understanding of their transport history and depositional processes. Kimberlite is dispersed primarily through glacial erosion, and can be transported a few tens of metres to tens of kilometres down-ice. As a result, boulder tracing and heavy-mineral sampling using till, glaciofluvial, beach or stream sediments are the most common drift prospecting methods used in diamond exploration or to explore any mineral deposit type that yields a characteristic suite of indicator minerals (*e.g.*, Ni–Cu–PGE deposits, Averill, 2009; McClenaghan and Kjarsgaard, 2007). Till is an admixture of crushed rock and mineral fragments, from boulder to clay-sized, transported by glaciers and blended with reworked sediments. Glaciofluvial sediments result from recycling of till by glacial meltwater (*e.g.*, eskers, outwash, or beaches). The fine fraction is washed out of these sediments and is transported farther and deposited as silt and clay in glaciolacustrine or glaciomarine environments (Klassen, 1999). Also, streams have the potential to transport kimberlite material several tens to hundreds of kilometres down-ice; however, this sediment may have undergone several cycles of transport and hence, may be more difficult to trace back to the bedrock source (McClenaghan and Kjarsgaard, 2007).

Glacial sediments (till) eroded from a discrete bedrock source are deposited down-ice in a dispersal train, a thin plume (typically ~ 3 m thick) that rises (with respect to the ice–bedrock interface) down-ice and gradually becomes diluted (McClenaghan *et al.*, 1997). Till dispersal trains are much larger than their bedrock sources, making them easier to find. The shape and orientation of dispersal trains vary depending on their location within the ice sheet (Klassen and Thompson, 1989). Dispersal trains in areas close to ice-sheet margins (where there has been a relatively simple ice-flow history) are typically ribbon-shaped and oriented down ice (*e.g.,* Strange Lake, Batterson, 1989). In intermediate locations (inland from the margin of the ice sheet), dispersal trains become more complex and ribbon-shaped trains may be reworked into fan-shaped dispersal trains recording transport during more than one phase of ice-flow (Batterson and Liverman, 2000). Closer to the centre of the ice sheet (in this case, the region of the Labrador Trough), ice divides and multiple ice-flow phases are present and dispersal trains are typically amoeboid-shaped (patches centred about their source) and the distances of transport are short (*e.g.*, Martin Lake Porphyry, Klassen and Thompson, 1993). In the case of the Martin Lake Porphyry, although it does have an amoeboid-shaped dispersal train, the greatest concentration of debris extends north-northwest and south from the bedrock source, consistent with the last prominent flow trends (Klassen and Thompson, 1989).

Dispersal trains, associated with eskers, are typically sourced primarily from underlying pre-existing till dispersal trains with secondary contributions from surrounding bedrock and/or debris-rich basal ice. For use in mineral exploration, esker dispersal trains are traced back to the till dispersal train, then the till dispersal train is traced back to the bedrock source. Although there are limited data on eskers dispersal trains, data based on eskers suggest that their dispersal trains are similar in length to the till-dispersal train from which they were sourced, but are shifted 1–25 km downflow. Regardless of esker length, the main control on the length of its dispersal train is the length of the underlying till dispersal train across which the esker passes (Cummings *et al.,* 2011).

Relative to till, eskers are commonly enriched in heavy minerals, in some cases by several times per unit volume (Averill, 2001). Eskers are typically divided into two components: gravelly ridges and sandy fans. It is the gravelly ridges that are normally sampled in indicator-mineral programs because heavy minerals tend to concentrate in the gravelly facies, whereas they may be scarce in sandy fans, and also because the gravelly ridges are proximal to the esker sedimentary system than sandy fans, which may record a more proximal provenance signal. Heavy mineral assemblages tend to be texturally and mineralogically immature with individual grains being relatively angular and the presence of easily weathered mineral species (*e.g.*, olivine) or easily weathered components of individual grains. Gravel clasts, in contrast to sand grains, tend to be well-rounded, and friable rock fragments, such as shale commonly become rounded in esker sedimentary systems (Cummings *et al.*, 2011).

GEOLOGY

The study area lies within the Canadian Shield, spanning three structural geological provinces: the Superior to the west, the Churchill to the east, and the Grenville to the south (Wardle *et al.*, 1997). The field area encompasses four 1: 250 000 map areas (NTS 23G, 23H, 23I and 23J) that extends from the Ashuanipi Complex (Superior Province) in the west to the Labrador Trough in the east (southeastern Churchill and Grenville provinces; Figure 1b). The region is characterized by a rough, undulating topography and has distinct physiographic characteristics associated with dominant geological features: rugged highland plateaus are associated with the Ashuanipi Complex, and distinctive northwest–southeast structural and lithological linear ridges and valleys (100 to 200 m relief) that characterize the Labrador Trough.

Bedrock of the Superior Province includes the Ashuanipi Complex, an Archean (2.7 to 2.65 Ga) gneiss domain that comprises predominantly high-grade supracrustal rocks of metatonalite and tonalite gneiss (Unit ANmt) intruded by gabbro (Unit ANga); granodiorite and monzogranite gneiss (Unit ANdgn); metasedimentary gneiss (Unit ANsgn; generally migmatitic); tonalite gneiss, quartz diorite gneiss, granodiorite gneiss, and amphibolite (Unit ANrgn); tonalite and quartz diorite (Unit ANt); and granitoid and granitoid gneiss (Unit ANg; Figure 2; James, 1997a; Wardle *et al.*, 1997).

The Ashuanipi Complex is unconformably overlain by the Labrador Trough, a sequence of Proterozoic supracrustal rocks forming the Kaniapiskau Supergroup. The Kaniapiskau Supergroup consists of the Knob Lake and Doublet groups; only the Knob Lake Group is present in the sampled region (James and van Gool, 1997). The Knob Lake Group includes units of massive to pillowed basalt (Unit P_2pmv), intruded by gabbro (Unit P_2ga) and peridotite (Unit P_2u) of the Montagnais Intrusive Suite; iron formation (Unit P_2i); arkosic siltstone and sandstone (Unit P_2as); arkose and conglomerate (Unit P_2ac); dolomite and chert (Unit P_2d); dolomitic marble (Unit P_2dm); sandstone, siltstone, shale and schistose equivalent rocks (Unit P_2s); and alkalic basalt and mafic pyroclastic rocks (Unit P_2amv;Wardle *et al.*, 1997).

The area east of the Labrador Trough is underlain by rocks of the southeastern Churchill Province: Neoarchean metatonalite and tonalite gneiss (Unit ANtgn), intruded by Mid-Paleoproterozoic gabbro (Unit P_2ga); Neoarchean granitic gneiss (Unit ANggn) intruded by tonalite, quartz diorite, granodiorite and granite (Unit P_2cg); Neoarchean metasedimentary gneiss (Unit ANsgn; generally migmatitic); Neoarchean granitic gneiss (Unit A-Pggn); Mid-Paleoproterozoic granite and granodiorite (Unit P_2g), orthopyroxene-bearing tonalite to granite plutons (Unit P_2cg); granite, quartz monzonite, granodiorite and syenite (Unit P_3gr); volcaniclastic sandstone, arkose and conglomerate (Unit P_3vs); pelitic gneiss (Unit P_3sgn) and rhyolite, dacite, andesite, ash-flow tuff and agglomerate (Unit P_3fv). The youngest rocks in the sampled area are the Early Mesoproterozoic monzonite, granite and charnockite (Unit M_1g); the Michikamau mafic intrusion consisting of anorthosite and locally layered mafic rocks (Unit M_1a); and arkose and quartzite of the Mid-Mesoproterozoic Seal Lake Group (Unit M_2aq). South of the Superior and Churchill provinces is the metamorphic gneissic terrane of the Grenville Province which includes metamorphic equivalents of the trough and gabbroic intrusive rocks, specifically early Mesoproterozoic gabbro and amphibolite (Unit M_1ga); granite, quartz monzonite, granodiorite and syenite (Unit P_3gr); gabbronorite, amphibolite, mafic granulite (Unit P_3ga); and pelitic gneiss (Unit P_3sgn) (Wardle *et al.*, 1997).

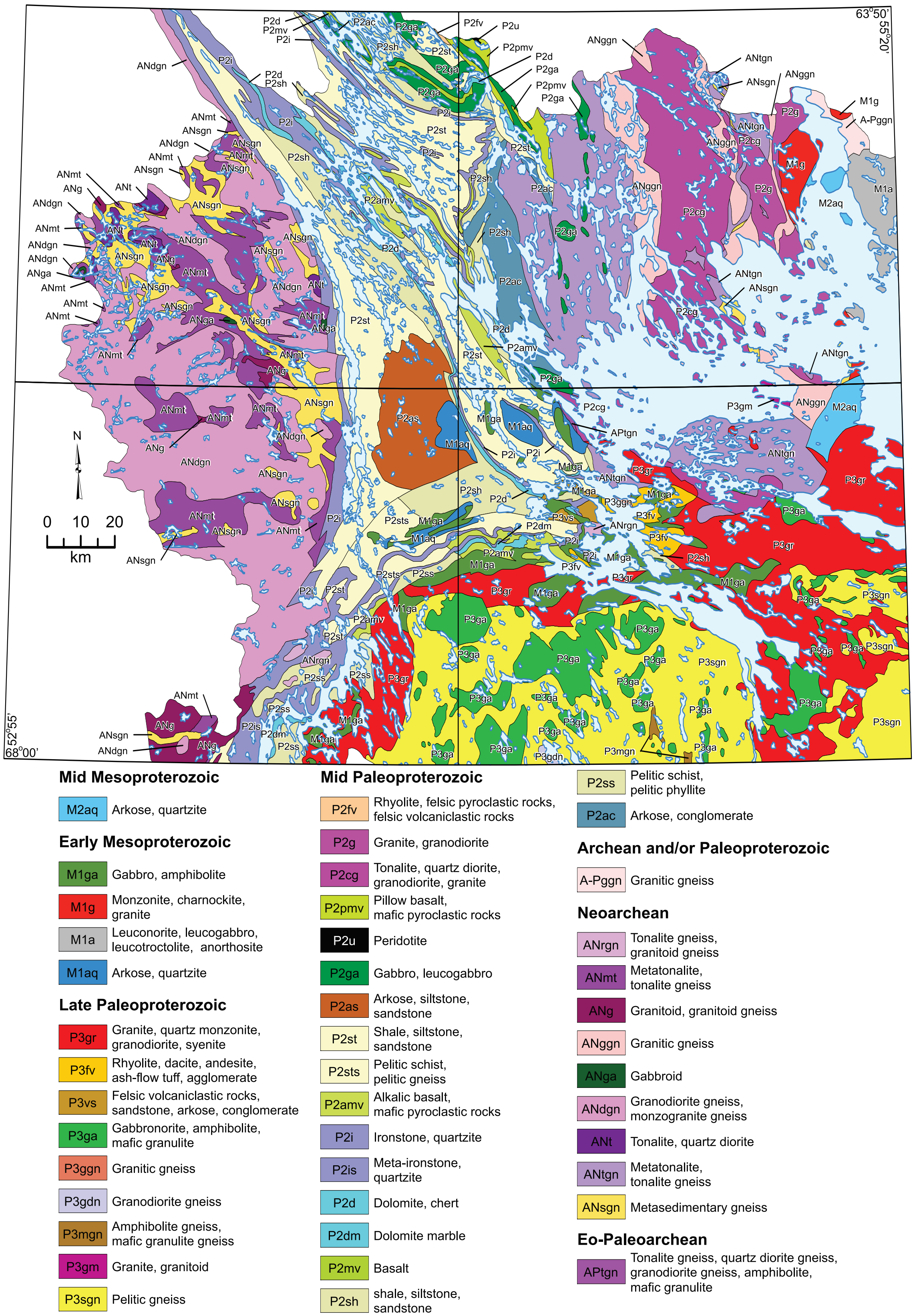

Figure 2. *Bedrock geology of the study area (modified, but see Wardle* et al., *1997 for detailed geology).*

SURFICIAL GEOLOGY

The landscape of western Labrador is dominated by glacial and glacially derived sediments, deposited by the Laurentide Ice Sheet which retreated from the region about 7500 years ago (Klassen and Thompson, 1990). Till is the most widespread glacial deposit (Figure 3) and is generally thin (< 2 m) to discontinuous in highlands, particularly over the Ashuanipi Complex, although crag-and-tail hills are locally common. Till is thicker in valleys (> 2 m) and local areas here are characterized by drumlins, hummocky terrain and ribbed moraine.

Extensive esker systems are present in western Labrador, similar to other areas within the Precambrian shield. Eskers are widespread throughout the field area; they are commonly discontinuous, vary in length from < 1 km to hundreds of kilometres and range from individual shoestring-shaped ridges of glaciofluvial sand and gravel to tree-shaped networks that resemble tributary stream networks (Plates 1 and 2). Typically, individual limbs of these esker networks consist of two geomorphic elements, a narrow, coarse-grained (gravelly) ridge, superimposed or flanked by broad, finer grained (sandy) fans.

Within the field area, eskers generally have a northwest–southeast orientation. A study of cobbles within eskers in central Labrador by Bolduc *et al.* (1987), which included some of the sampled eskers, suggested that flow within the eskers, based on the transport directions of indicator erratics, was to the southeast.

Plate 1. *This large sharp-crested esker is part of an extensive esker network overlying the Ashuanipi Complex.*

Plate 2. *The eskers are part of a large tree-shaped network northwest of Menihek Lakes.*

GLACIAL HISTORY

The study area was covered by the Laurentide Ice Sheet during the late Wisconsinan glaciation, which reached its maximum approximately 20 000 years ago (Grant, 1989). The ice-flow history is complex, particularly in the Labrador Trough where at least four ice-flow directions have been identified from striations, streamlined landforms and distribution of clasts and erratics (Klassen and Thompson, 1987, 1989; Figure 4). This variation in ice flow is a result of the area's proximity to the centre of the Labrador sector of the Laurentide Ice Sheet, including one or more of its ice divides (Prest, 1984). Dispersal trains in this and other areas that are close to the centre

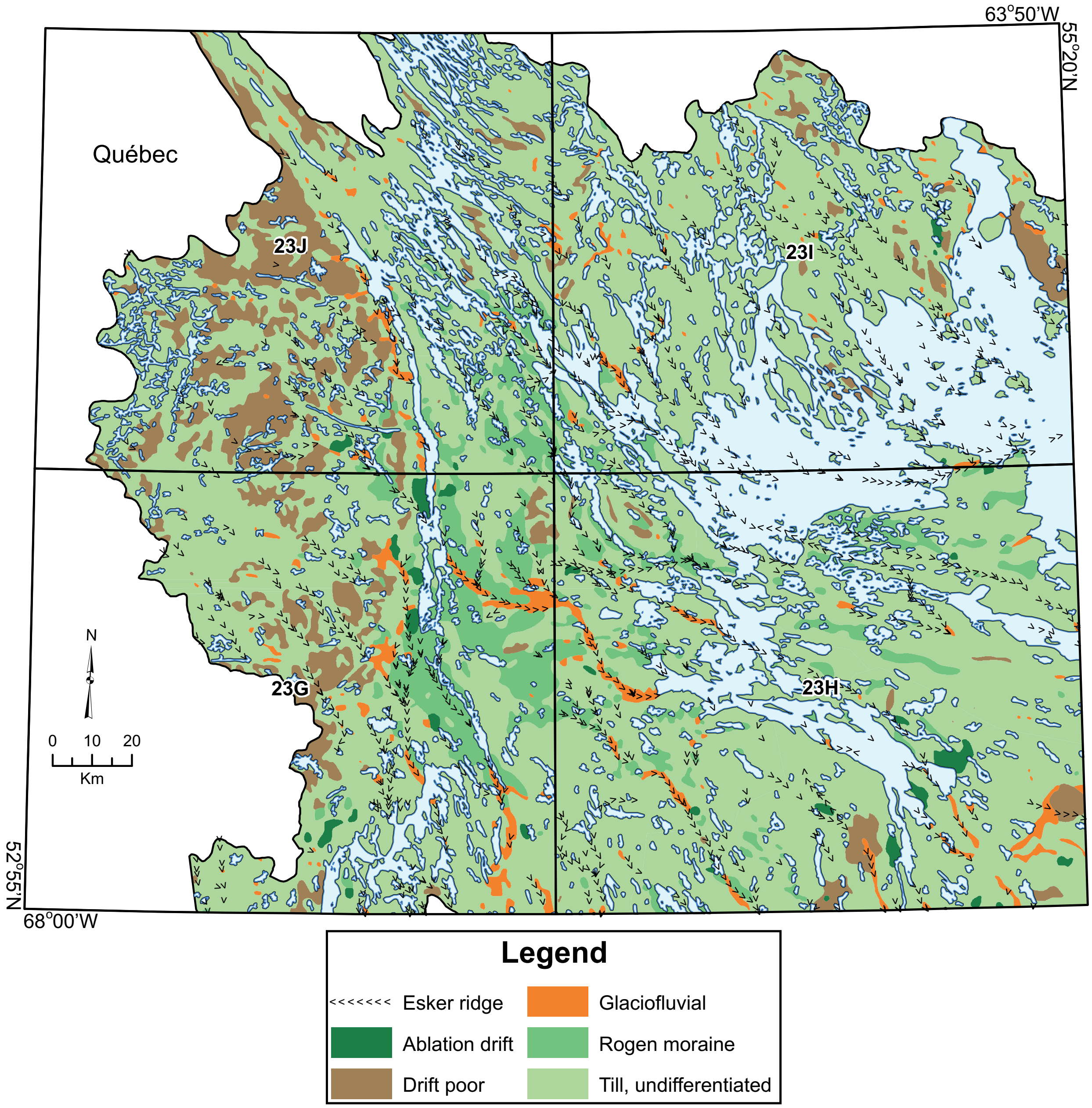

Figure 3. *Surficial geology of western Labrador (adapted from Klassen* et al., *1992).*

of the ice sheet are typically amoeboid-shaped (patches centred about their source) and the distances of transport are short (*e.g.*, Martin Lake Porphyry, Klassen and Thompson, 1993).

The oldest recorded ice flow (Figure 4, Event 1) was northeastward and southwestward, outward from the axis of the Labrador Trough. This ice-flow event was an important agent of glacial erosion and transport and bedrock clasts originating from the trough is common in tills overlying the Ashuanipi Complex. All later ice flow, across the Ashuanipi Complex, was toward the trough (Klassen, 1999).

Event 2 (Figure 4) was north to east-northeastward over much of the study area. In the central Labrador Trough, this ice flow was south to southeastward (Klassen, 1999). Evidence for this ice

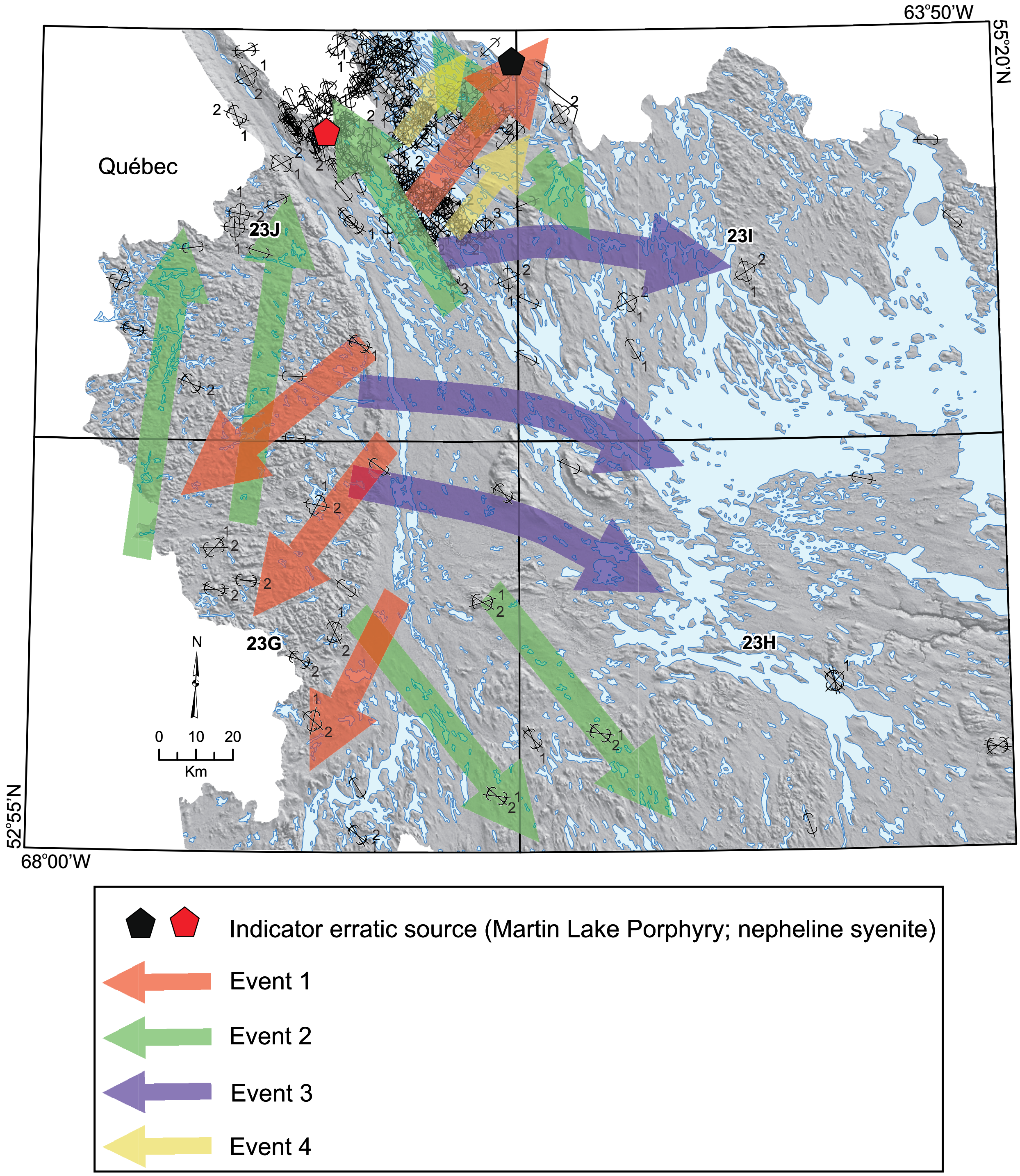

Figure 4. *Ice-flow patterns in western Labrador; numbers indicate the relative age of events with Event 1 being the oldest. Glacial dispersal trains defined by Martin Lake Porphyry and by nepheline syenite are also shown (adapted from Klassen, 1999).*

flow includes red porphyritic (Martin Lake Porphyry) erratics that have been distributed northwest and south to southeast from their source (Figure 4).

Event 3 extended east to southeastward across the southern Ashuanipi Complex into the southern part of the Labrador Trough where it merged with Event 2 ice flow. Event 3 was strongly erosional and marked by well-defined glacially molded bedrock and streamlined landforms. The geological record of this ice-flow event is consistent with the concept of a localized zone of 'fast ice', an ice stream within a more extensive ice sheet.

The youngest ice-flow event (Event 4) was northeastward, and is recorded by faint striations in the central part of the Labrador Trough near Schefferville, where it crosscuts striations associated with Event 3. Event 4 did not have a major effect on the geomorphology of the area nor was it a significant agent of glacial transport (Klassen, 1999).

SAMPLING AND ANALYSIS

SAMPLING AND SAMPLE PREPARATION METHODS

A total of 154 samples of esker material (medium to coarse sand and gravel) were collected. Both glacial (striation orientations) and glaciofluvial (esker trends) transport directions were considered when selecting sample sites. Sample density was approximately 1 per 16 km^2 and was constrained by the spatial distribution of eskers and accessibility. Most of the survey area has no direct road or lake access and helicopter support was required. Samples were collected from hand-dug pits below the oxidized layer, approximately 60 to 100 cm deep. Samples were sieved on site to < 4 mm and stored in heavy plastic sample bags and plastic four gallon buckets before being shipped. Each sample ranged from 10 to 15 kg to allow for the recovery of a sufficient weight of heavy minerals for visual sampling of indicator minerals (Averill, 2001).

The following parameters were recorded at each site: UTM coordinates, NTS 1:250 000 map sheet number, sample composition, size class (*e.g.*, silt, sand, gravel), compaction, deposit type (*e.g.*, glaciofluvial, till, esker, glaciolacustrine), exposure type (*e.g.*, stream-cut, hand-dug pits, lake shore) and thickness, and the presence of any sedimentary structures (*e.g.*, massive, stratified, crossbedded).

SAMPLE PROCESSING AND ANALYTICAL METHODS

Sample processing, which included sieving, and heavy-mineral separation using dense (SG~3.2) liquid and magnetic separation, was carried out by Overburden Drilling Management (ODM) (Figure 5). The resulting 0.25 to 2.0 mm heavy-mineral concentrates were subjected to binocular microscopic examination to identify three types of heavy indicator minerals: (1) KIM (Cr-pyrope garnet, Cr-poor pyrope garnet, eclogitic pyrope-almandine garnet, Cr-diopside, Mg-ilmenite, chromite, and forsteritic olivine); (2) base-metal indicators of three types of metamorphosed magmatic or volcanosedimentary massive sulphide deposits (chalcopyrite for Cu deposits, gahnite for Zn deposits and "low-Cr" diopside* for Ni deposits); and (3) gold grains.

* This term refers to diopside that is enriched in Cr but only to levels of 1.25 weight per cent Cr_2O_3. "High-Cr" diopside, containing higher Cr concentrations than this, is associated with kimberlites rather than magmatic massive sulphides indicator minerals (MMSIMs) (Averill, 2001).

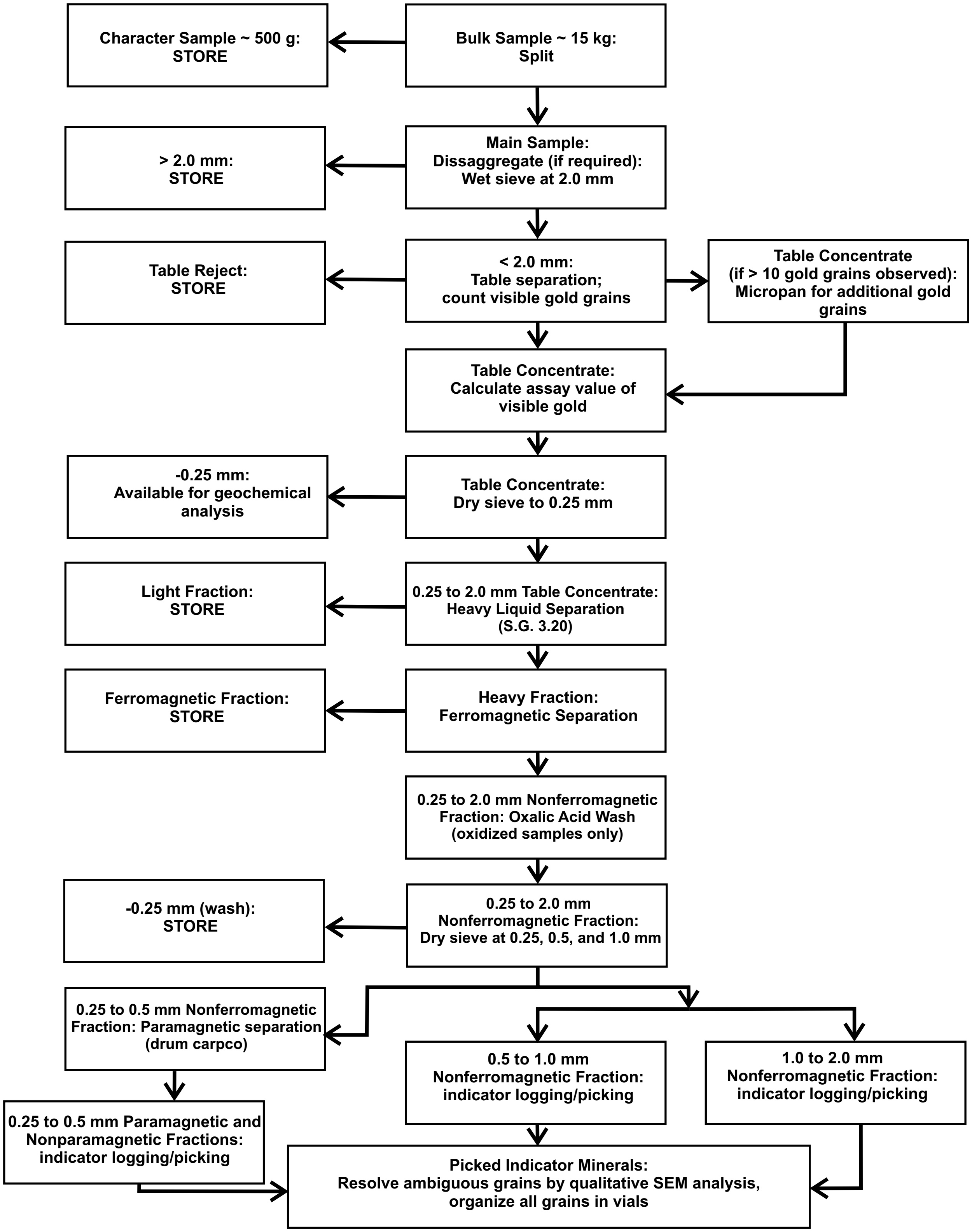

Figure 5. *Standard processing flowsheet for gold grains + kimberlite indicators.*

Grains were counted and vialed by size and species for 3 size fractions: 0.25–0.5 mm, 0.5–1.0 mm, and 1.0–2.0 mm.

Selected mineral grains (*i.e.*, any questionable grains of the above indicator minerals) were analyzed for major and minor elements by scanning electron microprobe. Major background minerals constituting more than 15% of either the paramagnetic or nonparamagnetic fraction of the heavy-mineral concentrates were also provided as a guide to the overall provenance of the sample and potential sources of any identified indicator minerals. Counting, measuring and classification of gold grains were also conducted.

RESULTS

SAMPLE DESCRIPTIONS

Data from 154 samples are presented in Figure 6. The appended data listings contain all the field and analytical data from the sampling survey (Appendix 1), KIM and MMSIM data (Appendix 2), gold grain data (Appendix 3), and laboratory abbreviations (Appendix 4). Dot-plot maps of selected indicator minerals are presented in Figures 7 to 27.

The majority of samples (139 out of 154) are described as ‘sand and gravel’. The remainder are of ‘sand’ and are concentrated just east of the boundary of the Ashuanipi Complex in the south of the sampled area, and just west of the boundary in the north. Most of the samples (128) are described as ‘medium and coarse sand’ and most of these have little or no silt fraction. The next most abundant sand-textural type is ‘coarse sand’, in 14 samples, most of which were collected over rocks of the Superior Province in the west (8 samples), or immediately east of its contact (6 samples). No samples contained clay or organics.

Most of the samples (149) were described as ‘ochre’; the remaining samples were ‘grey-beige’ and ‘grey’.

Overburden Drilling Management’s treatment of the samples includes visual classification of clasts (> 2 mm) into four groups: volcanics/sediments, granite, limestone, and other. The last two types were not reported from any samples of this study and the median supracrustal (volcanics/sediments) clast count is 30%, and plutonic rocks (probably include gneiss, and granite) making up the remaining 70%. Examination of the areal distribution of these components shows a very strong concentration of granitic clasts over the Ashuanipi Complex; the supracrustal content increases immediately west of the contact with the younger rocks of the Grenville Province and Labrador Trough.

KIMBERLITE INDICATOR MINERALS

With the exception of chromite and forsterite, whose occurrence is not confined to kimberlites and which do not, therefore, constitute specific kimberlite indicators, KIM are very scarce in the esker samples. Most of the higher **chromite** counts are confined to two eskers in the northeast (Figure 7); one extends in a southeasterly direction from NTS map area 23J/08 to 23I/04 and the other in an east-southeasterly direction from 23H/11 to 23H/10. Samples from both eskers also

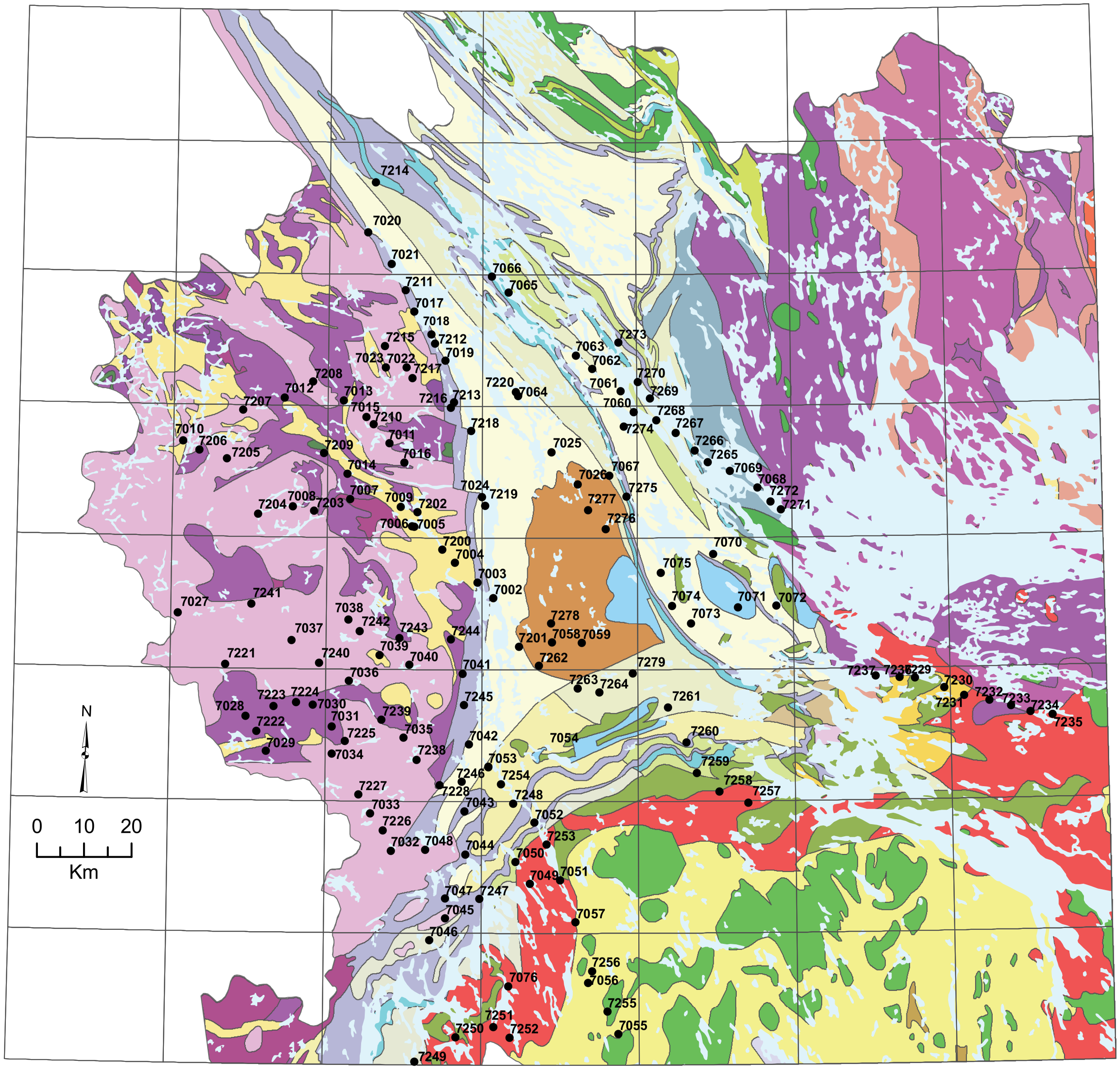

Figure 6. *Sample locations superimposed on bedrock geology map (from Wardle* et al., *1997).*

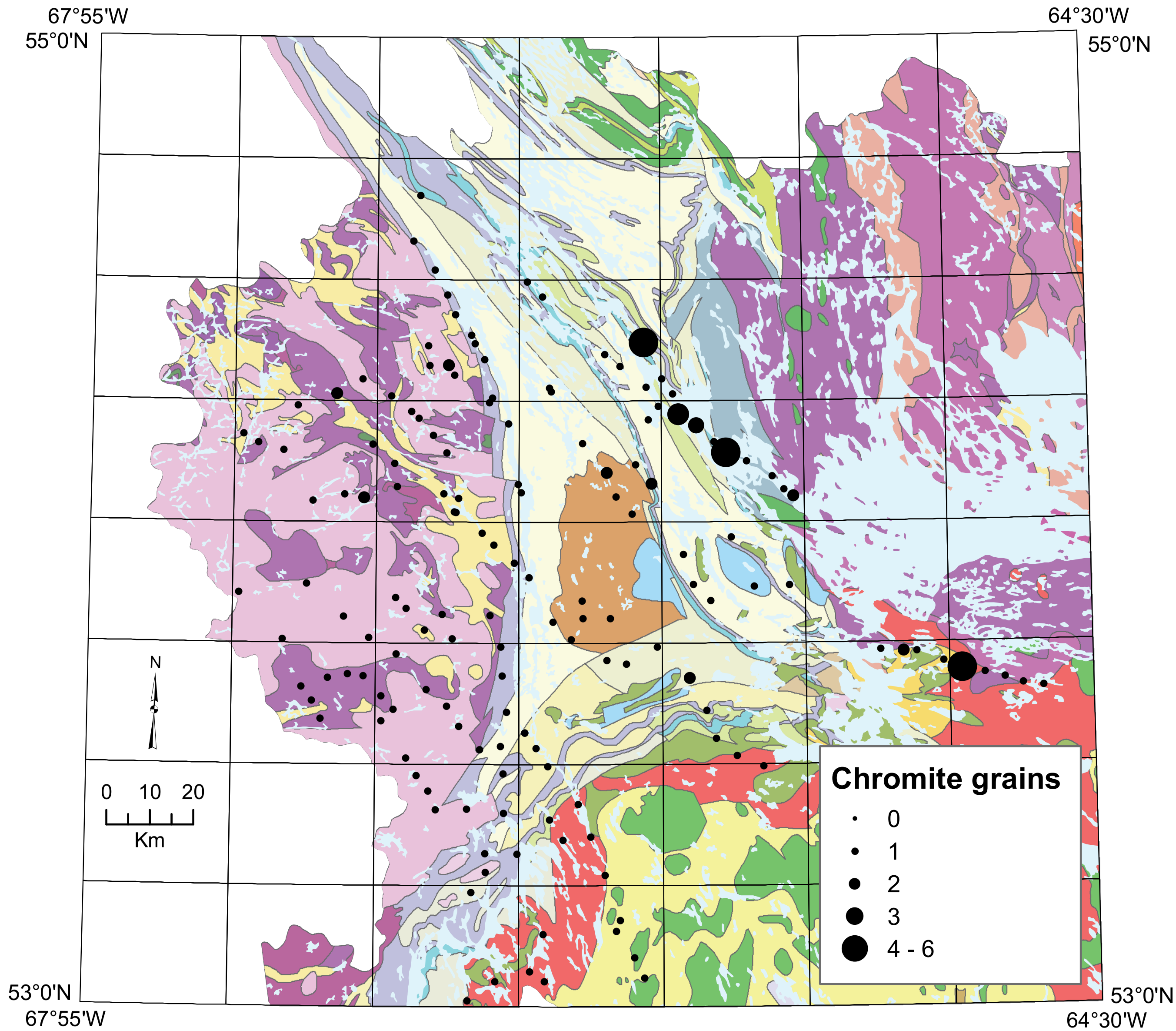

Figure 7. *Number of chromite (Cr) grains per esker sample superimposed on bedrock geology map (from Wardle* et al., *1997).*

show a relatively high content of magnetic minerals (median value 0.15% and maximum of 1.4%; Appendix 1) whose postulated source is in iron formation, although the elevated chromite in the latter esker may be derived from Grenvillian gabbro or amphibolite (Unit M_1ga).

Samples containing **forsterite** grains are almost entirely restricted to eskers extending in a southeasterly direction from NTS map area 23J/02 (Figure 8). The highest forsterite count, of approximately 300 grains (sample 7059) is from the apparent tail of the dispersion train in NTS map area 23G/16, overlying arkose, siltstone and sandstone of the Labrador Trough (Unit P_2as).

The potential source area for the minerals in the eskers is underlain by granodiorite and monzogranite gneiss (Unit ANdgn), metatonalite and tonalite gneiss (Unit ANmt), granitoid, granitoid gneiss (Unit ANg) and metasedimentary gneiss (Unit ANsgn) of the Ashuanipi Complex. An areally very restricted occurrence of gabbroid (Unit ANga) is present northwest of the head of the dispersion train on NTS map area 23J/03 (Wardle *et al*., 1997). More detailed mapping by Percival (1993) indicates that gabbro (Unit Agb) is slightly more abundant in the esker's catchment area. Other units described by Percival (op. cit.) do not constitute plausible sources: migmatitic metatonalite (Unit Amt), garnet diatexite (Unit Ahdg), migmatitic paragneiss (Unit Ap) and granite (Unit Ag). James (1997a) described dykes or sills of an olivine-bearing metapyroxenite up to several hundred metres thick. Although only two such units have been mapped, smaller occurrences are more widespread. However, the olivine appears to have been entirely serpentinized (James, 1997b) and these rocks are therefore, not a likely source for the forsterite either.

MAGMATIC MASSIVE SULPHIDE INDICATOR MINERALS

Although the forsterite identified in the esker concentrates are not believed to be kimberlitic in origin, Averill (2009) states that non-kimberlitic forsterite may be an indicator of magmatic Ni–Cu–PGE mineralization. The presence of uvarovite and Cr-andradite in two forsterite-bearing samples (7005 and 7006) in an esker overlying the Ashuanipi Complex adds support to the hypothesis that such mineralization, of which Percival's (1993) gabbro, Unit Agb, is the most plausible host, may have contributed to the esker. Furthermore, regional lake-sediment geochemistry (Friske *et al.*, 1996; Davenport *et al.*, 1998) indicates a regional Ni anomaly over the Ashuanipi complex. No Ni occurrences have been described over the complex in Labrador, and although there are a number of Cu occurrences in the esker's potential catchment area, all are hosted in gneissic rock and do not appear to be magmatic in origin.

Low-chromium diopside constitutes a potential indicator for magmatic copper–nickel deposits (Averill, 2001). This mineral was detected in 76 samples; the most conspicuous (and widespread) concentrations of counts in excess of 5 are over the Ashuanipi Complex, centred in NTS map areas 23G/10, 23G/11, 23G/14 and 23G/15 in the south (extending over younger rocks to the east), and 23J/02 in the north (Figure 9). In the latter area, Percival (1993) reports migmatitic metatonalite (Unit Amt), granite (Unit Ag), migmatitic paragneiss (Unit Ap), homogeneous garnet diatexite (Unit Ahdg), homogeneous orthopyroxene diatexite (Unit Ahdo), inhomogeneous garnet diatexite (Unit Aidg), diorite (Unit Ad) and very restricted outcrops of gabbro (Unit Agb). Some of the samples in which low-Cr diopside is abundant also contain forsterite, but forsterite is absent from most of them, and overall the diopside is too widespread to provide support for dispersion from a sulphide-bearing magmatic intrusion (*see* above).

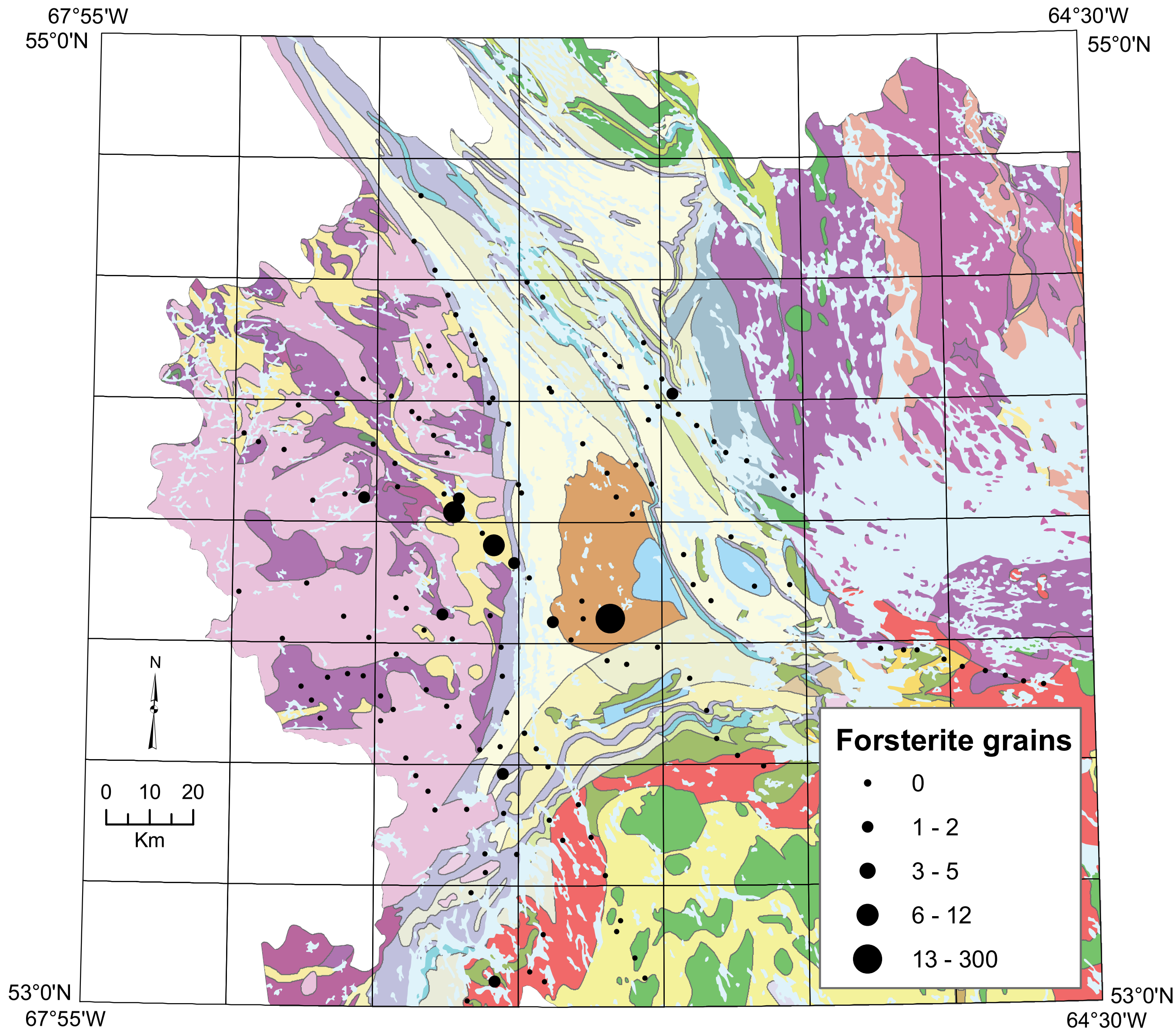

Figure 8. *Number of forsterite (Fo) grains per esker sample superimposed on bedrock geology map (from Wardle* et al., *1997).*

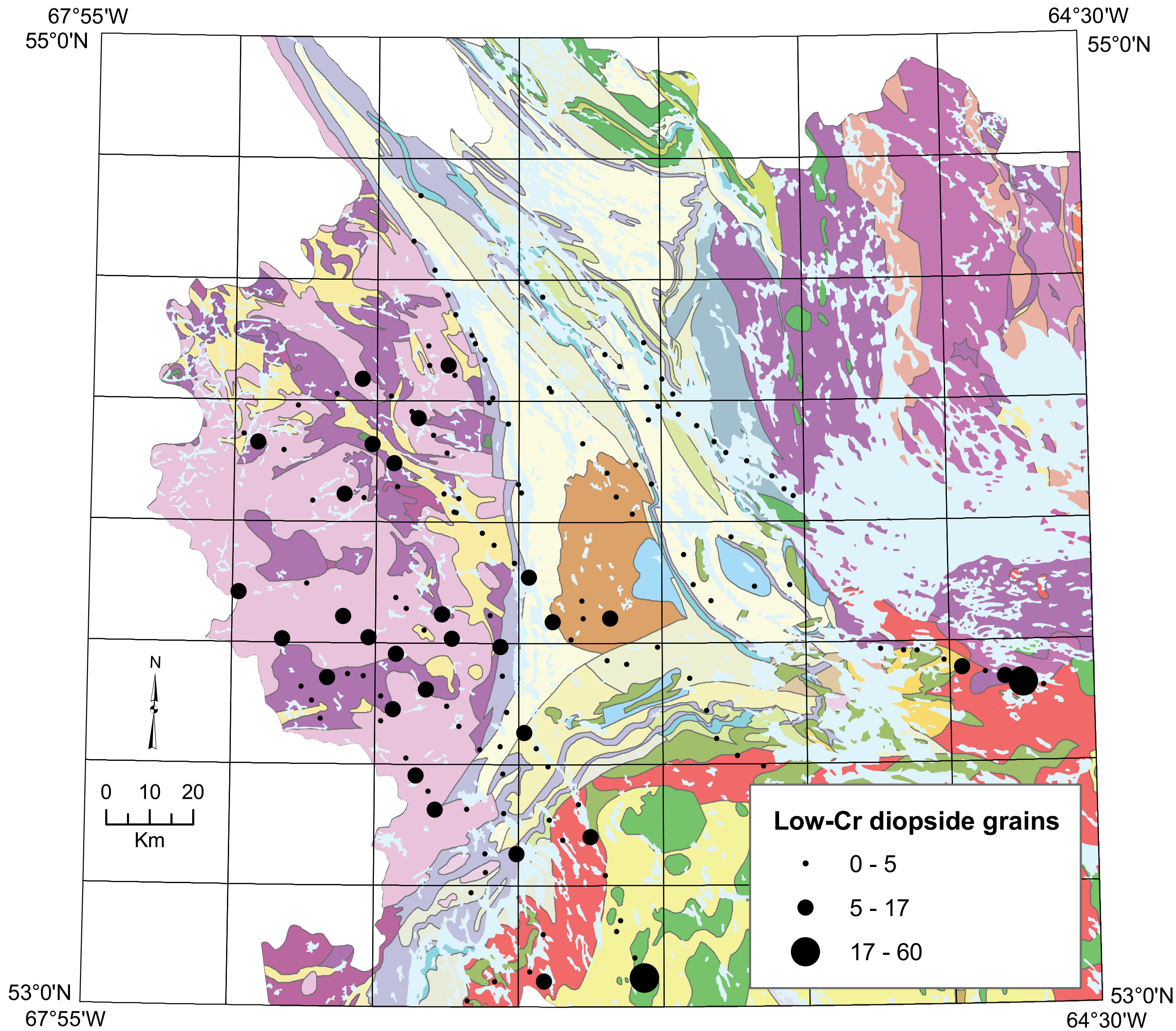

Figure 9. *Number of low chromium diopside grains per esker sample superimposed on bedrock geology map (from Wardle* et al., *1997).*

A smaller concentration of low-Cr diopside-bearing samples, including the highest count of 60 grains, is located in NTS map area 23H/10 at the eastern extremity of the sampled area. Grenville gabbro and amphibolite (Unit M_1ga) are present in the esker's potential catchment area and in this case, the presence of the low-Cr diopside may indeed indicate heightened potential for magmatic Ni–Cu mineralization.

Detectable low-Cr diopside, including one count of 31 grains in the southeast of NTS map area 23G/01, was also reported from samples in the south of the map area. Besides the Ashuanipi Complex, there are a number of other potential sources for the mineral, including gabbronorite, amphibolite and mafic granulite (Unit P_3ga) of Grenvillian age (with which the 31-grain sample is closely spatially associated), gabbro and amphibolite (Unit M_1ga) of the Labrador Trough, or even dolomite marble (Unit P_2dm), also of the Labrador Trough.

Chalcopyrite, which may be indicative of both magmatic Cu–Ni or volcanosedimentary massive sulphide (VMS) mineralization is present in detectable quantities in NTS map area 23G/08 (Figure 10). One sample in this cluster (sample 7253) returned 41 chalcopyrite grains; another (sample 127051) returned 5, as well as 9 grains of low-Cr diopside. The cluster is in close spatial association with gabbro and amphibolite (Unit M_1ga); however, a source in the sedimentary and volcanic rocks of the Labrador Trough to the northwest (NTS map areas 23G/09 and 10) seems more likely, particularly because a sample collected 5 km up-drainage (sample 7052), returned 24 chalcopyrite grains as well as 3 grains of pyrite and 5 grains of native copper (*see* below); these units comprise alkalic basalt and mafic pyroclastic rocks (Unit P_2amv), meta-ironstone and quartzite (Unit $P_2$is) and pelitic schist and pelitic gneiss (Unit P_2sts). Overburden Drilling Management comments that in samples 7051 and 7052, "*the ratio of chalcopyrite to pyrite is rather high at ~1:10. Therefore the chalcopyrite anomalies could be significant*".

Chalcopyrite was also detected over the Ashuanipi Complex in NTS map areas 23J/02 and 23J/07, in association with pyrite, malachite and gold, and over supracrustal rocks of the Labrador Trough in NTS map areas 23I/04 and 23J/08, potentially down-drainage of a number of documented occurrences of Cu (Cache-Cache Islands, 023J/08/Cu 001; Wet Lake, 023I/05Cu 001; Wade Lake East No 3, 023I/04/Cu 001; Stapleton *et al*., 2011) and other minerals.

GOLD

Gold grains are scarce in the esker samples with a maximum count of only two, and all are described as 'reshaped' (that is, most distant from their bedrock source) with the exception of samples 7216, 7233 and 7257 which each contain one modified grain, sample 7277 which contains one reshaped and one pristine grain, and sample 7202 which contains one modified and one pristine grain. These five samples indicate a more proximal origin are not spatially co-associated, although sample 7202 was collected only about 3 km from sample 7005 in which one reshaped gold grain was also counted, in NTS map area 23J/02 (Figure 11). The two nearest Au occurrences are the McPhadyen River North Au showing (MODS number 023J/02/Au 001), 13 km to the northeast and unlikely to have contributed any material to the sampled eskers, and the Lac Desliens East Au indication (MODS number 023J/06/Au 001), a potential contributor to the eskers but about 40 km to the northwest, and with at least six non-auriferous samples collected down-drainage. The sample locations themselves are underlain by metasedimentary gneiss (Unit

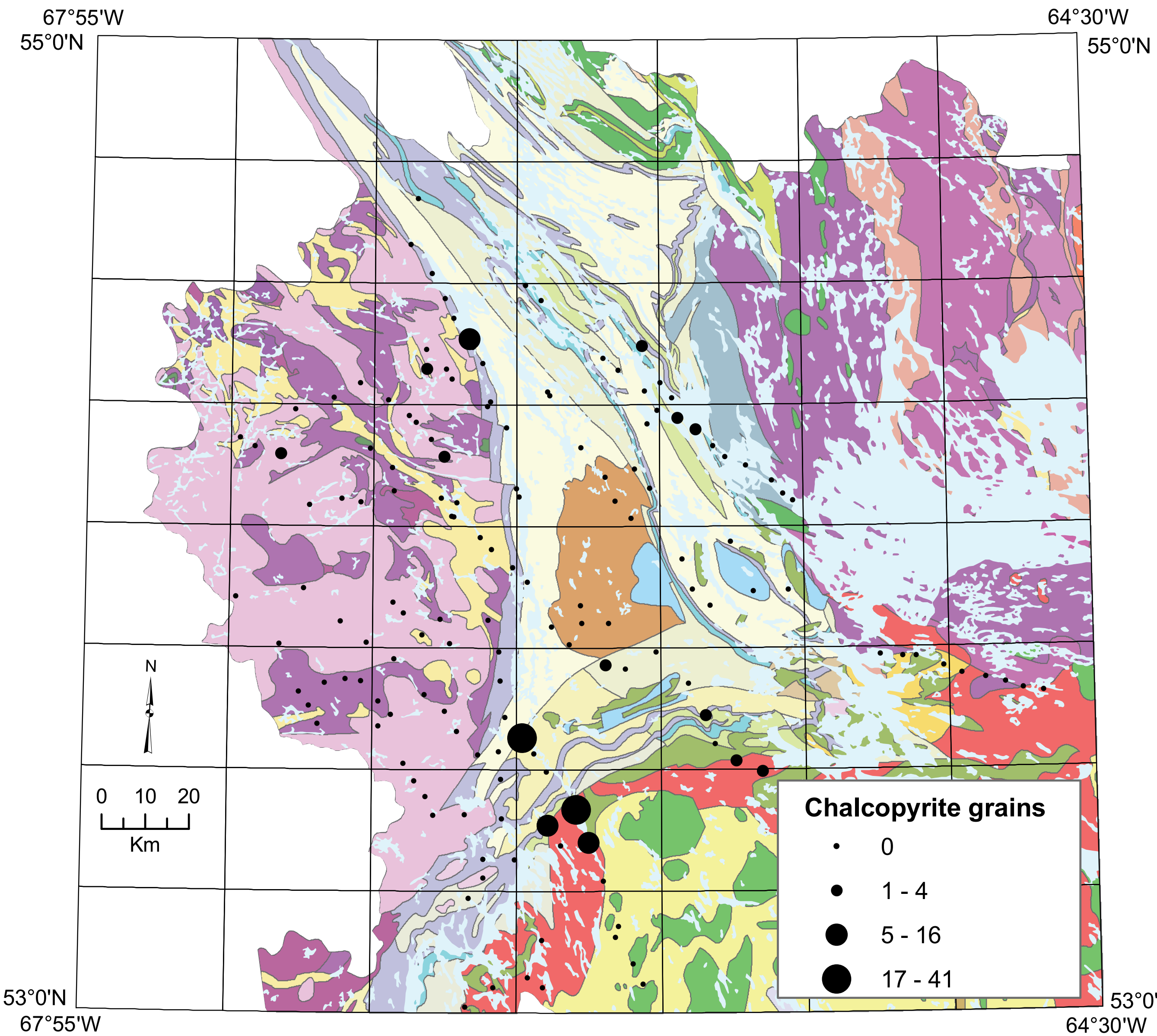

Figure 10. *Number of chalcopyrite grains per esker sample superimposed on bedrock geology map (from Wardle* et al., *1997).*

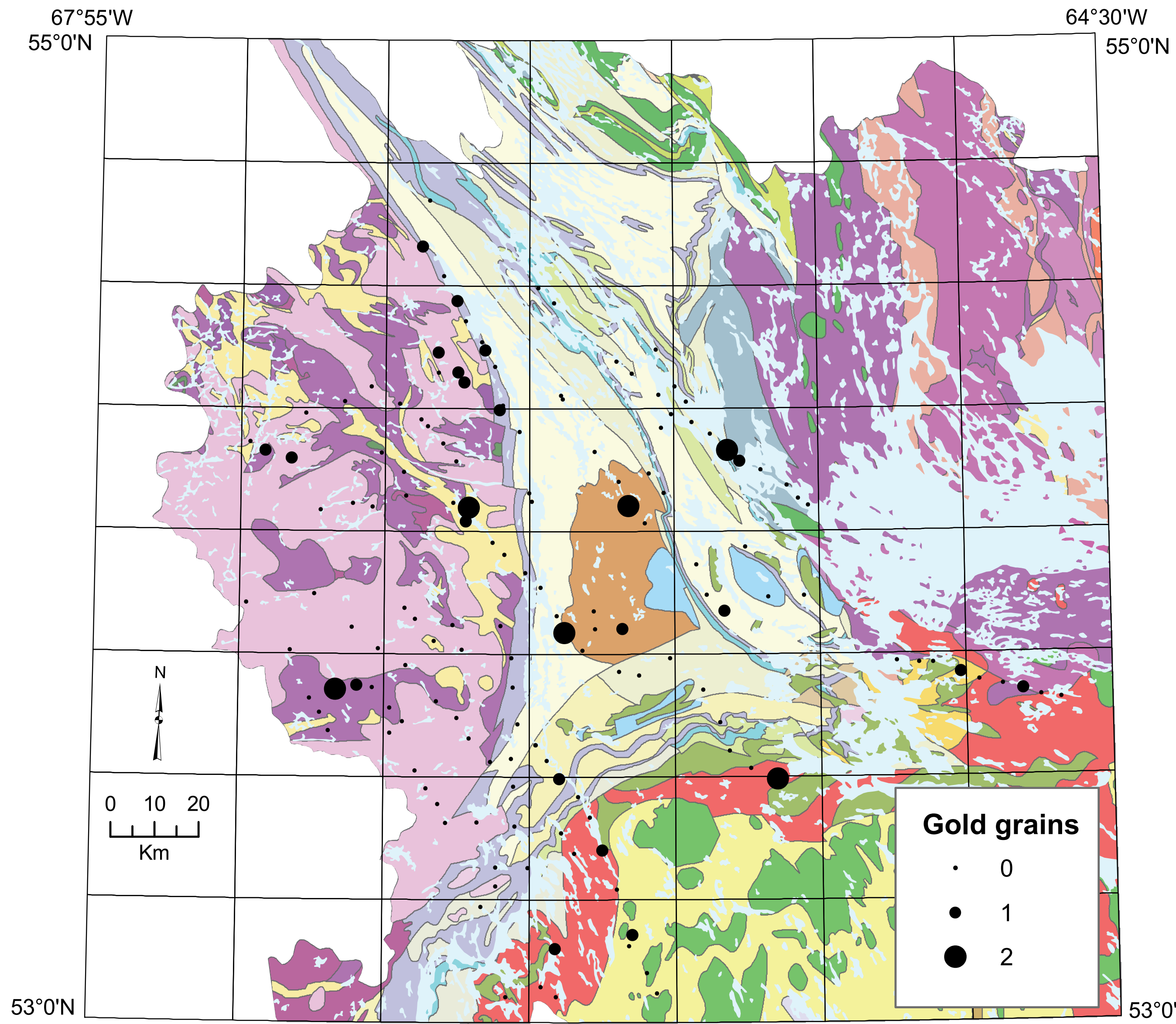

Figure 11. *Number of gold (Au) grains per esker sample superimposed on bedrock geology map (from Wardle* et al., *1997).*

ANsgn, Wardle *et al*., 1997), which seems a more plausible source than the predominant granodiorite gneiss and monzogranite gneiss (Unit ANdgn) and metatonalite and tonalite gneiss (Unit ANmt).

Of the 26 samples in which gold grains of any textural type were identified, nine were collected over the Ashuanipi Complex and another four collected within 2 km of the complex's contact with younger rocks to the east. As the latter were covered at greater extent by the sampling, this represents an imbalance in favour of the Archean rocks. The most significant concentration of auriferous samples (although no sample contains more than one grain, and all are classed as reshaped) is in NTS map area 23J/07. Of these six samples, three were collected over granodiorite gneiss and monzogranite gneiss and three over Proterozoic iron formation (Wardle *et al*., 1997), although the source of the gold in the latter three samples is probably in older rocks. Lapointe (1986) reports the occurrence of Au in association with arsenopyrite in iron-formation within paragneiss in the Ashuanipi complex farther north. Metasedimentary gneiss has also been mapped in the potential source area.

Gold grains were also returned from two adjacent samples collected in NTS map area 23I/04 over Labrador Trough rocks. Potential source rocks comprise units P_2ac (arkose, conglomerate), P_2d (dolomite, chert), P_2sh (shale, siltstone, sandstone), and P_2amv (alkalic basalt, mafic pyroclastic rocks).

Pyrite was encountered quite frequently in the samples, with 68 samples containing at least one grain (Figure 12). As stated below, pyrite forms part of the non-paramagnetic mineral assemblage (as opposed to being identified during more detailed examination) of one sample (7018 in NTS map area 23J/07, collected over the Ashuanipi Complex); the pyrite grain count of this sample was about 250 grains in the 5–50 µm range. The sample also contained 11 grains of chalcopyrite as well as **malachite** staining. Although no gold grains were reported in this sample, several of the neighbouring samples returned one reshaped grain each.

Another concentration of pyritic samples is present on NTS map areas 23I/04 and 23I/05, and 23J/01 and 23J/08. The highest pyrite count, of 50 grains, was reported for sample 7273. Two of these samples are also auriferous. The samples are underlain by rocks of the Labrador Trough, with units P_2st (shale, siltstone, sandstone), P_2amv (alkalic basalt, mafic pyroclastic rocks), P_2sh (shale, siltstone, sandstone), P_2d (dolomite, chert), and P_2i (ironstone, quartzite) constituting potential sources. There are numerous occurrences of iron and manganese in the area, mostly with the status of 'showing', as well as the Galena Lake Pb prospect (MODS number 023I/05/Pb 001; Stapleton *et al.*, 2011) in NTS map area 23I/05, although this last occurrence is unlikely to have contributed any material to most of the pyritic samples.

BACKGROUND ASSEMBLAGES: PARAMAGNETIC MINERALS

In this interpretation, attention is focused on minerals that represent a departure from the norm; the latter is characterized by minerals which appear in all or most of the samples. Such minerals are referred to here as 'background' assemblages. The minerals of interest include ore and ore-related minerals such as pyrite and barite, as well as silicate and oxide minerals that do not appear consistently in the background assemblage, some of which are accessory minerals in cer-

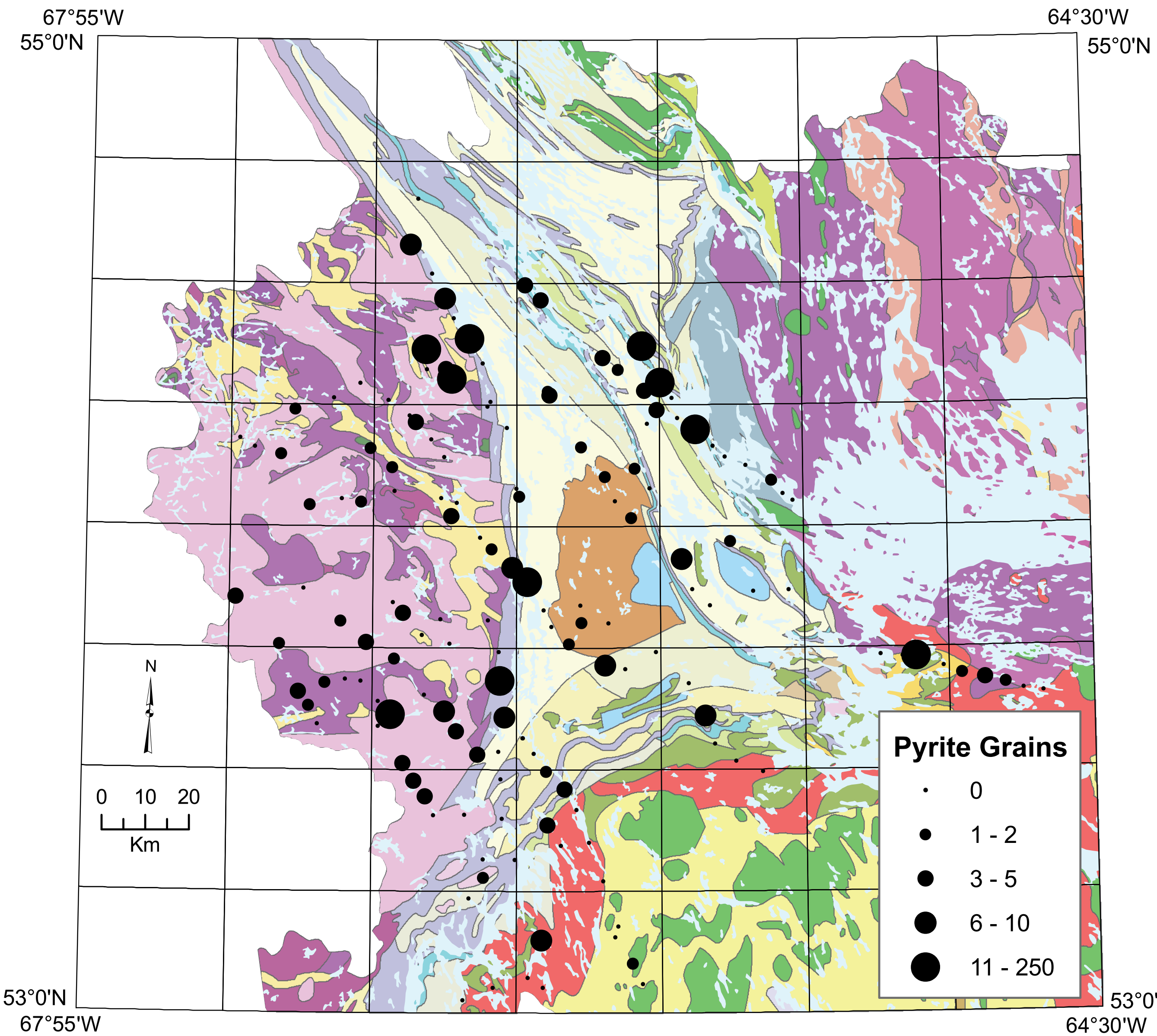

Figure 12. *Number of pyrite (Py) grains per esker sample superimposed on bedrock geology map (from Wardle* et al.*, 1997).*

tain kinds of mineralization. Others, while not directly indicative of mineralization, indicate unusual geological conditions that may be significant and may provide insights into transportation distances in the eskers.

The assemblages of paramagnetic minerals are dominated by hematite, orthopyroxene, almandine and goethite. A total of 140 samples have assemblages of one or more of these minerals, and no other, and no further attention will be directed to them. The remaining minerals in the assemblages are as follows:

Hornblende is present in the assemblage in six samples (Figure 13); all except one are located in NTS map areas 23G/01 and 23G/02 in the south of the map area over Grenvillian granite, quartz monzonite, granodiorite and syenite (Unit P_3gr; 4 samples) or politic gneiss (Unit P_3sgn; 1 sample); Grenvillian gabbro and amphibolite (Unit M_1ga) is also present in the vicinity. The remaining hornblende-bearing sample was collected in NTS map area 23H/10, in the east of the sampled area; this is also underlain by Unit P_3gr with a variety of Grenvillian intrusive and supracrustal rocks in its potential catchment area.

Augite is present in the assemblage of three samples; one is located over Superior Province rocks in NTS map area 23G/10; the other two are located on NTS map areas 23H/13 over Labrador Trough metasediments (units P_2st, P_2i, P_2d), although gabbro and amphibolite (Unit M_1ga) are also present (Figure 14). There is a co-association with fayalite and also loellingite in sample 7071 (*see* below).

Crustal (as opposed to mantle) **ilmenite** is present in the assemblage of two samples collected over gneisses and tonalites of the Ashuanipi Complex in NTS map area 23G10 (Figure 15).

Fayalite is present in two samples in NTS map area 23H/13. Augite is also present in the assemblage of one of the samples (7072) and both minerals may originate from the same rock unit. Both fayalite-bearing samples were collected over Labrador Trough metasediments (units P_2st, P_2i, P_2d) with a possible source in gabbro and amphibolite (Unit M_1ga) are also present (Figure 16).

BACKGROUND ASSEMBLAGES: NON-PARAMAGNETIC MINERALS

The assemblages of non-paramagnetic minerals are dominated by diopside, apatite and epidote. A total of 141 samples have assemblages of one or more of these minerals, and no other. The remaining minerals in the assemblages are as follows:

Titanite (sphene) is present in two samples collected in NTS map areas 23G/01 and 23G/08 (Figure 17). The mineral is not particularly diagnostic of a particular rock or mineralization type, although Unit P_3gr (Grenvillian granite, quartz monzonite, granodiorite and syenite) is a plausible source.

Monazite is present in the assemblage of a single sample collected over Superior Province tonalite and gneiss in NTS map area 23J/03 (Figure 18). Although the mineral is an important repository of rare-earth elements there is nothing in the regional lake-sediment and lake-water geochemistry to suggest the presence of significant REE mineralization associated with this sample.

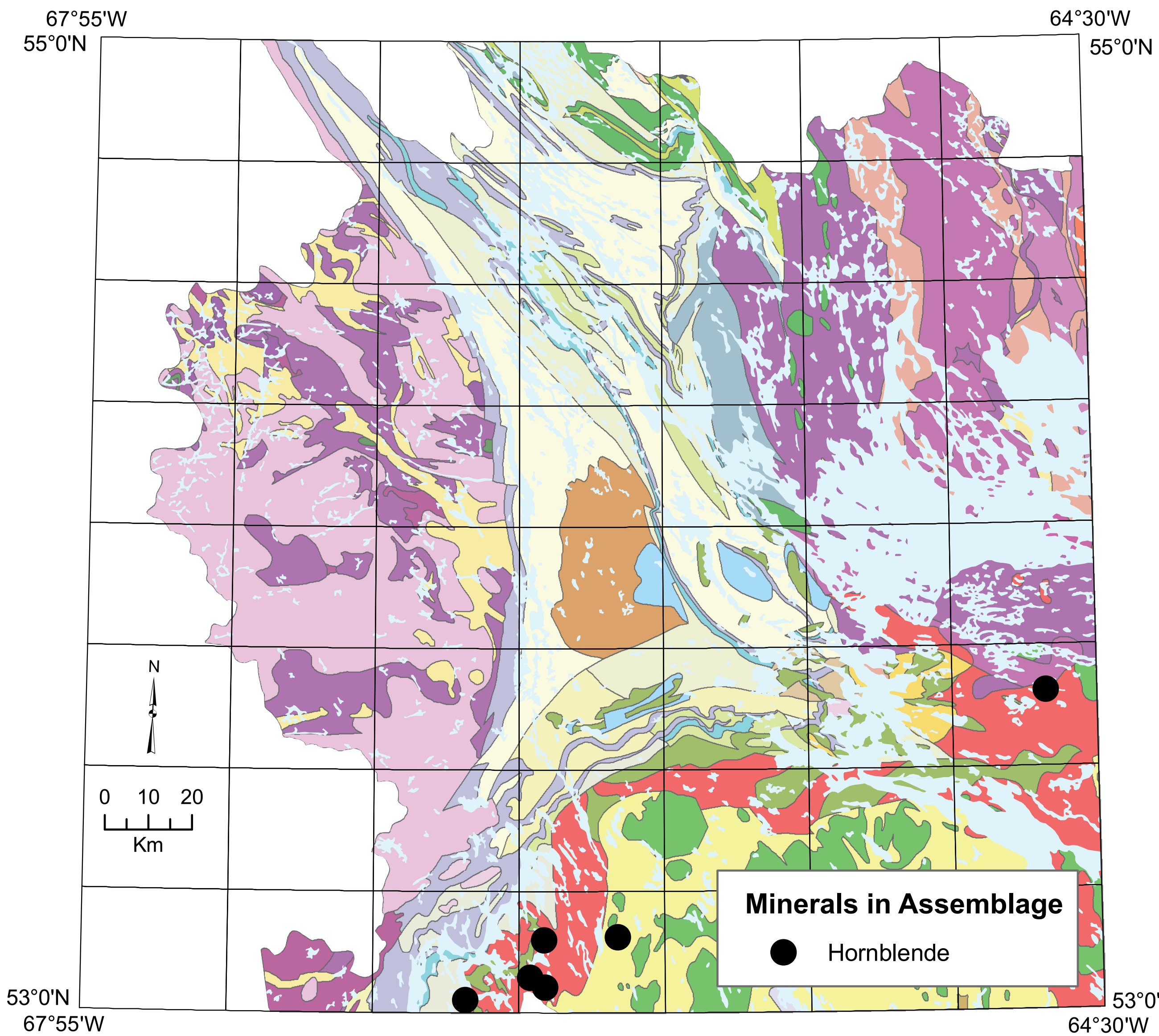

Figure 13. *Presence of hornblende (Hbl) in background assemblage of paramagnetic minerals superimposed on bedrock geology map (from Wardle* et al., *1997).*

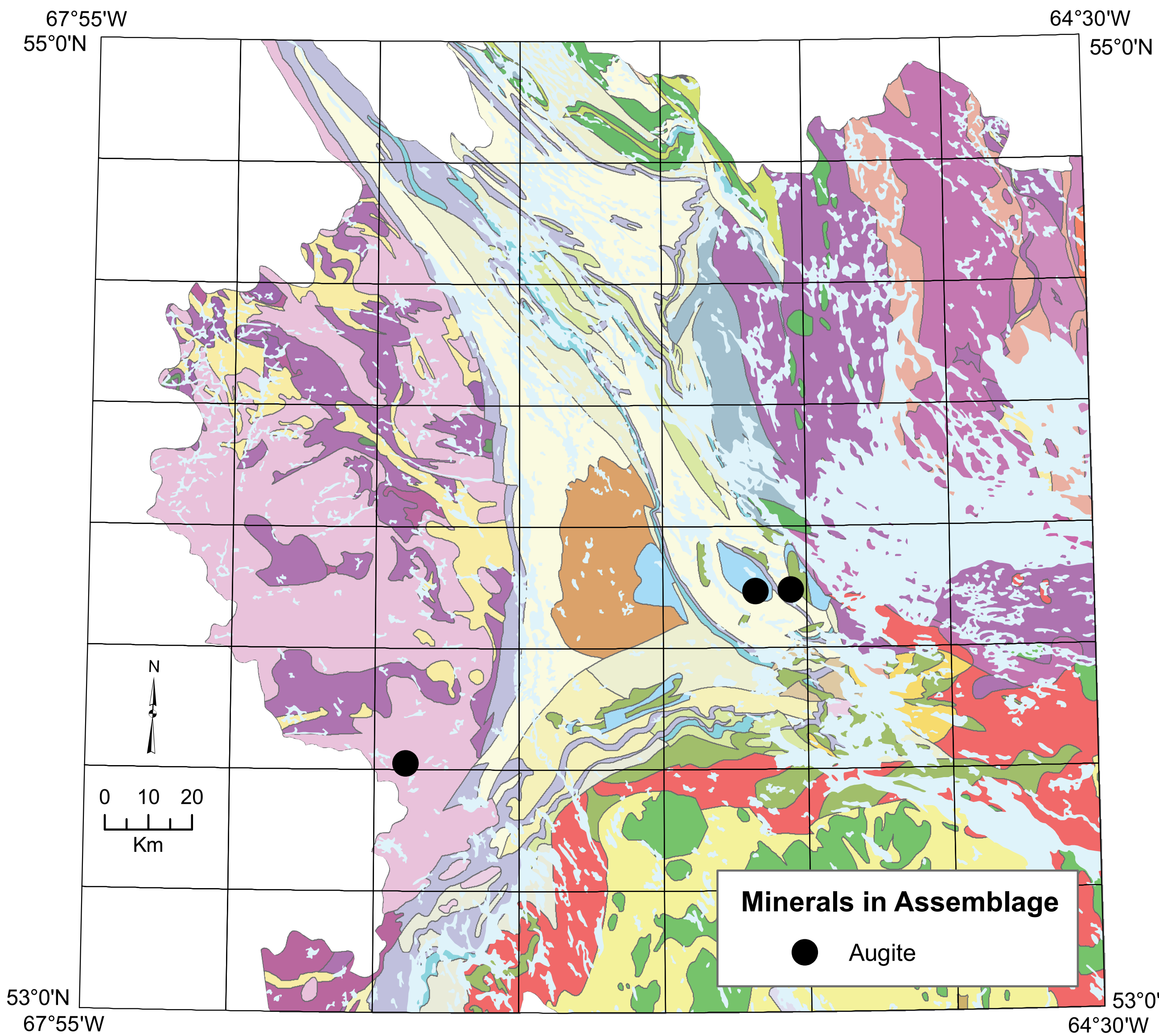

Figure 14. *Presence of augite (Aug) in background assemblage of paramagnetic minerals superimposed on bedrock geology map (from Wardle* et al.*, 1997).*

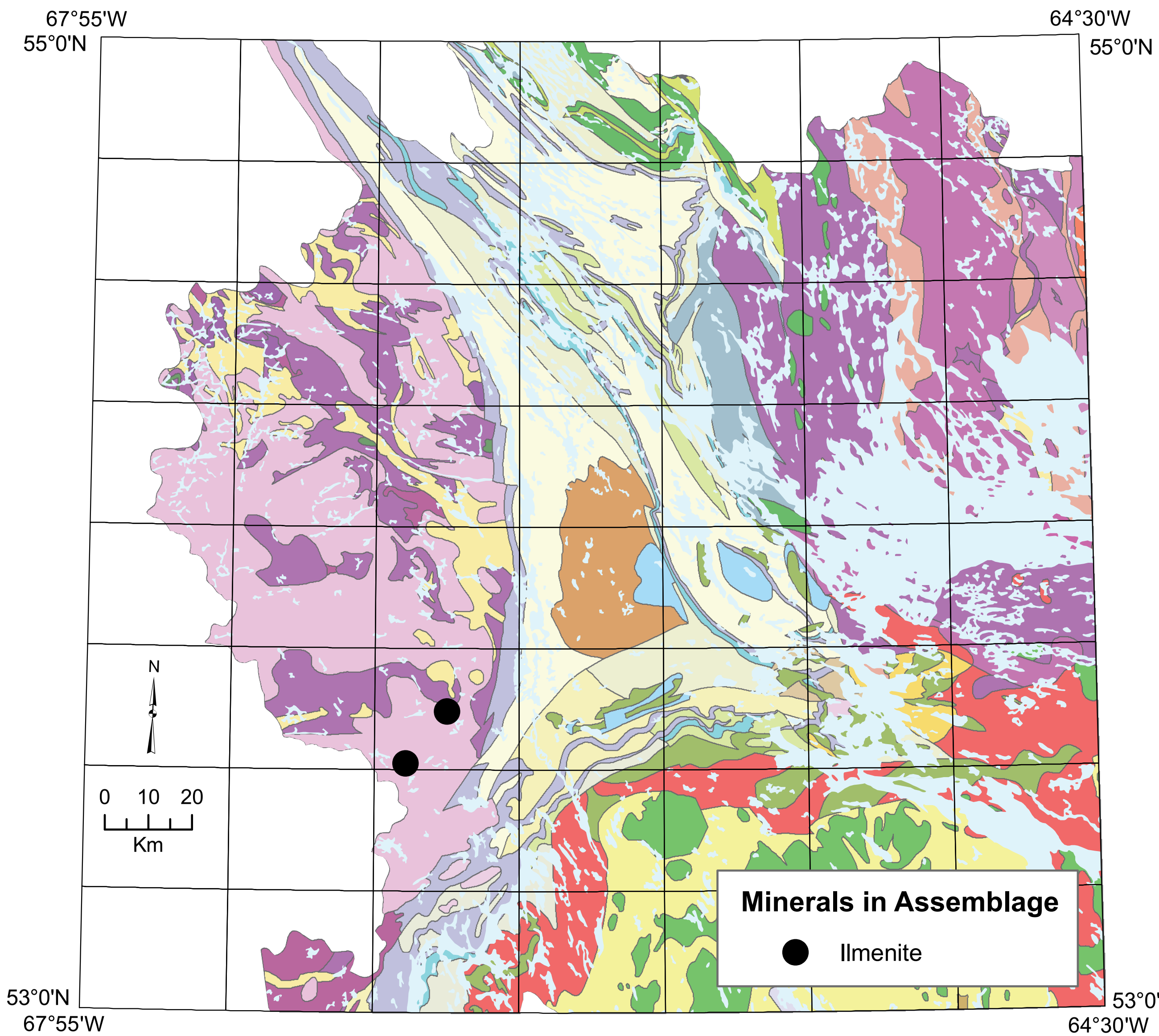

Figure 15. *Presence of ilmenite (Ilm) in background assemblage of paramagnetic minerals superimposed on bedrock geology map (from Wardle* et al., *1997).*

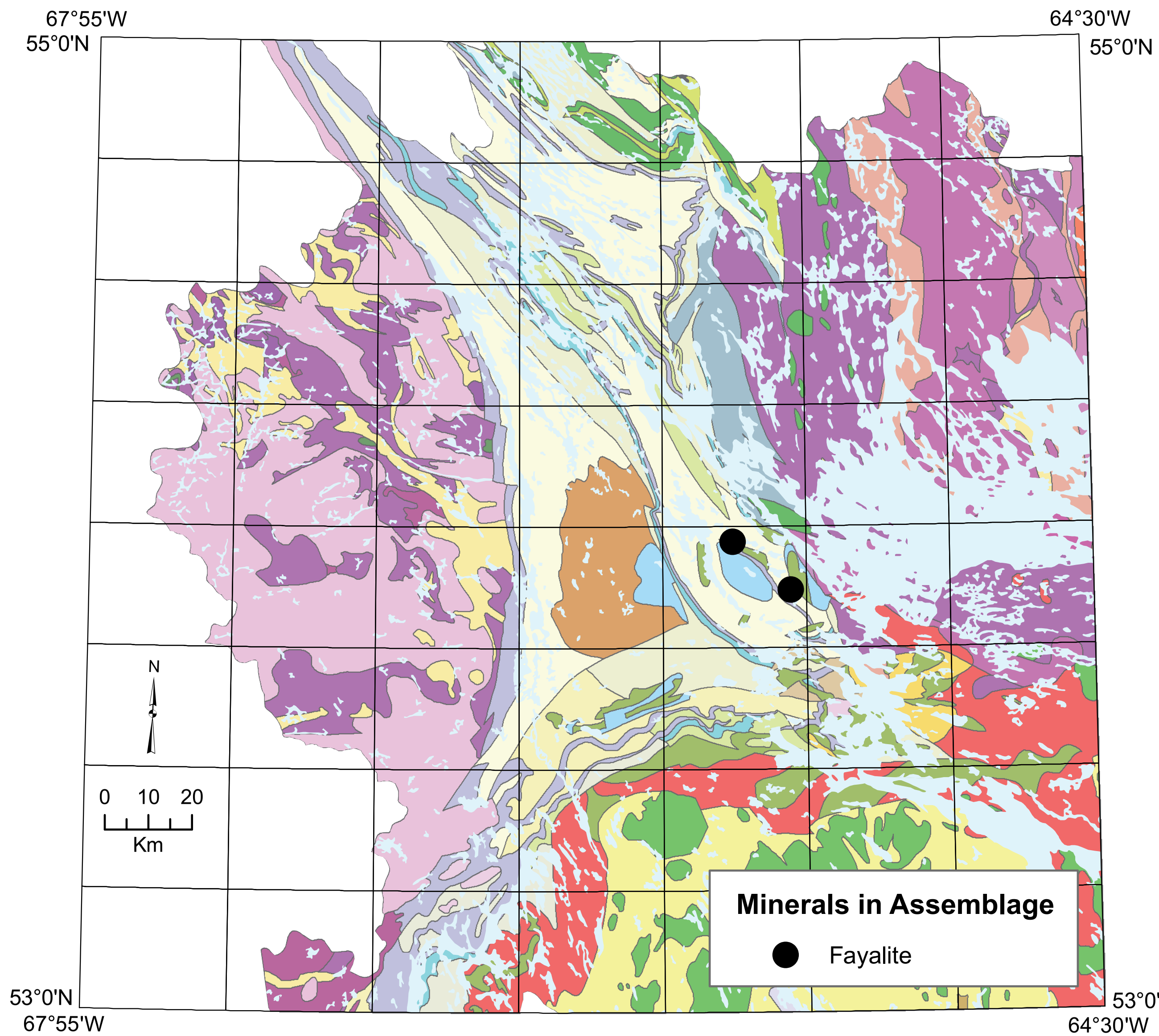

Figure 16. *Presence of fayalite (Fa) in background assemblage of paramagnetic minerals superimposed on bedrock geology map (from Wardle* et al., *1997).*

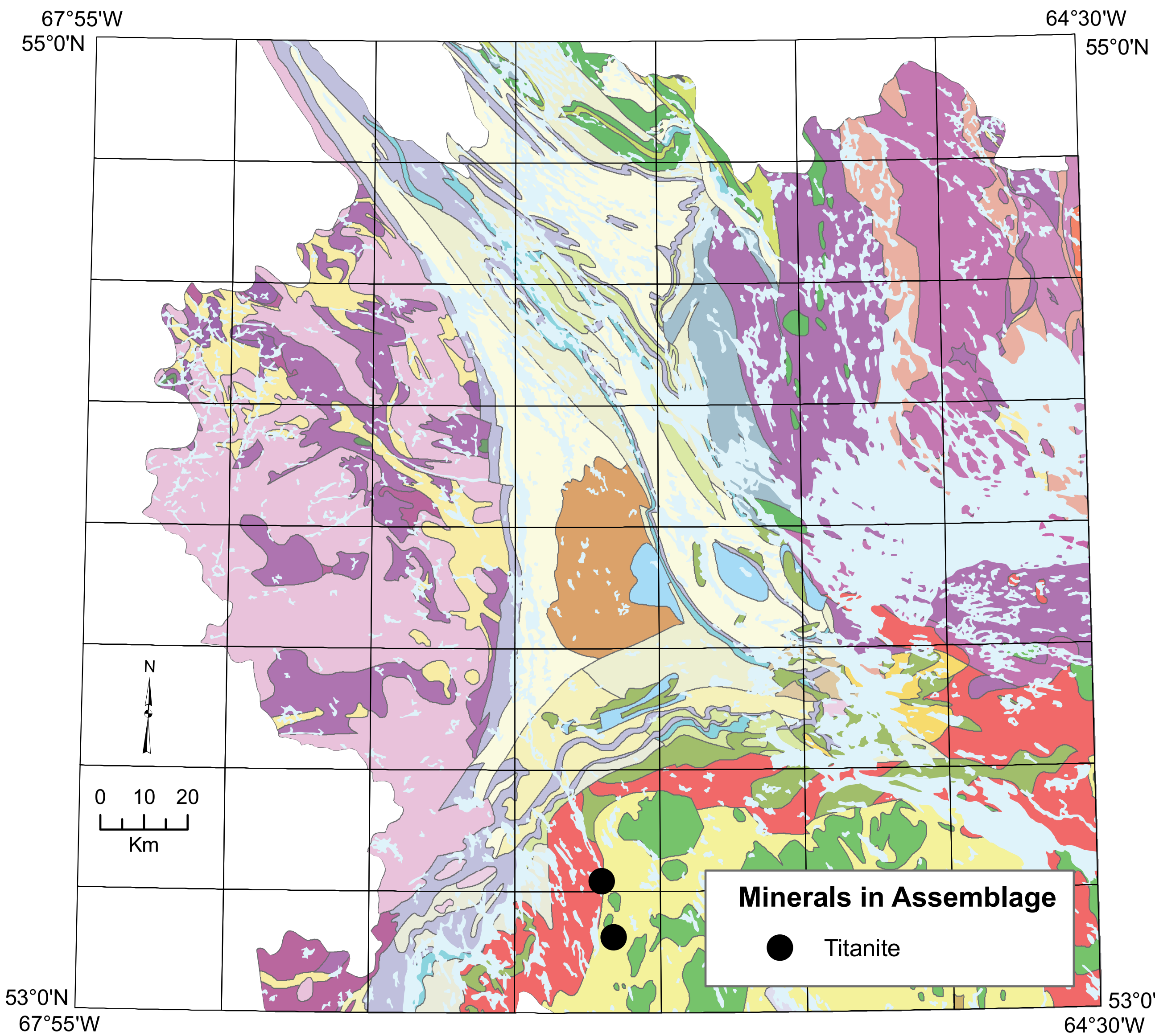

Figure 17. *Presence of titanite (Ttn) in background assemblage of non-paramagnetic minerals superimposed on bedrock geology map (from Wardle* et al., *1997).*

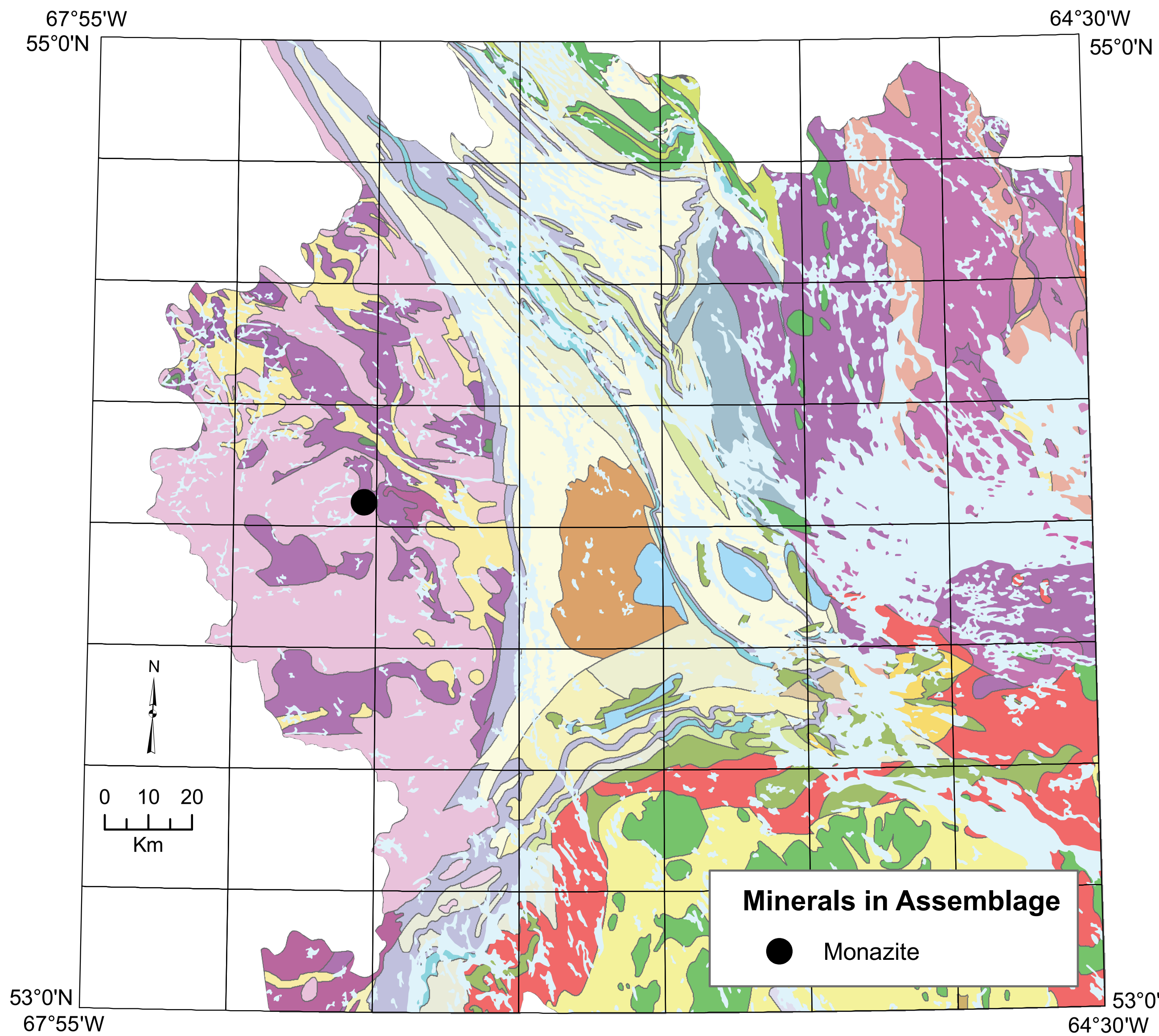

Figure 18. *Presence of monazite in background assemblage of non-paramagnetic minerals superimposed on bedrock geology map (from Wardle* et al., *1997).*

Sillimanite is present in the assemblage of a single sample in NTS map area 23G/02 (Figure 19). The sample, which also contains hornblende, was collected over the contact between Grenvillian granitic rocks (Unit P_3gr) and later mafic intrusive rocks (Unit M_1ga). Although sillimanite is a potential indicator of the presence of metamorphosed alteration zones associated with volcanosedimentary massive sulphide deposits, there is no supporting evidence for the presence of such mineralization, either in terms of mapped geology or other minerals.

Staurolite was reported in the assemblage of a single sample collected over Superior Province rocks in NTS map area 23J/07 (Figure 20). This mineral is also potentially indicative of metamorphosed alteration zones associated with volcanosedimentary massive sulphide deposits but once again, supporting geological and mineralogical evidence for such mineralization is lacking.

Kyanite is present in one sample on the southern boundary of NTS map area 23G/02 (Figure 21). This mineral is also indicative of metamorphosed VMS-associated alteration zones but has economic value in its own right; and two kyanite occurrences (Moose Head Lake North No. 1 and No. 2, MODS numbers 023G/02/Kyn001 and 023G/02/Kyn002) are located about 3 km northwest of the esker sample's location. The kyanite is reported to occur in a coarse, micaceous, feldspar-quartz gneiss and is also reported to be widespread in bands and trace amounts throughout the Wabush Lake area (Stapleton *et al*., 2011).

Barite is present in the assemblages of five samples; all are located over arenaceous rocks of the Sims Group (Tamarack and Muriel River formations) or the underlying argillaceous Menihek Formation of the Upper Knob Lake Group (Ware and Wardle, 1979) in NTS map areas 23G/09, 23G/16, 23H/13 and 23J/01 (Figure 22). Figure 23 shows the locations of the same baritiferous esker samples superimposed on factor-score residuals of Ba in lake sediment (Amor, unpublished data, 2013) and it is clear that there is a relationship between the compositions of the two sample media, and that the mineralogy of the eskers is in some way reflective of that of bedrock.

Pyrite is only present in the assemblage of one sample (although significant grain counts are present in many others) and was discussed above. The sample in question was collected over iron formation at the contact between rocks of the Superior Province and the overlying Labrador Trough. As the esker from which the sample was collected follows this contact, the source of the pyrite is uncertain.

INDIVIDUAL MINERALS

Native copper is described in five samples (7002, 7003, 7052, 7061 and 7257). Overburden Drilling Management has stated that the copper is probably derived from contamination although one of the samples (7052) also returned 24 grains of chalcopyrite; ODM had not analyzed this sample when they expressed this suspicion (Appendix 3). The copper- and chalcopyrite-bearing sample is spatially associated with several other samples in which chalcopyrite (which is not suspected to be the result of contamination) was identified, in NTS map area 23G/08 and probably derived from Labrador Trough rocks (Figure 24).

Loellingite ($FeAs_2$), a potential Ni–Cu MMSIM indicator, was noted in two samples, not spatially co-associated (Figure 25). One sample is located over the Ashuanipi Complex in the south-

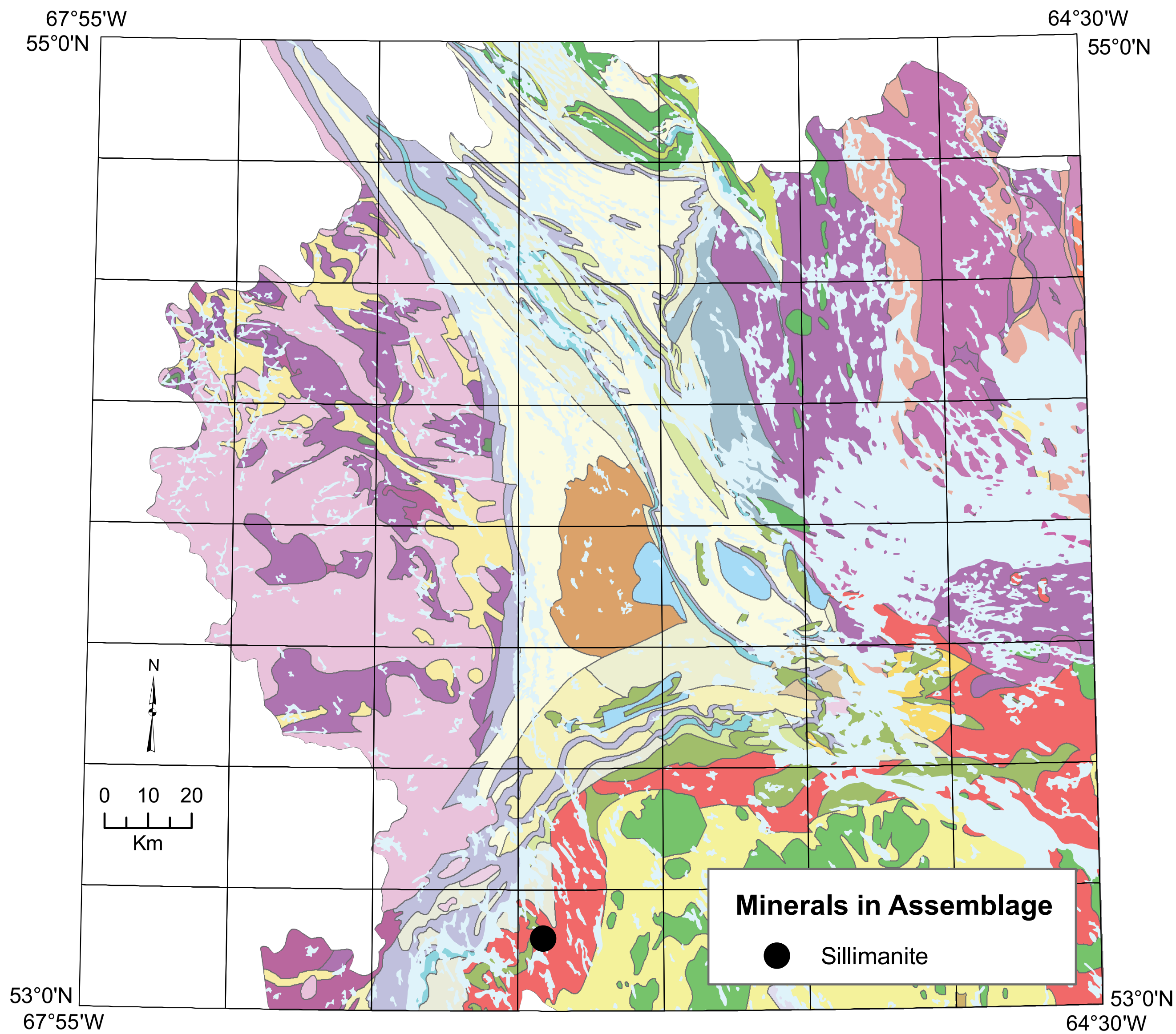

Figure 19. *Presence of sillimanite in background assemblage of non-paramagnetic minerals superimposed on bedrock geology map (from Wardle* et al., *1997).*

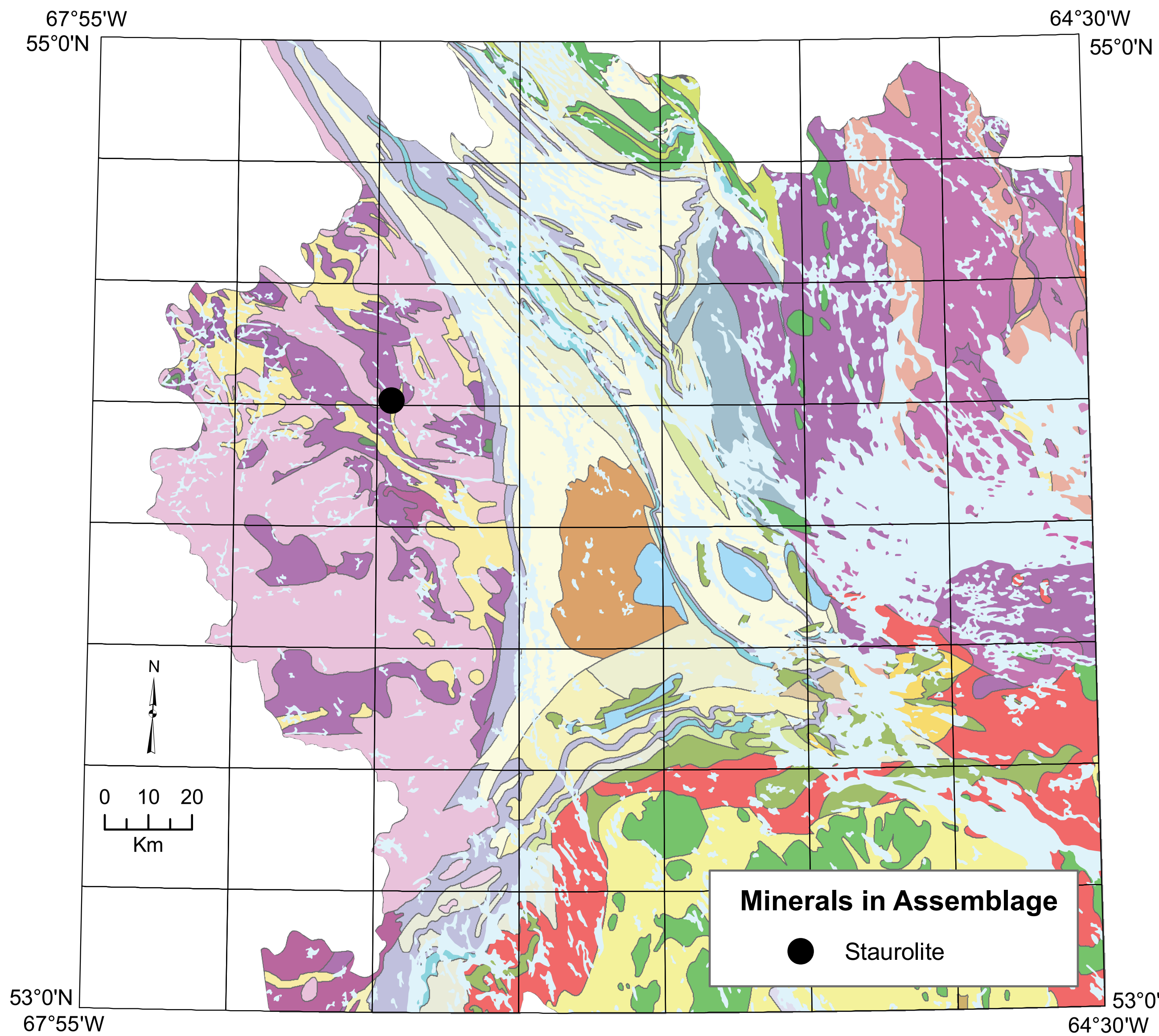

Figure 20. *Presence of staurolite in background assemblage of non-paramagnetic minerals superimposed on bedrock geology map (from Wardle* et al., *1997).*

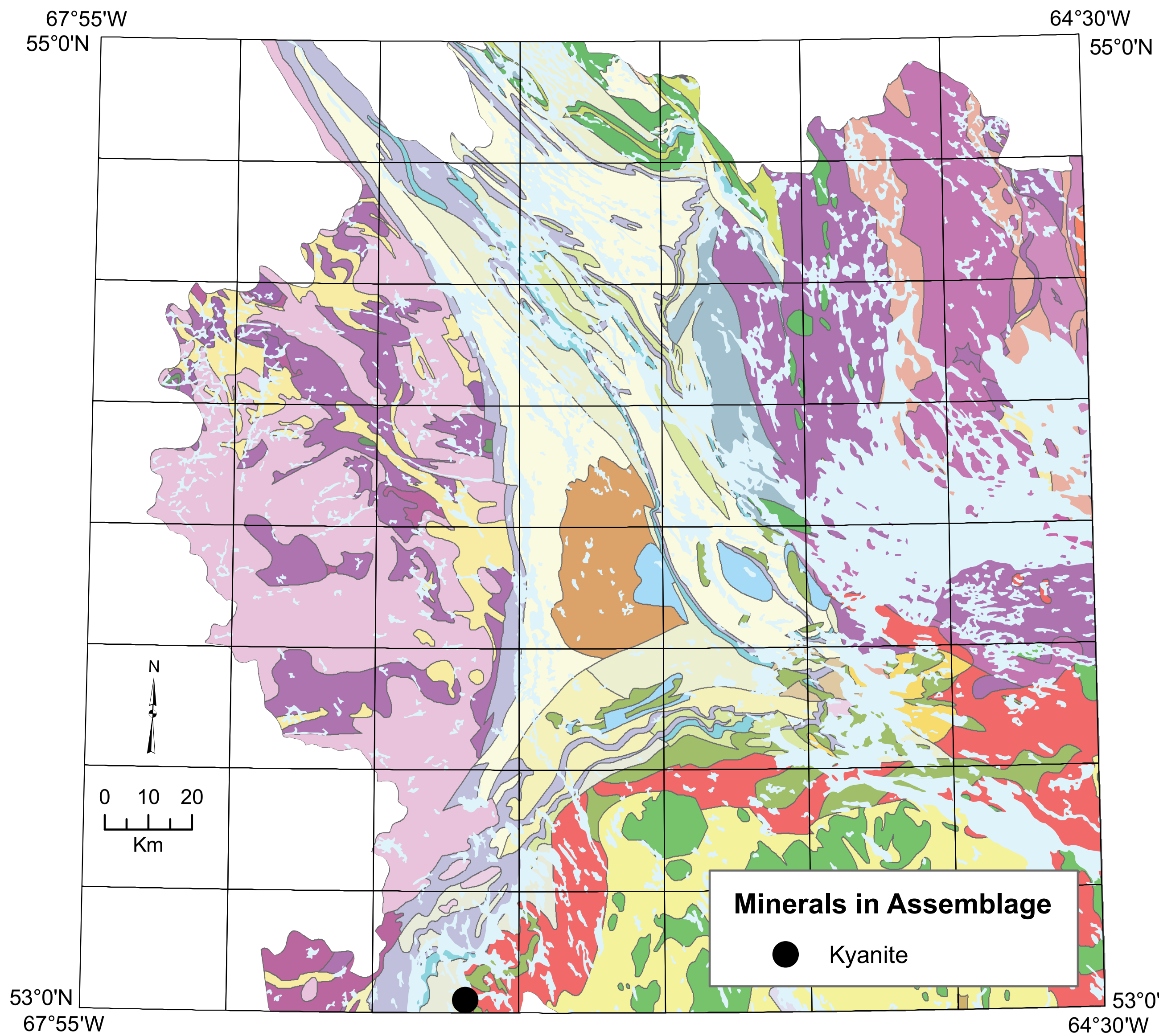

Figure 21. *Presence of kyanite in background assemblage of non-paramagnetic minerals superimposed on bedrock geology map (from Wardle* et al., *1997).*

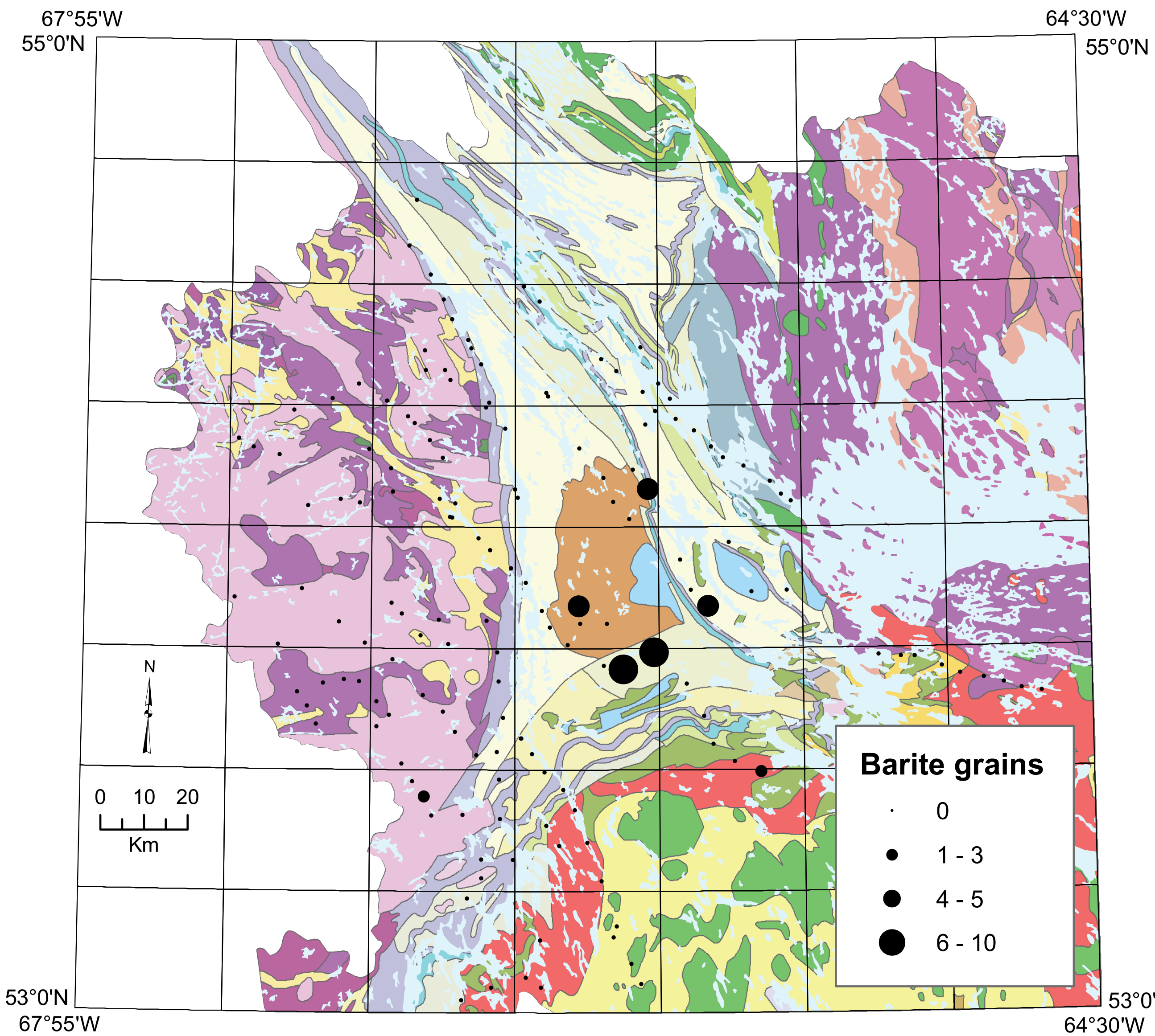

Figure 22. *Barite grains in background assemblage of on-paramagnetic minerals superimposed on bedrock geology map (from Wardle* et al., *1997).*

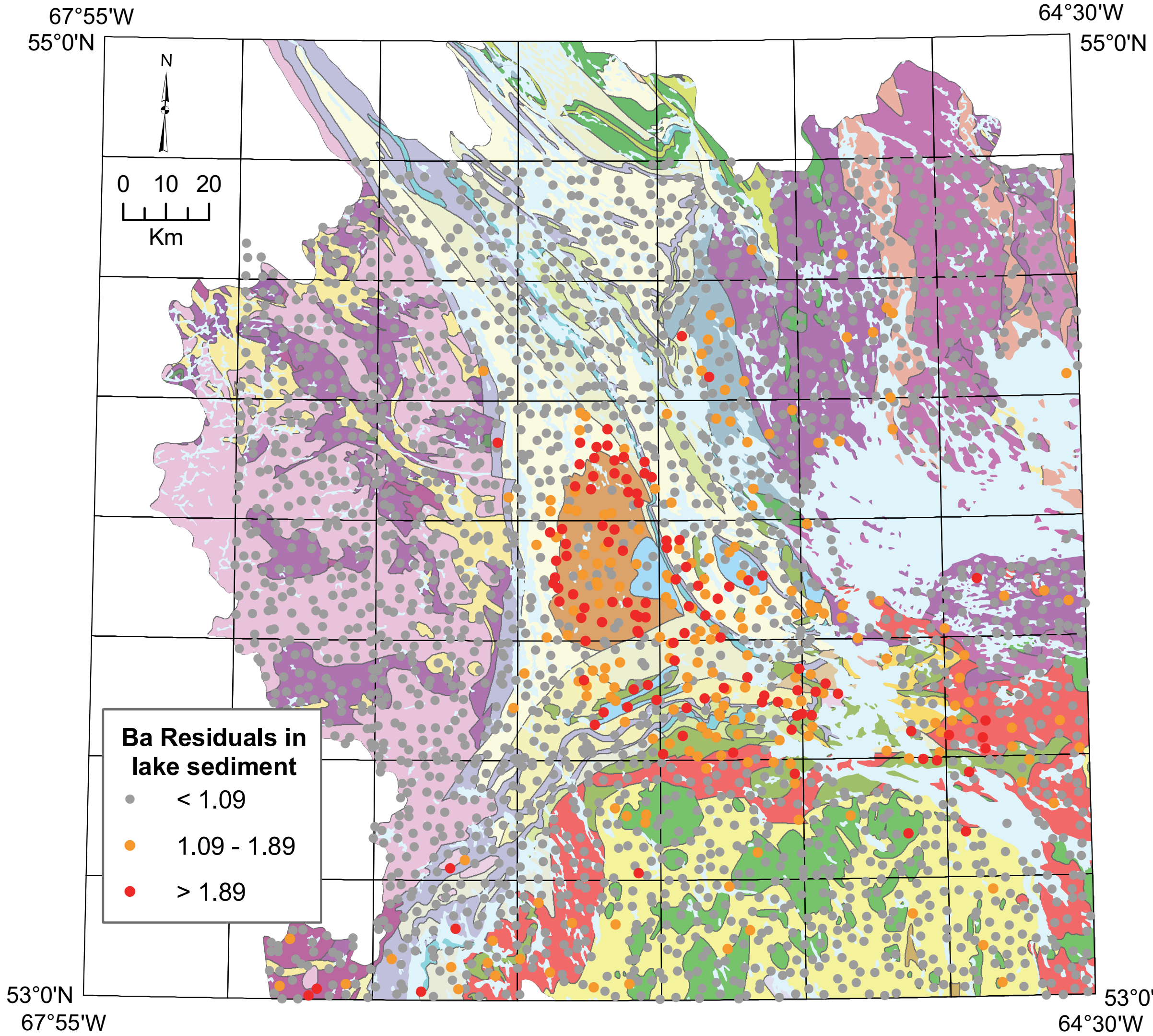

Figure 23. *R-mode factor analysis (Davis, 1973) of lake-sediment data suggests that throughout Labrador, the content of Ba in lake sediment (Davenport* et al.*, 1999) is strongly controlled by the relative amounts of clastic and chemically precipitated material in the sediment (Amor, unpublished data, 2013). Similar effects are noted for Cr, F, Hg, Na, Rb and Sc. This environmental control has a masking effect over more subtle responses attributable to bedrock enrichment. Calculation of factor-score regression residuals of Ba, following a method described by Closs and Nichol (1973), enables compensation of the former control so that the latter responses are highlighted. A zone east of Menihek Lake, whose lake sediments display strong Ba enrichment when filtered in this way, underlain by sediments of the mid-Paleoproterozoic Sims Group and unique in its strength and extent, is thus revealed. During the current study, five baritiferous esker samples were collected within the bounds of this zone; barite grain counts in esker samples are superimposed on standardized regression residuals of Ba. Red circles represent lake sediments whose residuals exceed 1.89, which represents the 97.5-percentile for Labrador; orange circles represent residuals in excess of the 90-percentile of 1.09. All lower residual values are represented by grey symbols.*

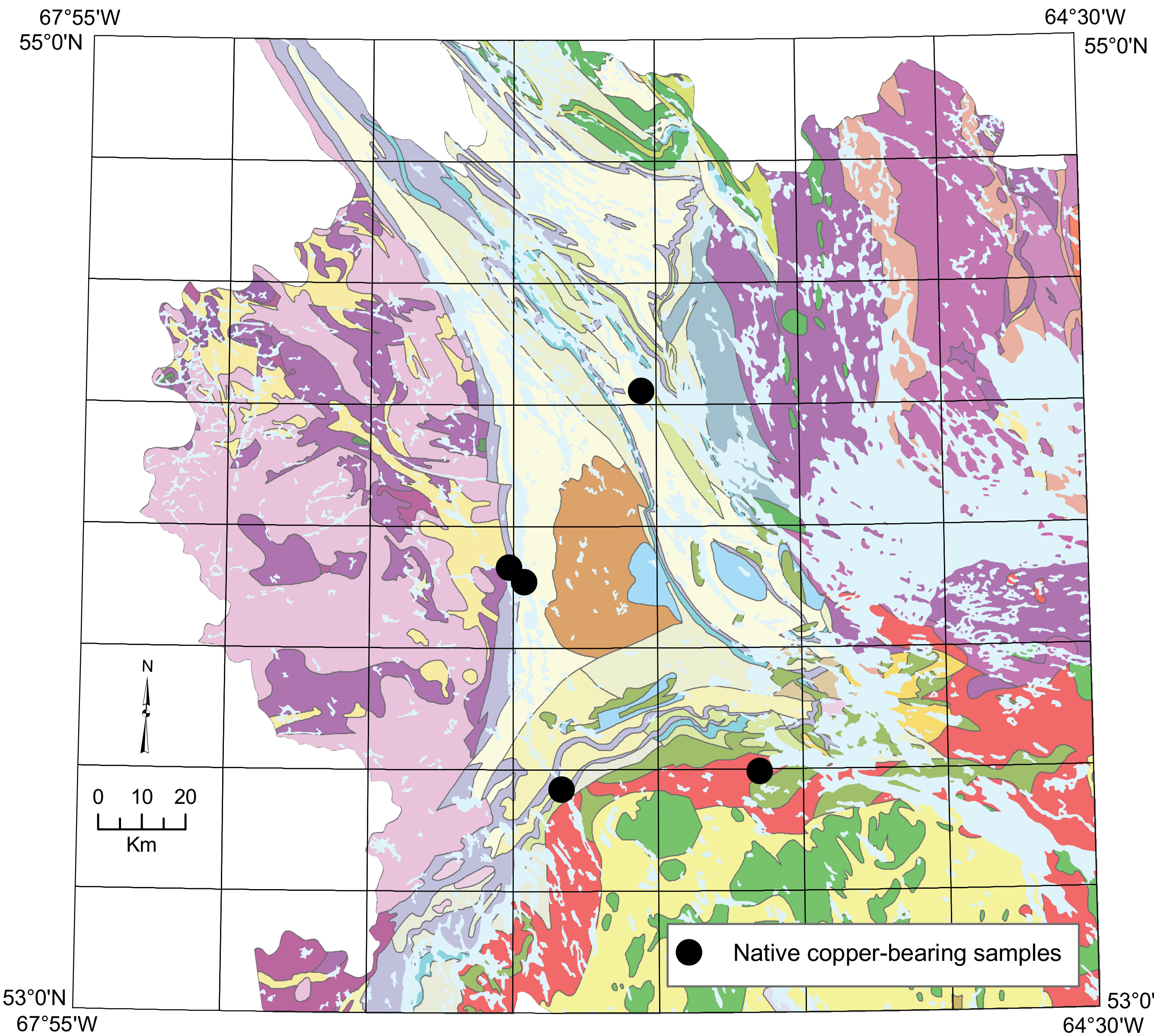

Figure 24. *Native copper-bearing samples superimposed on bedrock geology map (from Wardle* et al., *1997).*

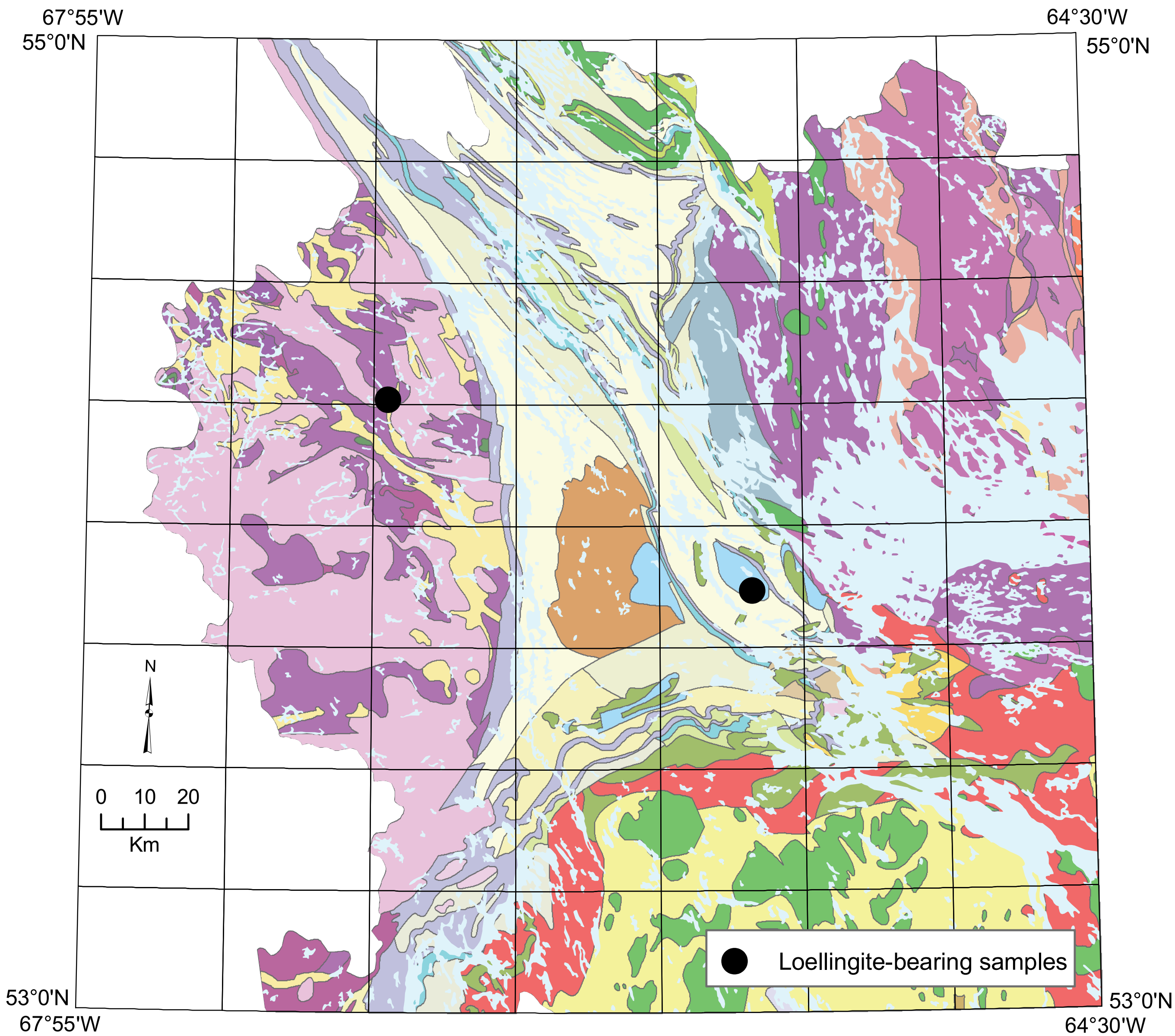

Figure 25. *Loellingite-bearing samples superimposed on bedrock geology map (from Wardle* et al., *1997).*

west corner of NTS map area 23J/07. The other is located over Labrador Trough rocks in NTS map area 23H/13; the paramagnetic assemblage of the sample includes augite, and that of two neighbouring samples, fayalite; the assemblage is probably related to gabbro and amphibolite (Unit M_1ga) that have been mapped in the area and assigned to the Montagnais Suite (Frarey and Duffell, 1964).

Three samples were reported to contain **molybdenite**; they are not spatially co-associated (Figure 26). One (sample 7046), on the northern boundary of NTS map area 23G/02, returned two molybdenite grains, unaccompanied by any indicator minerals, and was collected over pelitic schist or pelitic phyllite (Unit P_2ss) of the Labrador Trough. No neighbouring samples returned any indicator minerals. Sample 7073, in NTS map area 23H/13, is associated with metasediments of the Labrador Trough and also returned one gold grain as well as barite in the non-paramagnetic assemblage. Sample 7218 contains 3 grains of molybdenite and was collected in the northeast corner of NTS map area 23J/02; it is somewhat separate from the cluster of auriferous and pyritiferous samples on that map sheet, and its provenance could be from the Ashuanipi Complex or from the overlying rocks of the Labrador Trough.

Gahnite (zinc spinel) is an indicator of metamorphosed volcanosedimentary massive sulphide deposits. One sample (7201 in NTS map area 23G/16; Figure 27) returned a single gahnite grain, accompanied by two reshaped gold grains and no other indicator minerals; while not encouraging in isolation, the sample lies on the edge of an anomaly defined by factor score residuals of barium in lake sediment, suggesting a possible affinity to exhalative massive sulphide mineralization.

The chromium-bearing garnets **Cr-andradite** and **uvarovite** are present (in amounts of only one grain each) in samples 7005 and 7006, respectively. Both minerals are believed to be diagnostic of magmatic Ni–Cu–PGE mineralization, and both samples were collected (at sites separated by only 0.5 km) from the same esker that displays a dispersion pattern of non-kimberlitic forsterite, which is similarly diagnostic (Figure 28).

SUMMARY

A reconnaissance-sediment sampling program was conducted in western Labrador, where the surrounding bedrock geology and exploration suggests the potential existence of diamond-bearing kimberlites and lamproites. Examination of heavy minerals concentrated from 154 samples of esker gravel collected over rocks of the Archean Ashuanipi Complex (Superior Province; Percival, 1993; James, 1997a, b), the Proterozoic Labrador Trough (Kaniapiskau Supergroup) and Grenville Province (Wardle *et al.,* 1997) from Western Labrador has not revealed indications of the presence of kimberlites. Indeed, it is strongly suggested that kimberlites are absent from the eskers' source area because there is evidence that the composition of the gravels is reflective of that of local or regional bedrock. This is most strongly suggested by the supracrustal content of the esker clasts, which precisely delineates the contact between the largely gneissic Ashuanipi Complex and the volcanosedimentary Kaniapiskau Supergroup, and by the presence of kyanite in the non-paramagnetic assemblage of a sample collected within 5 km of two documented kyanite occurrences.

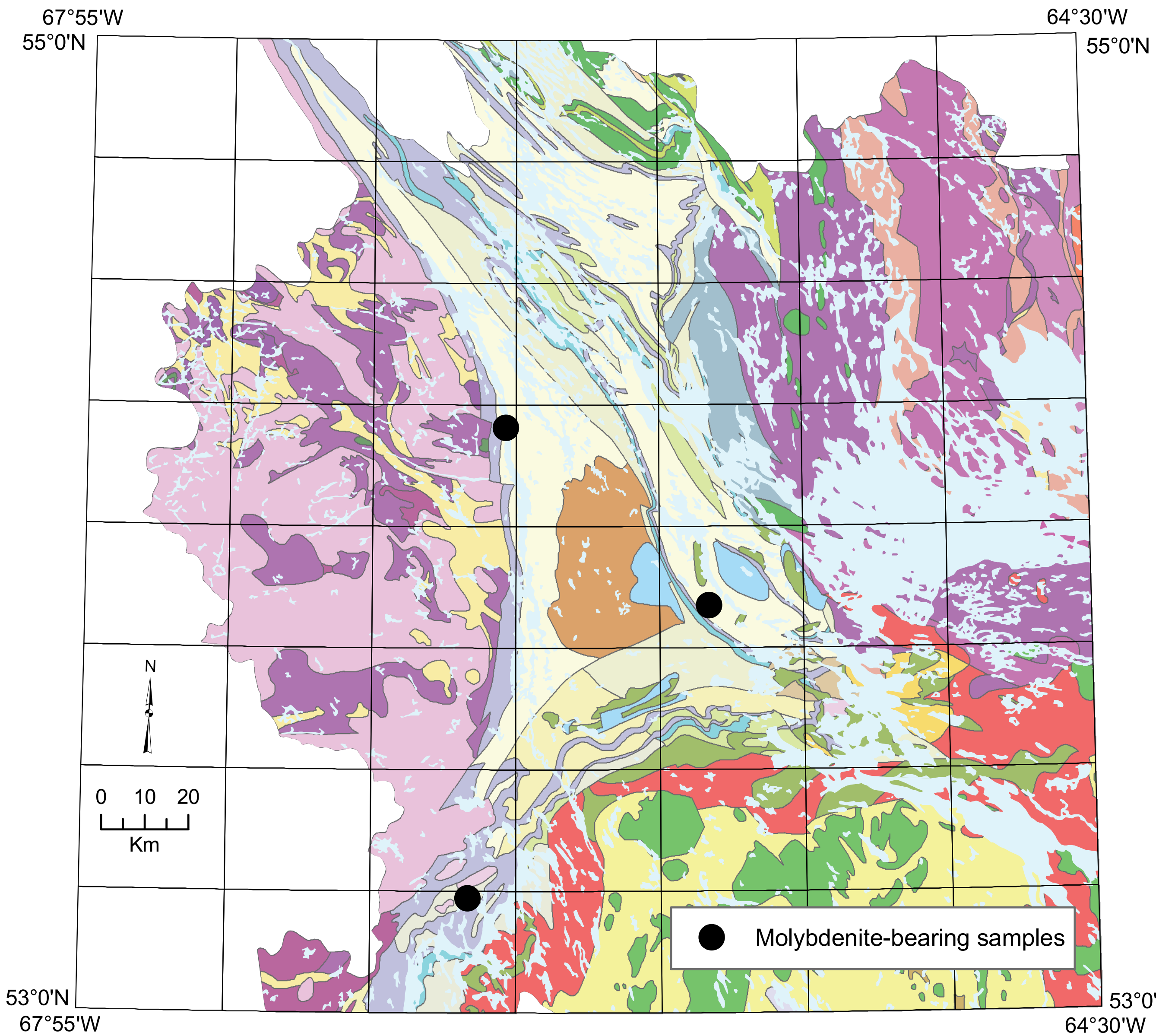

Figure 26. *Molybdenite-bearing samples superimposed on bedrock geology map (from Wardle* et al., *1997).*

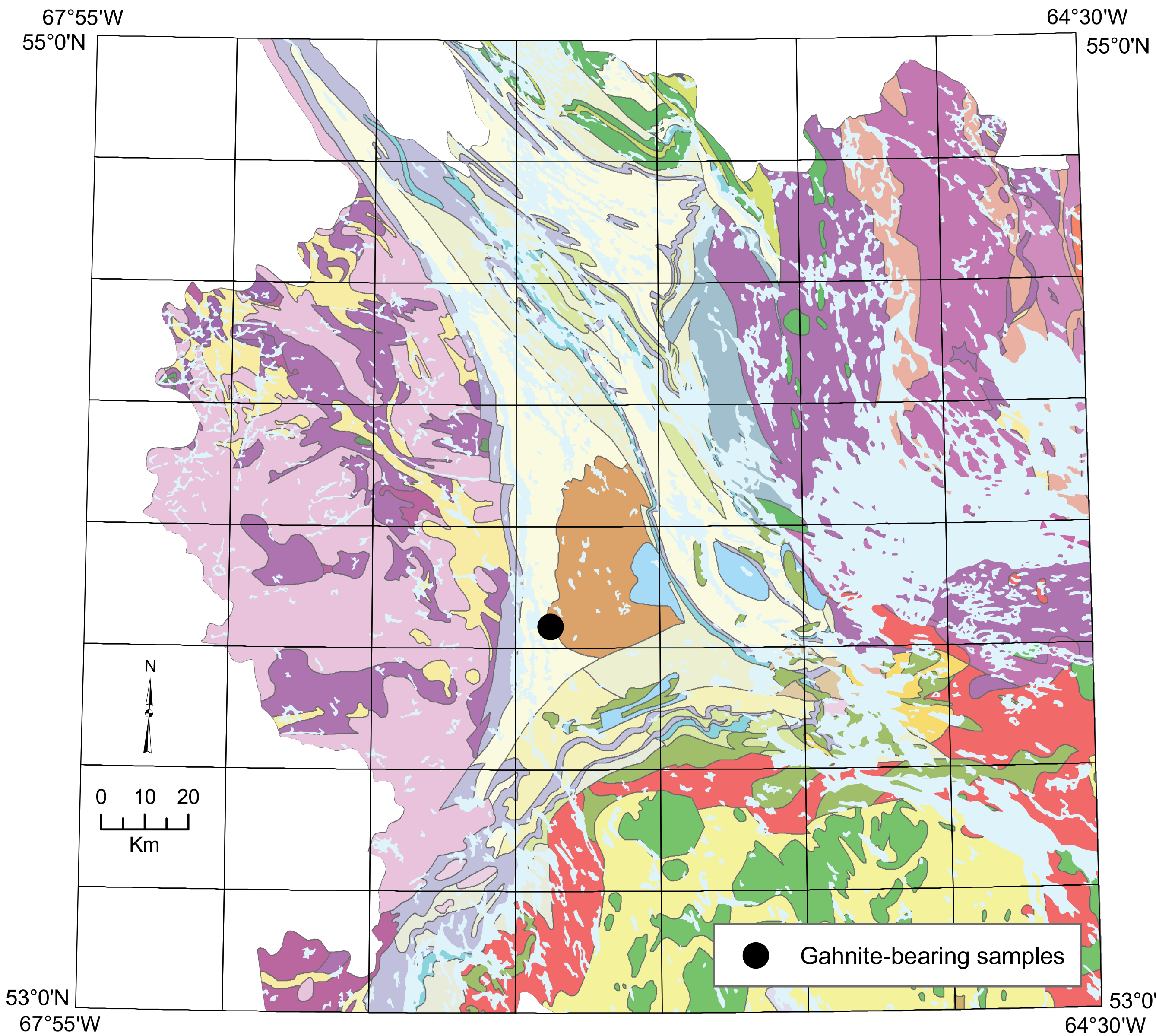

Figure 27. *Gahnite-bearing samples superimposed on bedrock geology map (from Wardle* et al., *1997).*

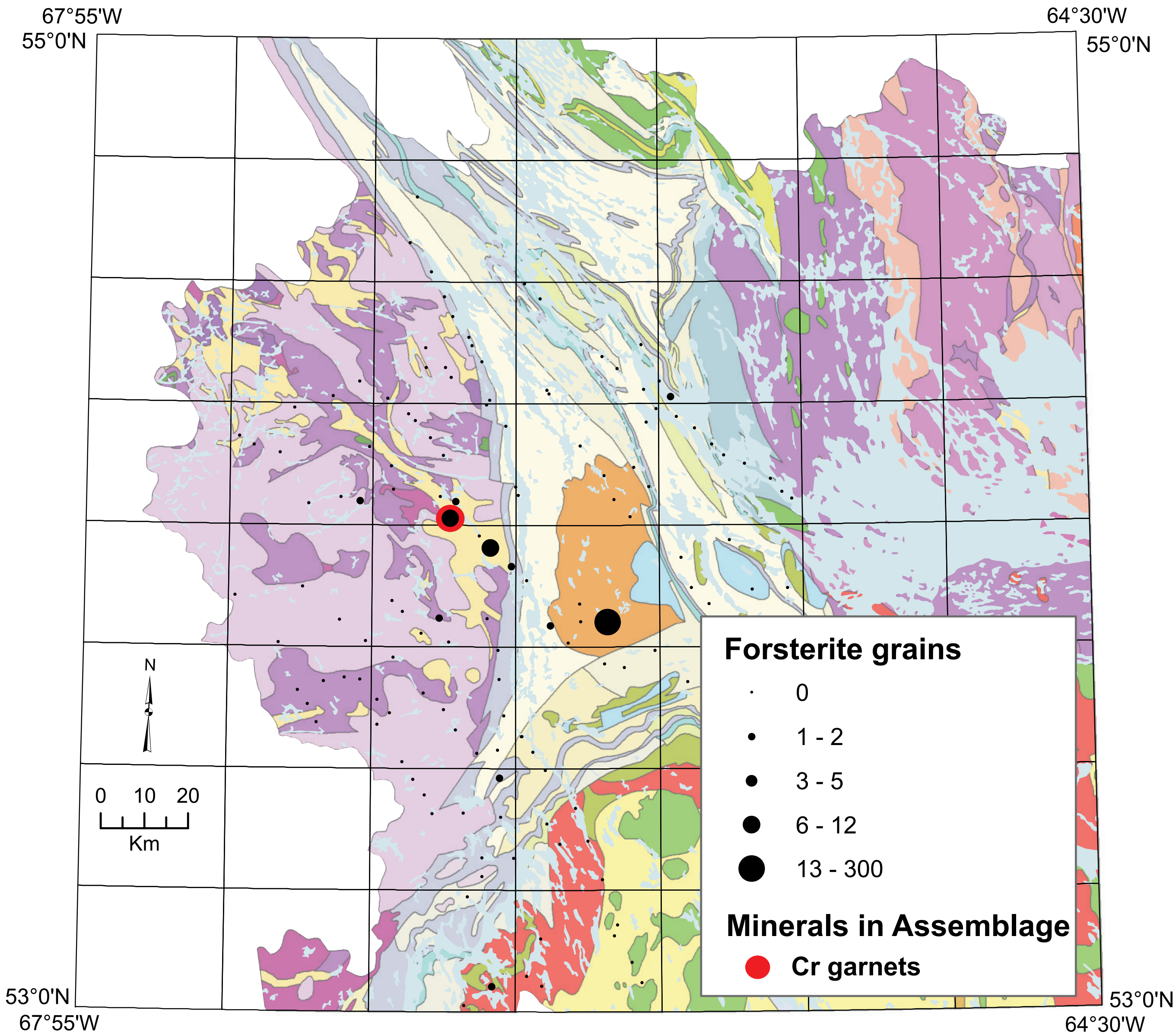

Figure 28. *Chromium-bearing garnet samples superimposed on bedrock geology map (from Wardle* et al., *1997).*

This allows not only for the region's kimberlite potential to be written off with reasonable confidence, but also provides evidence of the presence of other types of mineralization or unusual, unmapped rock types. In decreasing order of significance, these indications are as follows:

- Sedimentary or volcanosedimentary barite mineralization, possibly accompanied by base-metal sulphides, in Mid-Paleoproterozoic metasediments of the Sims Group (Tamarack and Muriel River formations; Ware and Wardle, 1979) Labrador Trough, centred in NTS map area 23G/16. There is independent evidence from lake-sediment geochemistry of Ba enrichment in the area.
- Magmatic Ni–Cu mineralization, possibly rather minor, in rocks of the Ashuanipi Complex in NTS map areas 23J/02 or 23J/03.
- Minor pyritic Au/Cu mineralization, probably hosted in paragneiss of the Ashuanipi Complex, in NTS map area 23J/07.
- 'Low-chromium' (cumulus, as opposed to kimberlitic) diopside indicating magmatic Ni–Cu mineralization, in Grenvillian metamorphosed mafic intrusive rocks in NTS map areas 23G/01 and 23H/11.
- Cu mineralization of unknown type in Labrador Trough supracrustal rocks on NTS map areas 23G/08 and 23G/09.
- Magmatic Ni–Cu mineralization in gabbroic rocks of the Montagnais suite (Labrador Trough).

FUTURE WORK

Samples have been submitted to the Geological Survey's Geochemical Laboratory where the archive splits of the samples will be sieved to the silt-clay fraction and additional analyses from a commercial laboratory where samples will be analyzed by ICP-OES and INAA for a suite of 58 elements. Results for these analyses are expected to be released in 2014.

ACKNOWLEDGEMENTS

The authors thank Wayne Tuttle and Gerry Hickey for logistic support. Jerry Ricketts provided much appreciated guidance and support during sampling. Krista Hawco, Aaron Anstey, and Alexanne Oke are thanked for their excellent field assistance. Matt Hoyles of Universal Helicopters is thanked for his piloting skills. Melanie Irvine is thanked for editing of this manuscript and Martin Batterson is thanked for his support during the field program and for providing a critical review of this manuscript.

REFERENCES

Averill, S.A.

2001: The application of heavy indicator mineralogy in mineral exploration with emphasis on base metal indicators in glaciated metamorphic and plutonic terrains. *In* Drift Exploration in Glaciated Terrain. Geological Society, London, Special Publications, Volume 185, pages 69-81.

2009: Useful Ni-Cu-PGE versus kimberlite indicator minerals in surficial sediments: similarities and differences. *In* Application of till and stream sediment heavy mineral and geochemical methods to mineral exploration in western and northern Canada. *Edited by* Paulen, R.C.

and McMartin, I.; Geological Association of Canada, Short course notes, Volume 18, pages 125-139.

Batterson, M.J.
1989: Glacial dispersal from the Strange Lake alkalic complex, northern Labrador. *In* Drift Prospecting. *Edited by* R.N.W. DiLabio and W.B. Coker; Geological Survey of Canada, Paper 89-20, pages 31-40.

Batterson, M.J. and Liverman, D.
2000: Contrasting styles of glacial dispersal in Newfoundland and Labrador: methods and case studies. *In* Current Research, Newfoundland Department of Mines and Energy, Geological Survey Branch, Report 2000-1, pages 1-31.

Bolduc, A.M., Klassen, R.A., and Evenson, E.B.
1987: Cobble lithologies in eskers in central Labrador. *In* Current Research, Part A, Geological Survey of Canada, Paper 87-1A, pages 43-51.

Cummings, D.I., Russell, H.A.J., Sharpe, D.R., and Kjarsgaard, B.A.
2011: Eskers as mineral exploration tools: A review. Geological Survey of Canada, Current Research 2011-03, 17 pages.

Davenport, P.H., Friske, P.W.B. and Nolan, L.W.
1998: Digital geochemical atlas of Labrador. *In* Report of activities, *Edited by* C.P.G. Pereira, Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey, Report of Activities, 1998, 31 pages.

Friske, P.W.B., McCurdy, M.W. and Day, S.J.A.
1996: National Geochemical Reconnaissance, Labrador compilation: distribution of nickel in 18,839 lake sediment samples and 1244 stream sediment samples, Newfoundland (Labrador). Geological Survey of Canada, Open File 3260b, 1 sheet.

Grant, D.R.
1989: Quaternary geology of the Atlantic Appalachian region of Canada. *In* Quaternary Geology of Canada and Greenland. *Edited by* R.J. Fulton. Geological Survey of Canada, Geology of Canada No. 1, pages 391-400.

Frarey, M. and Duffell, S.
1964: Revised stratigraphic nomenclature for the central part of the Labrador Trough. Geological Survey of Canada, Paper 64-25, 13 pages.

James, D.T.
1997a: Geology of the Archean Ashuanipi Complex, western Labrador [parts of NTS map areas 23G/6, G/7, G/10, G/11, G/13, G/14, G/15]. Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey, Map 97-03. Scale 1: 100 000.

1997b: Geology of the Archean Ashuanipi Complex, western Labrador. Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey, Report 97-02, 1997, 37 pages.

James, D.T. and van Gool, J.
1997: Geology of the Archean Ashuanipi Complex and Paleoproterozoic Knob Lake Group, western Labrador (parts of NTS map areas 23G/2, 2G/3, 23B/14). Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey Map 97-04. Scale: 1:100 000

Jensen, S.M. and Secher, K.
2004: Diamond exploration in Greenland. Greenland Mineral Resources, Fact Sheet Number 7. Geological Survey of Denmark and Greenland (GEUS), 2 pages.

Klassen, R.A.
1999: The application of glacial dispersal models to the interpretation of till geochemistry in Labrador, Canada. Journal of geochemical exploration. Volume 67, pages 245-269.

Klassen, R.A. and Thompson, F.J.
1987: Ice flow history and glacial dispersal in the Labrador Trough. *In* Current Research, Part A, Geological Survey of Canada, Paper 87-1A, pages 61-71.

1989: Ice flow history and glacial dispersal patterns, Labrador. *In* Drift Prospecting. *Edited by* R.N.W. DiLabio and W.B. Coker; Geological Survey of Canada, Paper 89-20, pages 21-29.

1990: Glacial history, drift composition and till geochemistry, Labrador. Geological Survey of Canada, Open File 2170, 25 pages.

1993: Glacial history, drift composition, and mineral exploration, central Labrador: Geological Survey of Canada, Bulletin 435, 76 pages.

1997: Glacial history and ice flow dynamics applied to drift prospecting and geochemical exploration. *In* Exploration geochemistry, Paper 30, pages 221-232.

Klassen, R.A., Paradis, S., Bolduc, A.M., and Thomas, R.D.
1992: Glacial landforms and deposits, Labrador, Newfoundland and eastern Quebec, Geological Survey of Canada, Map 1814A, scale 1:1 000 000.

Lapointe, B.
1986: Reconnaissance géologique de la région du Lac Pailleraut, Territoire du Nouveau Québec, Ministere de l'Energie et des Ressources du Québec MB 85-73, 10 pages.

1989: Quaternary geology of the Atlantic Appalachian region of Canada. *In* Quaternary Geology of Canada and Greenland. *Edited by* R.J. Fulton. Geological Survey of Canada, Geology of Canada No. 1, pages 391-400.

McClenaghan, M.B. and Kjarsgaard, B.A.
2007: Indicator mineral and surficial geochemical exploration methods for kimberlite in glaciated terrain; Examples from Canada. *In* Mineral deposits of Canada: A Synthesis of Major Deposit-Types, District Metallogeny, the Evolution of Geological Provinces, and Exploration Methods. *Edited by* W.D. Goodfellow. Geological Association of Canada, Mineral Deposits Division, Special Publication No. 5, pages 983-1006.

McClenaghan, M.B., Kjarsgaard, I.M, Kjarsgaard, B.A. and Heaman, L.M.
2002: Mineralogy of kimberlite boulders from eskers in the Lake Timiskaming and Kirkland areas, northeastern Ontario. Geological Survey of Canada, Open File 4361, 50 pages.

McClenaghan, M.B., Thorleifson, L.H., and DiLabio, R.N.W.
1997: Till geochemical and indicator mineral methods in mineral exploration. *In* Exploration geochemistry, Paper 31, pages 233- 248.

Moorhead, J. Perreault, A.B., Sharma, K.N.M., Beaumier, M. and Cadieux, A.M.
2000: Kimberlites and diamonds in northern Quebec, Geologie Quebec PRO 99-09, 10 pages.

Morris, T.J. and Kaszycki, C.A.
1995: A prospector's guide to drift prospecting for diamonds, northern Ontario. *In* Ontario Geological Survey, Open File Report 5933, 110 pages.

Pell, J.A.
1997: Kimberlites in the Slave Craton, Northwest Territories, Canada. *In* Geoscience Canada, Volume 24, Number 2, pages 77-90.

Percival, J.A.
1993: Geology, Ashuanapi Complex, Schefferville area, Newfoundland-Quebec: Geological Survey of Canada, Map 1785a.

Prest, V.K.
1984: The late Wisconsinan Glacier Complex. *In* Quaternary Stratigraphy of Canada – A Canadian Contribution to IGCP Project 24. *Edited by* R.J. Fulton. Geological Survey of Canada, Paper 84-10, pages 21 -36.

Ryan, B. and McConnell, J.
1995: The search for kimberlite and lamproite intrusions in eastern Labrador: Initial report of a bedrock and surficial-sediment sampling survey. *In* Current Research. Newfoundland Department of Natural Resources, Geological Survey, Report 95-1, pages 177-204.

Stapleton, G.J., Smith, J.L. and Rafuse, H.M.
2011: Mineral Occurrence Data System. *In* Current Research, Newfoundland and Labrador Department of Natural Resources, Geological Survey, Report 11-1, pages 341-345.

Van Rythoven, A.D., McCandless, T.E., Schulze, D.J., Bellis, A., Taylor, L.A. and Liu, Y.
2011: Diamond crystals and their mineral inclusions from the Lynx kimberlite dyke complex, central Quebec. *In* The Canadian Mineralogist, Volume 49, pages 691-706.

Wardle, R J, Gower, C F, Ryan, B, James, D T, Nolan, L W, Nunn, G A G and Kerr, A
1997: Digital geological map of Labrador. Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey, Open File LAB/1226 Version 1.0.

Ware, M.J. and Wardle, R.J.
1979: Geology of the Sims-Evening Lake area, western Labrador, with emphasis on the Helikian Sim's Group. Government of Newfoundland and Labrador, Department of Mines and Energy, Mineral Development Division, Report 79-05, 26 pages.

Wilton, D.H.C., Taylor, R.C., Sylvester, P.J. and Penney, G.T.
2002: A review of kimberlitic and ultramafic lamprophyre intrusives from northern Labrador. *In* Current Research. Newfoundland Department of Natural Resources, Geological Survey, Report 02-1, pages 343-352.

Sample Number	Weight (kg) Bulk Rec'd	Weight (kg) Table Split	Weight (kg) >2 mm Clasts	Weight (kg) Table Feed	Clasts >2.0 mm* Size	Clasts >2.0 mm* Percentage V/S	Percentage GR	Percentage LS	Percentage OT	Matrix <2.0 mm Distribution S/U	Distribution SD	Distribution ST	Distribution CY	Org	Colour Sand	Colour Clay	Class	Weight (g) <2.0 mm Table Concentrate Total	< 0.25 mm	0.25-2.0 mm Heavy Liquid Separation S.G 3.20 Heavy Liquid Lights	Mag HMC	Nonferromagnetic HMC Total	Processed Split %	Processed Split Weight	Total <0.25 mm (wash)	Total 0.25 to 0.5 mm	Total 0.5 to 1.0 mm	Total 1.0 to 2.0 mm
127002	10.2	9.7	0	9.7	No Clasts					S	MC	N	N	N	LOC	NA	SAND	1264.3	272.6	845.6	26.9	119.2	100	119.2	10.9	92.4	15.7	0.2
127003	10.9	10.4	0.2	10.2	G	10	90	0	0	S	FMC	-	N	N	OC	NA	SAND + GRAVEL	1358.2	686.8	492.8	5.2	173.4	50	86.7	11.3	54.6	18.5	2.3
127004	11.5	11	1.8	9.2	G	Tr	100	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	1540.4	297.5	1093.5	4	145.4	50	72.7	3.7	46.9	19.7	2.4
127005	10.6	10.1	2.3	7.8	G	Tr	100	0	0	S	MC	-	N	N	OC	NA	SAND + GRAVEL	720.2	408.7	258.8	4.8	47.9	100	47.9	3.8	21.8	12.7	9.6
127006	13.1	12.6	0.7	11.9	G	5	95	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	908.2	98.1	605.1	24	181	50	90.5	2.3	49.4	38.6	0.2
127007	13.2	12.7	0.9	11.8	G	Tr	100	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	1401	578.8	674.4	5.8	142	50	71	12.9	53.2	4.6	0.3
127008	13.9	13.4	1.7	11.7	G	Tr	100	0	0	S	FMC	Y	N	N	OC	NA	SAND + GRAVEL	1385.9	905	306.2	3.3	171.4	50	85.7	11.6	47.9	22.8	3.4
127009	15.8	15.3	1.6	13.7	G	Tr	100	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	1374.5	888.3	294.5	4.1	187.6	50	93.8	24.6	49.1	16	4.1
127010	11.9	11.4	4.9	6.5	G	Tr	100	0	0	S	C	N	N	N	OC	NA	SAND + GRAVEL	649.8	83.9	432.1	4.4	129.4	50	64.7	3.6	17.4	34.7	9
127011	12.4	11.9	0	11.9	No Clasts					S	FM	-	N	N	LOC	NA	SAND	1732.4	1451.2	174	2.5	104.7	100	104.7	40.7	60	3.5	0.5
127012	14.5	14	3.2	10.8	G	0	100	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	1175.9	393.7	503	10.8	268.4	50	134.2	72.4	41.1	18.5	2.2
127013	10.5	10	3.6	6.4	G	Tr	100	0	0	S	C	N	N	N	OC	NA	SAND + GRAVEL	885.9	110.9	539.4	8	227.6	50	113.8	5.4	51.2	50.1	7.1
127014	11.9	11.4	0	11.4	No Clasts					S	MC	N	N	N	LOC	NA	SAND	903	139.4	609.6	4.2	149.8	50	74.9	5.59	62.4	6.9	0.01
127015	12	11.5	3.4	8.1	G	Tr	100	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	1434.3	467.5	791.7	5.3	169.8	50	84.9	3.9	38.9	31	11.1
127016	14.9	14.4	5.8	8.6	G	Tr	100	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	1533.5	251.7	960.1	7.3	314.4	25	78.6	4	21.1	34.8	18.7
127017	13.8	13.3	4	9.3	G	20	80	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	1803.7	217.5	1306.2	8	272	25	68	2.7	29.3	26.4	9.6
127018	12.2	11.7	0.1	11.6	G	20	80	0	0	S	FM	N	N	N	LOC	NA	SAND	899.6	691.5	175.3	1.1	31.7	100	31.7	1.5	7.6	10.5	12.1
127019	14.4	13.9	0.3	13.6	P	Tr	100	0	0	S	FMC	-	N	N	OC	NA	SAND	1543	1222.9	196.7	5.8	117.6	100	117.6	22	76.3	12.8	6.5
127020	15.9	15.4	4	11.4	G	Tr	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	1394.7	422.3	750.6	4.4	217.4	50	108.7	14.8	57.8	24.8	11.3
127021	14.7	14.2	1.5	12.7	G	40	60	0	0	S	FM	Y	N	N	DOC	NA	SAND + GRAVEL	1432.5	778.1	256.9	189.1	208.4	25	52.1	12.3	26	9.9	3.9
127022	13.6	13.1	1.3	11.8	G	10	90	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	968.5	189.8	616.8	3.5	158.4	50	79.2	13.6	57.4	7.6	0.6
127023	12.5	12	2	10	G	40	60	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	1555.7	180.5	724.1	41.1	610	20	122	9.5	62.5	44.1	5.9
127024	12.1	11.6	5	6.6	G	5	95	0	0	S	C	N	N	N	OC	NA	SAND + GRAVEL	820.1	185	501.5	4.6	129	50	64.5	6.1	36.5	20	1.9
127025	14	13.5	2	11.5	G	90	10	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	1386.7	380.1	826	17	163.6	50	81.8	11.5	32.2	31.8	6.3
127026	12.9	12.4	5.5	6.9	G	100	Tr	0	0	S	C	N	N	N	DOC	NA	SAND + GRAVEL	1029.7	164.9	537.1	33.3	294.4	25	73.6	6.9	26	29.3	11.4
127027	13.9	13.4	2.7	10.7	G	Tr	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	905.8	221.5	525.2	3.3	155.8	50	77.9	11.7	57.2	8.2	0.8
127028	15.2	14.7	2.8	11.9	G	0	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	631.4	254.4	304.1	15	57.9	100	57.9	5.4	43.4	9	0.1
127029	10.4	9.9	5.6	4.3	G	Tr	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	566.3	101.9	424.6	11.2	28.6	100	28.6	2.6	15.3	9.5	1.2
127030	14.7	14.2	5.8	8.4	G	Tr	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	793.7	61	654.2	16.4	62.1	100	62.1	2.5	20.6	34.2	4.8
127031	11.9	11.4	0.8	10.6	G	Tr	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	953	61.2	778.7	24.6	88.5	100	88.5	3.7	39.2	42.9	2.7
127032	16.1	15.6	2.7	12.9	G	0	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	846.4	296.6	459.2	12.2	78.4	100	78.4	8.2	64.5	4.8	0.9
127033	12.2	11.7	3.5	8.2	G	Tr	100	0	0	S	MC	-	N	N	OC	NA	SAND + GRAVEL	1089.4	587.9	370.5	32.6	98.4	100	98.4	19.2	56.2	17.7	5.3
127034	14.6	14.1	1.9	12.2	G	Tr	100	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	1028.6	479.7	425.2	20.8	102.9	100	102.9	19.2	65.2	16.3	2.2
127035	13.3	12.8	6.3	6.5	G	0	100	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	739	70.9	614.6	11	42.5	100	42.5	2.2	15.9	22.4	2
127036	11.7	11.2	0.5	10.7	G	Tr	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	1034.1	271.5	618.8	19	124.8	50	62.4	11	49.7	1.4	0.3
127037	11.8	11.3	0.2	11.1	G	Tr	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	1117.3	168.9	771.9	12.7	163.8	50	81.9	10.2	68.8	2.8	0.1
127038	11.4	10.9	6.2	4.7	G	Tr	100	0	0	S	C	N	N	N	OC	NA	SAND + GRAVEL	775.4	127.7	568	8.1	71.6	100	71.6	4.1	28.9	31.1	7.5
127039	11.2	10.7	3.7	7	G	Tr	100	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	1467.7	282.6	1012.4	16.1	156.6	50	78.3	4.3	39	30.6	4.4
127040	11.3	10.8	3.9	6.9	G	Tr	100	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	1188.8	138.3	982	8	60.5	100	60.5	5	32.6	20.2	2.7
127041	11.2	10.7	0.1	10.6	G	Tr	100	0	0	S	FMC	N	N	N	LOC	NA	SAND	1180.5	584.3	440.4	9.6	146.2	50	73.1	14.4	55.4	2.8	0.5
127042	13.5	13	6.8	6.2	G	10	90	0	0	S	C	-	N	N	OC	NA	SAND + GRAVEL	915.4	127.1	464.1	189.2	135	50	67.5	3	20.1	33.8	10.6
127043	10.5	10	4.2	5.8	G	90	10	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	824.2	287.5	474.9	26.9	34.9	100	34.9	3	15.3	13.4	3.2
127044	11.4	10.9	4.5	6.4	G	80	20	0	0	S	C	-	N	N	DOC	NA	SAND + GRAVEL	986.4	179.7	712.7	33.1	60.9	100	60.9	2.4	19.2	33.3	6
127045	12.3	11.8	3.1	8.7	G	40	60	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	1429.8	176.6	1093	32.6	127.6	50	63.8	2	19.2	35.5	7.1
127046	12.4	11.9	4	7.9	G	40	60	0	0	S	C	-	N	N	DOC	NA	SAND + GRAVEL	1019.4	218.2	712.8	22.9	65.5	100	65.5	6.5	24	28	7
127047	14.1	13.6	0	13.6	No Clasts					S	FM	-	N	N	DOC	NA	SAND	1132	706.4	286.6	17	122	100	122	27.5	68.7	20.3	5.5
127048	17.1	16.6	6.6	10	G	Tr	100	0	0	S	C	N	N	N	OC	NA	SAND + GRAVEL	783.6	70.9	657	14	41.7	100	41.7	2	12.3	23.1	4.3
127049	12.5	12	4.3	7.7	G	50	50	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	713.5	230.7	380.4	27.9	74.5	100	74.5	9.5	20.2	27	17.8
127050	10.9	10.4	2.4	8	G	50	50	0	0	S	C	N	N	N	DOC	NA	SAND + GRAVEL	1204.9	107.4	1021.9	22.4	53.2	100	53.2	2.6	21.6	26.7	2.3
127051	10.2	9.7	1.2	8.5	G	90	10	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	1273	407.5	597.5	66.8	201.2	50	100.6	9.4	51.5	32.9	6.8
127052	14.1	13.6	1.1	12.5	G	90	10	0	0	S	MC	-	N	N	OC	NA	SAND + GRAVEL	1485.6	413.5	939.3	40.9	91.9	100	91.9	13.8	49.4	25.5	3.2
127054	10.2	9.7	0.2	9.5	G	80	20	0	0	S	MC	-	N	N	LOC	NA	SAND	862.7	705.5	123.8	7.4	26	100	26	9	14.5	2.2	0.3

Sample Number	Weight (kg)				Clasts >2.0 mm*					Matrix <2.0 mm							Class	Weight (g)										
																		<2.0 mm Table Concentrate										
																		Total	< 0.25 mm	0.25-2.0 mm Heavy Liquid Separation S.G 3.20								
																				Heavy Liquid Lights	Mag HMC	Nonferromagnetic HMC						
																						Total	Processed Split					
																									Total			
	Bulk Rec'd	Table Split	>2 mm Clasts	Table Feed	Size	Percentage				Distribution				Org	Colour								%	Weight	<0.25 mm (wash)	0.25 to 0.5 mm	0.5 to 1.0 mm	1.0 to 2.0 mm
						V/S	GR	LS	OT	S/U	SD	ST	CY		Sand	Clay												
127055	13.2	12.7	0	12.7	No Clasts					S	F	Y	N	N	OC	NA	SAND	1347.1	1235.3	59.9	5.8	46.1	100	46.1	13.6	31.3	1.1	0.1
127056	13.4	12.9	0.4	12.5	G	60	40	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	1675.8	502.2	877.5	42.9	253.2	25	63.3	8.4	38.5	14	2.4
127057	9.4	8.9	0	8.9	No Clasts					S	FM	-	N	N	OC	NA	SAND	1035.6	834.3	153	8.3	40	100	40	10.8	23.4	5.1	0.7
127058	13.2	12.7	4.6	8.1	G	100	Tr	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	1222.3	181.9	969.6	16.7	54.1	100	54.1	3.1	23.4	24.1	3.5
127059	11.8	11.3	0	11.3	No Clasts					S	F	N	N	N	OC	NA	SAND	1513.6	976.2	354.1	23.7	159.6	50	79.8	27.58	50.6	1.6	0.02
127060	12.8	12.3	2.9	9.4	G	100	Tr	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	1374.9	535.2	664.6	35.1	140	50	70	6.6	27.7	24	11.7
127061	10.4	9.9	1.8	8.1	G	100	Tr	0	0	S	MC	-	N	N	OC	NA	SAND + GRAVEL	1525.7	118.9	1008.7	59.6	338.5	20	67.7	3.8	21.4	31.6	10.9
127062	12.8	12.3	1.1	11.2	G	100	Tr	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	987.4	123.2	127.3	131.9	605	20	121	5.5	44.6	56.6	14.3
127063	11.2	10.7	3.9	6.8	G	90	10	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	657.3	130	158.4	52.9	316	20	63.2	3.8	22	31.3	6.1
127064	11.1	10.6	2.5	8.1	G	95	5	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	741.8	124.7	458	17.9	141.2	50	70.6	6.3	31.8	28.4	4.1
127065	12.3	11.8	0.7	11.1	G	100	Tr	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	1206.9	594.1	61.6	104.2	447	20	89.4	25.3	45.4	10.9	7.8
127066	11.2	10.7	3.9	6.8	G	100	Tr	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	775.6	74.5	148.2	100.9	452	20	90.4	6.2	21.5	46.9	15.8
127067	8.4	7.9	2.5	5.4	G	100	Tr	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	623	293	212.2	18.8	99	100	99	12	46.2	33.6	7.2
127068	10.4	9.9	2.2	7.7	G	100	Tr	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	990.3	279.5	429.5	56.5	224.8	25	56.2	4.9	32.5	17.6	1.2
127069	10.3	9.8	1.2	8.6	G	100	Tr	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	1062.7	157	584.7	62.6	258.4	25	64.6	2.9	30.2	28.3	3.2
127070	8.5	8	0.7	7.3	G	100	Tr	0	0	S	MC	-	N	N	OC	NA	SAND + GRAVEL	661.4	392	152.9	19.2	97.3	100	97.3	22.5	49.3	21.3	4.2
127071	9.6	9.1	1.5	7.6	G	100	Tr	0	0	S	MC	-	N	N	OC	NA	SAND + GRAVEL	990.4	494.5	402.1	17	76.8	100	76.8	14.5	38.8	18.5	5
127072	12.9	12.4	2.8	9.6	G	60	40	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	1606	445.5	555.7	118.8	486	20	97.2	14.9	39	36.7	6.6
127073	7.2	6.7	0.7	6	G	90	10	0	0	S	MC	-	N	N	OC	NA	SAND + GRAVEL	694.8	297.9	234.6	24.3	138	50	69	9.8	31.1	21.8	6.3
127074	10.8	10.3	0.6	9.7	G	100	Tr	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	1065.4	450	469.5	15.5	130.4	50	65.2	9	43.6	11.7	0.9
127075	6	5.5	0.8	4.7	G	100	Tr	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	715.4	267.6	338.6	15.2	94	100	94	10.9	54.1	24.9	4.1
127076	10	9.5	2	7.5	G	30	70	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	998.3	211	640.6	9.3	137.4	50	68.7	8.4	28.5	25.7	6.1
127200	12.1	11.6	0.1	11.5	G	10	90	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	870.1	192.4	524.9	10	142.8	50	71.4	4.6	44.8	21.3	0.7
127201	15.3	14.8	0.5	14.3	G	95	5	0	0	S	MC	-	N	N	GB	NA	SAND + GRAVEL	1462.2	985	266.6	39.8	170.8	50	85.4	9.8	59.5	15.2	0.9
127202	12.2	11.7	4.1	7.6	G	5	95	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	778.3	422.9	220.7	6.1	128.6	100	128.6	8.8	85.8	23	11
127203	13.2	12.7	2.5	10.2	G	Tr	100	0	0	S	C	N	N	N	LOC	NA	SAND + GRAVEL	1344.7	132.5	856.3	5.9	350	20	70	2.3	30.8	31.8	5.1
127204	14.4	13.9	1.9	12	G	Tr	100	0	0	S	MC	-	N	N	LOC	NA	SAND + GRAVEL	1346.8	595.2	512	8.2	231.4	50	115.7	9.3	74.6	24.3	7.5
127205	13.4	12.9	2.1	10.8	G	Tr	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	1343.7	183	937.9	9.2	213.6	50	106.8	4.3	54.3	41.9	6.3
127206	13.1	12.6	1.7	10.9	G	Tr	100	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	1243.8	234.9	715.3	13.2	280.4	25	70.1	3.8	42	21.7	2.6
127207	13.9	13.4	2.1	11.3	G	Tr	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	1303.9	310.2	759.4	9.5	224.8	50	112.4	3.8	72.9	29.8	5.9
127208	14	13.5	2.3	11.2	G	Tr	100	0	0	S	MC	N	N	N	GB	NA	SAND + GRAVEL	1510.1	459.5	910.3	4.9	135.4	50	67.7	3.2	43.3	17	4.2
127209	13.7	13.2	3.2	10	G	Tr	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	960.1	235.9	552.9	12.9	158.4	50	79.2	0.1	49.9	25.5	3.7
127210	15.4	14.9	2	12.9	G	Tr	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	1166.1	246.6	699	8.5	212	50	106	4.5	67.6	32.6	1.3
127211	13.5	13	2.4	10.6	G	5	95	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	1477.4	179.2	817.8	21.4	459	20	91.8	2.6	57.9	29	2.3
127212	12.2	11.7	1.2	10.5	G	30	70	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	1345.8	405.5	543.7	15.6	381	20	76.2	6.2	53.4	10.7	5.9
127213	13	12.5	3.8	8.7	G	50	50	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	1783.2	385.8	543.1	95.3	759	20	151.8	5.8	62.3	61.4	22.3
127214	14.2	13.7	8	5.7	G	95	5	0	0	S	C	N	N	N	GY	NA	SAND + GRAVEL	1051.2	170.4	660.2	63.2	157.4	100	157.4	3.1	15.9	69.2	69.2
127215	14.7	14.2	1.4	12.8	G	5	95	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	909.1	62.3	692.9	5.7	148.2	50	74.1	1.3	24.8	46.1	1.9
127216	14.5	14	4.2	9.8	G	40	60	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	1952.7	553.5	694.8	53.4	651	20	130.2	8.7	61.5	42.8	17.2
127217	16.1	15.6	1	14.6	G	5	95	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	1228	88.5	867.9	13.6	258	20	51.6	1.6	31.8	17.8	0.4
127218	13.8	13.3	0.3	13	G	70	30	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	2134.9	1227.2	413	30.2	464.5	20	92.9	11.8	46.8	26.5	7.8
127219	11.5	11	0.9	10.1	G	20	80	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	1425.1	777.4	465.7	16.4	165.6	50	82.8	6.3	45.4	21.8	9.3
127220	14.3	13.8	1	12.8	G	90	10	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	1317.2	423.8	507.3	40.5	345.6	25	86.4	4.6	55.4	21.9	4.5
127221	14.6	14.1	0.8	13.3	G	Tr	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	1168.4	319.2	737.2	4.9	107.1	100	107.1	17	75.4	13.1	1.6
127222	12.9	12.4	0.3	12.1	G	Tr	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	861.3	359.2	426.4	12.3	63.4	100	63.4	11.7	46.5	4.8	0.4
127223	15	14.5	3	11.5	G	Tr	100	0	0	S	MC	-	N	N	LOC	NA	SAND + GRAVEL	1096.8	427.9	519	25.7	124.2	50	62.1	6.2	35	18	2.9
127224	14.1	13.6	0.2	13.4	G	Tr	100	0	0	S	FM	N	N	N	LOC	NA	SAND	1184.2	870	271	5.2	38	100	38	16	17.6	3.6	0.8
127225	13.3	12.8	3.6	9.2	G	Tr	100	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	750.2	180.4	477.4	18.6	73.8	100	73.8	6	45.4	21.7	0.7
127226	16.5	16	6.5	9.5	G	Tr	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	937.8	271.5	582.4	20.6	63.3	100	63.3	5.2	32.8	21.6	3.7
127227	12.3	11.8	4.5	7.3	G	Tr	100	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	715.9	137	488	27.8	63.1	100	63.1	4.2	35.2	21.9	1.8
127228	12.9	12.4	3.8	8.6	G	Tr	100	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	811.1	211.4	547.1	11.6	41	100	41	6.1	22.3	10.2	2.4
127229	14.8	14.3	2.5	11.8	G	10	90	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	1028.8	221.9	680.9	19.3	106.7	100	106.7	7	61.1	37.8	0.8

Open File Lab/1620 - Appendix 1

Sample Number	Weight (kg) Bulk Rec'd	Weight (kg) Table Split	Weight (kg) >2 mm Clasts	Weight (kg) Table Feed	Clasts >2.0 mm* Size	Clasts Percentage V/S	Clasts Percentage GR	Clasts Percentage LS	Clasts Percentage OT	Matrix <2.0 mm Distribution S/U	Distribution SD	Distribution ST	Distribution CY	Org	Colour Sand	Colour Clay	Class	Weight (g) <2.0 mm Table Concentrate Total	< 0.25 mm	0.25-2.0 mm Heavy Liquid Separation S.G 3.20 Heavy Liquid Lights	Mag HMC	Nonferromagnetic HMC Total	Processed Split %	Processed Split Weight	Total <0.25 mm (wash)	Total 0.25 to 0.5 mm	Total 0.5 to 1.0 mm	Total 1.0 to 2.0 mm
127230	11.7	11.2	2	9.2	G	40	60	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	576.7	134.2	305.6	34.9	102	100	102	4.2	58.2	37.1	2.5
127231	10	9.5	3.2	6.3	G	40	60	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	663	108.5	403.1	45.1	106.3	100	106.3	6.5	31.3	56.2	12.3
127232	12.4	11.9	2.8	9.1	G	50	50	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	706.7	181.2	384.5	33.7	107.3	100	107.3	7.9	58.1	37.9	3.4
127233	11.4	10.9	5.5	5.4	G	40	60	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	544.5	119.1	324.9	26.3	74.2	100	74.2	5.7	24.7	35.1	8.7
127234	15.4	14.9	5.1	9.8	G	30	70	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	824.1	136.9	604.7	18.4	64.1	100	64.1	3.8	30.8	26.3	3.2
127235	13.6	13.1	5.9	7.2	G	5	95	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	530.4	136.9	323.1	12.6	57.8	100	57.8	4.7	26.7	24	2.4
127236	5.5	5	1.5	3.5	G	40	60	0	0	S	MC	-	N	N	OC	NA	SAND + GRAVEL	636.1	221.6	338.4	21.1	55	100	55	7.5	19.2	21	7.3
127237	13.3	12.8	1.7	11.1	G	50	50	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	1070.1	172.7	521.8	68.8	306.8	25	76.7	5.6	48.1	22.2	0.8
127238	11.2	10.7	6	4.7	G	Tr	100	0	0	S	C	N	N	N	OC	NA	SAND + GRAVEL	746.4	141.4	573.1	9.3	22.6	100	22.6	1.6	6.6	10.3	4.1
127239	13.5	13	2.4	10.6	G	0	100	0	0	S	MC	-	N	N	LOC	NA	SAND + GRAVEL	1282.8	892.4	341.5	9	39.9	100	39.9	12.8	22.5	3.7	0.9
127240	11.3	10.8	1.9	8.9	G	0	100	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	746.9	62.5	582.2	13.9	88.3	100	88.3	2.9	37.1	46.8	1.5
127241	14.2	13.7	1	12.7	G	Tr	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	1089.9	651.6	248.2	8.1	182	50	91	15.9	62.6	10.7	1.8
127242	15.4	14.9	6.9	8	G	Tr	100	0	0	S	C	N	N	N	OC	NA	SAND + GRAVEL	1081.4	175.8	755.4	12.6	137.6	50	68.8	5.3	27.4	31	5.1
127243	14.1	13.6	2.8	10.8	G	Tr	100	0	0	S	MC	N	N	N	LOC	NA	SAND + GRAVEL	1137.1	198	778.6	7.5	153	50	76.5	9.5	62.1	3.9	1
127244	10.5	10	0	10	No Clasts					S	MC	N	N	N	OC	NA	SAND	733.3	431.6	254.3	2.6	44.8	100	44.8	14.09	28.7	2	0.01
127245	14.2	13.7	5.9	7.8	G	30	70	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	876.1	185.3	500.6	88.1	102.1	100	102.1	6.7	37.2	44.7	13.5
127246	13.3	12.8	4.1	8.7	G	80	20	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	977.9	211.7	690.2	22	54	100	54	4.6	34.1	13.4	1.9
127247	12	11.5	1.4	10.1	G	90	10	0	0	S	MC	N	N	N	GB	NA	SAND + GRAVEL	1245.8	193.5	981.3	12.6	58.4	100	58.4	5.1	41.7	9.5	2.1
127248	16.4	15.9	4.5	11.4	G	70	30	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	1103.6	209	679	101.1	114.5	100	114.5	4.6	41.3	57.7	10.9
127249	12.2	11.7	0.3	11.4	G	5	95	0	0	S	MC	N	N	N	OC	NA	SAND	1089.1	358.2	481.8	19.3	229.8	50	114.9	18.2	86.9	7.3	2.5
127250	15.3	14.8	7	7.8	G	10	90	0	0	S	MC	-	N	N	OC	NA	SAND + GRAVEL	1244.8	149.4	609.4	98	388	25	97	3.2	22.8	42.4	28.6
127251	13.9	13.4	4.7	8.7	G	10	90	0	0	S	MC	-	N	N	OC	NA	SAND + GRAVEL	1041	232.6	518.2	28.8	261.4	50	130.7	6.6	50.5	44.9	28.7
127252	13.2	12.7	0.2	12.5	G	10	90	0	0	S	MC	-	N	N	OC	NA	SAND	1694.8	682.9	549.9	24.5	437.5	20	87.5	16.6	65.8	3.7	1.4
127253	12.4	11.9	1.8	10.1	G	75	25	0	0	S	MC	-	N	N	OC	NA	SAND + GRAVEL	815.8	208.8	536.4	19.2	51.4	100	51.4	4.7	19.1	21.1	6.5
127254	9.1	8.6	1.3	7.3	G	70	30	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	868.5	144.7	632	34.9	56.9	100	56.9	3.7	31.8	18.4	3
127255	11.2	10.7	3.7	7	G	25	75	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	998.3	245	382.5	78.8	292	25	73	6.4	26.1	33	7.5
127256	11.4	10.9	2.8	8.1	G	50	50	0	0	S	MC	-	N	N	OC	NA	SAND + GRAVEL	1208.6	509.3	377.8	55.9	265.6	25	66.4	4.9	19	26.6	15.9
127257	14.1	13.6	3.4	10.2	G	80	20	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	863.5	196.6	593.7	22.6	50.6	100	50.6	4	19.4	22.5	4.7
127258	14.1	13.6	4	9.6	G	90	10	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	1041	270.6	622.6	46.2	101.6	100	101.6	7.8	36.8	38.9	18.1
127259	10.3	9.8	4.5	5.3	G	80	20	0	0	S	MC	N	N	N	GB	NA	SAND + GRAVEL	912	172.9	666.4	29.6	43.1	100	43.1	3.1	9.1	15	15.9
127260	15	14.5	3.2	11.3	G	95	5	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	1259.7	160.6	995.5	33.2	70.4	100	70.4	4.4	34.8	25.1	6.1
127261	10.9	10.4	2	8.4	G	75	25	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	819.4	339.1	398.2	24.6	57.5	100	57.5	3.5	38.5	14	1.5
127262	11.6	11.1	1	10.1	G	90	10	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	1093.8	138.5	796.2	48.3	110.8	100	110.8	6.3	69.8	34	0.7
127263	10.3	9.8	2.9	6.9	G	70	30	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	857.2	206.8	536.3	40.2	73.9	100	73.9	6.6	37.2	25	5.1
127264	9.3	8.8	3.5	5.3	G	90	10	0	0	S	MC	N	N	N	OC	NA	SAND + GRAVEL	685.5	152.1	440.6	30.4	62.4	100	62.4	4.7	29.5	23.2	5
127265	10.1	9.6	0.9	8.7	G	100	Tr	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	1363.2	369.8	361.7	129.2	502.5	20	100.5	5.7	58.3	28.4	8.1
127266	9.8	9.3	1.3	8	G	95	5	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	1305.8	545	325.9	81.9	353	20	70.6	7.2	36.5	20.1	6.8
127267	5.4	4.9	1.2	3.7	G	100	Tr	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	374	73.1	187.9	24.9	88.1	100	88.1	6.7	30.5	33.9	17
127268	11.7	11.2	4.7	6.5	G	100	Tr	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	1526.3	272.6	656.7	134.5	462.5	20	92.5	3.7	26.7	39.6	22.5
127269	11.8	11.3	3.5	7.8	G	95	5	0	0	S	MC	N	N	N	DOC	NA	SAND + GRAVEL	777.8	353.1	410.3	2.6	11.8	100	11.8	1.5	3.7	5.3	1.3
127270	10.9	10.4	2.9	7.5	G	100	Tr	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	784.1	136.3	607.5	10.5	29.8	100	29.8	1.8	5.5	15.4	7.1
127271	8.3	7.8	1.7	6.1	G	80	20	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	850.4	127.5	484.6	52.9	185.4	50	92.7	2.9	29.2	45.4	15.2
127272	10.3	9.8	1.1	8.7	G	85	15	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	1501.7	673.4	490	71.5	266.8	25	66.7	4.9	25.3	21	15.5
127273	11.7	11.2	1.2	10	G	95	5	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	796.4	116.7	519.5	37.2	123	100	123	5.1	20.4	61.9	35.6
127274	11.7	11.2	4.8	6.4	G	100	Tr	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	1379	187.6	1005.2	31.4	154.8	50	77.4	6.9	57.8	12.1	0.6
127275	10.3	9.8	2.7	7.1	G	100	Tr	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	634.8	134.6	430.5	9.4	60.3	100	60.3	2.9	14.7	29.2	13.5
127276	11	10.5	3.2	7.3	G	100	Tr	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	1333.4	163	1075.4	8	87	100	87	3.7	45.5	30.3	7.5
127277	11.2	10.7	1.6	9.1	G	100	Tr	0	0	S	MC	-	N	N	OC	NA	SAND + GRAVEL	1465.5	873.5	348.5	12.3	231.2	25	57.8	4.1	47.3	5.4	1
127278	10.9	10.4	3.8	6.6	G	100	Tr	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	977.1	182	636	53.8	105.3	100	105.3	3.5	38.7	47.2	15.9
127279	10.4	9.9	3.4	6.5	G	100	Tr	0	0	S	MC	-	N	N	DOC	NA	SAND + GRAVEL	1060.2	122.6	882.9	11.4	43.3	100	43.3	1.1	16.1	21.1	5

					Number of Grains												
					Selected MMSIMs					KIMs							
Sample Number	UTM East	UTM North	UTM zone	NAD	Low Cr-diopside	Cpy	Cu	Py	Gh	GP	GO	DC	IM	CR	FO	Total KIMs	REMARKS:
7002	666674	5973719	19	27	8	0	5	50	0	0	0	0	0	0	0	0	Almandine-hematite/diopside assemblage.
7003	663167	5976841	19	27	3	0	20	7	0	0	0	0	0	0	1	1	Almandine/diopside assemblage.
7004	658261	5980898	19	27	4	0	0	1	0	0	0	0	0	0	12	12	Almandine-orthopyroxene/diopside-apatite-epidote assemblage.
7005	649341	5988066	19	27	0	0	0	1	0	0	0	0	0	0	5	5	Almandine-orthopyroxene/diopside assemblage.
7006	648855	5988173	19	27	0	0	0	3	0	0	0	0	0	0	11	11	Almandine-orthopyroxene/diopside-apatite assemblage.
7007	635594	5993407	19	27	5	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene-almandine/diopside assemblage.
7008	623621	5991394	19	27	6	0	0	0	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-apatite assemblage.
7009	646330	5992201	19	27	5	0	0	0	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-apatite assemblage.
7010	599924	6004476	19	27	3	0	0	0	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-apatite assemblage.
7011	643514	6005513	19	27	4	0	0	0	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-apatite assemblage.
7012	621018	6014385	19	27	0	0	0	0	0	0	0	0	0	1	0	1	Almandine-orthopyroxene/diopside assemblage.
7013	633497	6014162	19	27	1	0	0	0	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-staurolite assemblage.
7014	634815	5998734	19	27	7	0	0	1	0	0	0	0	0	0	0	0	Orthopyroxene-almandine/diopside assemblage.
7015	638318	6010873	19	27	3	0	0	0	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-apatite assemblage.
7016	646705	6001575	19	27	0	1	0	0	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-epidote-apatite assemblage.
7017	647623	6033480	19	27	1	0	0	0	0	0	0	0	0	0	0	0	Almandine/apatite-diopside assemblage.
7018	651471	6028839	19	27	0	13	0	250	0	0	0	0	0	0	0	0	Hematite-almandine/pyrite assemblage. 1 malachite from 0.25-0.5 mm fraction. Pyrite is mantled by goethite.
7019	654656	6023377	19	27	1	0	0	0	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside assemblage.
7020	637323	6049927	19	27	0	0	0	10	0	0	0	0	0	0	0	0	Hematite-almandine/apatite-diopside assemblage.
7021	642411	6043440	19	27	0	0	0	0	0	0	0	0	0	0	0	0	Almandine-goethite/apatite-diopside assemblage.
7022	646432	6021685	19	27	7	0	0	3	0	0	0	0	0	1	0	1	Almandine-hematite-goethite/diopside-apatite assemblage.
7023	642027	6021507	19	27	0	2	0	0	0	0	0	0	0	0	0	0	Hematite-goethite/diopside assemblage.
7024	663406	5994948	19	27	3	0	0	0	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-apatite assemblage.
7025	677836	6004904	19	27	0	0	0	2	0	0	0	0	0	0	0	0	Goethite-almandine-hematite/diopside assemblage.
7026	683597	5998294	19	27	0	0	0	1	0	0	0	0	0	1	0	1	Almandine-hematite/diopside-apatite assemblage.
7027	600145	5968157	19	27	6	0	0	3	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/apatite-diopside assemblage.
7028	615174	5946869	19	27	0	0	0	5	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside assemblage.
7029	619794	5939659	19	27	0	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene-almandine/diopside assemblage.
7030	629361	5949789	19	27	1	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene-almandine/diopside assemblage.
7031	633511	5945279	19	27	5	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene-almandine/diopside-apatite assemblage.
7032	647034	5919566	19	27	12	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene/diopside-apatite assemblage.
7033	642331	5927303	19	27	11	0	0	3	0	0	0	0	0	0	0	0	Orthopyroxene/diopside-apatite assemblage.
7034	633752	5939598	19	27	1	0	0	0	0	0	0	0	0	0	0	0	Augite-almandine/diopside-apatite assemblage.
7035	648794	5943475	19	27	0	0	0	6	0	0	0	0	0	0	0	0	Orthopyroxene-almandine-ilmenite/diopside assemblage.
7036	636819	5955054	19	27	8	0	0	2	0	0	0	0	0	0	0	0	Orthopyroxene-almandine/diopside-apatite assemblage.
7037	624313	5963281	19	27	14	0	0	1	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside assemblage.
7038	636174	5967994	19	27	3	0	0	0	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside assemblage.
7039	642999	5960718	19	27	0	0	0	0	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside assemblage.
7040	649427	5958999	19	27	8	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene-almandine/diopside-apatite assemblage.
7041	660742	5957465	19	27	17	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene-almandine/diopside-apatite assemblage.
7042	662580	5942573	19	27	1	0	0	7	0	0	0	0	0	0	0	0	Orthopyroxene-almandine-hematite/diopside-apatite assemblage.
7043	662255	5928426	19	27	0	0	0	0	0	0	0	0	0	0	1	1	Orthopyroxene-almandine-hematite/diopside assemblage.
7044	662770	5919333	19	27	3	0	0	0	0	0	0	0	0	0	0	0	Hematite-orthopyroxene/diopside assemblage.
7045	659010	5905675	19	27	0	0	0	2	0	0	0	0	0	0	0	0	Hematite-orthopyroxene/diopside-apatite assemblage.
7046	655857	5900940	19	27	1	0	0	0	0	0	0	0	0	0	0	0	Hematite/epidote-apatite assemblage. 2 molybdenite from 0.25-0.5 mm fraction.
7047	658807	5909887	19	27	0	0	0	0	0	0	0	0	0	0	0	0	Hematite-orthopyroxene/diopside-apatite assemblage.
7048	654205	5920023	19	27	0	0	0	0	0	0	0	0	0	0	0	0	Hematite-orthopyroxene/epidote-diopside assemblage.
7049	676597	5913701	19	27	0	0	0	0	0	0	0	0	0	0	0	0	Ilmenite-orthopyroxene/diopside assemblage.
7050	673351	5918206	19	27	2	6	0	4	0	0	0	0	0	0	0	0	Hematite-orthopyroxene/diopside-epidote assemblage.
7051	682968	5914636	19	27	9	5	0	0	0	0	0	0	0	0	0	0	Hematite-orthopyroxene-almandine/diopside-apatite assemblage.
7052	677042	5926578	19	27	0	24	5	3	0	0	0	0	0	0	0	0	Orthopyroxene-almandine-hematite/diopside assemblage. Chalcopyrite is mostly mantled by limonite. 2 chalcopyrite from 0.25-0.5 mm fraction lost in transfer to vial.
7054	666924	5938022	19	27	13	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene-almandine-hematite/diopside assemblage.
7055	696547	5882700	19	27	31	0	0	0	0	0	0	0	0	0	0	0	Hornblende-almandine-orthopyroxene/diopside assemblage.

					Number of Grains													
					Selected MMSIMs					KIMs								
Sample Number	UTM East	UTM North	UTM zone	NAD	Low Cr-diopside	Cpy	Cu	Py	Gh	GP	GO	DC	IM	CR	FO	Total KIMs	REMARKS:
7056	689783	5893187	19	27	2	0	0	0	0	0	0	0	0	0	0	0	Almandine-hornblende-orthopyroxene/epidote-titanite-diopside assemblage.
7057	686626	5905983	19	27	4	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene-almandine-hematite/epidote-titanite-diopside assemblage.
7058	679390	5964783	19	27	0	0	0	2	0	0	0	0	0	0	0	0	Orthopyroxene-almandine-hematite/diopside-apatite assemblage.
7059	685679	5964966	19	27	8	0	0	0	0	0	0	0	0	0	300	(300)	Almandine-orthopyroxene-hematite/diopside-apatite assemblage.
7060	694831	6014070	19	27	0	0	0	3	0	0	0	0	0	0	0	0	Hematite/epidote assemblage.
7061	691891	6018402	19	27	0	0	2	4	0	0	0	0	0	0	0	0	Hematite-goethite/epidote assemblage.
7062	685643	6022896	19	27	0	0	0	1	0	0	0	0	0	0	0	0	Hematite/epidote assemblage.
7063	682129	6025519	19	27	0	0	0	4	0	0	0	0	0	0	0	0	Hematite-goethite/epidote assemblage. Heavy mineral fraction consists mostly of paramagnetic hematite and goethite with very few nonparamagnetic minerals.
7064	670244	6016567	19	27	0	0	0	4	0	0	0	0	0	0	0	0	Goethite-hematite/epidote assemblage.
7065	667445	6038249	19	27	0	0	0	3	0	0	0	0	0	0	0	0	Hematite/epidote assemblage. Heavy mineral fraction consists mostly of paramagnetic hematite and goethite with very few nonparamagnetic minerals.
7066	663762	6041491	19	27	0	0	0	5	0	0	0	0	0	0	0	0	Hematite-goethite/epidote assemblage. Heavy mineral fraction consists mostly of paramagnetic hematite and goethite with very few nonparamagnetic minerals.
7067	690220	6000471	19	27	0	0	0	1	0	0	0	0	0	0	0	0	Hematite-almandine/epidote-apatite assemblage.
7068	329207	5996989	20	27	0	0	0	1	0	0	0	0	0	0	0	0	Hematite/epidote-apatite assemblage.
7069	323545	6000745	20	27	0	0	0	0	0	0	0	0	0	0	0	0	Hematite/epidote assemblage.
7070	319164	5983405	20	27	0	0	0	1	0	0	0	0	0	0	0	0	Almandine-hematite-fayalite/epidote assemblage.
7071	323889	5971875	20	27	0	0	0	0	0	0	0	0	0	0	0	0	Hematite-almandine-augite/epidote-apatite assemblage.
7072	332023	5971875	20	27	0	0	0	0	0	0	0	0	0	0	0	0	Augite-hematite-fayalite/epidote assemblage.
7073	313835	5968987	20	27	0	0	0	0	0	0	0	0	0	0	0	0	Almandine-hematite/barite assemblage.
7074	309962	5972834	20	27	0	0	0	0	0	0	0	0	0	0	0	0	Almandine-hematite/diopside-epidote assemblage.
7075	308005	5979931	20	27	0	0	0	6	0	0	0	0	0	0	0	0	Hematite-almandine/epidote assemblage.
7076	672895	5891844	19	27	0	0	0	6	0	0	0	0	0	0	0	0	Almandine-hematite-hornblende/diopside-sillimanite assemblage.
7200	655498	5983526	19	27	0	0	0	0	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside assemblage.
7201	672523	5963643	19	27	11	0	0	0	1	0	0	0	0	0	1	1	Hematite-almandine/diopside-apatite assemblage.
7202	649899	5991253	19	27	3	0	0	0	0	0	0	0	0	0	2	2	Almandine-orthopyroxene-hematite/diopside-epidote assemblage.
7203	628064	5990638	19	27	0	0	0	2	0	0	0	0	0	1	1	2	Almandine/apatite-diopside-monazite assemblage.
7204	616295	5989641	19	27	2	0	0	1	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-apatite assemblage.
7205	609280	6001103	19	27	0	1	0	2	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-apatite assemblage.
7206	603351	6002656	19	27	8	0	0	0	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside assemblage.
7207	612245	6011432	19	27	0	0	0	2	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-apatite assemblage.
7208	626886	6017944	19	27	12	0	0	0	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-apatite assemblage.
7209	629669	6002958	19	27	12	0	0	2	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-apatite assemblage.
7210	639970	6009384	19	27	7	0	0	4	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/apatite-diopside assemblage.
7211	645627	6037926	19	27	0	0	0	10	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-apatite assemblage.
7212	652322	6026917	19	27	0	0	0	1	0	0	0	0	0	0	0	0	Almandine-goethite-hematite/apatite assemblage.
7213	656748	6014644	19	27	0	0	0	0	0	0	0	0	0	0	0	0	Almandine-hematite/apatite assemblage.
7214	638569	6060506	19	27	0	0	0	0	0	0	0	0	0	0	0	0	Hematite/diopside assemblage.
7215	641717	6026039	19	27	0	0	0	25	0	0	0	0	0	0	0	0	Almandine/diopside assemblage.
7216	656073	6013557	19	27	0	0	0	0	0	0	0	0	0	0	0	0	Hematite-goethite-almandine/apatite assemblage.
7217	647808	6019476	19	27	0	0	0	25	0	0	0	0	0	0	0	0	Almandine/diopside-apatite assemblage.
7218	660643	6008761	19	27	0	0	0	0	0	0	0	0	0	0	0	0	Hematite-almandine/apatite assemblage. Also picked 3 molybdenite from 0.25-0.5 mm fraction.
7219	664145	5993072	19	27	0	0	0	1	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-apatite assemblage.
7220	669742	6017339	19	27	0	0	0	1	0	0	0	0	0	0	0	0	Hematite-almandine/apatite assemblage.
7221	610443	5957691	19	27	6	0	0	1	0	0	0	0	0	0	0	0	Orthopyroxene-almandine/diopside-apatite assemblage.
7222	617611	5943814	19	27	0	0	0	1	0	0	0	0	0	0	0	0	Orthopyroxene-almandine/diopside assemblage.
7223	621099	5949193	19	27	6	0	0	1	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-apatite assemblage.
7224	625787	5950119	19	27	1	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene-almandine/diopside-apatite assemblage.
7225	636470	5942379	19	27	11	0	0	20	0	0	0	0	0	0	0	0	Orthopyroxene/diopside-apatite assemblage.
7226	645154	5923807	19	27	2	0	0	5	0	0	0	0	0	0	0	0	Orthopyroxene/diopside-apatite assemblage.
7227	639745	5931193	19	27	0	0	0	5	0	0	0	0	0	0	0	0	Orthopyroxene-augite-ilmenite/diopside-apatite assemblage.
7228	656763	5933810	19	27	4	0	0	4	0	0	0	0	0	0	0	0	Orthopyroxene/diopside-apatite assemblage.
7229	360484	5955429	20	27	3	0	0	20	0	0	0	0	0	0	0	0	Orthopyroxene/diopside-epidote assemblage.

					Number of Grains													
					Selected MMSIMs					KIMs								
Sample Number	UTM East	UTM North	UTM zone	NAD	Low Cr-diopside	Cpy	Cu	Py	Gh	GP	GO	DC	IM	CR	FO	Total KIMs	REMARKS:
7230	366660	5953067	20	27	4	0	0	0	0	0	0	0	0	0	0	0	Hematite-orthopyroxene-almandine/diopside-epidote assemblage.
7231	370771	5951223	20	27	10	0	0	1	0	0	0	0	0	5	0	5	Orthopyroxene-hematite-almandine/diopside-epidote assemblage.
7232	376026	5949914	20	27	0	0	0	3	0	0	0	0	0	0	0	0	Hematite-almandine-orthopyroxene/diopside-epidote assemblage.
7233	380574	5948632	20	27	15	0	0	2	0	0	0	0	0	0	0	0	Orthopyroxene-hematite-almandine/diopside-epidote assemblage.
7234	384609	5947190	20	27	60	0	0	0	0	0	0	0	0	0	0	0	Hematite-orthopyroxene-almandine/diopside-epidote assemblage.
7235	389252	5946405	20	27	0	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene-hornblende-hematite/epidote-diopside assemblage.
7236	357401	5955649	20	27	0	0	0	0	0	0	0	0	0	1	0	1	Orthopyroxene/diopside-epidote assemblage.
7237	352267	5956183	20	27	2	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene/diopside-epidote assemblage.
7238	651718	5938910	19	27	0	0	0	5	0	0	0	0	0	0	0	0	Orthopyroxene/diopside assemblage.
7239	643978	5947151	19	27	9	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene/apatite-diopside assemblage.
7240	630357	5958610	19	27	11	0	0	5	0	0	0	0	0	0	0	0	Orthopyroxene-almandine/diopside assemblage.
7241	615572	5970580	19	27	2	0	0	0	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside assemblage.
7242	638623	5965664	19	27	0	0	0	4	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside assemblage.
7243	647065	5964533	19	27	15	0	0	0	0	0	0	0	0	0	1	1	Almandine-orthopyroxene/diopside assemblage.
7244	657998	5964642	19	27	3	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene-almandine/diopside-apatite assemblage.
7245	661311	5950833	19	27	0	0	0	30	0	0	0	0	0	0	0	0	Goethite-orthopyroxene-almandine/diopside-apatite assemblage.
7246	661475	5934679	19	27	3	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene-almandine-goethite/diopside-apatite assemblage.
7247	666141	5910073	19	27	12	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene-almandine-hematite/diopside assemblage.
7248	672549	5930468	19	27	2	0	0	2	0	0	0	0	0	0	0	0	Hematite-almandine-orthopyroxene/diopside assemblage.
7249	654007	5873772	19	27	0	0	0	0	0	0	0	0	0	0	0	0	Goethite-hematite-hornblende-almandine/epidote-kyanite assemblage.
7250	662159	5880679	19	27	3	0	0	0	0	0	0	0	0	0	1	1	Hematite-orthopyroxene-almandine/apatite assemblage.
7251	670113	5883155	19	27	0	0	0	0	0	0	0	0	0	0	0	0	Hornblende-almandine/diopside assemblage.
7252	673547	5881053	19	27	8	0	0	0	0	0	0	0	0	0	0	0	Almandine-hornblende-orthopyroxene/apatite-diopside assemblage.
7253	679823	5922059	19	27	0	41	0	0	0	0	0	0	0	0	0	0	Orthopyroxene-almandine/diopside assemblage.
7254	669656	5934496	19	27	2	0	0	0	0	0	0	0	0	0	0	0	Almandine-hematite-orthopyroxene/diopside assemblage.
7255	694122	5887304	19	27	1	0	0	2	0	0	0	0	0	0	0	0	Orthopyroxene-almandine-hematite/titanite-diopside-epidote assemblage.
7256	690426	5895714	19	27	0	0	0	0	0	0	0	0	0	0	0	0	Orthopyroxene-almandine-hematite/diopside-epidote assemblage.
7257	324128	5930595	20	27	0	2	4	0	0	0	0	0	0	0	0	0	Almandine-hematite-orthopyroxene/diopside-epidote assemblage.
7258	318193	5933191	20	27	0	2	0	0	0	0	0	0	0	0	0	0	Hematite-orthopyroxene-almandine-goethite/diopside-epidote assemblage.
7259	313547	5937359	20	27	0	0	0	0	0	0	0	0	0	0	0	0	Hematite-almandine/diopside assemblage.
7260	311679	5943871	20	27	3	1	0	10	0	0	0	0	0	0	0	0	Orthopyroxene-almandine-hematite/diopside assemblage.
7261	308139	5951432	20	27	1	0	0	0	0	0	0	0	0	1	0	1	Almandine-hematite-orthopyroxene/diopside assemblage.
7262	676821	5959745	19	27	3	0	0	2	0	0	0	0	0	0	0	0	Hematite-almandine-orthopyroxene/diopside assemblage.
7263	685246	5955252	19	27	1	2	0	10	0	0	0	0	0	0	0	0	Almandine-hematite/diopside assemblage.
7264	689756	5954646	19	27	4	0	0	0	0	0	0	0	0	0	0	0	Almandine-hematite/diopside-barite assemblage.
7265	318872	6002808	20	27	0	0	0	0	0	0	0	0	0	6	0	6	Hematite-goethite/epidote assemblage.
7266	316270	6005398	20	27	0	0	0	0	0	0	0	0	0	0	0	0	Hematite/epidote assemblage.
7267	312431	6009351	20	27	3	1	0	40	0	0	0	0	0	2	0	2	Hematite-goethite/epidote assemblage.
7268	308415	6012174	20	27	1	1	0	0	0	0	0	0	0	3	0	3	Hematite/epidote assemblage.
7269	307300	6016789	20	27	0	0	0	0	0	0	0	0	0	0	1	1	Hematite-goethite/diopside assemblage.
7270	304967	6020428	20	27	0	0	0	15	0	0	0	0	0	0	0	0	Hematite/epidote assemblage.
7271	333879	5992200	20	27	0	0	0	0	0	0	0	0	0	1	0	1	Hematite-goethite/diopside-epidote assemblage.
7272	331776	5993899	20	27	0	0	0	0	0	0	0	0	0	0	0	0	Hematite/epidote assemblage.
7273	690944	6028568	19	27	0	1	0	50	0	0	0	0	0	5	0	5	Hematite/epidote assemblage.
7274	692733	6010879	19	27	1	0	0	0	0	0	0	0	0	0	0	0	Hematite-almandine/epidote-diopside assemblage.
7275	693907	5996156	19	27	0	0	0	0	0	0	0	0	0	1	0	1	Hematite-almandine/epidote-barite assemblage.
7276	689823	5989106	19	27	0	0	0	1	0	0	0	0	0	0	0	0	Almandine-hematite/diopside-apatite assemblage.
7277	685989	5992942	19	27	0	0	0	0	0	0	0	0	0	0	0	0	Almandine-hematite/diopside-epidote assemblage.
7278	679024	5968759	19	27	3	0	0	0	0	0	0	0	0	0	0	0	Almandine-hematite-orthopyroxene/diopside-barite assemblage.
7279	696704	5958849	19	27	0	0	0	0	0	0	0	0	0	0	0	0	Almandine-orthopyroxene/diopside-barite assemblage.

* Numbers in brackets are estimated total indicator grains present in samples where not all of the grains were picked.

Sample Number	INPUT ASSEMBLAGE
7002	Almandine-hematite/diopside
7003	Almandine/diopside
7004	Almandine-orthopyroxene/diopside-apatite-epidote
7005	Almandine-orthopyroxene/diopside
7006	Almandine-orthopyroxene/diopside-apatite
7007	Orthopyroxene-almandine/diopside
7008	Almandine-orthopyroxene/diopside-apatite
7009	Almandine-orthopyroxene/diopside-apatite
7010	Almandine-orthopyroxene/diopside-apatite
7011	Almandine-orthopyroxene/diopside-apatite
7012	Almandine-orthopyroxene/diopside
7013	Almandine-orthopyroxene/diopside-staurolite
7014	Orthopyroxene-almandine/diopside
7015	Almandine-orthopyroxene/diopside-apatite
7016	Almandine-orthopyroxene/diopside-epidote-apatite
7017	Almandine/apatite-diopside
7018	Hematite-almandine/pyrite
7019	Almandine-orthopyroxene/diopside
7020	Hematite-almandine/apatite-diopside
7021	Almandine-goethite/apatite-diopside
7022	Almandine-hematite-goethite/diopside-apatite
7023	Hematite-goethite/diopside
7024	Almandine-orthopyroxene/diopside-apatite
7025	Goethite-almandine-hematite/diopside
7026	Almandine-hematite/diopside-apatite
7027	Almandine-orthopyroxene/apatite-diopside
7028	Almandine-orthopyroxene/diopside
7029	Orthopyroxene-almandine/diopside
7030	Orthopyroxene-almandine/diopside
7031	Orthopyroxene-almandine/diopside-apatite
7032	Orthopyroxene/diopside-apatite
7033	Orthopyroxene/diopside-apatite
7034	Augite-almandine/diopside-apatite
7035	Orthopyroxene-almandine-ilmenite/diopside
7036	Orthopyroxene-almandine/diopside-apatite
7037	Almandine-orthopyroxene/diopside
7038	Almandine-orthopyroxene/diopside
7039	Almandine-orthopyroxene/diopside
7040	Orthopyroxene-almandine/diopside-apatite
7041	Orthopyroxene-almandine/diopside-apatite
7042	Orthopyroxene-almandine-hematite/diopside-apatite
7043	Orthopyroxene-almandine-hematite/diopside
7044	Hematite-orthopyroxene/diopside
7045	Hematite-orthopyroxene/diopside-apatite
7046	Hematite/epidote-apatite
7047	Hematite-orthopyroxene/diopside-apatite
7048	Hematite-orthopyroxene/epidote-diopside
7049	Ilmenite-orthopyroxene/diopside
7050	Hematite-orthopyroxene/diopside-epidote
7051	Hematite-orthopyroxene-almandine/diopside-apatite
7052	Orthopyroxene-almandine-hematite/diopside
7054	Orthopyroxene-almandine-hematite/diopside
7055	Hornblende-almandine-orthopyroxene/diopside

Sample Number	INPUT ASSEMBLAGE
7056	Almandine-hornblende-orthopyroxene/epidote-titanite-diopside
7057	Orthopyroxene-almandine-hematite/epidote-titanite-diopside
7058	Orthopyroxene-almandine-hematite/diopside-apatite
7059	Almandine-orthopyroxene-hematite/diopside-apatite
7060	Hematite/epidote
7061	Hematite-goethite/epidote
7062	Hematite/epidote
7063	Hematite-goethite/epidote
7064	Goethite-hematite/epidote
7065	Hematite/epidote
7066	Hematite-goethite/epidote
7067	Hematite-almandine/epidote-apatite
7068	Hematite/epidote-apatite
7069	Hematite/epidote
7070	Almandine-hematite-fayalite/epidote
7071	Hematite-almandine-augite/epidote-apatite
7072	Augite-hematite-fayalite/epidote
7073	Almandine-hematite/barite
7074	Almandine-hematite/diopside-epidote
7075	Hematite-almandine/epidote
7076	Almandine-hematite-hornblende/diopside-sillimanite
7200	Almandine-orthopyroxene/diopside
7201	Hematite-almandine/diopside-apatite
7202	Almandine-orthopyroxene-hematite/diopside-epidote
7203	Almandine/apatite-diopside-monazite
7204	Almandine-orthopyroxene/diopside-apatite
7205	Almandine-orthopyroxene/diopside-apatite
7206	Almandine-orthopyroxene/diopside
7207	Almandine-orthopyroxene/diopside-apatite
7208	Almandine-orthopyroxene/diopside-apatite
7209	Almandine-orthopyroxene/diopside-apatite
7210	Almandine-orthopyroxene/apatite-diopside
7211	Almandine-orthopyroxene/diopside-apatite
7212	Almandine-goethite-hematite/apatite
7213	Almandine-hematite/apatite
7214	Hematite/diopside
7215	Almandine/diopside
7216	Hematite-goethite-almandine/apatite
7217	Almandine/diopside-apatite
7218	Hematite-almandine/apatite
7219	Almandine-orthopyroxene/diopside-apatite
7220	Hematite-almandine/apatite
7221	Orthopyroxene-almandine/diopside-apatite
7222	Orthopyroxene-almandine/diopside
7223	Almandine-orthopyroxene/diopside-apatite
7224	Orthopyroxene-almandine/diopside-apatite
7225	Orthopyroxene/diopside-apatite
7226	Orthopyroxene/diopside-apatite
7227	Orthopyroxene-augite-ilmenite/diopside-apatite
7228	Orthopyroxene/diopside-apatite
7229	Orthopyroxene/diopside-epidote

Sample Number	INPUT ASSEMBLAGE
7230	Hematite-orthopyroxene-almandine/diopside-epidote
7231	Orthopyroxene-hematite-almandine/diopside-epidote
7232	Hematite-almandine-orthopyroxene/diopside-epidote
7233	Orthopyroxene-hematite-almandine/diopside-epidote
7234	Hematite-orthopyroxene-almandine/diopside-epidote
7235	Orthopyroxene-hornblende-hematite/epidote-diopside
7236	Orthopyroxene/diopside-epidote
7237	Orthopyroxene/diopside-epidote
7238	Orthopyroxene/diopside
7239	Orthopyroxene/apatite-diopside
7240	Orthopyroxene-almandine/diopside
7241	Almandine-orthopyroxene/diopside
7242	Almandine-orthopyroxene/diopside
7243	Almandine-orthopyroxene/diopside
7244	Orthopyroxene-almandine/diopside-apatite
7245	Goethite-orthopyroxene-almandine/diopside-apatite
7246	Orthopyroxene-almandine-goethite/diopside-apatite
7247	Orthopyroxene-almandine-hematite/diopside
7248	Hematite-almandine-orthopyroxene/diopside
7249	Goethite-hematite-hornblende-almandine/epidote-kyanite
7250	Hematite-orthopyroxene-almandine/apatite
7251	Hornblende-almandine/diopside
7252	Almandine-hornblende-orthopyroxene/apatite-diopside
7253	Orthopyroxene-almandine/diopside
7254	Almandine-hematite-orthopyroxene/diopside
7255	Orthopyroxene-almandine-hematite/titanite-diopside-epidote
7256	Orthopyroxene-almandine-hematite/diopside-epidote
7257	Almandine-hematite-orthopyroxene/diopside-epidote
7258	Hematite-orthopyroxene-almandine-goethite/diopside-epidote
7259	Hematite-almandine/diopside
7260	Orthopyroxene-almandine-hematite/diopside
7261	Almandine-hematite-orthopyroxene/diopside
7262	Hematite-almandine-orthopyroxene/diopside
7263	Almandine-hematite/diopside
7264	Almandine-hematite/diopside-barite
7265	Hematite-goethite/epidote
7266	Hematite/epidote
7267	Hematite-goethite/epidote
7268	Hematite/epidote
7269	Hematite-goethite/diopside
7270	Hematite/epidote
7271	Hematite-goethite/diopside-epidote
7272	Hematite/epidote
7273	Hematite/epidote
7274	Hematite-almandine/epidote-diopside
7275	Hematite-almandine/epidote-barite
7276	Almandine-hematite/diopside-apatite
7277	Almandine-hematite/diopside-epidote
7278	Almandine-hematite-orthopyroxene/diopside-barite
7279	Almandine-orthopyroxene/diopside-barite

* Numbers

Sample Number	Dimensions (microns)			Number of Visible Gold Grains				Nonmag HMC Weight	Calculated V.G. Assay in HMC	Metallic Minerals in Pan Concentrate
	Thickness	Width	Length	Reshaped	Modified	Pristine	Total	(g)	(ppb)	
127002	NO VISIBLE GOLD									
127003	NO VISIBLE GOLD									7 grains pyrite (50-75µm).
127004	NO VISIBLE GOLD									1 grain pyrite (100µm).
127005	10.25 C	50	50	1			1			1 grain pyrite (25µm), ~20 grains copper (25-100µm).
							1	31.2	6.159855769	
127006	NO VISIBLE GOLD									3 grains pyrite (25-50µm).
127007	NO VISIBLE GOLD									No sulphides.
127008	NO VISIBLE GOLD									No sulphides.
127009	NO VISIBLE GOLD									No sulphides.
127010	NO VISIBLE GOLD									No sulphides.
127011	NO VISIBLE GOLD									No sulphides.
127012	NO VISIBLE GOLD									No sulphides.
127013	NO VISIBLE GOLD									1 grain pyrite (75µm).
127014	NO VISIBLE GOLD									1 grain pyrite (25µm).
127015	10.25 C	50	50	1			1			No sulphides.
							1	32.4	5.931712963	
127016	NO VISIBLE GOLD									No sulphides.
127017	NO VISIBLE GOLD									1 grain pyrite (50µm).
127018	NO VISIBLE GOLD									~250 grains pyrite (15-50µm).
127019	NO VISIBLE GOLD									No sulphides.
127020	50 M	100	175	1			1			10 grains pyrite (25-50µm).
							1	45.6	155.4790296	
127021	NO VISIBLE GOLD									No sulphides.
127022	75 M	100	225	1			1			3 grains pyrite (25-50µm).
							1	47.2	314.6931276	
127023	NO VISIBLE GOLD									No sulphides.
127024	NO VISIBLE GOLD									No sulphides.
127025	NO VISIBLE GOLD									2 grains pyrite (25µm).
127026	NO VISIBLE GOLD									1 grain pyrite (25µm).
127027	NO VISIBLE GOLD									3 grains pyrite (25-50µm).
127028	NO VISIBLE GOLD									5 grains pyrite (25m).
127029	NO VISIBLE GOLD									No sulphides.
127030	NO VISIBLE GOLD									No sulphides.
127031	NO VISIBLE GOLD									No sulphides.
127032	NO VISIBLE GOLD									No sulphides.
127033	NO VISIBLE GOLD									3 grains pyrite (25µm).
127034	NO VISIBLE GOLD									No sulphides.
127035	NO VISIBLE GOLD									6 grains pyrite (25µm).
127036	NO VISIBLE GOLD									2 grains pyrite (50µm).
127037	NO VISIBLE GOLD									1 grain pyrite (100µm).
127038	NO VISIBLE GOLD									No sulphides.
127039	NO VISIBLE GOLD									No sulphides.
127040	NO VISIBLE GOLD									No sulphides.
127041	NO VISIBLE GOLD									No sulphides.
127042	NO VISIBLE GOLD									7 grains pyrite (50-100µm).
127043	NO VISIBLE GOLD									No sulphides.
127044	NO VISIBLE GOLD									~30 grains pyrite (25-50µm).
127045	NO VISIBLE GOLD									2 grains pyrite (25µm).
127046	NO VISIBLE GOLD									No sulphides.
127047	NO VISIBLE GOLD									No sulphides.
127048	NO VISIBLE GOLD									2 grains pyrite (25µm).
127049	NO VISIBLE GOLD									No sulphides.
127050	NO VISIBLE GOLD									4 grains pyrite (75µm),
127051	15.1875 C	50	100	1			1			No sulphides.
							1	34	18.84478401	
127052	NO VISIBLE GOLD									5 grains copper (75-100µm).
										3 grains pyrite (50µm).
127054	NO VISIBLE GOLD									No sulphides.
127055	NO VISIBLE GOLD									No sulphides.
127056	NO VISIBLE GOLD									No sulphides.
127057	NO VISIBLE GOLD									No sulphides.
127058	NO VISIBLE GOLD									2 grains pyrite (25µm).
127059	10.25 C	50	50	1			1			No sulphides.
	12.734375 C	50	75	1			1			
							2	45.2	12.50586046	
127060	NO VISIBLE GOLD									3 grains pyrite (50-75µm).
127061	NO VISIBLE GOLD									2 grains copper (100µm), 4 grains pyrite (25-50µm).
127062	NO VISIBLE GOLD									1 grain pyrite (50µm).
127063	NO VISIBLE GOLD									4 grains pyrite (25-75µm).
127064	NO VISIBLE GOLD									4 grains pyrite (25-50µm).
127065	NO VISIBLE GOLD									3 grains pyrite (25-75m).
127066	NO VISIBLE GOLD									5 grains pyrite (25-75µm).
127067	NO VISIBLE GOLD									1 grain pyrite (25µm).
127068	NO VISIBLE GOLD									1 grain pyrite (25µm).
127069	NO VISIBLE GOLD									No sulphides.
127070	NO VISIBLE GOLD									1 grain pyrite (25µm).

Sample Number	Dimensions (microns)			Number of Visible Gold Grains				Nonmag HMC Weight	Calculated V.G. Assay in HMC	
	Thickness	Width	Length	Reshaped	Modified	Pristine	Total	(g)	(ppb)	Metallic Minerals in Pan Concentrate
127071	NO VISIBLE GOLD									No sulphides.
127072	NO VISIBLE GOLD									No sulphides.
127073	75 M	100	125	1			1			No sulphides.
							1	24	296.6308594	
127074	NO VISIBLE GOLD									No sulphides.
127075	NO VISIBLE GOLD									6 grain pyrite (25-75m).
127076	10.25 C	50	50	1			1			6 grains pyrite (25-50µm).
							1	30	6.40625	
127200	NO VISIBLE GOLD									No sulphides.
127201	10.25 C	50	50	2			2			No sulphides.
							2	57.2	6.719842657	
127202	12.734375 C	50	75		1		1			No sulphides.
	20 C	75	125			1	1			
							2	30.4	61.61438791	
127203	NO VISIBLE GOLD									2 grains pyrite (50µm).
127204	NO VISIBLE GOLD									1 grain pyrite (50µm).
127205	17.609375 C	75	100	1			1			2 grains pyrite (50µm).
							1	43.2	23.40655857	
127207	NO VISIBLE GOLD									2 grains pyrite (75-100µm).
127209	NO VISIBLE GOLD									2 grains pyrite (25µm).
127211	15.1875 C	75	75	1			1			~10 grains pyrite (25-75µm).
127212	12.734375 C	50	75	1			1			1 grain pyrite (75µm).
127213	NO VISIBLE GOLD									No sulphides.
127215	5.1875 C	25	25	1			1			~25 grains pyrite (25-100µm).
							1	51.2	<1	
							1	39.2	<1	
127217	NO VISIBLE GOLD									~25 grains pyrite (25µm).
127218	NO VISIBLE GOLD									No sulphides.
127219	NO VISIBLE GOLD									1 grain pyrite (25µm).
127220	NO VISIBLE GOLD									1 grain pyrite (25µm).
127221	NO VISIBLE GOLD									1 grain pyrite (25µm).
127222	NO VISIBLE GOLD									1 grain pyrite (25µm).
127223	7.734375 C	25	50	1			1			1 grain pyrite (25µm).
	10.25 C	50	50	1			1			
							2	46	5.95132579	
127224	10.25 C	25	75	1			1			No sulphides.
							1	53.6	3.585587687	
127225	NO VISIBLE GOLD									~20 grains pyrite (25-50µm).
127226	NO VISIBLE GOLD									5 grains pyrite (25-50µm).
127227	NO VISIBLE GOLD									5 grains pyrite (25-50µm).
127228	NO VISIBLE GOLD									4 grains pyrite (25-50µm).
127229	NO VISIBLE GOLD									~20 grains pyrite (25-50µm).
127230	10.25 C	50	50	1			1			No sulphides.
							1	36.8	5.222486413	
127231	NO VISIBLE GOLD									1 grain pyrite (25µm).
127232	NO VISIBLE GOLD									3 grains pyrite (25-50µm).
127233	3.1275 C	15	15		1		1			2 grains pyrite (50µm0.)
							1	21.6	<1	
127234	NO VISIBLE GOLD									No sulphides.
127235	NO VISIBLE GOLD									1 grain pyrite (25µm).
127236	NO VISIBLE GOLD									No sulphides.
127237	NO VISIBLE GOLD									No sulphides.
127238	NO VISIBLE GOLD									5 grains pyrite (25-50µm).
127239	NO VISIBLE GOLD									No sulphides.
127240	NO VISIBLE GOLD									5 grains pyrite (25-50µm).
127241	NO VISIBLE GOLD									No sulphides.
127242	NO VISIBLE GOLD									4 grains pyrite (25µm).
127243	NO VISIBLE GOLD									No sulphides.
127244	NO VISIBLE GOLD									No sulphides.
127245	NO VISIBLE GOLD									~30 grains pyrite (25-50µm).
127246	NO VISIBLE GOLD									3 grains pyrite (25-50µm).
127247	NO VISIBLE GOLD									No sulphides.
127248	15.1875 C	75	75	1			1			2 grains pyrite (25-50 µm).
							1	45.6	14.05093544	
127249	NO VISIBLE GOLD									No sulphides.
127250	NO VISIBLE GOLD									No sulphides.
127251	NO VISIBLE GOLD									No sulphides.
127252	NO VISIBLE GOLD									No sulphides.
127253	NO VISIBLE GOLD									No sulphides.
127254	NO VISIBLE GOLD									No sulphides.
127255	NO VISIBLE GOLD									2 grains pyrite (25-50µm).
127256	5.1875 C	25	25	1			1			No sulphides.
							1	32.4	0.750506366	
127257	10.25 C	50	50		1		1			4 grains copper (25-150µm; probably contamination)
	100 M	100	125	1			1			
							2	40.8	237.3621324	

Sample Number	Dimensions (microns)			Number of Visible Gold Grains				Nonmag HMC Weight	Calculated V.G. Assay in HMC	
	Thickness	Width	Length	Reshaped	Modified	Pristine	Total	(g)	(ppb)	Metallic Minerals in Pan Concentrate
127258	NO VISIBLE GOLD									No sulphides.
127259	NO VISIBLE GOLD									No sulphides.
127260	NO VISIBLE GOLD									~10 grains pyrite (50-125µm).
127261	NO VISIBLE GOLD									No sulphides.
127262	NO VISIBLE GOLD									2 grains pyrite (25µm).
127263	NO VISIBLE GOLD									10 grains pyrite (25-50µm).
127264	NO VISIBLE GOLD									No sulphides.
127265	10.25 C	50	50	1			1			No sulphides.
							1	34.8	5.52262931	
127266	12.734375 C	50	75	1			1			No sulphides.
	100 M	125	225	1			1			
							2	32	729.432106	
127267	NO VISIBLE GOLD									~40 grains pyrite (25-150µm).
127268	NO VISIBLE GOLD									No sulphides.
127269	NO VISIBLE GOLD									No sulphides.
127270	NO VISIBLE GOLD									~15 grains pyrite (25-50µm).
127271	NO VISIBLE GOLD									No sulphides.
127272	NO VISIBLE GOLD									No sulphides.
127273	NO VISIBLE GOLD									~50 grains pyrite (25-50µm).
127274	NO VISIBLE GOLD									No sulphides.
127275	NO VISIBLE GOLD									No sulphides.
127276	NO VISIBLE GOLD									1 grain pyrite (50µm), 4 grains Sn-solder (50-75µm),
127277	5.1875 C	25	25			1	1			No sulphides.
	20 C	75	125	1			1			1 grain Sn-solder (75µm; contamination).
							2	36.4	41.87682435	
127278	NO VISIBLE GOLD									No sulphides.
										1 grain Sn-solder (50µm; contamination).
127279	12.734375 C	50	75	1			1			No sulphides.
							1	26	14.34913048	1 grain Sn-solder (75µm; contamination).

OVERBURDEN DRILLING MANAGEMENT LIMITED
LABORATORY ABBREVIATIONS

APPENDIX 1: SEDIMENT LOG

Clasts (> 2mm):
Size (largest clasts present):
G: Granules
P: Pebbles
C: Cobbles

Clast Composition:
Field names:
V/S: Volcanics and/or sediments
GR: Granitics
LS: Limestone, carbonates
OT: Other Lithologies (refer to footnotes)
Values:
TR: Only trace present
Na: Not applicable
OX: Very oxidized, undifferentiated

Matrix Grain Size Distribution:
S/U: Sorted or Unsorted
SD: Sand (F: Fine; M: Medium; C: Coarse)
ST: Silt
CY: Clay
Y: Fraction present
+: Fraction more abundant than normal
-: Fraction less abundant than normal
N: Fraction not present

Matrix (< 2.0 mm):
ORG: Y: Organics present in matrix
N: Organics absent or negligible in matrix
+: Matrix is mainly organic

Matrix Colour:
Primary:
BE: Beige
GY: Grey
GB: Grey-beige
GN: Green
GG: Grey-green
PP: Purple
PK: Pink
PB: Pink-Beige
Secondary (soil):
OC: Ochre
BN: Brown
BK: Black
Secondary Colour Modifier:
L: Light
M: Medium
D: Dark

APPENDIX 2: KIM (kimberlite indicator mineral) LOG

GP: Purple to red peridotitic garnet (G9/10 Cr-pyrope)
GO: Orange mantle garnet; includes both eclogitic pyrope-almandine (G3) and Cr-poor megacrystic pyrope (G1/G2) varieties; may include unchecked (by SEM) grains of common crustal garnet (G5) lacking diagnostic inclusions or crystal faces
DC: Cr-diopside; distinctly emerald green (paler emerald green low-Cr diopside picked separately)
IM: Mg-ilmenite; may include unchecked (by SEM) grains of common crustal ilmenite lacking diagnostic inclusions or crystal faces
CR: Chromite
FO: Forsterite

MMSIM (metamorphosed or magmatic massive sulphide indicator mineral) and PCIM (porphyry Cu indicator mineral) LOGS

Adr:	Andradite	Cr:	Chromite	Ky:	Kyanite	Sil:	Sillimanite	Ttn:	Titanite
Ap:	Apatite	Fay:	Fayalite	Mz:	Monazite	Spi:	Spinel		
Ase:	Anatase	Gh:	Gahnite	Ol:	Olivine	Sps:	Spessartine		
Ax:	Axinite	Gr:	Grossular	Opx:	Orthopyroxene	St:	Staurolite		
Cpy:	Chalcopyrite	Gth:	Goethite	Py:	Pyrite	Tm:	Tourmaline		

APPENDIX 3: GOLD GRAIN LOG

Thickness:
VG: Visible gold grains
M: Actual measured thickness of grain (microns)
C: Thickness of grain (microns) calculated from measured width and length