ASSESSMENT WORK REPORT

for CELL CLAIMS 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465

arising from LEGACY CLAIM 4282402

Block 36, Gillies Limit

Larder Lake Mining Division

Claim Holder - Brian Anthony (Tony) Bishop client #108621

Report prepared and submitted by Tony Bishop

March 22, 2019

Table of Contents

ASSESSMENT REPORT FOR CELL CLAIMS 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465, arising from LEGACY CLAIM 4282402, GILLIES LIMIT, LARDER LAKE MINING DIVISION

Prepared by Brian A. (Tony) Bishop, submitted March 22, 2019

INTRO:

Hereby submitted by Brian Anthony (Tony) Bishop [Client No. 108621, 100% holder on record], on March 22, 2019, an assessment report for Legacy Claim no. L 4282402 (recorded on March 24, 2017), in respect of cell claims 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465, in grid cells 31M05B182, 31M05B162, 31M05B163, 31M05B183, 31M05B184, 31M05B164, 31M05B185, 31M05B203, 31M05B204, 31M05B205, 31M05B206, Larder Lake Mining Division [see Appendix 3: Map 1, page 26].

Legacy Claim #	Associated Full Cell Claim #	Grid Cell ID	Associated Boundary Cell Claim #	Grid Cell ID
4282402 Staked March 19, 2017 by Patrick Harrington. Recorded March 24, 2017 (16 claim units)	212123	31M05B182	326239	31M05B203
	128936	31M05B162	128937	31M05B204
	326238	31M05B163	117276	31M05B205
	279661	31M05B183	145465	31M05B206
	230928	31M05B184		
	326237	31M05B164		
	312714	31M05B185		

Work completed to date includes an on-foot observational examination of the claim, a research component, carefully determined and mapped out soil sampling plans, screening, concentrating, sorting and examining potential kimberlite indicator minerals (KIMs) in collected soil samples, microphotography, and recording these and other findings.

Traverses occurred on the following of these new claim numbers: Traverse 1: 128937, 230928, 117276, 145465; Traverse 2: 212123, 128936, 326239, 230928, 326237, 312714, 326238.

Appendices include detailed methodologies for field work and till sample processing (including results of processing efficiency test and flowchart for concentrating), narratives, maps and field notes for 2 traverses, a brief narrative on area history, notes on structural geology, and discussion points on the importance of non-magnetic signatures and geo-chemical and structural geology for advances in diamond exploration in Canada, as well as in-depth discussions of the importance of various types of kimberlitic & non-kimberlitic grains. A Map Appendix includes general claim location and road access, geological types, faults, glacial directions, magnetics, and Google Earth views of the claim.

PURPOSE:

The purpose of staking Claim L 4282402 and the goal of the assessment work done to date and included in this report is to look for evidence and test the hypothesis that the claim may contain the top of a kimberlite pipe manifested in the post-glacial topography by an apparent somewhat darker circular impression in Hound Chute Lake. As Shigley et al (2016) state, in reference to the Diavik Mine, "Because kimberlites weather and decompose faster than much older surrounding rocks, pipes often occur in topographical depressions beneath lakes…most [pipes] are buried beneath bodies of water".

4 – Hound Chute Lake – 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465

ACCESS:

Access to Claim no. 4282402 can be made by travelling south from Latchford on Hwy 11 (Trans Canada Highway) for approximately 3km and turning east onto a seasonal gravel road (Roosevelt Road), for approximately 6km. Hound Chute Lake is approximately 1km north of the road.

PREVIOUS WORK and significance to Claim 4282402:

Except for one drill hole to the north western part of the legacy claim by Silver Tower Mines Ltd. in 1965, some distance from Hound Chute Lake itself as shown on the MLAS maps website, no other work could be found. This drill hole is not on any of the claim cells included in this report.

GEOLOGY:

Claim 4282402 is underlain by sedimentary rocks of the Gowganda Formation with a diabase contact to the near east of Hound Chute Lake, and Lorrain Formation to the near west of Hound Chute Lake. There is a northeast-southwest fault that runs from some distance south of Hound Chute Lake that appears to bisect Hound Chute Lake itself. The Montreal River Fault lies approximately 4km to the west.

FIELDWORK:

Taking many smaller till samples from various locations down-ice was deemed appropriate to mitigate the extreme nugget effect caused by KIMs potentially being restricted to thin stratigraphic horizons in the till.

Nineteen till samples, and three creek samples (as well as six samples that are not included for work assessment credit) were collected on two traverses [see Appendix 4, page 34]. General prospecting and site examination were also undertaken on each traverse.

DISCUSSION & CONCLUSIONS:

Further discussion is presented on page 9.

TRAVERSES:

Please refer to Appendix 4 for Traverses for detailed narratives, maps, and coordinates/field notes.

METHODOLOGIES:

Please refer to Appendix 5 for Methodologies for Fieldwork and Till Processing

5 – Hound Chute Lake – 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465

RESULTS:

MICROSCOPE PHOTOS OF KIMs: most of the following photos were taken from unpicked concentrates

Photo 1 - CrP – 0.3mm

Photo 2- CrP – 0.8mm

Photo 3 - Non-magnetic Grains – 0.25mm

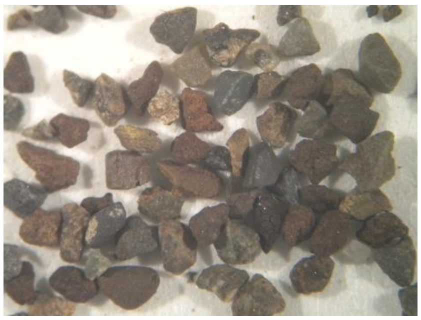


Photo 4 - Cons from stream samples

Photo 5 - CrP – 1.4mm

Photo 6 - CrP – 1.0mm

Photo 7 - CrP – 0.8mm

Photo 8 - CrP – 1.3mm

Photo 9 - GO – 0.7mm

Photo 10 - CrP – 0.5mm

Photo 11 - Unidentified grain – 0.6mm

Photo 12 - CrP – 0.4mm

Photo 13 - GO – 0.7mm

Photo 14 - CrP – 0.3mm

Photo 15 - CrP – 0.5mm

6 – Hound Chute Lake – 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465


Photo 16 - GO – 0.5mm


Photo 17 - CrP – 0.4mm

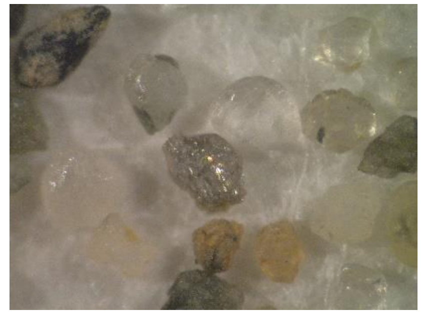


Photo 18 - Shiny, unidentified grain – 0.4mm


Photo 19 - CrP – 0.5mm


Photo 20 - CrP – 0.25mm


Photo 21 - CrP – 0.3mm


Photo 22 - Mg Ilmenite – 0.6mm


Photo 23 - Cr Diopside – 0.5mm

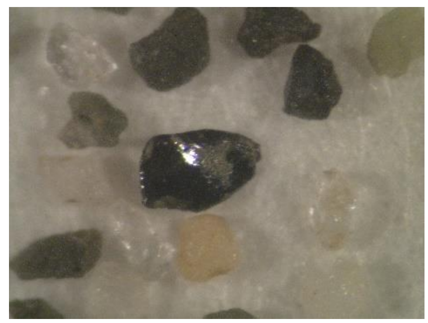


Photo 24 - Mg Ilmenite – 0.6mm

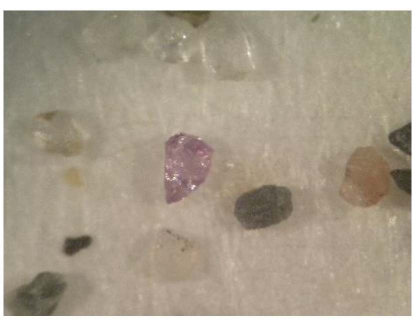


Photo 25 - CrP – 0.4mm


Photo 26 - CrP – 0.3mm


Photo 27 - CrP – 0.25mm


Photo 28 - CrP – 0.25mm

7 – Hound Chute Lake – 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465

NOTES & OBSERVATIONS:

- 3 garnets (as seen in Photos 2, 8, & 13) have attached kimberlite
- Photos 2, 6, 8, 9, 10, 12, & 13 show garnets with kelyphytic rims
- Photo 4 shows heavy mineralised coating on stream samples that must be removed before picking KIMs under the microscope. A number of rust removers and acids will be tested for best results.
- Photo 11 looks similar to grains previously tested (SEM/microprobed) that were determined to be titanite
- Photo 18 has a 'greasy' luster and colour that closely resembles a diamond rough. This grain is in its own vial for future testing
- Photos 22 & 24 show ilmenite grains with a leucoxene coating

HOUND CHUTE LAKE KIMs – MAGNETIC SUSCEPTIBILITY COMPARATIVE:

Glassy, black spheroids were observed in the cons but the few picked were magnetic (probably FeO, based on lab testing on similar grains at Sudbury Labs on other claims); however, of particular interest are the non-magnetic garnets (no response to a small N-52 magnet). There are two Cr Pyropes (purple), three GO (vivid orange, transparent), and nine garnets (light orange). In the Grassy Lake Report (Bishop, B.A. (2018b)), two similar purple Cr Pyropes were tested as G11s (FeO content 6.696% & 8.064%). A vivid orange garnet that was labelled an almandine is non-magnetic, which is very odd due to its iron content of 30.772% FeO.

One sample of picked KIMs (with red/purple garnets and euhedral chromites etc. previously removed) was tested with a small but powerful neodymium magnet and separated based on magnetic susceptibility. Interesting grains are in the very weakly and non-magnetic fractions. At this small grain size, the iron content must be very low to zero and therefore the garnets are not crustal (or are grossular or uvarovite – both rare and green). Further testing/microprobes are recommended to further clarify results. Magnetic susceptibility testing is a very important tool to assist the underfunded grassroots prospector in discerning which grains to send for EMP analysis and going forward I will begin utilising this for future lab submissions.

A - Non-magnetic (inert) garnets – 0.25-1.4mm

B - CrP (deep purple), non-magnetic – 1.4mm

C - (same as B & D) – showing frosted surface & attached kimberlite

D - (same as B & C) – showing frosted surface & attached kimberlite

E - CrP (purple) – non-magnetic – 0.3mm

F - Garnets – orange – non-magnetic – 0.3-0.6mm

8 – Hound Chute Lake – 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465

G - Garnets – medium orange – non-magnetic

FLUORESCENT GRAINS PICKED FROM CONS:

H – GNL – light pink grain in cons, 0.25mm

I – GNL – white ceramic background

J – RL – white ceramic background

The three photos above (Photos H-J) are of a 0.25mm light pink grain that fluoresces a vivid (neon) bright red using a commercial-quality multi(5)-frequency longwave ultraviolet LED light (LWUV).

I tried to film the fluorescing grains, but the pictures did not turn out. High level camera equipment would be required for this type of shot of a 0.25mm grain.

A single frequency super-bright II (very strong) longwave UV light (LWUV) gives little to no response.

A shortwave super-bright 2000SW (very strong) shortwave (SWUV) light produces no response.

Longwave UV fluorescence is comparatively rare in minerals, while shortwave UV commonly produces fluorescence. The one exception is in (a certain percentage) of diamonds.

In the past as part of my research, I tested a packet of several hundred very tiny African diamonds with this LWUV flashlight and they all fluoresced very brightly in various colours, including this colour of red (and orange, green, yellow, blue-white). A research paper on Wawa diamonds reported similar results with excellent photographs of this fluorescence. Further research revealed a 0.4 carat Type IIA diamond that displayed similar bright red fluorescence under longwave UV.

With much research, I have not found any mineral except diamond that reacts this way.

This grain, as well as two others discussed below, are safely stored and labelled for future testing.

Similarly, a colourless, transparent, 0.4mm grain fluoresced bright blue-white under the LW flashlight, barely fluoresced with the LW super-bright II, and had no response to the SW super-bright 2000 SW. This response to a LWUV light and the blue-white colour is the most common fluorescent response of colourless diamonds and is generally considered unique to diamonds. The 187 carat Canadian Foxfire diamond (Diavik Mine), which has a slight yellow hue, fluoresces very bright blue-white under longwave UV, and less so under shortwave UV.

Another pink 0.4mm transparent grain fluoresced soft orange with the LW flashlight but had no response to the super-bright LW or SW.

Photographs were not obtained for these last two grains due to the difficulty transferring the first one to a white surface (I almost lost the stone).

These three grains are safely stored for future testing by SEM or microprobe.

DISCUSSION & CONCLUSIONS:

The results of the till sampling program were very satisfactory. Some of the grains have been set aside for eventual SEM and EMP testing, namely the three fluorescent potential diamonds, the non-magnetic garnets & Cr Pyropes, ilmenites, etc., to better ascertain kimberlitic origin and diamond association potential of these grains.

Numerous kimberlitic grains were picked from the till samples taken down-ice of Hound Chute Lake under the microscope. A number of the more interesting ones were photographed, some of which are included in this report. Of particular interest are the Cr Pyropes with attached kimberlite and kelyphyite alteration rims, and similarly leucoxene for ilmenites.

As the size of the Cr Pyrope grains decreases in my samples, so does the evidence of kelyphytic coating. This makes sense, as when grains are less proximal and transported more, they have less coating and break into smaller sizes. Larger grains, therefore, are directly related to having more coating preserved.

This, combined with the greater mass of larger grains, also shows close proximity to the target/source (see Appendix 10: “Arctic Star Presentation”, page 55).

Recall that many diamond exploration firms only report 0.25-0.5mm fraction of KIMs in press releases in order to maximise results.

In Hound Chute Lake till (not stream) samples, the largest five Cr Pyropes picked (0.7mm, 0.8mm, 1.0mm, 1.3mm, & 1.4mm) are mass (weight) equivalent to 434½ - 0.25mm grains and ~55 - 0.5mm grains. I have similar and sometimes far greater comparative results from many of my other targets.

Unless otherwise instructed, when ODM and other KIM processing labs are picking grains, they pick a given number of KIMs and then estimate the amount in the rest of the concentrates, based on this number to save time/expense.

It is also relevant to compare till and alluvium (stream) samples as the geologists in the OGS-OFR reports basically gave up on till samples due to low KIM results. They almost exclusively relied on alluvium placer to concentrate heavy minerals as this very much magnifies high KIM (especially Cr Pyrope) results from till (see Conclusions, page 17, to view charts describing this method).

A number of brilliant, transparent yellow grains were found in the concentrates. Similar grains have also been found on other targets/claims when high levels of KIMs were also found. Previously, I had them lab tested and they tested as quartz, and therefore are citrine, a very rare mineral (almost all ‘citrine’ is heat-treated smoky quartz or amethyst), as far as I can research not found in Canada, and epidote, which is seldom found as yellow (usually yellow-green to green). Another grain that fluoresces yellow is pink-purple coloured zircon, an unusual colour for zircon, with rounded, slightly frosted appearance. Very many small watermelon-to-round shaped frosted zircons, which are diagnostic for kimberlitic zircons, another commonly found KIM, are also in the concentrates.

ON ILMENITES:

Presently, most companies will not consider a diamond prospect/pipe unless the ‘chemistry’ of the indicators are a certain value. Specifically the chemistry for ilmenite, although they are not a kimberlite (mantle) mineral, they are ‘picked up’ from the country rock by the ascending kimberlite diatreme.

Many properties are made or ignored based on this premise. I recently encountered this when a major I spoke with wanted to see the ilmenite chemistry (expensive to test for 15 individual targets at the prospecting level) and from the company’s past history, the results are treated as gospel for pipe/diamond content.

However, as quoted below showing various viewpoints on this, perhaps they should reconsider their long ago entrenched beliefs.

"… the importance of ilmenite composition during the evaluation of a pipe for diamond content may be related to diamond preservation (McCallum and Waldman 1991). … the magma may be subjected to later near-surface oxidizing environments. Such oxidation may show up as high Fe^3/Fe^{2+} ratios … in ilmenite. In such cases, it has been suggested that … diamonds in the host magma may be substantially resorbed to produce graphite, CO_2, or CO.

"Survival of diamond at elevated temperatures … is linked to low oxygen fugacity; elevated oxygen levels favor resorption. Ferrimagnetic ilmenite high in Cr_2O_3 is found in some diamond-poor kimberlites, and these ilmenites characteristically show exsolution texture.

"In contrast, homogenous ilmenites are found in kimberlites that are interpreted to have risen comparatively rapidly. … typically results in later ilmenites that have lower MgO and Cr_2O_3 contents.

"It has been reported that ilmenite in equilibrium with diamond contains almost no Fe^{3+}

"High Cr_2O_3 and MgO components in ilmenite relate to low oxygen fugacity. This association has led to the use of Cr_2O_3/MgO plots to evaluate ilmenite trends for diamond preservation.

"Gurney (1989) and Gurney, Helmstadt, and Moore (1993) report that 'ilmenites with low Fe^{3+}/Fe^{2+} rations are associated with higher diamond content than those with more Fe^{3+}, whereas **diamonds are not associated with ilmenites of high Fe^{3+} content at all.**'

"**However, this association is not supported by all observations.** As pointed out by Schulze et al. (1995) and Coopersmith and Schulz (1996), on the basis of ilmenite geochemistry, an exploration geologist would be forced to conclude that finding diamonds in the Mir, Frank Smith, DeBeers, Monastery, and Kelsey Lake mines would be unlikely because these kimberlites all have ilmenites with high hematite [Fe(III)] component. Yet, unresorbed diamonds and relatively high ore grades are found in kimberlites at Mir (200 carats/100 tonnes), Frank Smith (known for its sharp-edged octahedrons), DeBeers (90 carats/100 tonnes), and Monastery (50 carats/100 tonnes). Low diamond grades are reported at the Kelsey Lake mine, but the diamonds are excellent and include many spectacular gem-quality octahedrons with little evidence of resorption. The ilmenite geochemistry of Kelsey Lake shows as much as 38% hematite component (Schulze et al. 1995; Coopersmith and Schulze 1996) which would lead to a prediction, based on ilmenite geochemistry, that these kimberlites would be devoid of diamond. However, diamond production at the mine includes a large percentage of high-quality gemstones with octahedral habit indicating that diamond preservation was favorable.

"In all probability, many picroilmenite nodules did not coexist with the magma at the time they were incorporated in to the kimberlite. Therefore, … their oxidation state would have little bearing on the diamond resorption potential (Schulze et al. 1995; Coopersmith and Schulze 1996).

[G10s] "Some diamondiferous pipes, such as the Argyle, contain few (if any) G10 garnets, whereas some barren pipes such as Zero and Buljah, Western Australia, contain abundant G10 garnets." (Erlich & Hausel (2002). p 330-331.)

11 – Hound Chute Lake – 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465

ON NON-MAGNETIC GARNETS AND OTHER KIMS:

For more information on the importance of non-magnetic garnets, refer to Bishop, B.A. (2017c).

In many 1000s of samples tested by microprobe in OGS and other reports from various/numerous sources, non-kimberlitic (crustal garnets) vary approximately between 20-40% FeO. Others considered to be kimberlitic are eclogitic and Cr poor megacrysts from ~10-20% FeO. G1, G3, G5, G9, G10, G11, and G12 garnets vary from ~5-10% FeO.

However, a while back I tested a small group of concentrates picked from KIMs from Little Grassy Lake (where I found probable kimberlite cobbles during sampling) in till samples with a very powerful, small neodymium magnet, and **discovered a few inert (diamagnetic) garnets, which when microprobed, had normal iron levels (two of three G11s tested diamagnetic).**

Then recently, with this information in mind as reported in my previous Work Assessment Report on Legacy Claim 4282142 (Bishop, 2018a), I rechecked the concentrates and picked KIMs from other targets to test for the magnetic susceptibility of the garnets. Many of the orange garnets and some Cr Pyropes (purple) were non-magnetic. This result, according to classic literature, is not possible.

I then recalled another report that was very useful for a different reason. In several years of extensive research and then from conversations with a prominent lab, it appears that **most companies and labs** involved in the quest for **KIMs pick pink eclogitic garnets based on an orange colour; the deeper, brighter (pretty) garnets were at the top of the picking list**. However, I had found an article titled 'Garnet xenocrysts from the Diavik Mine, NWT, Canada: Composition, color, and paragenesis' (McLean, Banas, et al. (2007), p 1136, 1138, 1139), which in part I've described below.

As can be clearly seen, the comparison shown on Diagram A (Conclusions, page 12), shows G3s in light, medium-dark, and dark orange colours. In Diavik tests all eclogitic G1, G3, and G4 grains were various shades of orange. These look basically identical to the nine non-magnetic orange garnets shown in Photo G (Results, page 8)

Diagram A (McLean, Banas, et al. (2007), p 1136)

In addition, this article drew attention to the importance of pink garnets, which I'm finding in very high numbers in my heavy concentrates along with KIMs from many of my targets. No company or lab reports pink garnets in KIMs picked that I've found in three years of research, except for this article. From the charts made on Diavik garnets (they only tested a few pinks), the pink garnets seem to be far more likely than other colours to be G10s. Only purple garnets are more likely to be G10s.

From various articles and from a direct conversation with a senior representative of DeBeers, G10s are their primary focus, perhaps from their African kimberlite background. However, a 2011 article from SRC shows that from their research of the various types of kimberlitic garnets found as inclusions in diamonds, worldwide 86% of diamonds have G10 inclusions (and only 3% G11s), whereas Lac de Gras only has 16% G10 inclusions and 17% G11 inclusions (Creighton, Harvey, & Read, 2011). Saskatchewan craton garnets numbers are 5% G10, 17% G11 (and 36%G1, and 41% G9). However, so far as I know, magnetic susceptibility of garnets is so far of no interest in the diamond exploration field. The aforementioned DeBeers executive said he'd never heard of G11s when sitting at my kitchen table and was exclusively focused on G10s.

ON GLACIATION AND DETERMINING SOURCE OF KIMS:

If only the large-scale Ice Flow Movement map [see Appendix 3: Map 5, page 30] is referred to then it would lead to the conclusion of a northwest – southeast glacial flow when tracing KIMs back to their source, in the whole area of the map.

However, locally I plotted 88 recent glacial striae on a map that takes in an area from the New Liskeard/Haileybury kimberlites to the north and the Bishop Claims to the south. These were utilised to create the Detailed Ice Flow Movement map [see Appendix 3: Map 6, page 31]. Next, utilising Cobalt 31M5 Map, Google Earth, and the Ministry of Natural Resources and Forestry, I shaded in the height of land (i.e. hills) above the 30^{+}M and 60^{+}M as compared to the New Liskeard kimberlites.

As you can see the glacial flow from the striae indicates flowing around the hills the glaciers encountered. On a smaller scale, this is very nicely shown on the 'Nip Hill' in Cobalt, which on the west side, the deep striae are basically to the southwest, and on the hilltop – to the south and on the east side are oriented somewhat to the southeast.

So, utilising this map, for claim 4282402 there is a very slim possibility for transport from the distance to the known kimberlites. As well, 4282402 is ~50m uphill from the New Liskeard kimberlites which makes KIM transport from 14km to the more northern kimberlites unlikely. Therefore, it is very probable the KIMs found here are from close by (proximal).

[See Appendix 3: Map 6, page 31]

> "Basal sliding occurs only where a glacier is at pressure melting point at its base. Most of the fast ice flow associated with ice streams comes about because of basal sliding. Wet glacier ice on a smooth surface is slippery. The sliding at the ice-bed interface is controlled by freezing to the bed, bed roughness, the quantity of water at the bed, and the amount of rock debris in the basal glacier ice.
>
> "Glacier beds are rough [i.e. bedrock], not smooth. Bumps in the surface of the glacier bed cause melting on the upstream side, and re-freezing on the downstream side. This is called regelation, and it occurs because pressures mount up from behind obstacles to ice flow. Ice melts under pressure, and this lubricates the bed of the glacier.
>
> "Meltwater at the ice-bed interface reduces the adhesion of the glacier to its bed, making it more slippery and enhancing sliding. If a glacier is flowing over a rock bed, a water film may enhance sliding and submerge minor obstacles, making the bed smoother." (Davies, B. (2017))

So, as you can see from the Local Glacial Flow Direction map [Appendix 3: Map 6, page 31], when the glacier encounters a hill, pressure builds up and the ice will flow much like water in a creek flows around a boulder. This of course forces material in the creek to flow with it. As such, any heavy materials in the water/ice flow will be forced around the obstacle, not over it. So, ignoring this effect when interpreting a regional or local sampling program will cause misinterpretation of results.

To further complicate KIM emplacement, local to the Cobalt area one must also take into account the final stages of glaciation melt which formed Lake Ojibway (see reference (Roy, M. et al (2015). p14-23) for more information). Basically, 8400 years ago there was a massive post-glacial lake in and around the Cobalt area (Lake Ojibway-Barlow), that rose to 272-299 metres above current sea levels (based on the ancient shorelines created by the temporary lake). At that time, due to the staggering weight of the Pleistocene glaciers, the crust of the earth was deformed by downward pressure; the isostatic rebound of the crust since that time has raised the general topographic elevation considerably. This isostatic rebound does not affect the higher relative elevation of the Bishop Claims to the water level of the postglacial lake; the Bishop Claims are between 300-394m above current sea level [see Diagram B below]. However, the kimberlites in the New Liskeard area are 30-60m below that (230-270m above sea level), so water movement and wave action would have spread out and diluted heavy mineral concentrates disrupting a classic till KIM emplacement profile. Further, the water level of Ojibway-Barlow was 250m above sea level when the post-glacial lake finally drained-out (apparently flowing north into Hudson Bay, not into the Ottawa River system) further complicating KIM emplacement in the Haileybury-New Liskeard area. Coincidentally, the Bishop Claims in the Lorrain hills were elevated and escaped the complicating factors of the post-glacial lake altering KIM train disruption.

From Haileybury Map 5024, claim 4282402 (and to a greater extent 4282172, Ice Chisel Lake) is the only claim in the Bishop Claims group to be affected by glaciofluvial deposits. However, the high numbers of garnets south of the lake somewhat fits this possibility.

> "Short transport (distance) is expected in an esker because esker streams are thought to be short lived and overloaded with sediment, transport peaks at ±0.9 miles [~1.5km] in a bell curve for distance/heavy mineral concentration." (Lee (1965). p 7)

So, the point of all this is that it is unlikely the possibility of the high numbers of KIMs I'm finding on Claim 4282402 and the rest of the Bishop Claims could have originated from the known kimberlites in the New Liskeard area.

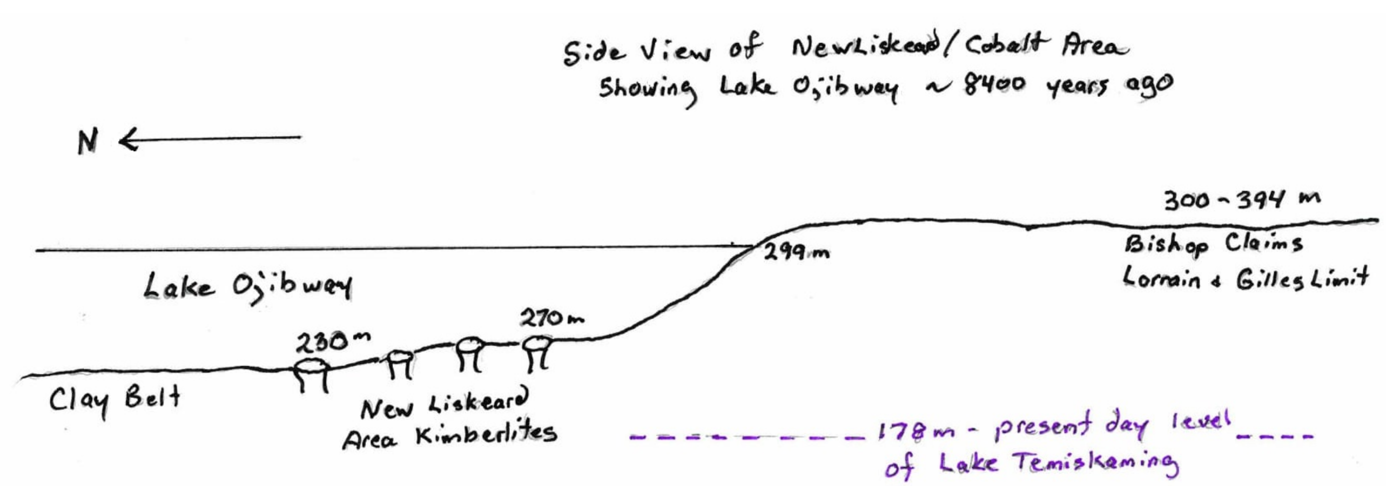


Diagram B – Side view of New Liskeard/Cobalt Area, showing Lake Ojibway ~8400 years ago

What makes the results that I'm finding in my concentrates even more interesting is that they are taken <1m deep in till. Most samples weigh from 1-3kg unscreened, as compared to the 10-30kg screened to <5mm samples recommended in OGS-OFR and other reports. This effect makes my typical samples 10-20x smaller when screened to <5mm.

Of five OGS-OFR reports, namely 6060-2001, 6043-2001, 6088-2002, 6119-2004, and 6124-2005, only 6060 took till samples, 400 of them which produced 13 pyrope garnet grains (G9s), recovered from 12 of the 400 samples. 1 in $33^{1}/_{3}$, or only 3 in every 100 samples produced a Cr pyrope.

15 – Hound Chute Lake – 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465

As such, the other reports relied always exclusively on alluvium (creek) samples, or less so esker or beach deposits. A creek can concentrate heavy minerals 100-1000x+ over unconsolidated till, hence gold creeks of British Columbia, California, etc., which is why the KIM count increased considerably in the next four OGS-OFR reports. For example, 6043 took 256 alluvium and 2 till; 6088 – 254 alluvium, 14 glaciofluvial, 1 beach, and 8 till; 6119 – 175 alluvium, 6 glaciofluvial, and 2 till; 6124 – 317 alluvium, 22 glaciofluvial, 2 beach, and 6 till. Grand total: 876 pre-concentrated alluvium, etc. samples and 18 till results in 1371(69) and 45(610) or 12 Cr pyropes in every 19 samples. This is 21x higher results than till samples alone.

However, in OGS OFR 6088, the sample 01-JR-SG-001 taken approximately 1½ km down-ice of Hound Chute Lake, 80 Cr Pyropes were found, as well as the only Group I ECL garnet and 37 megacrystic garnets.

An interesting read is GSC-Open File 7111-2014. This report's basic premise is

> "indicator minerals break down (comminute) during transport as they contact each other or the bed … which causes a decrease in mineral frequency and size … and an increase in mineral roundness downflow in dispersal trains … the larger, more numerous and more angular … the closer the ore body source." (Cummings et al. (2014))

So the investigators tumbled each individual type of KIMs (sourced from various kimberlites) with stainless steel shot and at various intervals, checked the results for grain size and mass lost to 'mud'. The KIMs were pyrope, garnet, ilmenite, and Cr diopside. However, chromite and olivine were not tested due to problems related to equipment and test parameters.

The results were surprising as they contradict many previous assumptions (other previous test experiments used **non-kimberlitic** industrial garnets), particularly related to garnet durability. Garnets lost mass and broke into small 'pieces' way faster than the other KIMs.

> "The experimental results have several implications for mineral exploration. One of these relates to the use of KIM abundance as an indicator for proximity to source. Kimberlite indicator minerals are typically picked and counted from a portion of the sand fraction … If larger pyrope garnets, such as those analyzed in the experiment, were present in the kimberlite source rock, break down of these grains at the head of the dispersal train could flood the sand fraction with garnet fragments. This could potentially lead to an *increase* in the number of garnet and total KIM fragments moving downflow, with a commensurate increase in angularity of garnet grains [Fig. 7]. In situations where this occurs, **the total mass of KIM fragments in the sand and gravel fraction might serve as a better proxy for transport distance than KIM counts**, given that it should always decrease downflow in dispersal trains due to some combination of comminution, dilution, and/or selective sorting." (Cummings et al. (2014))

In a nutshell, one large KIM grain (especially garnet) is equivalent to large numbers of smaller grains and better indicates proximity to a pipe.

Till sampling and processing of till samples on many of the Bishop Claims' Targets regularly produce Cr Pyropes and other KIMs in the 1-2mm and 2-3mm size. On some targets, more KIMs are found than in the whole of the OGS-OFR 6088 report. This is statistically proof of proximity to the source of these KIMs.

16 – Hound Chute Lake – 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465

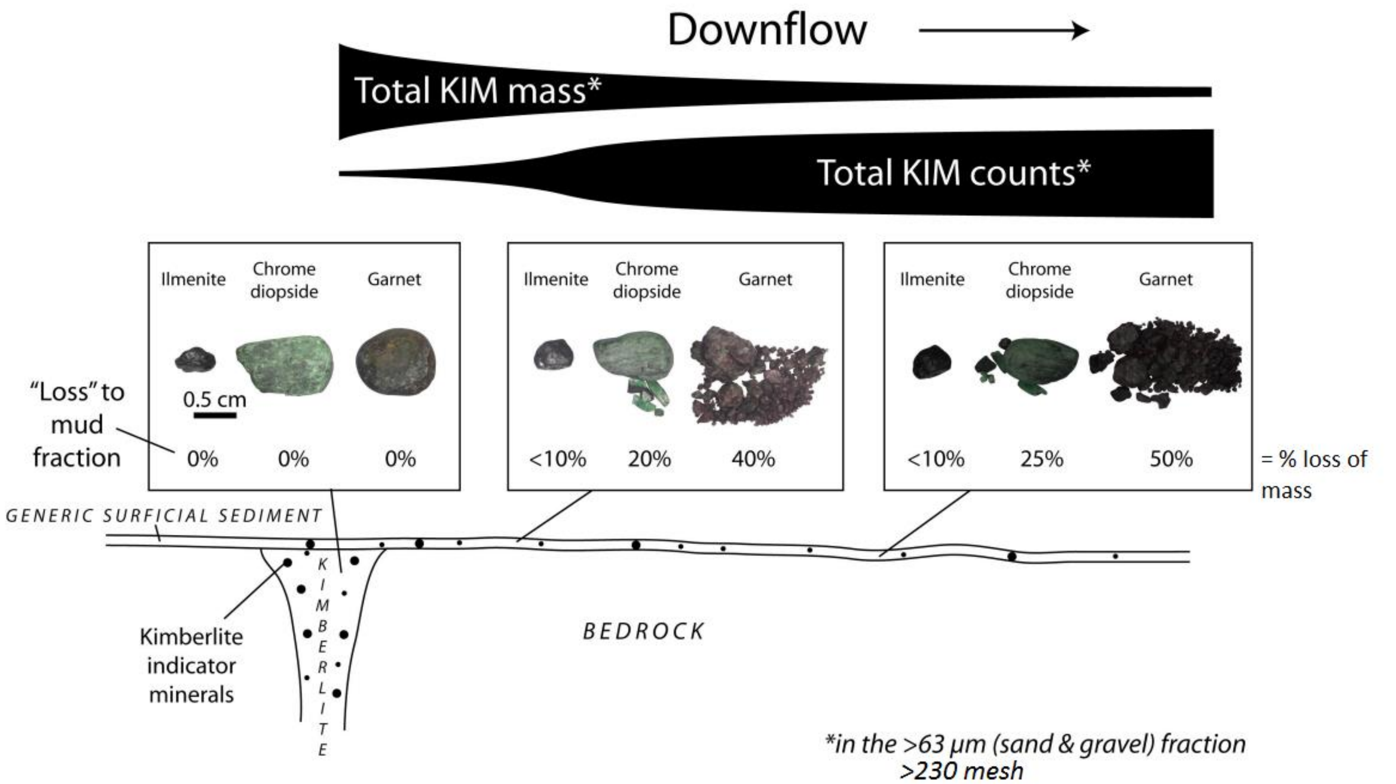


Figure 1: Farther downflow, total KIM counts would decrease, assuming continued comminution (in addition to selective sorting and/or dilution). (Cummings et al. (2014))

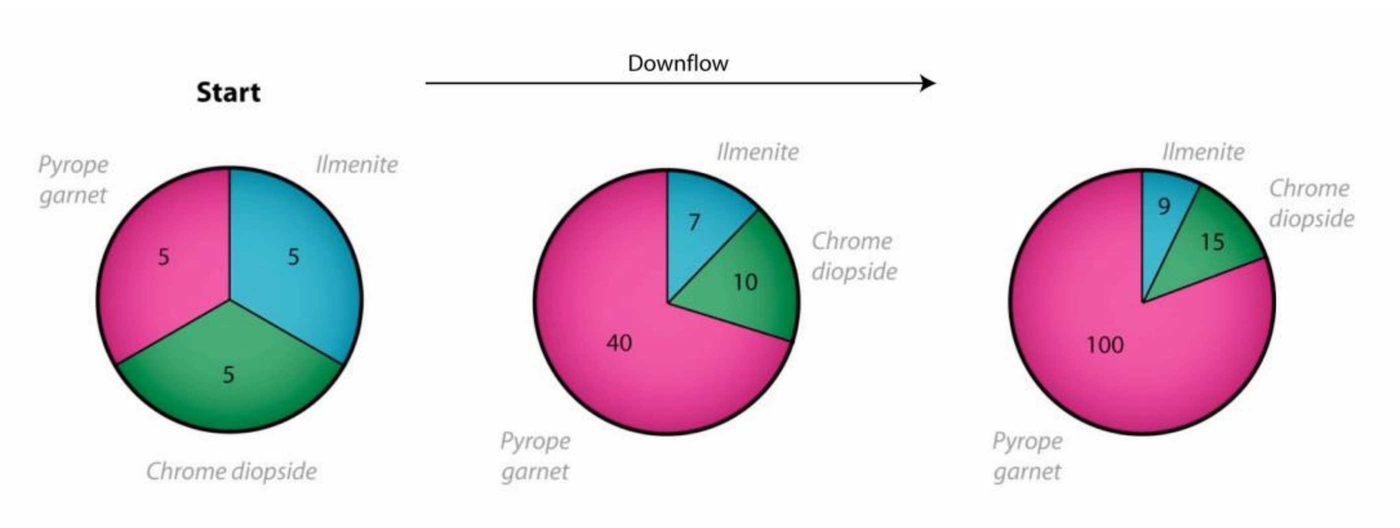


Figure 2: Downflow evolution of indicator mineral assemblages … in which rapid break down of larger pyrope garnets produces abundant sand-sized grains. … Numbers refer to grain counts. (Cummings et al. (2014))

So for interest's sake and interpretation of sampling results for KIMs, I produced the following charts. For simplicity in calculations, I assumed rounded grains. These charts show the relative masses/volume of various sizes of KIM grains and the numbers of smaller grains required to equal the mass of each successive larger size.

17 – Hound Chute Lake – 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465

Using the formula for volume of a sphere ($V = \frac{4}{3}\pi r^3$), where r = radius of the grain, will reflect an equal relative increase in mass in KIMs from 0.25mm to 2.5mm in diameter, as shown in the following chart.

Kim Grains

Diameter (mm)	Radius (mm)	Volume (mm^3)
0.25	0.125	0.00818
0.375	0.1875	0.028
0.5	0.25	0.065
0.75	0.35	0.22
1.0	0.5	0.52
1.5	0.75	1.77
2.0	1.0	4.19
2.5	1.25	8.18

The next chart shows the total number of smaller grains required to equal the mass of larger grains (number of grains increases as size decreases). (Read: left to right)

Size of grain (mm) → decreases

2.5	**2.0**	**1.5**	**1.0**	**0.75**	**0.5**	**0.375**	**0.25**	**Grain Size**
1.0	1.95	4.6	15.7	37	126	292	1000	**# of grains required to maintain same total mass**
	1.0	2.4	8	19	64.5	150	512	
		1.0	3.4	8	27	63	216.4	
			1.0	2.4	8	18.6	63.5	
				1.0	3.4	8	27	
					1.0	2.3	8	
						1.0	3.4	
							1.0	

So, as you can see finding one 2.5mm grain is potentially equivalent to 1000 0.25mm grains. Companies generally recommend only looking in the 0.25-0.5mm fraction for KIMs in order to maximise returns – this chart explains why.

However, looking for 1.0-2.0mm and 2.0-3.0mm grains becomes much more important (especially Cr pyrope) as one or two of this size indicates a proximal source, even (especially) if many small grains are also encountered.

So larger grains should be given more value than many smaller grains.

18 – Hound Chute Lake – 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465

RECOMMENDATIONS FOR FUTURE WORK:

Microscopic picking of KIMs on stream samples after removing opaque coating is the next step. This will require testing a number of commercial rust removers (ex. CLR, Oxalic Acid, Muriatic Acid, etc.) for best results. This will require being outdoors in better weather. The samples have been fully concentrated and screened to size. The price per sample has been adjusted to reflect the final step(s) required. A separate report will be submitted when this process is completed.

Drone magnometer flyovers are planned on a number of targets, and pending results and interpretation, potentially drilling for kimberlite will commence.

Because of the unexpected staking rush that blanketed Lorrain, Gillies Limit, and other nearby townships, further till sampling outside the claim/cells' boundary to further delineate KIM placement/target mapping is problematic at this present time. It would appear, however, that interest in cobalt is declining in the Cobalt camp area, so time will tell.

EXPENSES of Cell Claims 212123, 128936, 326238, 279661, 326239, 128937, 230928, 326237, 312714, 117276, 145465

Resulting from work on Hound Chute Legacy Claim 4282402 for March 24, 2017 – March 22, 2019

Work Type	Units of Work	Cost per Unit of Work	Portion re: 212123	Portion re: 128936	Portion re: 326238	Portion re: 279661	Portion re: 326239	Portion re: 128937	Portion re: 230928	Portion re: 326237	Portion re: 312714	Portion re: 117276	Portion re: 145465	Total Cost
Prospecting/sampling/field supervision June 24, 2017 and Aug 20, 2017	Tony Bishop: 2 days	$500 per day	$90	$90	$95	$95	$90	$90	$90	$90	$90	$90	$90	$1,000
Field assistant for traverses June 24, 2017 and Aug 20, 2017	Graeme Bishop: 2 days	$285 per day	$52	$52	$51	$51	$52	$52	$52	$52	$52	$52	$52	$570
Till sample processing, HMC, separating into multiple size fractions, sorting, microscope picking, magnetic susceptibility, fluoroscopy, interpretation of KIMs and logging results, storage of picked grains & concentrates picked	Tony Bishop: 19 till samples, 3 creek samples *KIM picking creek samples incomplete as requires acid bath cleaning first-future work	$500 per till sample $400 per creek sample * reduced fee – see note for rationale	$500 (1 till)	$500 (1 till)			$500 (1 till)	$1,000 (2 till)	$4,200 (6 till; 3 creek)	$500 (1 till)	$2,500 (5 till)	$500 (1 till)	$500 (1 till)	$10,700
Microphotography of select grains & KIMs picked, selection of photos for report from among total grains photographed, labelling & computer storage of microphotos	40 microphotos in report	$5 per microphoto	$10	$10			$10	$20	$70	$10	$50	$10	$10	$200
Sampling plans, report preparations, map compilations, interpretations	Tony Bishop: 4 days	$500 per day	$182	$182	$181	$181	$182	$182	$182	$182	$182	$182	$182	$2,000
Clerical support for reports & technical computer support	Chloë Bishop Mar 24, 2017 to Mar 22, 2019	$500	$45	$45	$45	$45	$45	$45	$50	$45	$45	$45	$45	$500
Transportation based on OPA OEC rate. June 24, 2017 and Aug 20, 2017	2 return trips @ 274 km = 548 km	$0.50 per km x 548 km	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$24	$274
Food re: traverses June 24, 2017 and Aug 20, 2017	4 man days	$35 per man day			$70	$70								$140
Office supplies Ap 13/17 printer paper $5.64; Sep 15/17 USB $33.87; Sep 30/17 ink/paper $85.85; Aug 16/18 printer ink $94.90 = $220.26			$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$220
Field supplies Jul 7/17 bins for separating samples $11.30; Jul 10/17 sampling bags $177.98 = $189.28			$21	$21			$21	$21	$21	$21	$21	$21	$21	$189
Total Value of Assessment Work			**$945**	**$945**	**$487**	**$487**	**$945**	**$1,455**	**$4,710**	**$945**	**$2,985**	**$945**	**$944**	**$15,793**

Appendix 1

History of Development in the Cobalt Area

Before 1900, when the surveyors for the right-of-way of the Temiskaming and North Ontario (T.&N.O.) Railway worked north from North Bay past Long Lake Station (Cobalt, ON) up to Cochrane, there was limited activity in what is now Lorrain Township. Some early fur trading and logging expeditions entered Lake Temiskaming after coming up the Ottawa River from Montreal as early as the late 1700s and some mid-to-late 1800s colonization of Lake Temiskaming on the Quebec shore. A farming community was settled in the 1880s on a bay a bit south and east of the Bishop claims in Lorrain Township, in addition to a mission of oblate Fathers, and the posts of the Northwest Company and Hudson Bay Trading Companies not far away on Lake Temiskaming. Charles Farr founded Haileybury in the late 1880s and petitioned the government for railway access to facilitate colonization of the area. A colonisation road did exist which reached the southernmost part of Lake Temiskaming on the Ontario side, but was never widely used.

The first government infrastructure nearest the claim was the building of the T. & N.O. railway which passed to the west, reaching Cobalt, Ontario in 1903-1904, where a silver and cobalt-nickel arsenide deposit was discovered. The mining boom which followed the discovery of silver at Cobalt often dominated the geological interest in the area for many decades, and although prospectors and geologists closely explored the terrain all around Cobalt (leading to the settling of Silver Centre south of these claims in 1907-08), most of the exploration was guided by the search for more silver and cobalt-nickel arsenide deposits.

In the 1980s, there was renewed interest in the geology of the area, this time in search of diamond-bearing kimberlite pipes, stimulated in part by the discovery of an 800-carat yellow diamond by a settler “somewhere in the Cobalt area” in or around 1904 (which was subsequently tested and confirmed and cut into gemstones by Tiffany’s), but became overshadowed by the vastly rich silver discoveries of the day (for detailed information on the ‘Nipissing Diamond’, please refer to Bishop, B.A. (2018a)). Soil sampling and geophysics by companies like Cabo, Tres-Or Resources Ltd., DeBeers, and others in addition to exploration by the Ontario Geological Survey, uncovered more than 50 known kimberlite pipes, some diamondiferous, which helped to outline the existence of a Lake Temiskaming Kimberlite Field on the Lake Temiskaming structural zone, which appears to have intruded the Canadian Shield in this region approximately 148 million years before present. Deep sonar has also revealed circular features beneath the water of Lake Temiskaming itself which are inferred to be kimberlite pipes.

As well, a number of diamondiferous lamprophyres have been discovered near Cobalt, including one just NW of Latour Lake in the south part of Lorrain Twp, and another on the “Nip” Hill in Cobalt, as well as others.

Appendix 2

Advances in Diamond Exploration in Canada: Understanding the Importance of Non-Magnetic Signatures and Geo-Chemical and Structural Geology

There seems to be a general misconception concerning the necessity of having a “magnetic bullseye” as being the primary method of locating kimberlite pipes and indeed, during the 1980s-1990s, a necessity. The following articles will help dispel that outdated belief, given more recent research and outcomes from Lac de Gras kimberlite pipes, including producing mines, and advances in geo-chemical and structural geology analysis. This is not true of the Attawapiskat area where all but one kimberlite pipe exhibits high positive mags. This is due to having a magnetically quiet Paleozoic carbonite bedrock. As well, numerous kimberlite samples have secondary magnetite that creates a larger mag than just the kimberlite pipe itself would have.

However, the geology of Lac de Gras is largely granite cut by diabase dykes, similar to Lorrain and Gillies Limit, which explains why looking for magnetic anomalies will likely result in failure to detect kimberlite pipes. The kimberlites nearby to the north in the New Liskeard/Haileybury area were, however, found by their mag signatures, but as is shown on the Geological Compilation map [see Appendix 3: Map 3, page 28], all these known pipes are in sedimentary (or metasedimentary – Peddie Pipe), a bedrock similar to Attawapiskat.

From Energie et Ressources naturelles Quebec*, Exploration Methods,* accessed online at: https://www.mern.gouv.qc.ca/english/mines/industry/diamond/diamond-methods.jsp:

- “Anomalies may be negative or positive and locally very close together (Sage, 1996; Saint-Pierre, 1999). A few diamondiferous lamproite and kimberlite intrusions do not create magnetic anomalies (Atkinson, 1989; Brummer *et al*., 1992; Fipke *et al.*, 1995).”

- **“Geophysical Surveys:** Kimberlites often form swarms that are generally associated with large, deep fractures (or faults) and with the intersection of major weakness zones in the earth’s crust**….** In exploration programs for diamond-bearing kimberlite pipes between 100 m and 1,000 m in diameter world-wide (average of 300 m), the optimal flight line spacing in aeromagnetic surveys is believed to be 100 m, but a line spacing of 200-250 m is considered sufficient [for much of the world, however diamond pipes in Canada tend to be only ~50m to 200m in diameter, i.e., Lac de Gras and Attawapiskat]….In general, the cost of airborne surveys increases exponentially as the line spacing narrows. Magnetic or electromagnetic surveys spaced at 100 m are very expensive. The investment for this type of exploration can quickly become exorbitant. It is therefore important to use other techniques to target locations for conducting these surveys. The most commonly used technique consists of identifying indicator minerals in the heavy fraction of glacial deposits.

- **“Indicator Minerals:** For both kimberlites and lamproites, the “indicator minerals” must present a very specific chemical composition that reflects the prevailing pressure, temperature, and oxidation-reduction conditions for the formation or preservation of diamonds. It is therefore very important to chemically analyze as many “indicator minerals” as possible in order to ensure that a number of grains possess the right chemical composition. This unavoidably results in high costs for analyzing and interpreting results.

- **“Tracer minerals:** This is the most common method used in diamond exploration, especially in the early stages of exploration well before the considerably expensive geophysical methods are used. This method consists of looking in secondary environments (soil, streams, rivers, etc.) for minerals characteristically associated with diamond-bearing kimberlites and retracing them back to their source…. In northern regions, glaciers have eroded kimberlite rocks, dispersing the minerals that compose these rocks over large distances, either in tills or eskers….Studying glacial movement provides information on the directions and distances that glaciers traveled and makes it possible to go back to the source of the dispersal. A number of sampling campaigns based on relatively tight grids will be needed depending on progress made in the work. These sampling campaigns will take place over a number of years. They will also be difficult to carry out and very expensive.”

22 – Hound Chute Lake – 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465

From Geophysical Survey Methods in Diamond Exploration
Posted by: Maiko Sell in Exploration Geophysics, Exploration Methods. Accessed online at https://www.geologyforinvestors.com/geophysical-survey-methods-diamond-exploration/ :

- "Gravity surveys can be time consuming and expensive. When choosing to do a gravity survey at the exploration level, one is generally expecting to find kimberlites that have no discernible magnetic or electromagnetic response."

From http://www.pdac.ca/docs/default-source/publications---papers-presentations---conventions/jaques.pdf?sfvrsn=4

- "These companies reported the discovery of 4 new non-magnetic satellite pipes surrounding Aries kimberlite pipe using the Falcon airborne gravity gradiometer. Subsequent microdiamond sampling indicated that all were diamondiferous including the most recently discovered Niobe pipe." From page 20 of presentation at PDAC conference

From http://www.adamera.com/i/pdf/ppt/Amaruk-Project-Presentation.pdf page 9:

- "In Lac de Gras all economic kimberlites are strong EM conductors with weak magnetic signatures." Page 9
- "Many of the >200 kimberlites discovered on the Slave Craton are magnetic discoveries, often tested with only one diamond drill hole. Non-magnetic kimberlites are often *more diamondiferous* than magnetic kimberlites, and these kimberlitic phases would be missed if only magnetic anomalies were tested."

From http://www.metalexventures.com/html/attawapiskat.html on magnetics not evident on most productive pipes in Attawapiskat

From http://resourceclips.com/tag/add_ca/ Arctic Star/Margaret Lake Diamonds form JV, follow Kennady's approach to NWT kimberlites, by Greg Klein | November 15, 2016

- "De Beers considered Kelvin and Faraday low grade, based on their lack of prominent magnetic anomalies, according to the **Arctic/Margaret** JV. **Mountain Province** then spun out **Kennady** to explore the pipes. That company "applied ground geophysics, gravity and Ohm mapper EM, which revealed extensions to these kimberlites that were not revealed in the magnetics," the Diagras partners stated. "Subsequent drilling and bulk sampling has shown that these non-magnetic phases of the kimberlites have superior diamond grades to the magnetic phases and significantly increase the tonnage potential." Looking at some nearby deposits, the JV states that certain kimberlites at the **Rio Tinto NYSE:RIO**/**Dominion Diamond TSX:DDC** Diavik mine and the high-grade portions of **Peregrine Diamonds' (TSX:PGD)** majority-held DO-27 kimberlite "are non-magnetic, proof that a magnetic-only approach in the Lac de Gras field could miss significant diamondiferous kimberlite bodies."

From http://www.grizzlydiscoveries.com/index.php/investor-relations/news/91-grizzly-provides-update-for-diamond-exploration-in-northern-alberta

- "The potential for discovery of additional diamondiferous kimberlites within Grizzly's Buffalo Head Hills properties is considered high, based upon the favourable regional geological setting and the positive results of exploration conducted to date, including the identification of numerous priority geophysical targets. Grizzly's past work has shown that the focus should be on kimberlites with a weak magnetic signature with or without an accompanying electromagnetic, gravity and/or seismic signature, which have tended to yield better diamond counts in the Buffalo Head Hills kimberlite field."

23 – Hound Chute Lake – 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465

From Kennedy, C.M. (2008). The Physical Properties of the Lac de Gras Kimberlites and Host Rocks with Correlations to Geophysical Signatures at Diavik Diamond Mines, NWT: http://research.library.mun.ca/10786/1/Kennedy_Carla.pdf

- "To date, the majority of kimberlites discovered using magnetic surveys have been negative magnetic anomalies. These small, circular, negative anomalies are easy to pick out in the comparatively positive magnetic background. It is assumed that there are still many kimberlites that have not yet been discovered due to their neutral or positive magnetic responses" (Kennedy, 2008, p 5).

- "In the Diavik area, diabase dykes have large positive magnetic signatures making pipes located close to these dykes difficult to detect. There is also the issue of remanent magnetization obscuring magnetic signatures" (Kennedy, 2008, p 149).

From: http://www.arcticstar.ca/s/NewsReleases.asp?ReportID=684168&_Title=Arctic-Announces-new-100-owned-Property-in-the-heart-of-the-Lac-de-Gras-dia... November 18, 2014
Arctic Announces new 100% owned Property in the heart of the Lac de Gras diamond field:

- "Twenty years of diamond exploration on the Slave Craton has proven that kimberlites can be small with complex shapes (dykes, sills, and multi-phase pipes) with complex geophysical signatures. …Many of the >200 kimberlites discovered on the Slave Craton are magnetic discoveries…Non-magnetic kimberlites are often more diamondiferous than magnetic kimberlites, and…would be missed if only magnetic anomalies were tested. The Kennady Diamonds Property (TSXv-KDI) is a recent examples of exploration success that resulted from exploring for non-magnetic kimberlite. Close-spaced airborne gravity, ground gravity, and ground EM techniques discovered high diamond grade kimberlites…. On the adjacent Ekati property, 6 new kimberlites were discovered by a modern heli-borne gravity survey. One kimberlite… is significantly diamondiferous. …The Diavik mine itself consists of non-magnetic kimberlite, detected by electromagnetic (EM) surveys. …These new discoveries represented separate, usually volcanic pyroclastic events which were always more diamondiferous than their magnetic partners. We also found diamondiferous kimberlites with no magnetic and EM signature using gravity techniques."

From Kjarsgaard, B. A. (2007). Kimberlite Pipe Models: Significance for Exploration. In B. Milkereit. *Proceedings of Exploration 07: Fifth Decennial International Conference on Mineral Exploration.* (pp. 667-677). Retrieved from http://www.dmec.ca/ex07-dvd/E07/pdfs/46.pdf

- "The physical and geochemical signatures of the host rocks are widely variable in terms of their magnetic response, electrical resistivity, density and elemental distributions. Hence a variety of kimberlite – host rock responses are possible i.e. positive anomaly, negative anomaly, or no anomaly" (Kjarsgaard, B.A., 2007, p 674).

From Shigley, J.E., Shor, R., Padua, P., Breeding, Shirey, S.B., Ashbury, D. (2016). Mining Diamonds in the Canadian Arctic: The Diavik Mine. Gems & Gemology, Summer 2016, Vol. 52, No. 2. Retrieved from https://www.gia.edu/gems-gemology/summer-2016-diamonds-canadian-arctic-diavik-mine

- "Because kimberlites weather and decompose faster than much older surrounding rocks, the pipes often occur in topographic depressions beneath lakes. …The pipes are capped by several meters of glacial till, a thin layer of lacustrine sediments, and 15–20 meters of lake water. … With the retreat of the glaciers, the pipe locations often became depressions in the land surface, which filled with water to become lakes. The lakes at pipe locations are generally deeper than those formed by just glacial action." (Shigley et al, 2016).

From Kono, M (Ed) (2010): Geomagnetism: Treatise on Geophysics. Elsevier, May 11, 2010. *Science* pp205. Retrieved from https://books.google.ca/books?id=_YDNCgAAQBAJ&pg=PA205&lpg=PA205#v=onepage&q&f=false

- "Kimberlite pipes are often found in geographically localized groups, frequently under lakes because of differential erosion, and the remanence directions within those groups is often similar. Kimberlite pipes are often associated with diabase dikes, and are also commonly intruded along pre-existing zones of weakness regional faults, geological contacts." (Kono (Ed), 2010, p 205)

From Kjarsgaard, B. A. (2007). Kimberlite Pipe Models: Significance for Exploration. In B. Milkereit. *Proceedings of Exploration 07: Fifth Decennial International Conference on Mineral Exploration.* (pp. 667-677). Retrieved from http://www.dmec.ca/ex07-dvd/E07/pdfs/46.pdf

- "Known, economically viable kimberlites range in size from thin (1 - 4 m) dykes or sills, to small pipes of ~75 m in diameter to very large pipes with sizes of ~1.5 km diameter. Just about any type of rock can host kimberlite bodies. …Kimberlites in the Lac de Gras field tend to be small (50-200m diameter) steep sided bodies…" (Kjarsgaard, B.A., 2007, p 674).

From Power, M., Hildes, D. (2007). *Geophysical strategies for kimberlite exploration in northern Canada*. Paper 89 in "Proceedings of Exploration 07: Fifth Decennial International Conference on Mineral Exploration" edited by B. Milkereit, pp1025-1031. Retrieved from https://www.911metallurgist.com/blog/wp-content/uploads/2015/10/Geophysical-strategies-for-kimberlite-exploration-in-northern-Canada.pdf

- "Kimberlite intrusions tend to occur in clusters or fields, with the large-scale distribution possibly controlled by deep seated structural features and local emplacement controlled by shallow zones of weakness such as faults or the margins of diabase dykes" (Power & Hildes, 2007, p 1025).

From Erlich, E.I., Hausel, W.D. (2002). *Diamond Deposits: Origin, Exploration, and History of Discovery*. Society for Mining, Metallurgy, and Exploration, Inc. (SME). Littleton, CO, USA

- "**Gravity.** The high relative density of kimberlite and lamproite should make these rocks detectable by gravity and seismic surveys. However, most diamondiferous intrusives are small and weathered, and gravity and seismics are generally not sensitive or practical enough to use in the search for kimberlite or lamproite. For example, Hausel, McCallum, Woodzick (1979) noted that diamondiferous kimberlite intruded in granite in the Wyoming craton showed no detectable density differences with the host granite." (Erlich & Hausel, 2002, p 313)

Map Appendix Overview

MAP 1: Claim Location; Tenure cell claims resulting from Legacy Claim 4282402, Hound Chute Lake

MAP 2: Road Access, Google Earth

MAP 3: Geological Compilation (portion of OGS P.3581)

MAP 4: Mag Map (portion of OGS Map 82 066)

MAP 5: Ice Flow Movement (from OGS OFR 6088)

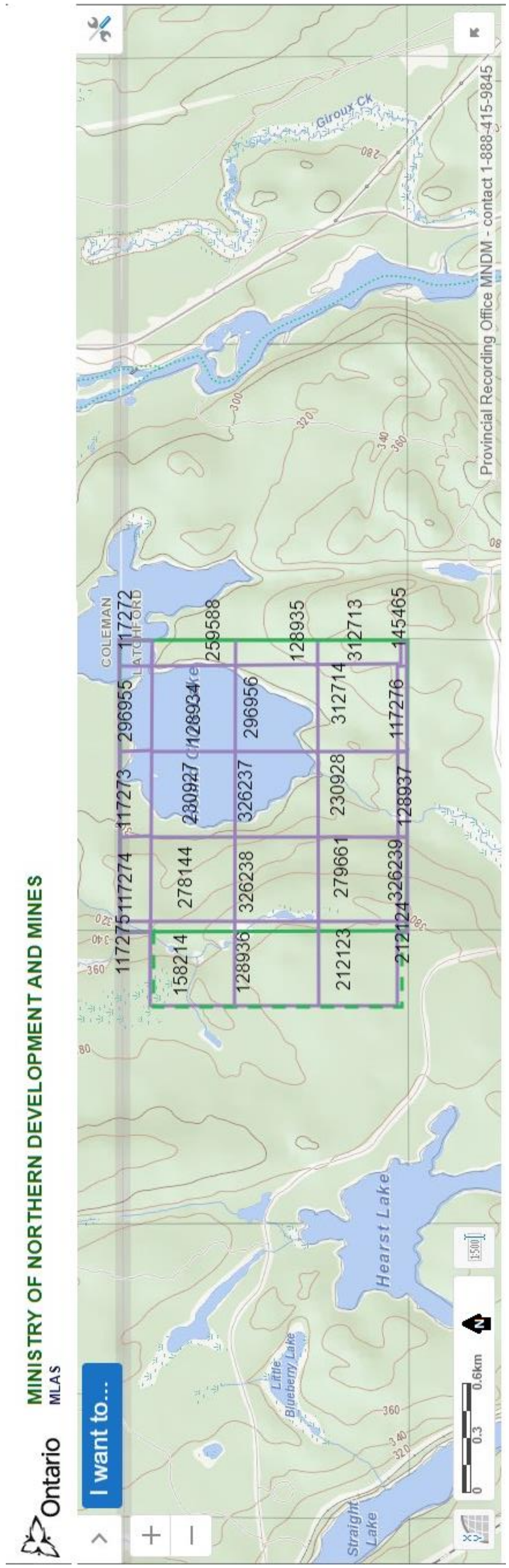
MAP 6: Local Glacial Flow Direction

MAP 7: Lake Temiskaming Structural Zone (from OGS OFR 6088)

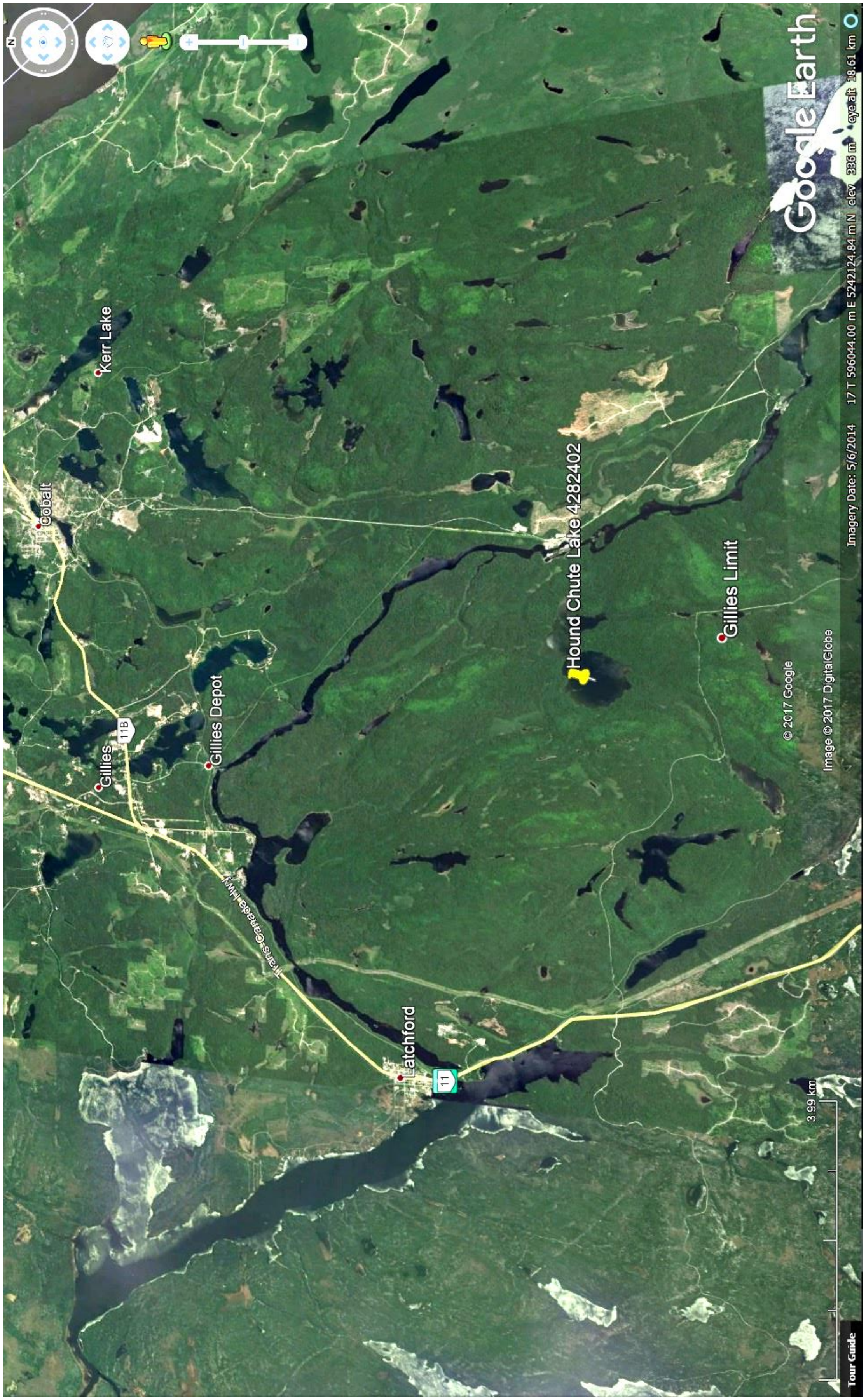
Map 8: Detailed Local Faults

26 – Hound Chute Lake – 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465

Appendix 3

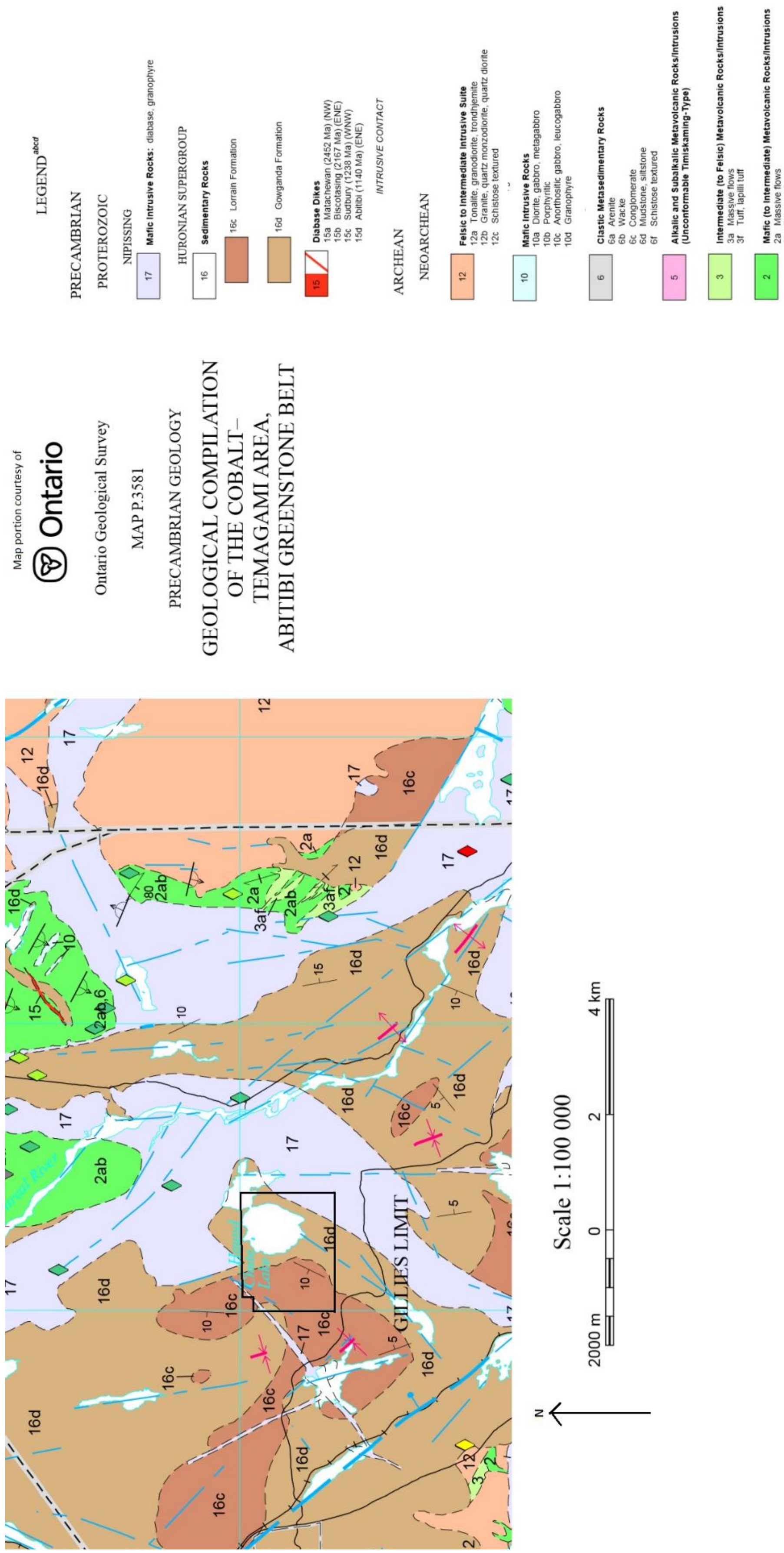


Map 1: Claim Location; Tenure cell claims resulting from Legacy Claim 4282402, Hound Chute Lake

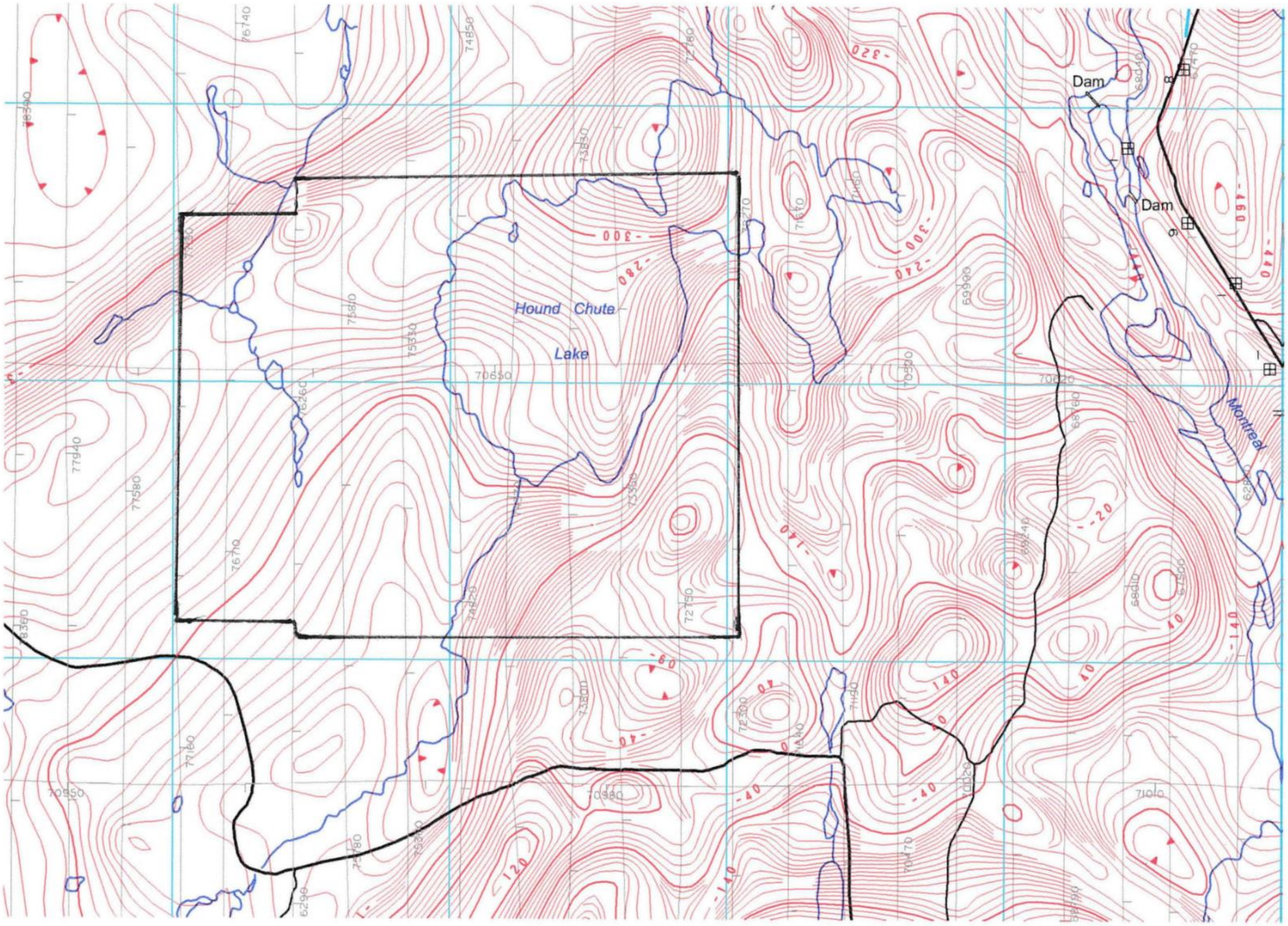


Map 2: Road Access, Google Earth

Appendix 3



Map 3: Geological Compilation (portion of OGS P.3581)



0 1900 M

N

Map portion courtesy Ontario

Ontario Geological Survey

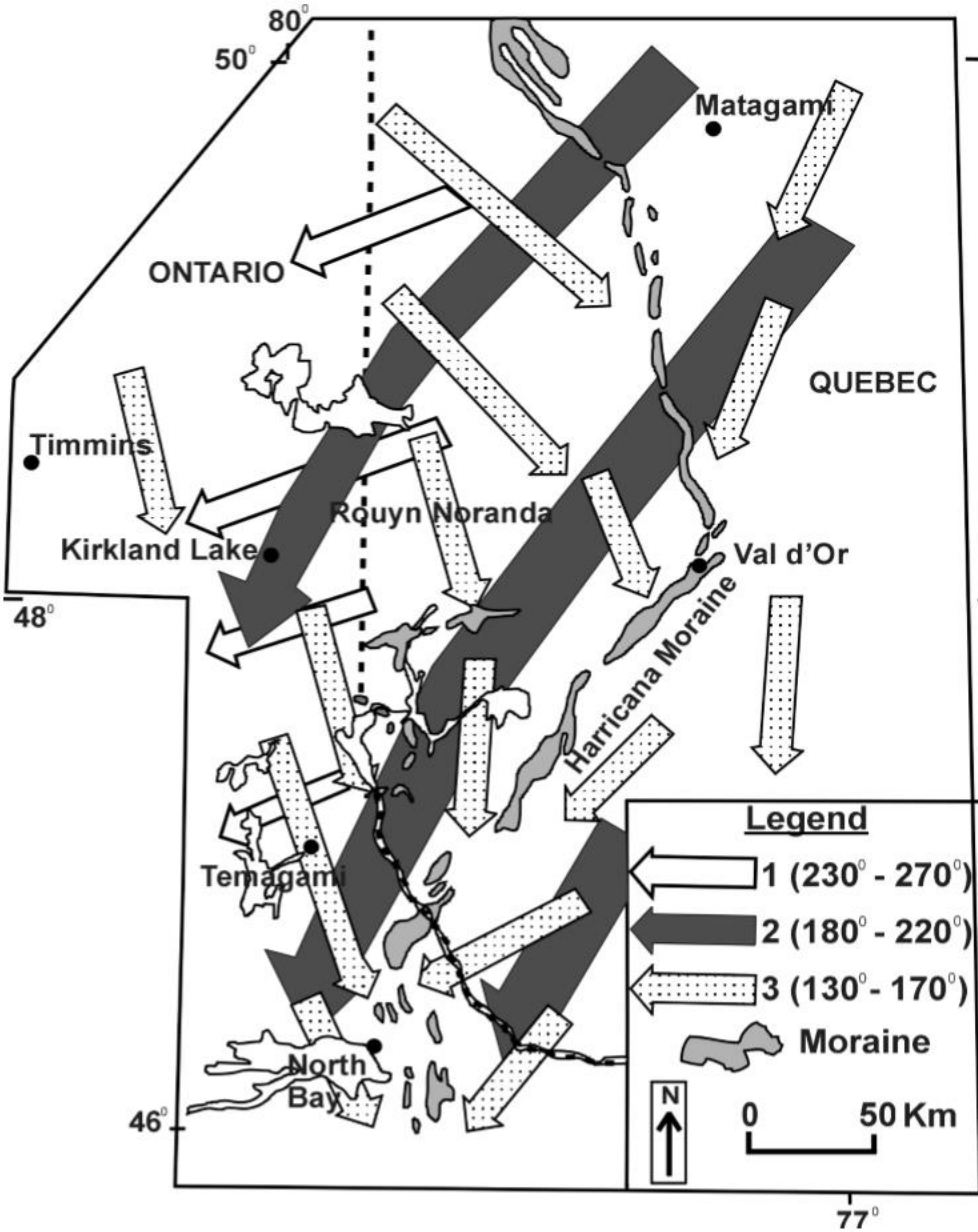
MAP 82 066

AIRBORNE MAGNETIC AND
ELECTROMAGNETIC SURVEYS

TEMAGAMI AREA

Map 4: Mag Map (portion of OGS Map 82 066)

Appendix 3

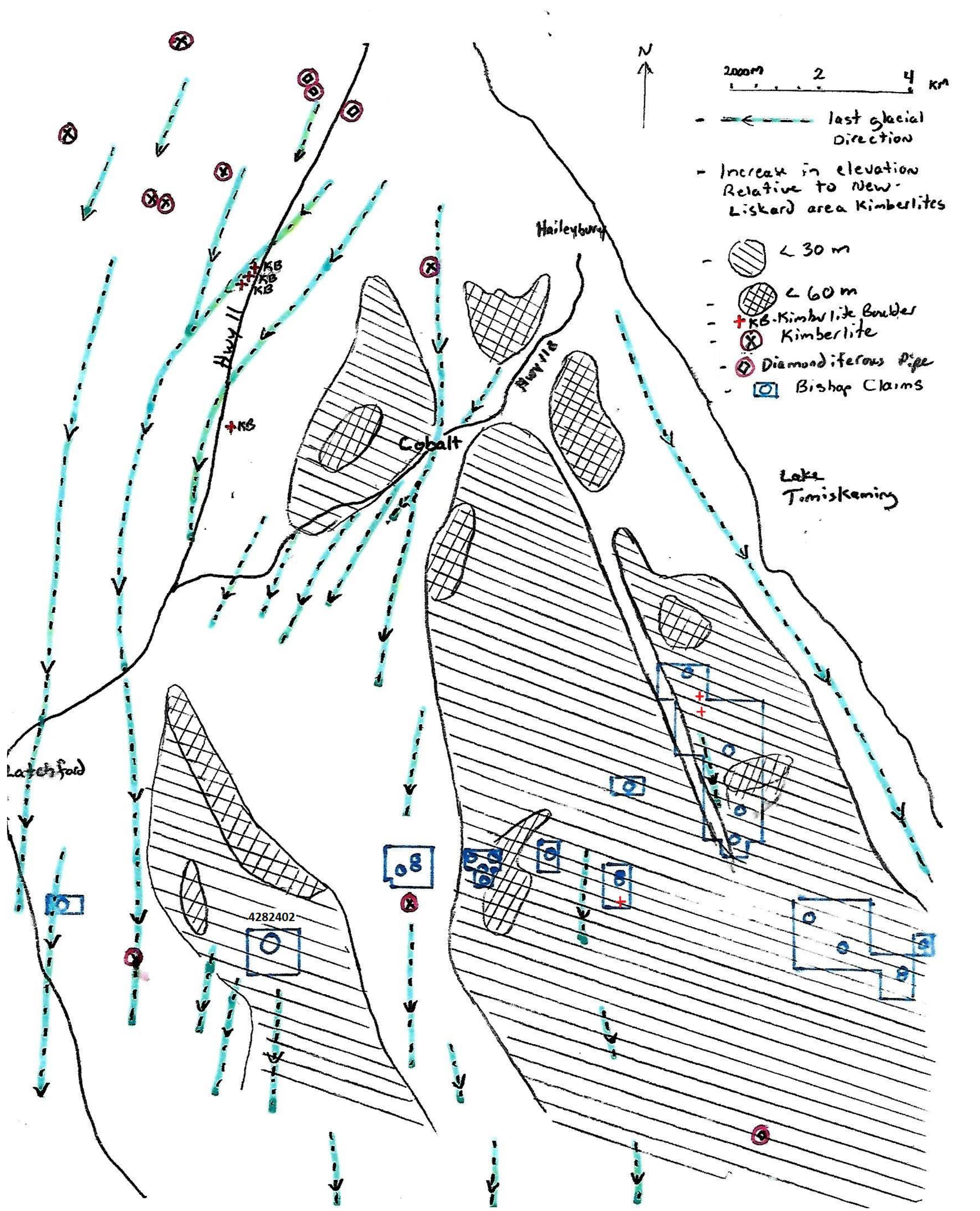


Ice flow movement in the Abitibi-Temiskaming area. The oldest ice flow event is the number 1 movement, the youngest the number 3 movement (after Veillette 1986).

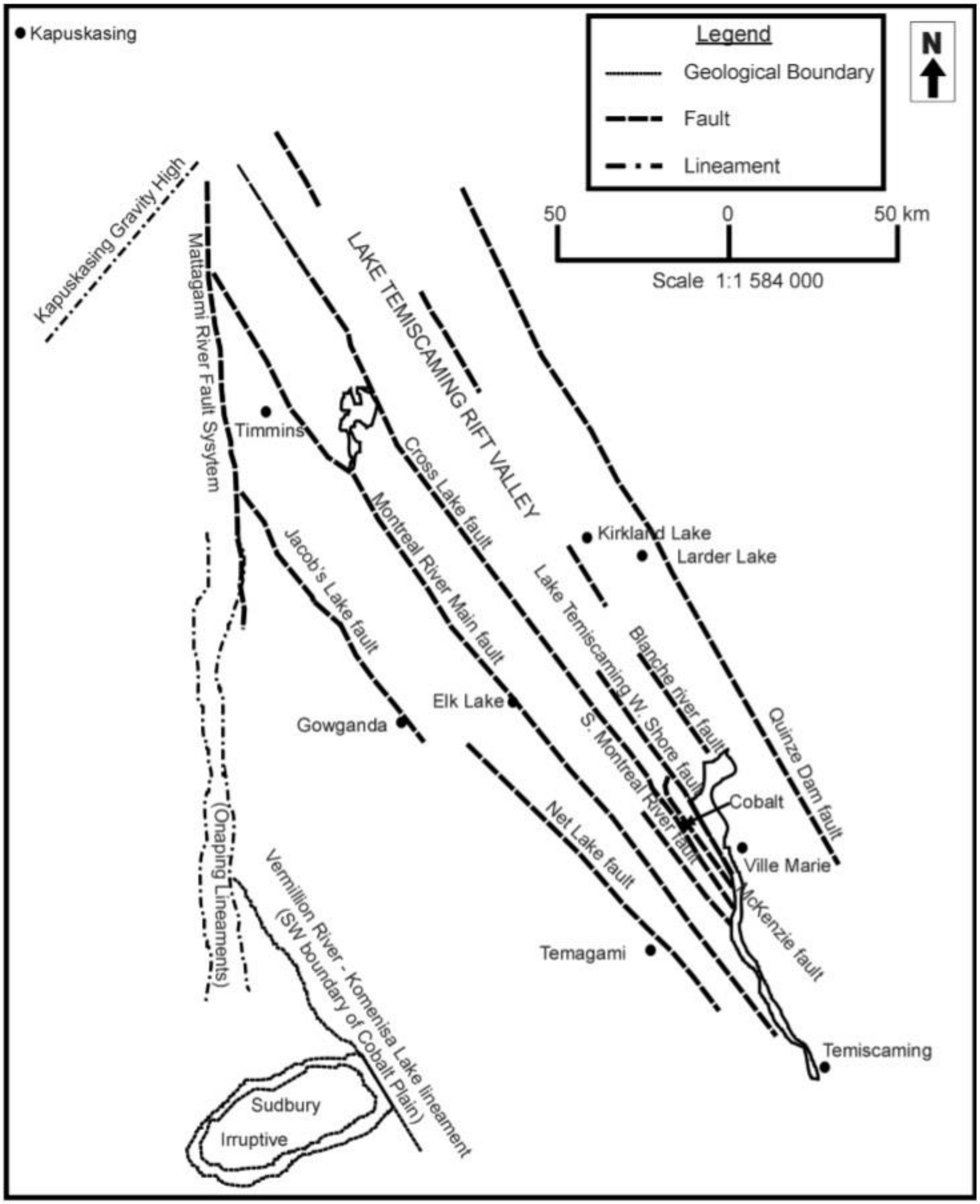
Used courtesy of
Ontario Geological Survey
Open File Report 6088

Map 5: Ice Flow Movement (from OGS OFR 6088)

Appendix 3



Map 6: Local Glacial Flow Direction

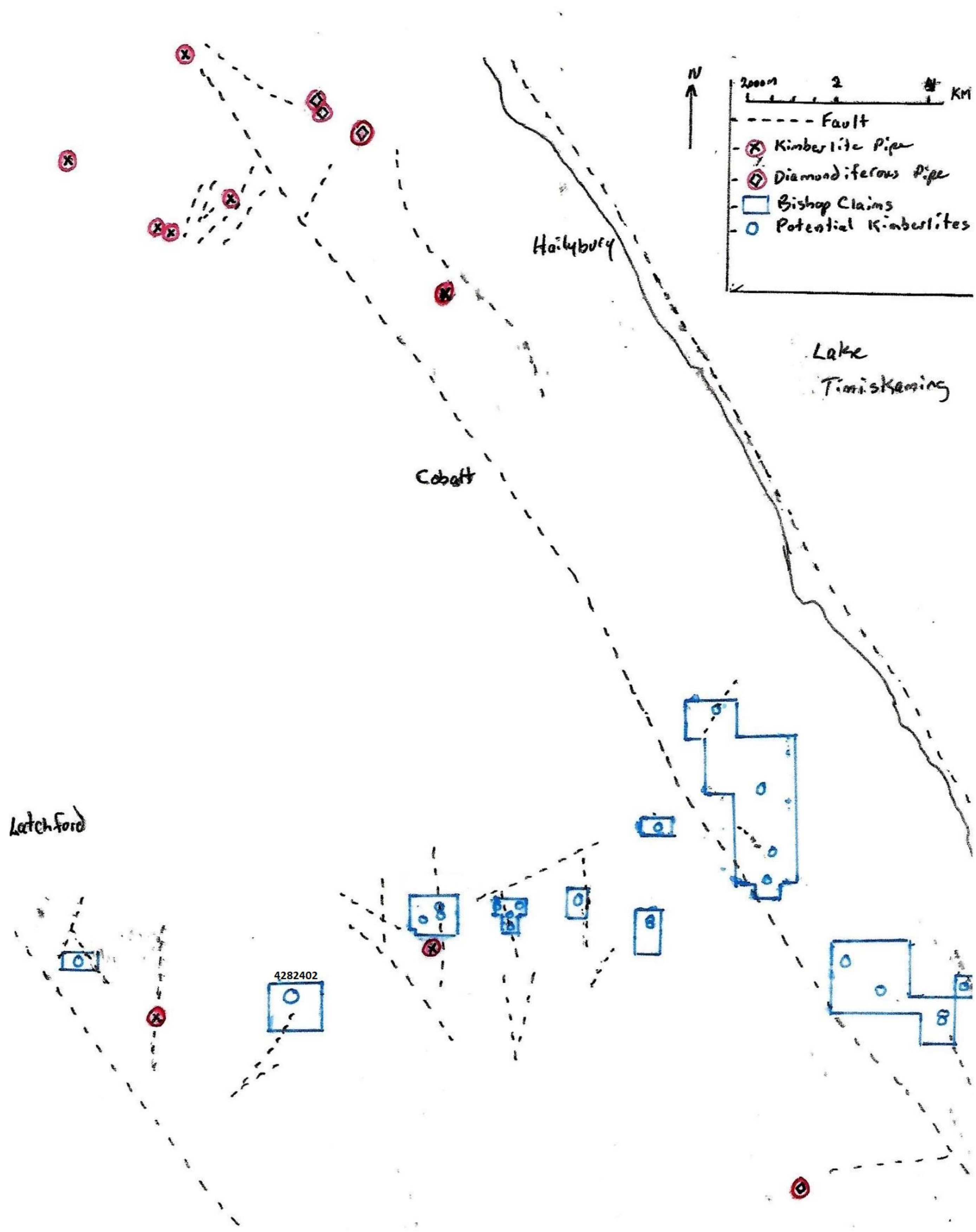


The Lake Temiskaming Rift Valley (also known as the Lake Temiskaming Structural Zone) (after Lovell and Caine 1970).

Used courtesy of
Ontario Geological Survey
Open File Report 6088

Map 7: Lake Temiskaming Structural Zone (from OGS OFR 6088)

Appendix 3



Map 8: Detailed Local Faults

Appendix 4

Traverses Appendix Overview

TRAVERSE 1: June 24, 2017 – Fieldwork, Map, & Field Notes

TRAVERSE 2: August 20, 2017 – Fieldwork, Map, & Field Notes

FIELDWORK: Please refer to Appendix 5 for Methodologies for Field Work and Till Sample Processing

L 4282402 – Hound Chute Lake

Traverse 1: fieldwork June 24, 2017 Brian A. (Tony) Bishop, Graeme Bishop

We left early in the morning and drove two hours south on Highway 11, over the Latchford bridge, and then turned East onto Roosevelt Road. Once we reached the planned spot south of Hound Chute Lake, (having crossed the creek which runs from Raede Lake north to Hound Chute lake), we parked the truck on Roosevelt Road near the northbound trail marked by fire#1950. My son and I planned to hike the traverse together, to split the weight of the samples we were after, particularly the creek samples (always much heavier), and for safety. From the truck park site, Graeme and I traversed north-west along the trail until reaching the vicinity of claim L4282402's south boundary and took note of the north-south oriented till ridges we hiked over.

We crossed to the west side of the creek at the approximate southern extension of the claim and moving north collected a till sample from dry ground west of the creek (sample 1); with the locally oriented north-south glacial transport observed from bedrock striations, we were down-ice of the target. My son and I traversed northeast beside the creek, which was at that place a wide wet-bottom meadow, and thus could not be sampled yet. Graeme dug beneath an upturned root-wall and collected a good till sample from three feet below the ground level (sample 2). Sample 3 was taken shortly after from the creek, requiring us to move aside many large cobbles in the creek to reach material suitable for sampling (sample 3). While screening the creek material with ¼" sampling screen prior to collection, we observed a uniform dark-brown staining/mineral adhesion which coated the pebbles, cobbles, and boulders in the creek.

Still travelling north and east towards Hound Chute Lake, we took a second creek sample (sample 4). Whenever taking a sample, it is practice to briefly examine the +5mm material being removed by the sampling screen (just in case there is something interesting). While collecting sample 4 from the creek, Graeme took note of a number of dark mineral nodules in the screened-out portion of the creek material. He collected some of these nodules (see Photos K & L on the following page); these by appearance might be ferromanganese nodules growing in the creek. A third creek sample was next obtained about 200 meters south of Hound Chute Lake, from a well stratified cache of fine material behind a large rock in the creek (sample 5). Between sample 4 and 5, the creek is crowded by the bush, and runs beneath large disorganized angular boulders which obscure the creek itself. Now on the east side of the creek, we angled to the southeast and collected a till sample directly south of Hound Chute Lake (sample 6). The bush in this area is mixed and has a lot of hardwood trees, and the ground undulates with many north-south till rises.

We took another sample from the till near the south edge of the claim (sample 7) and continued eastward in the down-ice area south of Hound Chute Lake. The earlier travel beside the creek, and through the bush was rough going at times, while there were natural clearings beneath the trees in some places. By the time we collected sample number 8, it was mid afternoon and we were becoming fatigued; we took the sample from a good spot, where the soil did not require much screening (sample 8). Still directly south of the target, we continued traversing due east, climbing the rising ground, and took another sample near the south-east corner of the claim (sample 9). We traversed southward in the high ground until we reached Roosevelt Road and walked to the truck park.

On the way out, after sorting and loading our samples into the truck, we drove to a second truck park location where there is an old gravel pit next to the road and beside the creek we had sampled. This gravel pit was a location that OGS-OFR 6088 had excellent results during their testing in 2002, and my son and I took a moment to collect several samples from the pit for later comparison (coordinates in field notes section). These samples are not entered as assessment work credits and were collected only for scientific comparison with the OGS study results. I included the KIMs picked in my results as valid sampling down-ice of Hound Chute Lake. We next took several creek samples adjacent and northward from the gravel pit area, for scientific comparison with the creek samples we collected from claim L 4282402.

It was late afternoon when we packed up everything and started driving out towards the highway. We stopped several times as we drove west on Roosevelt Road to take compass readings on all exposed bedrock which exhibited clear glacial striations, confirming the local north-south trend. The grooving was very pronounced in a north-south orientation (see Photos M-O below).

We arrived home twelve hours after we left. We had taken fifteen samples at Hound Chute Lake; nine samples in L4282402, and six off-claim pit/creek samples for scientific study and comparison. We were unable to sample as much area as we planned to, and after having just traversed the topography down-ice of our target, we knew the ground better and planned to return and conduct another sampling program. (See: Traverse 2)

Photo K – black nodule found in creek sample, 15mm

Photo L – black nodule found in creek sample, 19mm

Photo M – Striations on small outcrop on Roosevelt Road (north side)

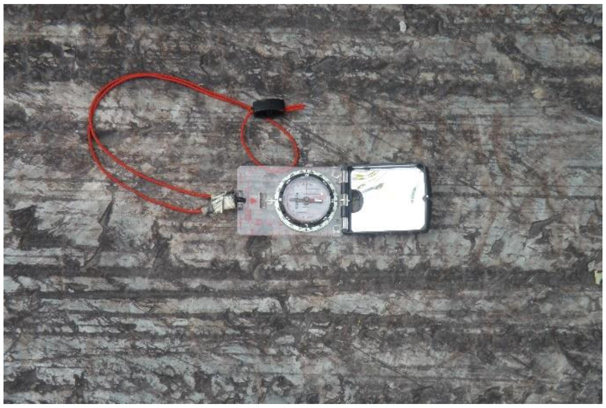


Photo N – Closeup of Photo O of striated outcrop on Roosevelt Road (south side)

Photo O – Overall view of Photo N of striated outcrop on Roosevelt Road (south side)

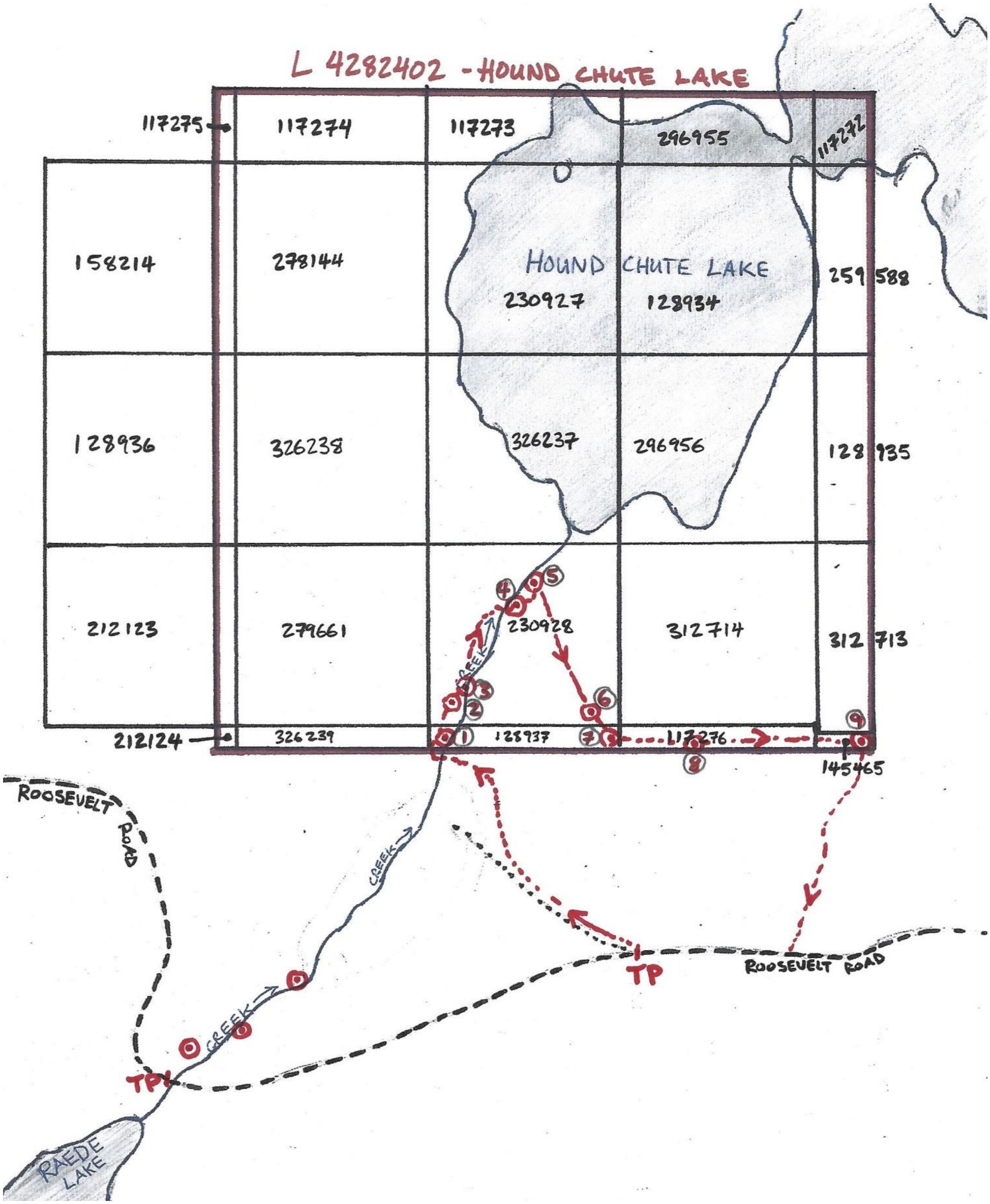
Appendix 4

L 4282402 – Hound Chute Lake

Traverse 1: map

June 24, 2017

Brian A. (Tony) Bishop, Graeme Bishop



Appendix 4

L 4282402 – Hound Chute Lake

Traverse 1: field notes

June 24, 2017 Brian A. (Tony) Bishop, Graeme Bishop

Sample #	Coordinates 17T UTM	Elevation (metres)	Activity/Description
1	0595965_E 5238325_N	325	Till sample
2	0595984_E 5238410_N	327	Till sample, under raised tree root wall
3	0596048_E 5238457_N	321	Creek sample
4	0596137_E 5238609_N	317	Creek sample – (nodule collection)
5	0595143_E 5239130_N	317	Creek sample, from beside perfect rock
6	0595430_E 5238325_N	326	Till sample
7	0596329_E 5238325_N	334	Till sample
8	0596630_E 5238355_N	331	Till sample, at place where ground tips to the south slightly
9	0596996_E 5238347_N	360	Till sample, at SW corner of claim area, climbing a rise

Features/landmarks mentioned in Traverse 1 report	Coordinates 17T UTM
Truck Park (TP) on Roosevelt Road	0596353_E / 5237817_N
Trail forking west to meet Creek from road (fire#1950)	0596206_E / 5238224_N
Truck Park (TP) at old gravel pit on Roosevelt Road at Creek intersection	0595306_E / 5237474_N
OGS sample area (off claim) in gravel pit (for comparison)	0595334_E / 5237536_N
Creek sample (off claim) for comparison to downstream on-claim samples	0595334_E / 5237467_N
Creek sample (off claim) for comparison to downstream on-claim samples	0595366_E / 5237491_N
Photograph site of glacial striations (North-South, indicating local due south)	0593597_E / 5239062_N

Appendix 4

L 4282402 – Hound Chute Lake

Traverse 2: fieldwork August 20, 2017 Brian A. (Tony) Bishop, Graeme Bishop

About two months after collecting the first soil samples from L 4282402, I planned out Traverse 2 and my son and I again drove to the claim for a sampling expedition, taking the same route described in Traverse 1 to get there. After the first traverse, I had studied my notes and my son's notes and took note of areas that still required sampling below Hound Chute Lake. Traverse 1 produced only nine samples for assessment. This time in order to get the samples we needed, Graeme and I each had our own traverses to complete; I would sample the dry ground in a wide arc directly within the down-ice area of Hound Chute Lake, and Graeme would collect samples from the western side of the claim, then travel south to the area of the creek just below the target to collect dry till samples from west of the creek, in the dry ground on that side, just below the target lake. I used the same truck park location (see field notes) on Roosevelt Road, but stopped earlier and let Graeme out to set off north into his own traverse near 0595200_E / 5238204_N.

At the truck park site, I put my pack together, locked the truck and started my own traverse in the same place as during Traverse 1. I made use of the northbound trail which heads towards the creek, but exited it sooner this time, travelling due north until I was on-claim and within the area I wanted to sample. It was mid-morning when I reached the claim, and the day was sunny and already getting warm. The bush and the ground seemed drier than during the first traverse earlier in the summer. I took my first till sample about half a kilometer south of the target (sample 1). I travelled further north and a bit to the east and collected another good dry sample (sample 2). The topography within my planned traverse is generally uniform mature bush, with a generous mix of trees, and generally flat terrain (with the exception of the gentle north-south till ridges which are present below the lake) but it is situated in a wide natural trough between the hills to the east and west of Hound Chute Lake. I continued my east-trending arc and took another sample from the till in the bottom of a small dried-out depression which would be full of water earlier in the year. Beneath the dark muck and detritus, I collected a good sample of mixed clay and till (sample 3). Continuing my east-bound traverse, I crossed what looked like an overgrown trail heading north. I took the next sample shortly after crossing this trail (sample 4). The area I was sampling was ideal for assessment of the glacial deposit of possible indicator minerals from the target, so I took another sample not far away, still traversing east (sample 5). I began to trend to the south-east after sample 5, intending to exit the claim boundary near the place that Graeme and I exited during Traverse 1. Midway to the claim's south boundary I collected sample 6 from good ground that did not require much screening to remove larger material once the groundcover and detritus was moved aside (sample 6). It was now mid afternoon, and my pack was becoming heavy with the weight of large samples. I continued heading southeast and took another sample in dry till (sample 7) before exiting the claim area on my way back to Roosevelt Road. I was hiking south on high ground and returned to the truck park location with no issue. I had collected seven large dry samples from the ideal area for testing below the target. I sorted out my notes and loaded the samples into the truck. I would have to wait for my son to finish his traverse. He planned to exit the bush and reach the truck park location using the same trail I had started north on early that morning.

The next section was written using Graeme's traverse field notes.

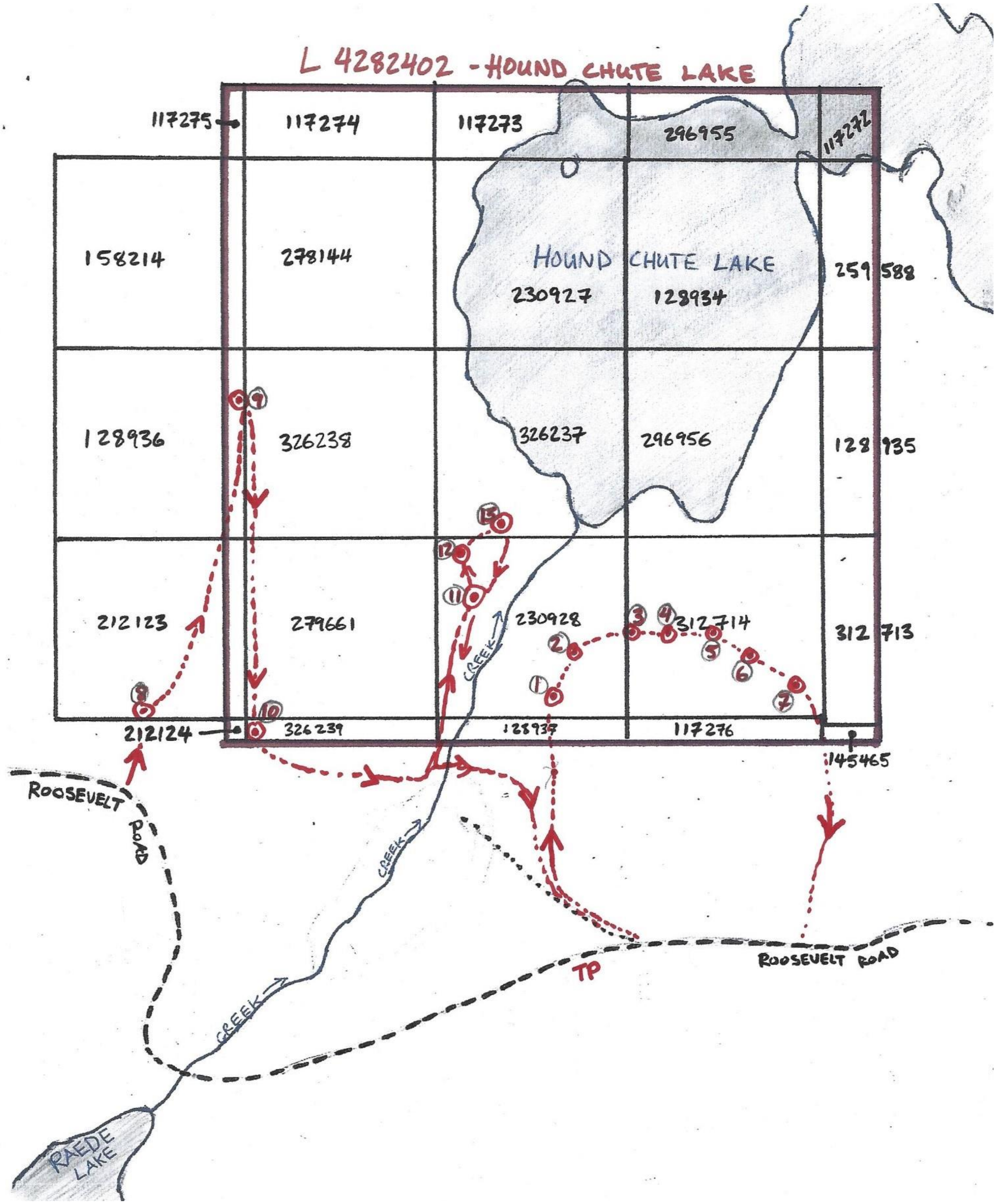
Dad dropped me off before we crossed the creek from Raede to Hound Chute Lake, and after checking that I had everything I needed, I left Roosevelt Road, travelling north and east towards the claim area. The first half of my planned traverse occupied the high ground in the rocky hills which lie west of Hound Chute Lake. I took my first sample when I found an ideal pit beneath an upturned tree (sample 8). Continuing north, I encountered some exposed bedrock which faced east, and began having to pick my route carefully. There is a small creek system which rests in the hills I was traversing, which made the ground swampy in some areas. I traversed along the east side of outcropping bedrock and passed by several spots where the bush was sparse but occupied by swampy openings. The small swampy areas which dot the creek were raising in steps to the north and west when I reached my next sample location. I took my sample from a good exposed deposit of till and clay material which was in the general trend of the creek system and was now dry but overlain by some black muck which would probably be under water earlier in the year (sample 9). I took a moment to investigate a bright red *something* that I could see in a clearing on the east side of the depleted creek, since I was heading in that direction anyway. A red balloon had drifted in from somewhere and gotten caught in the upper branches of a birch tree. Now on the east side of the creek, I began travelling almost due south along the high ground, intending to collect another sample before I angled to the east again. I collected the next sample in a depression where the vegetation was thick but offered a particular opening ideal for digging (sample 10). I continued eastward, back toward the creek we sampled in Traverse 1, crossing over several extended ridges of till covered by forest. When I reached the area of the creek, I was back at the small meadow around the creek and the two bedrock-water-runs mentioned in Traverse 1 and realized I had travelled too far south since my last sample. I took the coordinates of a large graywacke erratic on top of a ridge west of the creek (in field notes). Keeping the creek on my right side I traversed northward to the planned location of my next samples. I needed three samples from the dry ground south of the target, and west of the northernmost creek samples we had collected during the first traverse. In this location, the bush is not as thick as some of what I had been traversing, and I collected two samples in short time (sample 11, sample 12). Next, I headed a little further north and east toward the lake and collected my final sample; I had to dig through twelve inches or more of detritus before reaching the soil profiles I was after (sample 13). Intending to exit the bush by means of the trail which heads south to the truck park location, I crossed the creek and began to retrace the same route used northbound during our traverse earlier in the summer.

I took a moment while crossing the creek and screened out another small sample of the ferromanganese nodules for later study. My pack was already too heavy, and I had been traversing for six hours through demanding terrain, so I did not collect another full creek sample (we had collected samples from that part of the creek during the first traverse anyway). I followed one of the till ridges due south, looking for the trail out. I was coming over a small rise in the ground when I encountered a large black bear, perhaps twenty feet ahead of me. Since morning time, I had been stepping around bear droppings (sometimes in) and had noted several places the bear had flattened the ferns while sleeping, thus, I had been on the look-out for bears all day. It was still a shock to come face to face with the bear, which was blocking my way out. I quietly backtracked and headed a few hundred meters east, intending to get around the bear. I headed due south again, and in short time encountered the same bear a second time. I almost laughed. Instead, I backtracked north again, and headed west until I was near the creek again before finally turning south. I did not see the bear a third time and found the trail out in short order. By the time I got back to the truck and unloaded my samples, I was exhausted. It was a good day of work in the bush.

Appendix 4

L 4282402 – Hound Chute Lake

Traverse 2: map   August 20, 2017   Brian A. (Tony) Bishop, Graeme Bishop



Appendix 4

L 4282402 – Hound Chute Lake

Traverse 2: field notes August 20, 2017 Brian A. (Tony) Bishop, Graeme Bishop

Sample #	Coordinates 17T UTM	Elevation (metres)	Activity/Description
1 -T	0596479_E 5238567_N	343	Till sample, high dry ground, bedrock exposure to east
2 -T	0596679_E 5238517_N	324	Till sample, in a depression
3 -T	0596593_E 5238578_N	314	Till sample, moist ground
4 -T	0596488_E 5238573_N	311	Till sample
5 -T	0596378_E 5238555_N	315	Till sample
6 -T	0596251_E 5238503_N	321	Till sample
7 -T	0596198_E 5238398_N	327	Till sample
8 -G	0595200_E 5238368_N	398	Till sample, dry ground
9 -G	0595431_E 5239130_N	382	Till sample, wet ground, bedrock exposure to west
10 -G	0595430_E 5238315_N	380	Till sample
11 -G	0596000_E 5238655_N	327	Till sample
12 -G	0595958_E 5238772_N	328	Till sample
13 -G	0596100_E 5238874_N	322	Till sample

Features/landmarks mentioned in Traverse 2 report	Coordinates 17T UTM
Truck Park (TP) on Roosevelt Road	0596353_E / 5237817_N
Trail forking west to meet Creek from road (fire#1950)	0596206_E / 5238224_N
Smooth bedrock waterfall/waterrun on Creek	0596072_E / 5238247_N
Second smooth bedrock waterfall/waterrun on Creek	0596024_E / 5238273_N
Small meadow around Creek	0595590_E / 5237807_N
Till ridge with large greywacke erratic on top, west of creek	0595958_E / 5238140_N
North-south till ridges with natural troughs in between	0595958_E / 5238140_N

Appendix 5

Methodologies for Field Work and Till Sample Processing

PREFACE:

Diamond exploration is unlike that for any other mineral resource. Search areas are 'limited' to ancient 'cratons' (such as the 'Canadian Shield') which in themselves are vast areas. Geological maps are, in a general sense, of little to no use, as economic kimberlite pipes, relatively small circular to semi-circular, vertical diatremes, when found may have no direct correlation to local rock types, although locating faults and contacts between different rock types, such as granite/diabase, can be very useful once a kimberlite field has been located by geophysics or till sampling.

Locating a pipe is largely a matter of detective work. Typically, mag maps have been utilized in the search for magnetic 'bulls-eyes' which are then, as funds permit, drilled to see if it is kimberlite or some other magnetic target. **However, in Canada so far most of the production pipes have little to no magnetic signature**. As well, EM surveys often don't work for the same reason, as is also true of gravity surveys (i.e. no detectible mag, EM, or gravity anomaly). [See Appendix 3]

Soil sampling, either in till or streams, is the simplest and most common method of looking for kimberlites. In fact, though, the search is not directly for diamonds but for kimberlite indicator minerals (KIMs), which include certain garnets, chrome diopsides, ilmenites, chromites, zircons and others.

Stream sediment surveys are for larger scale drainage basins to initially locate KIMs. Till sampling should be then utilized to best zero in on a pipe's location.

These grains must be separated by utilizing their slightly greater specific gravity (SG) compared to most other minerals in the 'soil' samples. However, these grains are generally only 0.25mm to 2.0mm in diameter. This, and the very slightest difference in SG, make it very difficult to concentrate and recognize and pick KIMs from. Basically, commercial-grade microscopes, tweezers, and concentrators must be acquired at great initial cost with trained operators.

As a result, most exploration companies utilize a dedicated lab at a cost of $500 and up per sample for concentrating, visual identification and estimate of KIM grain numbers.

Old-fashioned gold panning for KIMs as one would with gold grains is next to impossible: gold has a specific gravity (SG) of ~20 and therefore is roughly 7 times heavier than the other soil and rocks in a sample. KIMs have an SG 3.3 to 4.3, only very slightly (i.e. <1.4 times) more than most other grains in a field sample. (Common non-KIMs have an SG of ~2.6 to 2.9). As well, size matters. Even experienced individuals can have trouble with separating gold grains the size of KIMs from till or stream gravels, and one basically cannot pan gold this size out of 'black sands', i.e. magnetite. Magnetite (SG of 5.2) is commonly found in kimberlites and hence is also found with KIMs, further complicating concentration of a sample, as magnetite is actually heavier.

Specific Gravities			
	Gold	-	19.3
(KIM)	Magnetite	-	5.2
(KIM)	Zircon	-	4.6-4.8
(KIM)	Ilmenite	-	4.3
(KIM)	Garnet	-	3.5-4.3
(KIM)	Pyrope	-	3.56
(KIM)	Diamond	-	3.52
(KIM)	Cr. Diopside	-	3.3
(KIM)	Olivine	-	3.3
	Mica	-	2.9
	Dolomite	-	2.85
	Conglomerate	-	2.8
	Gabbro	-	2.8
	Calcite	-	2.7
	Granite	-	2.7
	Quartz	<=	2.65
	Feldspar	-	2.6
	Clay	-	2.2

With the right equipment however, an individual with some background, specifically in placer-type deposits, can concentrate and pick KIMs from till samples.

To further complicate issues, due to a number of glaciations in Canada in different directions, samples must be taken from tens of metres to several kilometres down-ice (usually along the last glacial direction) of the potential kimberlite source. This requires the bulk of meaningful sampling to be done off claim, sometimes a long way off claim, which then cannot be applied for assessment work to maintain that claim in good standing. Direct sampling of a kimberlite target is only accomplished by bulk sampling with a large diamond drilling program, or if near surface, directly with heavy machinery (both very costly and permit-intensive).

These initial obstacles can only be overcome by a lone prospector with determination, knowledge, the use of a collection of specialized and costly equipment, and lots of time (and patience). Even for established commercial labs the bulk of the time and cost comes down to an individual meticulously picking KIMs with a pair of tweezers while viewing the concentrates from a sample under a microscope. This lengthy time-consuming process is such that if large numbers of indicators are encountered, only a portion of the sample is picked for KIMs in a lab and then averaged (i.e. ‘guesstimated’) to the full sample, possibly risking losing the few/any all-important G10s and other similar grains in the remaining portion.

METHODOLOGY/OVERVIEW OF FIELD WORK & TILL SAMPLE COLLECTION:

Standard 38cm x 28cm sample bags are used for collecting till samples. Small shovels are used to dig a 1' to 3' deep hole below the humus line and the bags filled ½ to ⅔ full, taped shut, and labelled. When possible, the sample is screened through a 4-mesh screen (typically just creek samples), or if not, then larger rocks and roots are removed by hand. If a sample site is very near to the transport vehicle I just remove larger cobbles and take a larger sample to be screened later, before concentrating. In between samples the equipment is cleaned as well as possible to avoid cross-contamination. GPS coordinates are taken at each sample site and then recorded if not matching the prechosen map coordinates.

The base of logging roads is basically composed of till collected immediately adjacent to the road as it is constructed. This makes for a very useful till sampling location, namely the area beside the road where the heavy machinery dug down from several to 10+ feet deep. This creates the possibility to collect from a number of horizons at various locations without mechanized equipment, thereby increasing the possibility of finding KIMs.

Whereas most approaches initially involve a regional sampling survey and then trace up-ice to the possible target, I start with identifying a potential target based on structural, glacial, landscape features, and publicly available OGS reports. I then take multiple samples to determine the likelihood of my target hypothesis, down-ice and off-ice for comparison.

My intent is basically to determine kimberlite pipe/or not a kimberlite pipe, based on a visual identification and number of KIMs picked from my till sample concentrates, and EMP analysis of an affordable minimal # of grains selected and sent for lab analysis. Interestingly, a number of exploration companies as well as ODM in Nepean have stated (within the last 5 years) that visually picked KIM grains and total number of KIMs are their criteria for continued interest in an area rather than analysis of grains. ODM said recently in an email that most companies have been adopting this approach (from personal research it also appears that many of the most successful companies at finding new discoveries of diamondiferous kimberlite pipes now are looking for non- to low-mag and EM targets utilizing gravity surveys, which do not always produce usable results, and finally results in till sampling for KIMs as the primary prospecting tool), especially in a region with known kimberlites.

In their sampling programs, OGS Open File Reports on Alluvium Sampling Surveys recommend creek samples for a far more pre-concentrated material for heavy minerals including KIMs (not for some distance down-ice/water flow of a lake due to its being a heavy mineral trap), and so recommend to "maximise the distance between the sample site and the lake", so I then thought that this is not true if the lake (heavy trap) is the source of KIMs. Large distances between sample spacing and large 10-30kg samples, however, are more applicable to doing regional surveys while hunting for a 'target', i.e. in this case a kimberlite pipe. Also, creeks are rarely conveniently placed directly down-ice of a pipe-sized target (in Canada typically 50-200m in diameter) and they concentrate material from a large area, so when sampled can strongly skew results to high numbers of KIMs compared to till samples. In my case, where the lake itself is a potential kimberlite pipe, I take many (5-20) small 1-3 kg unscreened till samples, relatively closely spaced, from between ±50 to 1000 metres down-ice of the target, and generally combine the results into one larger sample, creating a more representative sampling of post-glacial conditions for emplacing KIMs into till.

As you can see, due to the lake being a heavy mineral trap for material up-ice/water flow, all the samples I take from 'close' proximity down-ice/water flow can in all probability be attributed to that lake (or in theory, a hidden pipe in very close proximity down-ice of the lake). So, any of these samples below a proposed pipe can individually or collectively statistically be attributed to this discrete target. Taking many smaller till samples from various locations down-ice was deemed appropriate to mitigate the extreme nugget effect caused by KIMs potentially being restricted to thin stratigraphic horizons in the till.

Side View – Till Sampling Program

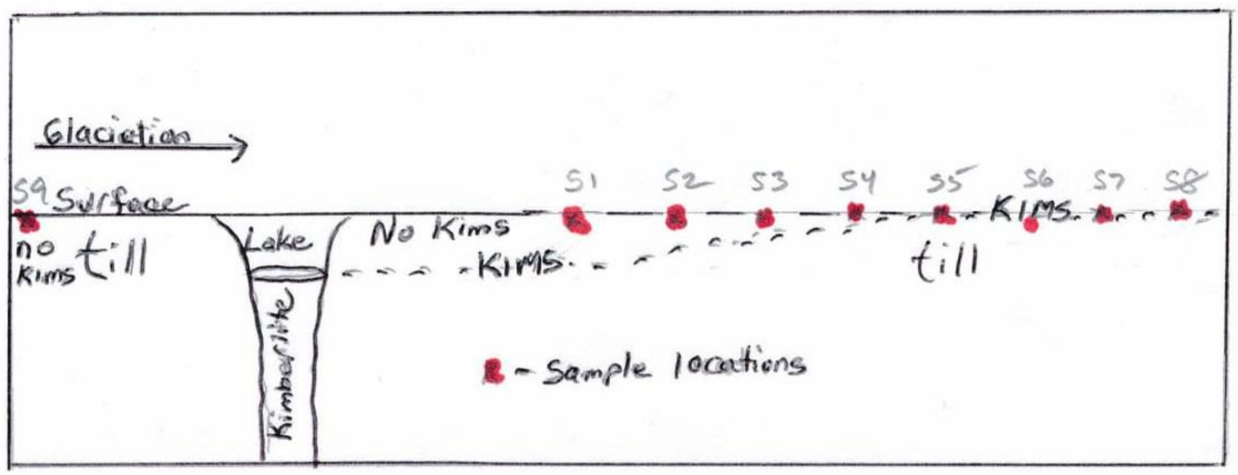


Diagram C

- If only S1 and/or S2 and/or S3 and/or S4 in till were sampled, one would find no KIMs and conclude no kimberlite up-ice
- If any one of S5, S6, S7, or S8 were sampled one might get favourable results for KIMs
- If the S1 ↔ S8 results, after concentrating and picking KIMs, are combined to a single larger sample result the chance of finding KIMs increases dramatically even though only 'one' or more samples contained KIMs initially. This is demonstrably more efficient and accurate at predicting proximity to a kimberlite pipe than only one larger sample would do
- Up-ice, S9 is a check and should statistically contain little to no KIMs
- Further sampling can then help verify/delineate the source of the KIMs

Top View – Till Sampling Program

Diagram D

- Same as Diagram C, with off-ice samples containing little-to-no KIMs if lake is a kimberlite pipe

My blended till samples increases finding one or more that are confined to the appropriate KIM emplacement zone: I concentrate off-ice samples individually/separately. When KIM counts in off-ice samples drop to very few to zero, it adds to the probability of a favourable target location.

After concentrating the individual till samples, picking KIMs is done under a variable power binocular microscope with multiple lighting arrangements. I try to pick all KIMs, unless, as in some cases, they are in the thousands, then numbers are estimated. This of course takes many hours to days (sometime weeks) of work, especially when photographing and entering the photos into the computer correctly labelled, along with many hours of research identifying unusual/uncommon grains.

Also, to maximize local topography in the field, my knowledgeable samplers or I can make on the spot decisions in the field to sample near but not on my pre-planned coordinates (e.g., an upended tree root nearby etc.), and GPS coordinates are accepted by field workers as possibly being $\pm$ 10-50 metres off on any given day.

The up-ice samples are processed separately and considered separately. This initial sampling program was performed to obtain a yes/no probability of my target hypothesis. Additional sampling program(s) help further delineate these preliminary results.

Included in picking pyrope garnets are red, pink, and purple colours. Typically, Cr pyrope (by definition) garnets, in most literature, are considered to be red (colour comes from enhanced chromium and/or iron content) or purple depending on the article; however, McLean et al (2007) shows that the colours in the Canadian Diavik Mine A154-S kimberlite pipe garnets, in order of Chromium content which is important for diamond exploration, are as follows:

- "Orange xenocrysts have <1 wt.% Cr_2O_3, and are inferred to have eclogitic derivation
- There is a general increase in Cr content from orange → red → pink → purple. A similar trend may be seen in the data of Hawthorne et al. (1979) for garnets from the Dokolwayo kimberlite and Hlane paleoalluvial deposits in Swaziland
- Red grains increase in Cr from light → dark red
- Purple xenocrysts are more likely than pink or red to be harzburgitic (G10 or G10D), but colour alone cannot be used as a definitive test"

Pink garnets, however, are not commonly mentioned in diamond exploration literature. In samples from Canadian kimberlites, the Cr content of the pink-purple garnets seem to exceed that of the darker purple garnets when tested at the lab in Sudbury (verbal communication, Dave Crabtree, Geoscience Lab), (McLean et al, 2007), (Grutter et al, 2004); therefore, I am including pink garnets in pyrope garnet counts. This is, of course, subject to change as I continue to sample and have picked garnet grains analysed.

From reading a great number of articles it seems that there is no definitive rule concerning kimberlite minerals, colours of G10s can vary, some diamond pipes have no G10s at all and many other differences also occur. The differences are so numerous and interesting that a future paper or book could be compiled.

In targeting and evaluating potential kimberlite pipes it is important also to note an article on 'Following kimberlite indicator minerals to source' in GSC OF-7374, "**The corollary for exploration at Chidliak is that any source of high garnet counts in sediment samples is considered worthy of pursuit, regardless of garnet compositions**" (Clements et al, 2013, p 51). With that in mind, if I attempt to normalize my results vs. sample size as compared to say, the OGS-OF report 6088 (see p 13 & 17), taking into account my samples were unscreened (until processed in the sluice and/or GoldCube®), the number of KIMs I picked could be averaged up a considerable amount in quantity.

Of course, while till sampling a large part of the day/traverse is spent investigating boulders by removing moss, etc. and in this case specifically looking for kimberlite boulders (which have been located on 2 claims so far with other possible grain sized pieces that might be) or other interesting rocks with mineralization. Because this target and sampling area is in and down-ice of a large expanse of diabase, nearly all boulders and outcrops are diabase with minor amounts of granite, dolomite, etc. As stated earlier, oversize from the sluice is bagged and viewed as time permits. No attempt will be made to identify every possible cobble if it is well worn and unrelated to kimberlite prospecting.

So… I'm sampling unconsolidated till, down-ice of a heavy mineral trap (lake) and taking comparatively small samples and getting high to very high in KIM anomalous results, which in classic teachings should result in poor→ no results. Unless of course the heavy mineral trap (lake) is the source of the heavy minerals.

METHODOLOGY FOR PROCESSING TILL SAMPLES: **Please also see Flow Sheet for Concentrating and Retrieving KIMs from Till and Stream Samples [Appendix 7]**

EQUIPMENT:

1) GOLDFINDER CUSTOM MADE SLUICE *(since modified by the author for the efficient processing ~10 to 100+ lb soil samples, for initial kimberlite indicators / heavy mineral concentration)***:**

The Goldfinder sluice (see Equipment photo 1) is manufactured with aircraft grade aluminum in 3 sections, with sturdy fast connecting latches. It is 14' long, 14" wide, and has height adjustments at front and back of the top section, and front and back of the fully assembled sluice. From the manufacturer, it excels at saving very fine flour as well as coarser gold. The ability to save 90%+ of flour gold in any sluice is exceedingly rare [The Goldfinder sluice was tested extensively in the 1970s by designer and developer Wayne Loewen on the Saskatchewan River as well as in-house tests with known gold grains counted before and after running through the sluice]. This particular sluice was rented from me by the then Resident Geologist Gerhard Meyer and District Geologist Gary Grabowski, both of the Kirkland Lake MRO, for testing for gold in eskers on the shores of Abitibi Lake. I determined that with certain beneficial modifications from stock it could also be very good at saving kimberlite indicator minerals (KIMs) from larger till samples.

Saving gold by gravity methods is comparatively easy as gold is about 7x heavier than indicator minerals or diamonds. To use the sluice to obtain a primary concentrate of KIMs, I removed the Hungarian riffles and the solid-backed 'miner's moss' carpet. I used a thicker, slightly more open-weave miner's moss, and overlying the miner's moss, a specific 4 mesh nylon classifying screen. This was cut to fit in the top of the sluice and overlaps the original grizzly bars to reduce the size of the feed material being concentrated prior to the miners' moss sections, and to spill the +4mm feed off the end of the top section which spills into a bucket and saved to visually check for kimberlites or other minerals of interest. A heavy duty ¾ HP submersible sump pump with a large flow rate replaced the 6 ½ HP Honda high pressure pump for a more correct water flow for the lighter material being run. This gave a 1" depth of water running above the top of the miner's moss. The sluice was run at a less steep angle than for gold to further enhance saving potential KIMs, with the first top section of the sluice adjusted to an angle with a drop of ½" over 36". The larger bottom section drops 3" every 5'. Great care must be exercised to level the sluice in the 14" width to provide an even water flow across its surface.

The modified sluice considerably reduced the original volume of material, but most importantly the modified wrap around spray bar [see Equipment photo in Appendix 8] blasts apart clay and other clumped material very quickly and the water flow then also quickly removes very fine silt, humus, and plant matter as well as +4mm rocks (previously, I would spend 1 – 2 hrs or more trying to break this clay and such by hand with various utensils and water spray, and afterwards would have to screen out the humus and then pan and classify with various screens). Efficiently saving the 1mm and smaller grains from clay/till strictly by hand methods is nearly impossible.

To test efficiency after the initial trial run using this equipment, I cleaned and kept separate the 4 carpet sections and the overflow of the sluice, which after further processing resulted in 25 separate samples of various meshes, and then checked the results under the microscope for indicators to determine if any losses were incurred and where. With this information, I was then able to make further modifications and retest to compare efficiencies which I continue to do and modify as needed.

The sluice concentrates <1.0mm are ran through the GoldCube® and the trays are cleaned (i.e. washed for concentrates). The rejects are saved and are again ran through the GoldCube®. The new rejects are discarded. Concentrates from the 1st and 2nd run are then blended and reran through the GoldCube®. The 1st tray is then cleaned and saved separately, as are the 2nd and 3rd trays. These rejects are then saved separately. These will all be dried and demagnetized and screened into a number of different mesh fractions, and these, if individually too large to directly pick for KIMs, are carefully panned to a manageable size. Although time consuming, this results in a very efficient and consistent method of concentrating till for KIMs and other heavy minerals.

Interestingly, many professional labs still list panning as the final concentration technique. This preliminary work was all necessary to determine the efficiency of sluicing till samples for KIMs and other heavy minerals with this particular sluice. Surprisingly, the first top section with no miner's moss had an interesting number of potential KIMs as well as a 1.5mm purple garnet in my sluice efficiency test. The next carpet had very many indicators, the next a sizable number of indicators, the final carpet and overflow had no KIMs or magnetite etc. that would typically comprise a heavy concentration.

2) GOLDCUBE®:

The GoldCube® is a 'new' and excellent concentrator built for gold, but after much testing I've discovered it works very well for kimberlite indicators minerals and is uncomplicated and easy to use. After numerous tests (much the same as for the sluice), I determined it is very efficient for smaller sized 1-4kg till/creek samples, after wet screening the samples to 1.0-2.0mm and <1.0mm which are ran through the concentrator individually. It has a very high recovery rate for <1.0mm heavy minerals and for removing virtually all the silt sized grains, and it's easy to clean after use. This piece of equipment has become indispensable and very efficient at concentrating individual till samples.

3) TYLER PORTABLE SIEVE SHAKER:

The Tyler sieve shaker (Equipment photo 2) is utilized for larger samples. For individual small samples, screening is done by hand with standard sieve screens and larger diamond screens.

4) MANSKER JIG:

I also acquired and compared the efficiency of using a Mansker Jig for concentrating till samples, as some labs and explorationists use this device extensively for this purpose. I purchased one Coleparmer 8" HHSS #40 sieve for KIMs, and one Coleparmer 8" HHSS #100 sieve for lamprophyre indicators. Based on my findings I have determined a preference for my sluicing and Goldcube® methodology, as this appears to be superior to the Mansker Jig in concentrating KIMs, more so when considering a several thousand US dollar price tag.

5) CAMEL SPIRAL CONCENTRATOR:

A Camel Spiral Concentrator, which is used by some commercial labs, was also tested for KIM concentrates and I found it to be the worst of the lot – essentially useless.

6) HIGH-SPEED CENTRIFUGE:

I acquired and tested a high-speed centrifuge to separate the final concentrate into specific gravity layers. The centrifuge only seems to work to an extent on the finest fraction of concentrates. For now, I will continue to use a high-quality pan for final concentrating.

7) OTHER:

I considered the use of Polytungstate for heavy liquid separation but at $2500 US for 500 ml and special licensing and equipment requirements to use this product I quickly nixed that idea.

8) MICROSCOPE:

After these steps the indicators are then visually picked out (or a number estimated, and/or photographed under the microscope if too many to pick out or count) from each fraction under a Nikon SMZ-2B 8-50x binocular microscope with the help of Pelco (ceramic or carbon-fibre tipped) medical grade tweezers, and colour correct LED lamps for top, left and right, and below lighting. LW and SW ultraviolet lamps are also used in conjunction with the microscope to further identify various mineral grains. I have also been researching and experimenting with the use of switching between incandescent, fluorescent, and LED light, as some/many kimberlite garnets are also rare colour-change garnets.

9) PHOTOGRAPIC RECORDING:

An extra but very important (and time consuming) step is to photograph many of the large/important/unusual potential KIM or other heavy mineral through the microscope ocular, recording the type, size, colour, etc. of each grain, and storing and labelling the images on the computer for later viewing or to aid when consulting with geologists and other experts in the field of mineralogy, especially as related to diamond exploration of which a number of interesting grains are represented in this report. Many photographs were taken for this claim of concentrates/various grains have been taken and stored. As well, when dealing with grains that are from 0.25 to <3.0mm in size, one simply cannot easily find a certain one in picked KIMs and show it to individuals to ascertain their potential importance, and once sent to a lab for microprobe analysis, important physical characteristics such as kelyphytic rims and physical wear are lost. Photographing all KIMs picked (or many representative grains if too numerous) also helps estimate total numbers in the sample.

10) LIGHTING:

Another useful tool for picking kimberlitic Cr Pyropes was discovered in my research.

> "Pyrope grains larger than 0.5mm and have a higher Cr content (Cr203) showed a metameric colour change from purplish in incandescent light to grey, blue-grey, or blue in daylight type fluorescent light (Springfield and Manslar, 1985) which is useful qualitative and for picking garnets with higher Cr content." (Carter Hearn Jr. (2004), p 481)

> "[A] color change garnet is an especially rare and valuable … garnet" (GemSelect (2018))

> "[A] color change garnet is one of the most rare, interesting, and unique of all gemstones." (AJS Gems)

> "Cr pyropes are picked at ODM by switching light sources (LED and Fluorescent) to find colour change garnets which are from this and other sources indication of kimberlitic chrome pyrope garnets" (personal communication)

Over the last several years, I've tried many (several dozen) types and colours of bulbs and a number of lamp configurations. The latest and so far best is a pair of desk-sized gooseneck LED lamps (Jansjö LED Lamp from Ikea) which gives a true colour image under the microscope and in a microphotography image, and a variable intensity ring light (AmScope – 144 Bright White LED Ring Light) that mounts directly onto the lower part of the microscope and provides a very white (daylight) illumination.

After finding a Cr Pyrope (pink → purple), I can switch from one light to the other separately.

The results are dramatic with a colour change from lilac-purple to grey.

Sluice Efficiency Test Results

Appendix 6

Overflow Chart: collected in stainless steel pan after exiting sluice			
Dry weight from sluice = 3160 grams			
	Screened dry weight (grams)	**Magnetic portion (grams)**	**After panning dry weight (grams)**
-4+10 mesh =	1469		24
-10+20 mesh =	290	3	25
-20+28 mesh =	141	2	19
-28+35 mesh =	171	2	23
-35 mesh =	1058	x	
Total =	**3129**		

Sluice Top: expanded metal over classifying screen – no carpet			
Dry weight from sluice = 940 grams			
	Screened dry weight (grams)	**Magnetic portion (grams)**	**After panning dry weight (grams)**
-4+10 mesh =	241	15	24
-10+20 mesh =	128	6	25
-20+28 mesh =	66	3	19
-28+35 mesh =	80	3	23
-35 mesh =	419	x	
Total =	**934**		

Sluice 1: classifying screen over miner's moss			
Dry weight from sluice = 2860 grams			
	Screened dry weight (grams)	**Magnetic portion (grams)**	**After panning dry weight (grams)**
-4+10 mesh =	136	6	26
-10+20 mesh =	495	20	18
-20+28 mesh =	258	6	19
-28+35 mesh =	336	7	17
-35 mesh =	1610	x	
Total =	**2835**		

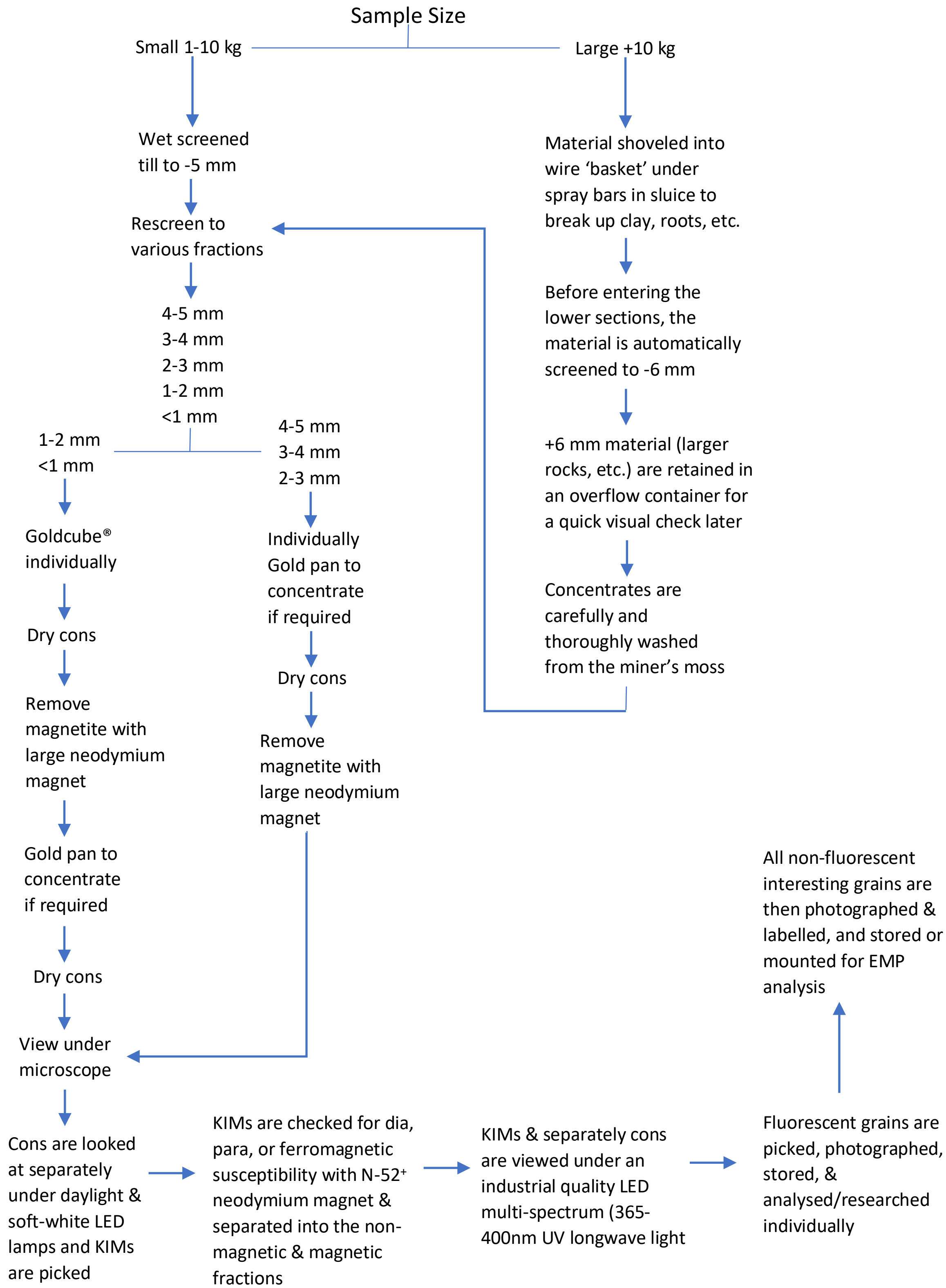
Sluice 2: classifying screen over miner's moss			
Dry weight from sluice = 3020 grams			
	Screened dry weight (grams)	**Magnetic portion (grams)**	**After panning dry weight (grams)**
-4+10 mesh =	29	1	22
-10+20 mesh =	269	8	18
-20+28 mesh =	248	6	20
-28+35 mesh =	359	7	17
-35 mesh =	2106	x	
Total =	**3011**		

Sluice 3: classifying screen over miner's moss			
Dry weight from sluice = 2550 grams			
	Screened dry weight (grams)	**Magnetic portion (grams)**	**After panning dry weight (grams)**
-4+10 mesh =	220	10	15
-10+20 mesh =	441	13	17
-20+28 mesh =	198	5	16
-28+35 mesh =	210	4	16
-35 mesh =	1425	x	
Total =	**2494**		

(note: slight differences in sluice and screen weights could be accounted for by moisture differences and loss during screening, tumbling, and container transfers, but are statistically inconsequential)

Appendix 7

Flow Sheet for Concentrating and Retrieving KIMs from Till & Stream Samples



Appendix 8

Equipment List

- Mansker Jig
- Camel Spiral Concentrator
- Custom designed proprietary tube/spiral concentrator for fine to very fine material
- Diamond sieves
- Tyler – 8 sieve Motorized Portable Sieve Shaker
- Various test sieves from -4 to -100 mesh
- 12V and 120V and motorized water pumps for concentrators as needed
- Garrett Au Pans: 15” super sluice, 10”
- Keene’s Engineering Au Pans: 14”, 12”, 10”
- Heavy duty 18” x 16” rubber panning tub
- Goldcube® fine Au/heavy mineral concentrator
- Goldspears (2 of) with extra 4’ extensions for precious metal and magnetite soil testing, wet & dry
- Scintrex-Scintillation Counter Model BGS-1S
- Rock saws: 10”, 18”, 24”, 36”
- Various metal/mineral detectors: MineLab Pro-find Pinpointer, Garrett’s BFO, ADS VLF 5khz, AT-Gold 15 khz, ATX multi-frequency pulse
- Goldfinder 14’ aircraft aluminum collapsible sluice with ¾ hp 120V submersible pump, 6 ½ hp Honda pump, dredging (3”) capability, custom designed Hungarian and expanded metal riffles, -4 mesh classifying screen
- Digiweigh digital scale, readability 0.1 gram
- Mettler PM30, 0-60lb, 0.1g scales
- Fujifilm Finepix SL, Nikon Coolpix digital cameras, custom microscope adapter for Coolpix
- Canon EOS Rebel SLR, with commercial microscope adapter
- Zeiss OPMI-1 stereo 4-25x microscope with thru the lens variable halogen lighting, 6’ articulating boom stand
- Zeiss Jena 4-25x compound microscope with separate oculars to 80x
- Bristal 40-1000x microscope
- Nikon SMZ 2B continuously variable 8-50x microscope with adjustable boom stand
- Turnstile microscope viewing platform
- Diamond Selector II
- Superbright 2000SW and Superbright II LW370 portable ultraviolet lights /battery/120V
- Inova multi-wavelength LW UV LED flashlight
- Jansjö LED gooseneck microscope lamps
- AmScope 144 bright-white variable intensity ring light
- Clay-Adams high speed centrifuge
- 2” Neodymium magnet in waterproof ABS shell
- Weaker 4” x 6” flat magnet cut to fit Au pans
- Various shovels, auger, containers, compasses, GPS, maps, etc. as needed for soil/rock sampling
- Electronic pH tester and pH strips
- Toyota Tacoma 4x4
- 8’ Boler, 14’ Boler trailers/portable camps

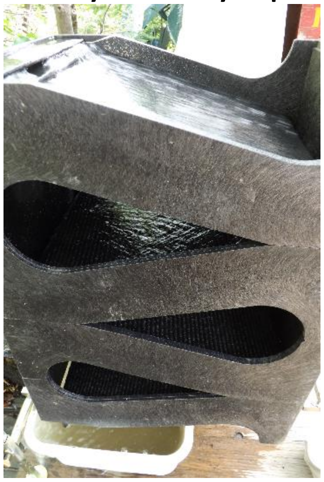
Equipment Photos

Appendix 9

1 - Goldfinder Sluice

1a - Panned and dried concentrates from sluice efficiency test ready to pick for KIMs under microscope

2 -Tyler motorized portable sieve shaker



3 - Goldcube®

4 - Variable speed industrial tumbler

5 - Microscopes

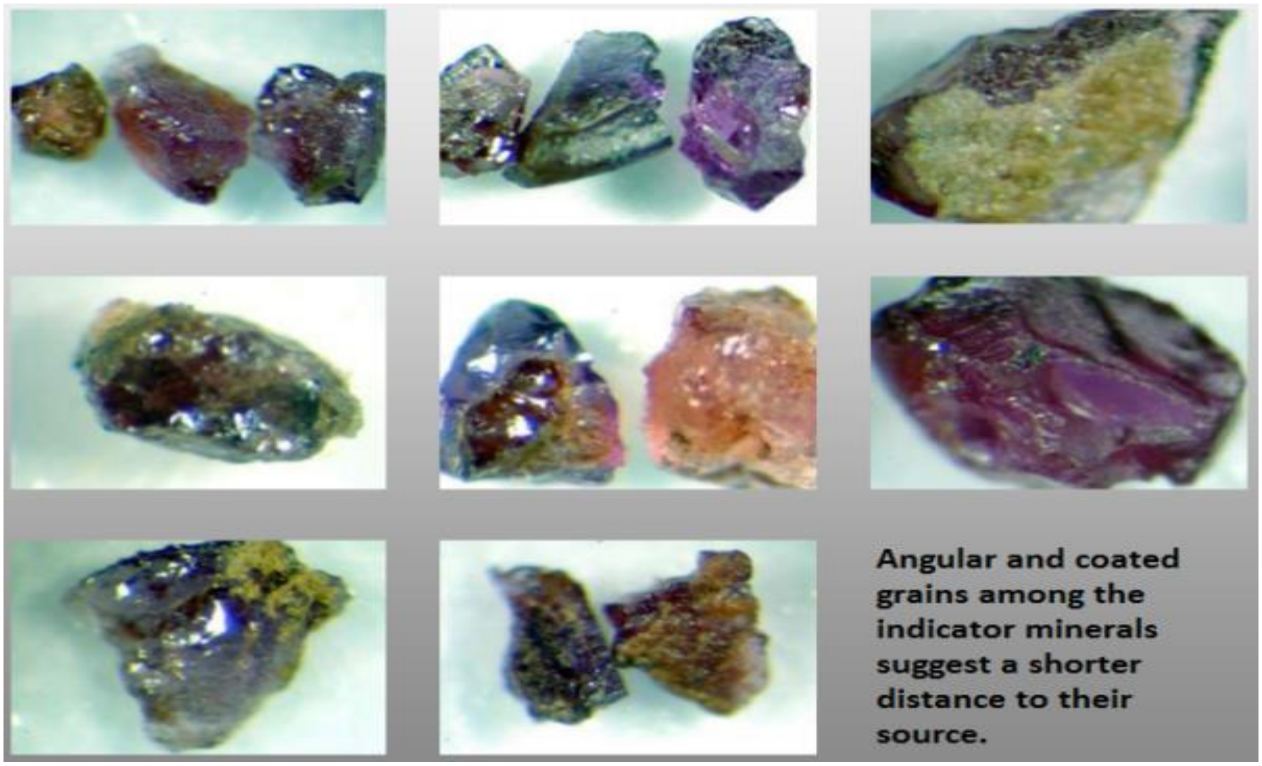
6 - 2-inch neodymium magnet

7 - Portable camp near claim

Reference Photos

"Angular and coated grains among the indicator minerals suggest a shorter distance to their source" ("Arctic Star Presentation", 2016, p 13)

Arctic Star and North Arrow Announce Drilling at Redemption Diamond Project



"Studies of the indicator minerals from the South Coppermine train, some of which are imaged to the right, show very angular habits, some with soft alteration rims, (kelyphyite for pyrope and leucoxene for ilmenite), all evidence for close proximity to source. Mineral grains lose their coats and become rounded as they travel down ice in the glacier. The angular/coated grains were most abundant at the head of the South Coppermine train. One grain with kimberlite attached was also noted." ("Arctic Star Presentation", 2016, p 13)

Statement of Qualifications: Brian Anthony (Tony) Bishop

I have been prospecting and placer mining part-time for 43+ years in Ontario, British Columbia, and Nova Scotia (which led to writing a book *The Gold Hunter's Guide to Nova Scotia* (Nimbus Publishing, 1988, ISBN 0-920852-93-9) which was used in prospecting courses in Nova Scotia). I have held an Ontario Prospector's License for 39 years and was issued a Permanent Prospector's License in 2005. I have completed a number of prospecting courses given by the Ministry and have my Prospector's Blasting Permit. I was one of the Directors on the Northern Prospectors Association (NPA) in the early years when Mike Leahy revitalized/resurrected the NPA in Kirkland Lake, and with Mike, initiated the annual gold panning event as part of Kirkland Lake Gold Days.

As well, I sold and used small scale mining and concentrating/processing equipment for over 20 years. This included instructing others in their use. Since then I have designed, built and used new types of concentrating equipment for heavy minerals/metals.

For over forty years I was a dealer for many of the major metal detector manufacturers at that time. I was also a dealer for Keene's Engineering of California, possibly the best-known manufacturer of small to medium scale prospecting and mineral recovery equipment. I was also (the only) dealer for Goldfinder Custom Sluices built by Wayne Loewan in Alberta. Until recently I was sent new models/types of Garrett metal detectors to test in the field for their prospecting capabilities.

On short term contracts I have performed specialized work for Cobatec, Macassa, Castle Silver Mines Inc., Gold Bullion Development Corp, as well as short stints in Ecuador and Montana.

I was the first (and possibly only) person to use a Garrett Sentry Tracing instrument (used to find underground cables etc.) to look for silver veins (Cobatec, Castle Resources), and underground at Macassa Mine (now Kirkland Lake Gold) to successfully locate 600' and 800' vertical length large bore holes (for paste) that had missed the adit by 14' and 18' respectively.

I have also been hired by two different mining exploration companies to locate samples of gold and silver with metal detectors and grade waste dumps with metal detectors to determine if they could be profitably re-milled.

The last four and a half years I have devoted to full-time diamond exploration. While interpreting the results of till sampling programs and the KIMs that were found, the primary author has conducted 1,000+ hours of research on the scientific and exploration aspects of Canadian diamond discoveries from many diverse sources on exploration and processing techniques. The Resident Geologist's office (MNDM, Kirkland Lake) has many kimberlite and KIM samples that were compared to the ones found on the Bishop Claims. One present and two former Resident Geologists were regularly consulted, as well as the former District Geologist who is considered the local diamond expert for this area. Other prospectors and geologists are regularly consulted, especially Douglas Robinson, P.Eng Geo, who has overseen and verified much of the results and methodologies of the work.

My comprehensive assessment reports can be viewed online on the MNDM website. In the last few years I've developed new techniques for identifying KIMs and for determining the diamond potential in kimberlite pipes, and some of these are outlined in my latest reports.

Drawing on this research and my many years of practical experience, especially in placer mining techniques, I have assembled a complete till processing lab I feel rivals many commercial ones. Importantly, I sometimes exceed their results by testing a wider range of samples' fraction sizes and as a result have found a number of kimberlite indicator minerals, notably a number of indicators in the 2.0 – 3.0 mm size that are larger than the usual upper cut-off for commercial labs' mesh sizes. Additionally, I pick far more potential KIMs than any lab can reasonably do, given time/cost constraints. I recently purchased a complete heavy mineral lab formerly operated by True North Mineral Laboratories in Timmins to integrate as another part of my KIM processing equipment.

Redundancy tests are routinely performed to monitor potential losses of the KIMs and I feel my equipment and techniques closely match that of the industry.

Signed:

March 22, 2019

57 – Hound Chute Lake – 212123, 128936, 326238, 279661, 230928, 326237, 312714, 326239, 128937, 117276, 145465

References & Resources:

Adamera Minerals: Amaruk Project Presentation. Accessed online at http://www.adamera.com/i/pdf/ppt/Amaruk-Project-Presentation.pdf

Agashev, A.M., Nakai, S., Orihashi, Y., Pokhilenko, N.P., Serov, I.V., Tolstov, A.V. (2016). Age of Mirny field kimberlites (Siberia) and application of rutile and titanite for U-Pb dating of kimberlite emplacement by LA-ICP-MS; in Geochemical Journal Vol. 50 (2016) No. 5 pp 431-438, pub by Geochemical Society of Japan; Accessed from: https://www.jstage.jst.go.jp/article/geochemj/50/5/50_2.0438/_article

AJS Gems (n.d.). Accessed at https://www.ajsgem.com/gemstone-information/color-change-garnet-36.html

AJS Gems (n.d.). Accessed at https://www.ajsgem.com/articles/rare-leuco-garnet.html

Allan, S.E. (2001). Regional modern alluvium sampling survey of the Temagami-Marten River area, northeastern Ontario; Ontario Geological Survey, Open File Report 6043, 194p.

Amor, S., Brushett, D. (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 p.

Arctic Star Presentation (2014). Arctic Announces new 100% owned Property in the heart of the Lac de Gras diamond field. Accessed online at http://www.arcticstar.ca/s/NewsReleases.asp?ReportID=684168&_Title=Arctic-Announces-new-100-owned-Property-in-the-heart-of-the-Lac-de-Gras-dia...

Arctic Star Presentation (2016). Retrieved from: http://www.arcticstar.ca/i/pdf/Presentation-2016-03.pdf page 13 of 22

Ashbury, D., Breeding, Padua, P., Shigley, J.E., Shirey, S.B., Shor, R. (2016). Mining Diamonds in the Canadian Arctic: The Diavik Mine. Gems & Gemology, Summer 2016, Vol. 52, No. 2. Retrieved from https://www.gia.edu/gems-gemology/summer-2016diamonds-canadian-arctic-diavik-mine

Ashchepkov, I.V., Ntaflos, T., Logvinova, A.M., Spetsius, Z.V., Downes, H., Vladykin, N.V. (2016). Monomineral universal clinopyroxene and garnet barometers for peridotitic, eclogitic and basaltic systems: China University of Geosciences (Beijing); Geoscience Frontiers 8 (2017) 775-795. Accessed online at: http://www.sciencedirect.com/science/article/pii/S1674987116300688

Attawapiskat. (2015). Retrieved from http://metalexventures.com/attawapiskat/

Ayer, J.A., Chartrand, J.E., Grabowski, G.P.D., Josey, S., Rainsford, D. and Trowell, N.F. (2006). Geological compilation of the Cobalt–Temagami area, Abitibi greenstone belt; Ontario Geological Survey, Preliminary Map P.3581, scale 1:100 000

Bajc, A.F. and Crabtree, D.C. (2001). Results of regional till sampling for kimberlite and base metal indicator minerals, Peterlong Lake-Radisson Lake area, northeastern Ontario; Ontario Geological Survey, Open File Report 6060, 65p.

Baker, C.L., Gao, C. and Perttunen, M. (2010). Quaternary geology of the Cobalt area, northern Ontario; Ontario Geological Survey, Map 2685, scale 1:50 000

Barnett, R. L., Baron, K. M., Ewanchuck, J. (1995). Case history of the OPAP kimberlite pipe, Northeastern Ontario. Unpublished report, Cobalt Resident Geologists Office

Barron, K. M., Barnett, R. L., and Ewanchuck, J. (1995). Case history of the OPAP kimberlite pipe, Northeastern Ontario. Unpublished report, Cobalt Resident Geologists Office

Barron, K. M. (1995). A Geologist on the Trail of a Canadian Find (Dec 3, 1995). Accessed online at http://www.diamonds.net/News/NewsItem.aspx?ArticleID=1032&ArticleTitle=A+Geologist+on+the+Trail+of+a+Canadian+Find

Basa, E. (2006, Dec 16). *Assessment Report on Till Sampling, Prospecting and Ground Geophysics on Kimberlite Targets in Lorrain Township.* Larder Lake Mining Division for Tres-Or Resources Ltd.

Basa, E. (2007, Dec 8). *Assessment Report on Prospecting and Trenching on Kimberlite Targets in Lorrain Township*. Larder Lake Mining Division for Tres-Or Resources Ltd.

Baumgartner, M.C., Gurney, J.J., Moore, R.O., Nowicki, T.E. (2007). Diamonds and associated heavy minerals in kimberlite: a review of key concepts and applications. Developments in Sedimentology, Vol. 58, Chapter 46 pp1235–1267. Accessed online at http://www.msgroup.net/documents/Nowicki-et-al-2007-Diamonds-and-assoc-HMs-in-kimberlite-.pdf

Beaudoin, G., Dupuis, C., McClenaghan, B., Blain, J., & McMartin, I. (2011). Application of iron-oxide discriminant diagrams in mineral exploration. in the 25th International Applied Geochemistry Symposium 2011, 22-26 August 2011 Rovaniemi, Finland. Vuorimiesyhdistys, pp 35-39. Accessed online at http://www.vuorimiesyhdistys.fi/sites/default/files/julkaisut/25thIAGS2011_W3_net.pdf

Belousova, E.A., Fisher, N.I., Griffin, W.L., O'Reilly, S.Y. (2002). Igneous zircon: trace element composition as an indicator of source rock type. Contrib Mineral Petrol (2002) 143: 602–622. Accessed online at: http://gemoc.mq.edu.au/TerraneChronpds/269%20Belousova.pdf

Berger, J., Demaiffe, D., Pivin, M. (2011). Nature and origin of an exceptional Cr-rich kyanite-bearing clinopyroxenite xenolith from Mbuji-Mayi kimberlite (DRC). Eur. J. Mineral. 2011, 23, 257–268 Published online January 2011. Accessed at http://www.ulb.ac.be/sciences/gigc/index_fichiers/publication/publi%20Pivin%20EJM.pdf

Berggren, G., Fels P., Kresten, P. (1975). Kimberlitic Zircons - A Possible Aid in Prospecting for Kimberlites; Mineralium Deposita February 1975, Volume 10, Issue 1, pp 47–56. Accessed online at https://link.springer.com/article/10.1007/BF00207460

Bishop, B.A. (2016). Paradis Pond Work Assessment Report, Legacy Claim L4273040, Lorrain Township, Larder Lake Mining Division, MNDM, Oct 3, 2016

Bishop, B.A. (2017a). Mozart Lake Work Assessment Report, Legacy Claim L4284088, Gillies Limit, Larder Lake Mining Division, MNDM, Jan 26, 2017

Bishop, B.A. (2017b). Cedar Pond Work Assessment Report, Legacy Claims L4282189 and L4282187, Lorrain Township, Larder Lake Mining Division, MNDM, Nov 2, 2017

Bishop, B.A. (2017c). Ice Chisel and Darwin Lakes Work Assessment Report, Legacy Claim L4282172, Gillies Limit, Larder Lake Mining Division, MNDM, Nov 27, 2017

Bishop, B.A. (2017d). Chopin Lake Work Assessment Report, Legacy Claim L4282175, Gillies Limit, Larder Lake Mining Division, MNDM, Nov 27, 2017

Bishop, B.A. (2017e). Work Assessment Report, Legacy Claim L4282176, Gillies Limit, Larder Lake Mining Division, MNDM, Nov 27, 2017

Bishop, B.A. (2017f). Criostal Lake Work Assessment Report, Legacy Claim L4282146, Lorrain Township, Larder Lake Mining Division, MNDM, Nov 27, 2017

Bishop, B.A. (2017g). Longfellow Lake Work Assessment Report, Legacy Claims L4282174 and L4282408, Lorrain Township, Larder Lake Mining Division, MNDM, Nov 27, 2017

Bishop, B.A. (2017h). Lightning Lake Work Assessment Report, Legacy Claims L4281431 and L4282409, Lorrain Township, Larder Lake Mining Division, MNDM, Nov 27, 2017

Bishop, B.A. (2018a). The Trench Work Assessment Report, Legacy Claim L4282142, Lorrain Township, Larder Lake Mining Division, MNDM, June 6, 2018
Bishop, B.A. (2018a). The Trench Work Assessment Report, Legacy Claim L4282142, Lorrain Township, Larder Lake Mining Division, MNDM, June 6, 2018

Bishop, B.A. (2018b). The Grassy Lake Project Work Assessment Report, Legacy Claims L4282444, L4282707, and L4286187, Lorrain Township, Larder Lake Mining Division, MDNM, June 18, 2018

Bishop, B.A. (2018c). Assessment Work Report for Cell Claims 337054, 241583, 194992, 241582, 230056 arising from Legacy Claim 4282412 (Peanut Lake), Lorrain Township, Larder Lake Mining Division, MNDM, August 17, 2018

Black Orthopyroxene (n.d.). Image referenced from https://en.wikipedia.org/wiki/Pyroxene

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.

Brushett, D. (2014). Prospecting Under Cover: Using Knowledge of Glacial Processes in Mineral Exploration. Notes to accompany CIM Short Course Nov 5, 2014. Geological Survey of Newfoundland and Labrador.

Burt, A.K. and Hamilton, S.M. (2004). A comparison of selective leach signatures over kimberlites and other targets; Ontario Geological Survey, Open File Report 6142, 179p.

Campbell, J.E., McClenaghan, M.B., McMartin, I., Paulen, R.C., Plouffe, A., Spirito, W.A. (2013). Quality Assurance and Quality Control Measures Applied to Indicator Mineral Studies at the Geological Survey of Canada. *New frontiers for exploration in glaciated terrain*; Geological Survey of Canada, Open File 7374, pp13-19. doi:10.4095/292679

Carlson, S. M. *Prospector's Guide to the Field Recognition of Kimberlites, Lamproites and Lamprophyres,* Kit 56, Mining Recording Office, Kirkland Lake

Carter Hearn Jr., B. (2004). The Homestead Kimberlite, Central Montana, USA: Mineralogy, xenocrysts, and upper-mantel xenoliths. In The 8th International Kimberlite Conference, Selected Papers Vol 2: The J. Barry Hawthorne Volume, Editors R.H. Mitchell, H.S. Grütter, L.M. Heaman, B.H. Scott Smith, T. Stachel (2004) Elsevier. pp 481

Chakhmouradian A.R., Mitchell, R.H. (2000). Occurrence, Alteration Patterns and Compositional Variation Of Perovskite In Kimberlites; The Canadian Mineralogist August 2000 38 (4) pub by Mineralogical Association of Canada, 2000 Vol 55 (4). Accessed online at: http://canmin.geoscienceworld.org/content/38/4/975

Cisowski, S.M. (1990). The significance of magnetic spheroids and magnesioferrite occurring in K/T boundary sediments, *in* Sharpton, V.L., and Ward, P.D., eds, Global catastrophes in Earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality: Geological Society of America Special Paper 247, 1990.

Citrine (2013). Is your Citrine Real or Fake Citrine. Accessed online at: https://hibiscusmooncrystalacademy.com/?s=citrine

CLAIMaps IV. Retrieved from http://www.gisapplication.lrc.gov.on.ca/CLAIMaps/Index.html?site=CLAIMaps&viewer=CLAIMaps&locale=en-US

Clements, B., Grenon, H., Grütter, H., Neilson, S., Pell, J. (2013). Following Kimberlite Indicator Minerals to Source in the Chidliak Kimberlite Province, Nunavut. Geological Survey of Canada, Open File 7374. pp51

Cook, F.A. (2002). Geophysical Methods Used in Exploration for Gemstones. In RECORDER, Nov 2002, Vol 27 No.9. Retrieved from http://csegrecorder.com/articles/view/geophysical-methods-used-in-exploration-for-gemstones

Crabtree, D.C., Tardif, N.P. (2000). Kimberlite indicator minerals from till samples in the River Valley–Verner area, northeastern Ontario; Ontario Geological Survey, Open File Report 6040, 61p.

Creighton, S., Harvey, S., Read, G. (2011). Diamond Exploration on the Sask Craton: A challenge for current paradigms. Saskatchewan Research Council, 2011. Accessed at http://www.publications.gov.sk.ca/details.cfm?p=82822&cl=4

Cummings, D.I., Kjarsgaard, B.A., Russell, H.A.J., and Sharpe, D.R., (2014). Comminution of kimberlite indicator minerals in a tumbling mill: Implications for mineral exploration; Geological Survey of Canada, Open File 7111. doi:10.4095/293467 accessed at http://publications.gc.ca/collections/collection_2014/rncan-nrcan/M183-2-7111-eng.pdf

Daniels, L.R.M., Tshireletso A. Dira, T.A., Kufandikamwe, O. (2017). The magnitude of termites to the future of kimberlite exploration in Botswana. 11th International Kimberlite Conference Extended Abstract No. 11IKC-4555, 2017

Daniels, L.R.M., Gurney, J.J., Harte, B. (1996). A crustal mineral in a mantle diamond: *Nature* **379**, 153 - 156 (11 January 1996); doi:10.1038/379153a0. Accessed online at http://www.nature.com/nature/journal/v379/n6561/abs/379153a0.html?foxtrotcallback=true

Danoczi, J. (2008, February). Water requirements for the recovery of diamonds using grease technology. *The Journal of The South African Institute of Mining and Metalurgy, 108*, pp.123-129. Retrieved from http://www.saimm.co.za/Journal/v108n02p123.pdf

Das, J.N., Fareeduddin, M.M., Korakoppa, Shivanna, S., Srivastava, J.K. (2013). Tuffisitic Kimberlite from Eastern Dharwar Craton, Undraldoddi Area, Raichur District, Karnataka, India; in DG Pearson et al. (eds) Proceedings of the 10th International Kimberlite Conference, Vol 2, Special Issue of the Journal of the Geological Society of India

Davies, B. (2017). Stress and Strain. In *Explaining the science of Antarctic Glaciology* (AntarcticGlaciers.org). Accessed online at http://www.antarcticglaciers.org/modern-glaciers/glacier-flow-2/glacier-flow-ii-stress-and-strain/

de Lazaro, E. (2012, May 16). Diamonds and Chocolate: New Volcanic Process Discovered. Accessed at http://www.sci-news.com/othersciences/geophysics/article00319.html

de Silva, S.L., Wolff, J.A., and Sharpton, V.L., (1990). Explosive volcanism and associated pressures: Implications for models of endogenically shocked quartz, *in* Sharpton, V.L., and Ward, P.D., eds, Global catastrophes in Earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality: Geological Society of America Special Paper 247, 1990.

deGris, J., Lovell, H.L. (1978). Lorrain Township, Southern Part, Concessions I to VI, District of Timiskaming. Ontario Geological Survey Preliminary Map. P1559

Dempsey, S., Grenon, H., Grütter, H., Lockhart, G., Neilson, S., Pell, J. (2012). Exploration and Discovery of the Chidliak Kimberlite Province, Baffin Island, Nunavut: Canada's Newest Diamond District. Proceedings of the 10th International Kimberlite Conference, Volume 2. pp209-227. January 2013. Retrieved from https://www.researchgate.net/publication/257922249

Department of Energy, Mines and Resources, Surveys and Mapping Branch (1983). Cobalt, Ontario-Quebec map 31 M/5

Diamond Recovery. Retrieved from http://www.stornowaydiamonds.com/English/our-business/diamond-fundamentals/diamondrecovery/default.aspx

Diamonds from the Deep and Shallow. Retrieved from http://www.gemoc.mq.edu.au/Annualreport/annrep1998/Reshighlights98.htm#diamonds

DiLabio, R.N.W., Coker, W.B. (Editors) (1989). Drift Prospecting. Geological Survey of Canada, Paper 89-20.

Dredge, L.A., Kerr, D.E., Kjarsgaard, I.M., Knight, R.D., Ward, B.C. (1997). Kimberlite Indicator Minerals in Till, Central Slave Province, N.W.T., Canada; In "Proceedings of Exploration 97: Fourth Decennial International Conference on Mineral Exploration" edited by A.G. Gubins, 1997, p. 359–362

Eccles, D.R. (2008). *Geological Evaluation of Garnet-Rich Beaches in East-Central Alberta, with Emphasis on Industrial Mineral and Diamondiferous Kimberlite Potential*. Energy Resources Conservation Board Alberta Geological Survey September 2008. Retrieved from http://ags.aer.ca/document/OFR/OFR_2008_06.PDF

Energie et Ressources naturelles Quebec*, Exploration Methods,* accessed online at: https://www.mern.gouv.qc.ca/english/mines/industry/diamond/diamond-methods.jsp

Erlich, E.I., Hausel, W.D. (2002). *Diamond Deposits: Origin, Exploration, and History of Discovery*. Society for Mining, Metallurgy, and Exploration, Inc. (SME). Littleton, CO, USA
Feral, K. (2011). Idiochromatic or Allochromatic. In Magnetism in Gemstones: An Effective Tool and Method for Gem Identification. Retrieved from http://www.gemstonemagnetism.com/garnets_pg_3.html

Feral, K. (2011). Varieties of Pyrope Garnet. In Magnetism in Gemstones: An Effective Tool and Method for Gem Identification. Retrieved from http://www.gemstonemagnetism.com/garnets_pg_4.html

Feral, K. (2010). Magnetic Susceptibility Index. In Magnetism in Gemstones: An Effective Tool and Method for Gem Identification. Retrieved from http://www.gemstonemagnetism.com/garnets_pg_2.html

Feral, K. (2009). The Floatation Method - Magnetic Susceptibility Index. In Magnetism in Gemstones: An Effective Tool and Method for Gem Identification. Retrieved from https://www.gemstonemagnetism.com/how_to_pg_2.html

Feral, K. (2011). Color Change Garnet. In Magnetism in Gemstones: An Effective Tool and Method for Gem Identification. Retrieved from https://www.gemstonemagnetism.com/color_change_garnet.html

Ferguson, S.A., Freeman, E.B. (1978). Ontario Occurrences of Float, Placer Gold, and other Heavy Minerals. Ontario Geological Survey, Mineral Deposits Circular 17.

Firestone, R.B. (2009). The Case for the Younger Dryas Extraterrestrial Impact Event:Mammoth, Megafauna, and Clovis Extinction, 12,900 Years Ago. Journal of Cosmology, 2009, Vol 2, pages 256-285.
Cosmology, October 27, 2009. Accessed at http://cosmology.com/Extinction105.html

Foster, W. R. (1948, November). Useful aspects of the fluorescence of accessory-mineral-zircon. *American Mineralogist, 33*(11), pp.724-735. Retrieved from http://www.minsocam.org/ammin/AM33/AM33_724.pdf

Gao, C. (2012). Results of regional till sampling in the Cobalt-New Liskeard-Englehart areas, northern Ontario; Ontario Geological Survey, Open File Report 6259, 87p.

Gee, J.S., Heaman, LM., Kent, D.V., Kjarsgaard, B.A., Muttoni, G. (2015). Tracking the Late Jurassic apparent (or true) polar shift in UPb-dated kimberlites from cratonic North America (Superior Province of Canada). *Geochemistry Geophysics Geosystems*. 16:983-994. Retrieved from http://scrippsscholars.ucsd.edu/jsgee/content/tracking-late-jurassic-apparent-or-true-polar-shift-u-pb-datedkimberlites-cratonic-north-am

Gem Select (2018). Accessed at https://www.gemselect.com/gem-info/color-change-garnet/color-change-garnet-info.php

Geology and Geosciences. Natural Resources Canada. http://www.nrcan.gc.ca/earth-sciences/geography/atlas-canada/selectedthematic-maps/16876

Google Inc. (2016). Google Earth (Version 7.1.7.2600) [Software]. Available from https://www.google.ca/earth/download/ge/agree.html

Grabowski, G. (2006). 1) Exploration for kimberlite and diamonds in Kirkland Lake-New Liskeard area; 2) Diamonds in Lamprophyre – Kirkland Lake area; 3) Where are the kimberlites in NW Ontario. In 2005-2006 Recommendations for Mineral Exploration – Ontario. Accessed at
https://www.mndm.gov.on.ca/sites/default/files/article_files/recommendations_for_exploration_2005_2006.pdf

Grizzly Discoveries: Buffalo Hills Diamond Property, Alberta. Accessed online at **From** http://www.grizzlydiscoveries.com/index.php/investor-relations/news/91-grizzly-provides-update-for-diamond-exploration-in-northern-alberta

Grutter, H. S., Gurney, J. J., Menzies, A. H., Winter, F. (2004, June 17). An updated classification scheme for mantle-derived garnet, for use by diamond explorers. *Lithos 77*, pp.841-857. Retrieved from https://www.pdiam.com/assets/docs/articles/grutter-et-alupdated-garnet-classification-scheme-for-explorers-lithos-2004.pdf

Guindon, D.L. and Reid, J.L. (2005). Regional modern alluvium sampling of the Kirkland Lake-Matachewan area, northeastern Ontario; Ontario Geological Survey, Open File Report 6124, 121p.

Guindon, D.L., Farrow D.G., Grabowski, G.P.B., Debicki, R.L., Lockwood, H.C., Wilson, A.C., Halet, S.E., Bardeggia, L.A. and Sabiri, N. (2013). Report of Activities 2012, Resident Geologist Program, Kirkland Lake Regional Resident Geologist Report: Kirkland Lake and Sudbury Districts; Ontario Geological Survey, Open File Report 6287, 117p.

Haggerty, S.F., Fung, A. (2006). Orbicular oxides in carbonatitic kimberlites. In American Mineralogist, Vol 91, pp1461-1472, 2006. Accessed at http://www.minsocam.org/MSA/AmMin/TOC/Abstracts/2006_Abstracts/Oct06_Abstracts/Haggerty_p1461_06.pdf

Harvey, S.E., Kjarsgaard, B.A., Kelley, L.I. (2001). Kimberlites of Central Saskatchewan: Compilation and Significance of Indicator Mineral Geochemistry with Respect to Diamond Potential. In Summary of Investigations, 2001, Volume 2, Saskatchewan Geological Survey, Sask. Energy Mines, Misc. Rep. 2001-4.2. Accessed at http://publications.gov.sk.ca/documents/310/88680-kjarsgaard.pdf

Hausel, W.D. (2014). *A Guide to Finding Gemstones, Gold Minerals & Rocks*. GemHunter Publications.

Head III, J. W., Wilson, L. (2007, May 3). An integrated model of kimberlite ascent and eruption. *Nature,* 4471

Heffernan, V. (2008, August 15). Diamond Discoveries in Canada's North. *Earth Explorer.* Retrieved from http://www.earthexplorer.com/2008-08/Diamond_Discoveries_in_Canada_North.asp

Hetman, C.M., Paul, J.L., Smith S.B.H., Webb, K.J. (2004). Geology of the Victor Kimberlite, Attawapiskat, Northern Ontario, Canada: cross-cutting and nested craters. Accessed online at http://www.kwgresources.com/_resources/McFadyen/v762004Webb-geol_of_Victor_kimberlite_Attawapiskat_Ont.pdf

Hiyate, A. (2017). SHORE finds potential partner in Rio Tinto. In *Diamonds in Canada*, November 2017, The Northern Miner, pp8-10.

Horita, J., Polyakov, V.B. (2015). Carbon-bearing iron phases and the carbon isotope composition of the deep Earth. Proc Natl Acad Sci U S A. 2015 Jan 6; 112(1): 31–36. Accessed online at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4291649/

Hornung, G., Nixon, P.H. (1968). A New Chromium Garnet End Member, Knorringite, From Kimberlite, The American Mineralogist, Vol. 53, November-December, 1968. pp

Hot Zircons: An Indicator for Diamond Exploration (2009, June). Retrieved from http://www.asipl.com.au/f.ashx/Downloads/Alphachron/Alphachron-Diamond.pdf

Hunt, L., Stachel, T., Morton, R., Grütter, H., & Creaser, R. A. (2009). The Carolina kimberlite, Brazil - Insights into an unconventional diamond deposit. *Lithos*, *112*, 843-851. DOI: 10.1016/j.lithos.2009.04.018

Indicator Minerals for Diamonds. Retrieved from http://earthsci.org/mineral/mindep/diamond/Indicator.html

Joy S., Lynn M., Preston R. (2013). The Geology and Geochemistry of the Wadagera Kimberlite and the Characteristics of the Underlying Subcontinental Lithospheric Mantle, Dharwar Craton, India. In: Pearson D. et al. (eds) Proceedings of 10th International Kimberlite Conference. Springer, New Delhi

Kaminsky, F. V., Wirth (2011). Iron carbide inclusions in lower-mantle diamond from Juina, Brazil. The Canadian Mineralogist, 49, 2, 555-572. Accessed online at http://gfzpublic.gfz-potsdam.de/pubman/item/escidoc:243553:2/component/escidoc:243552/17067.pdf

Kavanagh, J.L., Sparks, R.S.J. (2009). "Temperature changes in ascending kimberlite magmas". *Earth and Planetary Science Letters*. Elsevier. 286 (3–4): 404-413. Accessed at http://www.academia.edu/193612/Temperature_changes_in_ascending_kimberlite_magma

Keating, P., Sailhac, P. (2004). Use of the analytic signal to identify magnetic anomalies due to kimberlite pipes. Geophysics Vol 69 Jan 2004 pp180-190. Retrieved from http://geophysics.geoscienceworld.org/content/69/1/180.full

Kennedy, C.M. (2008). The Physical Properties of the Lac de Gras Kimberlites and Host Rocks with Correlations to Geophysical Signatures at Diavik Diamond Mines, NWT: A thesis submitted to the School of Graduate Studies in the partial fulfillment of the requirements for the degree of Masters of Science (Geophysics) Department of Earth Sciences Memorial University of Newfoundland St. John's, Newfoundland. February 3, 2008. Retrieved from http://research.library.mun.ca/10786/1/Kennedy_Carla.pdf

Kerr, D.E., Dredge, L.A., Kjarsgaard, I.M, Knight, R.D., and Ward, B.C. (1997). Kimberlite Indicator Minerals in Till, Central Slave Province, N.W.T., Canada; In "Proceedings of Exploration 97: Fourth Decennial International Conference on Mineral Exploration" edited by A.G. Gubins, 1997, p. 359–362

Kimberlites. Retrieved from http://www.umanitoba.ca/science/geological_sciences/faculty/arc/kimberlite.html

Kiseeva, E.S., Vasiukov, D.M., Wood B.J., *et al*. (2018). Oxidized iron in garnets from the mantle transition zone. *Nature Geoscience*, published online January 22, 2018; doi: 10.1038/s41561-017-0055-7. Accessed online at https://www.nature.com/articles/s41561-017-0055-7

Kjarsgaard, B.A. (2007). Kimberlite Pipe Models: Significance for Exploration. In B. Milkereit. *Proceedings of Exploration 07: Fifth Decennial International Conference on Mineral Exploration.* (pp. 667-677). Retrieved from http://www.dmec.ca/ex07dvd/E07/pdfs/46.pdf

Kjarsgaard, B.A., Kjarsgaard, I.M., McClenaghan, M.B. (2004). Kimberlite Mineral Chemistry and Till Geochemistry around the Seed and Triple B Kimberlites, Lake Timiskaming, Ontario; *Geological Survey of Canada, Open File 4822*, pp. 27

Kjarsgaard, B.A., McClenaghan, M.B. (2001). Indicator mineral and geochemical methods for diamond exploration in glaciated terrain in Canada. In Drift Exploration in Glaciated Terrain. Geological Society of London, Special Publications, 185, 83-123

Kjarsgaard, B.A., McClenaghan, M.B. (2003). the Seed and Triple B Kimberlites and Associated Glacial Sediments, Lake Timiskaming, Ontario; *Geological Survey of Canada, Open File 4492*

Kjarsgaard, I.M., Paulen, R.C., Plouffe, A., Smith, I.R. (2007). Chemistry of kimberlite indicator minerals and sphalerite derived from glacial sediments of northwest Alberta, *Alberta Energy and Utilities Board, Alberta Geological Survey, Special Report 87, Geological Survey of Canada, Open File 5545*

Klein, G. (2016). Arctic Star and North Arrow Announce Drilling at Redemption Diamond Project, March 22 2016. Accessed online at www.arcticstar.ca/i/pdf/presentation-2016-03.pdf

Kon, A.S. (2010). Work Report from 2009: Till Sampling, Prospecting, & Mechanical Stripping, Prepared for Cabo Mining Enterprises, Mar 29, 2010. Accessed at MRO, Kirkland Lake.

Kong, J.M., Boucher, D.R., Scott Smith, B.H. (1998) Exploration and Geology of the Attawapiskat kimberlites, James Bay Lowlands, Northern Ontario. Accessed at file:///D:/Attawapaskat%20kimberlites-KONG-BOUCHER-SCOTTSMITH-1998.pdf

Kono, M. (Ed) (2010). Geomagnetism: Treatise on Geophysics. Elsevier, May 11, 2010. *Science* pp205. Retrieved from https://books.google.ca/books?id=_YDNCgAAQBAJ&pg=PA205&lpg=PA205#v=onepage&q&f=false

Krajick, K. (2001). *Barren Lands: An epic search for diamonds in the North American Arctic*. Henry Holt and Company. New York, NY
Kravchinsky, V. (2014). Geomagnetism. *Earth Sciences Series. Encyclopedia of Scientific Dating Methods.* University of Alberta, Edmonton, Canada. Retrieved from 2014-Geomagnetism-Springer.pdf

Kresten, P, Fels P, and Berggren, G (1975). Kimberlitic Zircons - A Possible Aid in Prospecting for Kimberlites; Mineralium Deposita February 1975, Volume 10, Issue 1, pp 47–56. Accessed online at https://link.springer.com/article/10.1007/BF00207460

Lauf, R.J. (2012). *Collector's Guide to the Garnet Group.* Schiffer Earth Science Monographs Volume 12. Schiffer Publishing Ltd, Atglen, PA, USA

Lee, C. (n.d.). Contribution of structural geology. SRK News: Focus on Diamonds, 31, 3. Retrieved from http://www.srk.com/files/File/newsletters/SRKnews31-Diamonds_A4.pdf

Lovell, H.L., and de Grijs, J.W.. (1976). Lorrain Township, Southern Part, Concessions I to VI, District of Timiskaming; Ontario Dev. Mines, MP51, 16p.

Lynn M., Joy S., Preston R. (2013). The Geology and Geochemistry of the Wadagera Kimberlite and the Characteristics of the Underlying Subcontinental Lithospheric Mantle, Dharwar Craton, India. In: Pearson D. et al. (eds) Proceedings of 10th International Kimberlite Conference. Springer, New Delhi

Maiko Sell: Geophysical Survey Methods in Diamond Exploration. In Exploration Geophysics, Exploration Methods. Accessed online at: https://www.geologyforinvestors.com/geophysical-survey-methods-diamond-exploration/

Makvandi, S. (2015). Indicator mineral exploration methodologies for VMS deposits using geochemistry and physical characteristics of magnetite. PhD Thesis, University of Laval, Quebec.

McClenaghan, B., Peuraniemi, V. and Lehtonen, M. (2011). Indicator mineral methods in mineral exploration. Workshop in the 25th International Applied Geochemistry Symposium 2011, 22-26 August 2011 Rovaniemi, Finland. Vuorimiesyhdistys, B92-4, 72 pages.

McClenaghan, M.B. (2005). Indicator mineral methods in mineral exploration. Geochemistry: Exploration, Environment, Analysis, Vol. 5 2005, pp. 233–245. Geological Society of London

McClenaghan, M.B. , Kjarsgaard, B.A. (2001). Indicator mineral and geochemical methods for diamond exploration in glaciated terrain in Canada. In Drift Exploration in Glaciated Terrain. Geological Society of London, Special Publications, 185, 83-123

McClenaghan, M.B., Kjarsgaard, B.A., Kjarsgaard, I.M., Paulen, R.C., Stirling, J.A.R. (1999). Mineralogy and geochemistry of the Peddie kimberlite and associated glacial sediments, Lake Temiskaming, Ontario. Geological Survey of Canada, Open File 3775

McClenaghan, M.B., Paulen, R.C. (2013). New frontiers for exploration in glaciated terrain; Geological Survey of Canada, Open File 7374, pp85 doi:10.4095/292679

McLean, H., Banas, A., Creighton, S., Whiteford, S., Luth, R.W., Stachel, T., (2007). Garnet Xenocrysts from the Diavik Mine, NWT, Canada: Composition, Color, and Paragenesis. *The Canadian Mineralogist, 45.* pp. 1131-1145

Miller, W.G. (1905). Map of Cobalt-Nickel-Arsenic-Silver Area near Lake Temiskaming, to accompany report of W.G. Miller in the Fourteenth Report of the Bureau of Mines, 1905, based on Geological Survey by Willet G. Miller and Cyril W. Knight, 1904.

Milligan, R.S. (2014). Reaction of Iron-Titanium Oxide Minerals with Kimberlite Magma: A Case Study for Orapa Kimberlite Cluster. Submitted in Partial Fulfilment of the Requirements For the Degree of Bachelor of Sciences, Honours Department of Earth Sciences Dalhousie University, Halifax, Nova Scotia March, 2014. Accessed online at http://earthsciences.dal.ca/aboutus/publications/theses/BSc/ES_2014_BSc_Milligan_Rachel_final.pdf

Mineral Resources of the United States, Calendar Year, 1906. (1907). pp. 1220

Mining Land Administration System (MLAS) Map Viewer (2018). MNDM. Accessed at https://www.mndm.gov.on.ca/en/mines-and-minerals/applications/mining-lands-administration-system-mlas-map-viewer

Ministry of Natural Resources and Forestry: Make a Topo Map. Accessed online at: http://www.gisapplication.lrc.gov.on.ca/matm/Index.html?site=Make_A_Topographic_Map&viewer=MATM&locale=en-US

Ministry of Northern Development and Mines. Retrieved from http://www.mndm.gov.on.ca/en

Mitchell, R.H. (1986). Kimberlites: Mineralogy, Geochemistry, and Petrology; Springer Science & Business Media pub 2013, p. 263 Zirconian Minerals. Accessed online at: https://books.google.ca/books?id=RqvzBwAAQBAJ&pg=PA263&lpg=PA263&dq=kimberlite+zircon+fluorescence&source=bl&ots=SggCgci4jE&sig=1kbv2EnYEz-QkY4EdnD-r23rcXU&hl=en&sa=X&ved=0ahUKEwjU4oXRps_WAhVjJJoKHeNnDLsQ6AEIPjAG#v=onepage&q=kimberlite%20zircon%20fluorescence&f=false

Morimoto, N., Fabries, J., Ferguson, A K., Ginzburg, I.V., Ross, M., Seifeit, F.A., Zussman J. (1989). Nomenclature of Pyroxenes: Commission on New Minerals and Mineral Names, International Mineralogical Association. Canadian Mineralogist, Vol.27, pp. 143-156. Accessed at http://www.mineralogicalassociation.ca/doc/abstracts/ima98/ima98(12).pdf

Moss, S., Kobussen, A., Powell, W., Pollock, K., Cutts, J. (2017). Kimberlite emplacement and mantle sampling through time at A154N kimberlite volcano, Diavik Diamond Mine. In 11th International Kimberlite Conference Extended Abstract No. 111KC-4522, 2017. Accessed online at http://11ikc.com/long_abstract/11IKC%20Long%20Abstracts/11IKC_4522.pdf

Neilson, S., Grütter, H., Pell, J., Grenon, H. (2012). The evolution of kimberlite indicator mineral interpretation on the Chidliak Project, Baffin Island, Nunavut. Extended abstract 10IKC-162 in 10th International Kimberlite Conference, Bangalore, 2012.

Nestola, F., Jung, H., Taylor, L.A. (2016) Mineral inclusions in diamonds may be synchronous but not syngenetic. In Nature Communications. 24 Jan 2017. DOI: 10.1038/ncomms14168

Nguno, A.K. (2004). Kimberlite indicator minerals of the Gibeon Kimberlite Province (GKP), southern Namibia: Their character and distribution in kimberlite intrusions and fluval sediments. *Geological Survey of Namibia*, Namibia, 13. pp. 33-42

Nixon, P.H. And Hornung, G. (1968). A New Chromium Garnet End Member, Knorringite, From Kimberlite, The American Mineralogist, Vol.53, November December, 1968 Pp 1840

Nowicki, T.E., Moore, R.O., Gurney, J.J., Baumgartner, M.C. (2007). Diamonds and Associated Heavy Minerals in Kimberlite: A review of key concepts and applications. Developments in Sedimentology Vol 58 pp 1235-1267

Ontario Geological Survey (2000). Airborne Magnetic and Electromagnetic Survey, Temagami area, Ontario Geological Survey, Map 82 066

Pavel. K. (2011). Indicator minerals in diamond exploration: A case study from eastern Finnmark, Arkhangelsk and the Devonian Belt (Estonia, Lithuania, Novgorod, and Pskov) in the 25th International Applied Geochemistry Symposium 2011, 22-26 August 2011 Rovaniemi, Finland. Vuorimiesyhdistys, pp 15-19. Accessed online at http://www.vuorimiesyhdistys.fi/sites/default/files/julkaisut/25thIAGS2011_W3_net.pdf

Pilchin, A., Eppelbaum, L.V. (2004). On the stability of ferrous and ferric iron oxides and its role in rocks and rock-forming minerals stability. Scientific Israel, 2004, **6**, No. 3-4, 119-136. Accessed at https://www.researchgate.net/publication/240028866

Pivin M., Berger, J., And Demaiffe, D. (2011). Nature and origin of an exceptional Cr-rich kyanite-bearing clinopyroxenite xenolith from Mbuji-Mayi kimberlite (DRC). Eur. J. Mineral. 2011, 23, 257–268 Published online January 2011. Accessed at http://www.ulb.ac.be/sciences/gigc/index_fichiers/publication/publi%20Pivin%20EJM.pdf

Plouffe, A., McClenaghan, M.B., Paulen, R.C., McMartin, I, Campbell, J.E. and Spirito, W.A. (2013). Quality assurance and quality control measures applied to indicator mineral studies at the Geological Survey of Canada. In Paulen, R.C. and McClenaghan, M.B. (ed.), New frontiers for exploration in glaciated terrain; Geological Survey of Canada, Open File 7374 (2013).

Plouffe, A., Paulen, R.C., Smith, I.R., Kjarsgaard, I.M. (2007). Chemistry of kimberlite indicator minerals and sphalerite derived from glacial sediments of northwest Alberta, Alberta Energy and Utilities Board, Alberta Geological Survey, Special Report 87, Geological Survey of Canada, Open File 5545,

Power, M., Hildes, D. (2007). *Geophysical strategies for kimberlite exploration in northern Canada*. Paper 89 in "Proceedings of Exploration 07: Fifth Decennial International Conference on Mineral Exploration" edited by B. Milkereit, pp1025-1031. Retrieved from https://www.911metallurgist.com/blog/wp-content/uploads/2015/10/Geophysical-strategies-for-kimberlite-exploration-innorthern-Canada.pdf

Prairie C Lorrain Batholith Project: accessed at http://www.geocities.ws/Eureka/Account/6322/PcProprt.html

Quirt, D.H. (2004). Cr-diopside (clinopyroxene) as a kimberlite indicator mineral for diamond exploration in glaciated terrains; in Summary of Investigations 2004, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2004- 4.2, CDROM, Paper A-10, pp14. Retrieved from http://publications.gov.sk.ca/documents/310/88824-cquirt.pdf

Reed, L.E., Witherly, K.E. (2007). 50 Years of Kimberlite Geophysics, A Review; Ore Deposits and Exploration Technology, Paper 47. In Proceedings of Exploration 07: Fifth decennial International Conference on Mineral Exploration edited by B. Milkereit, 2007, p. 679-689. Accessed online at: https://www.911metallurgist.com/blog/wp-content/uploads/2015/10/50-Years-of-Kimberlite-Geophysics-A-Review.pdf

Reid, J. L. (2002). Regional modern alluvium sampling survey of the Mattawa-Cobalt corridor, northeastern Ontario. *Ontario Geological Survey, Open File Report 6088*. pp. 235

Reid, J.L. (2004). Regional modern alluvium sampling survey of the Cobalt-Elk Lake area, northeastern Ontario; Ontario Geological Survey, Open File Report 6119, 140p.

Roed, M.A., Hallett, D.R. (1979). Northern Ontario Engineering Geology Terrain Study, Data Base Map, Haileybury. Ontario Geological Survey, Map 5024.

Roy, M., Veillette, J.J., Daubois, V., Menard, M. (2015). Late-stage phases of glacial Lake Ojibway in the central Abitibi region, eastern Canada. In Geomorphology, Vol 248, Nov 2015, pp 14-23. Accessed online at http://www.sciencedirect.com/science/article/pii/S0169555X15300891

Sage, R. P. (2000). Kimberlites of the Lake Timiskaming Structural Zone. Supplement. *Ontario Geological Survey, Open File Report 6018*, pp. 12

Scott Smith, B.H., Nowicki, T.E., Russell, J.K., Webb, K.J., Mitchell, R.H., Hetman, C.M., Harder, M., Skinner, E.M.W., and Robey, Jv. A. (2013). Kimberlite Terminology and Classification. In Proceedings of 10th Annual Kimberlite Conference, Vol 2. Editors D. Graham Pearson, Herman S. Grutter, Jeff W. Harris, Bruce A. Kjarsgaard, Hugh O'Brien, N V Chalapathi Rao, Steven Sparks, 2013.

Sears, S.M. (2001). Report on Alluvial Sampling in the Schumann Lake Area Cobalt Project, for Cabo Mining Corp, Mar 14, 2001. Accessed at MRO, Kirkland Lake.

Senecal, C.O., Richard, L.N., Prudhomme, O.E., Lefebvre, H. (1910) Map 18A, Lake Timiskaming, Mining Region, Ontario and Quebec. Canada Department of Mines, Geological Survey, 1910.

Sharygin, I.S., Litasov, K.D., Shatskiy, A., Safonov, O.G., Golovin, V., EijiOhtani, Pokhilenko, N. (2017). Experimental constraints on orthopyroxene dissolution in alkali-carbonate melts in the lithospheric mantle: Implications for kimberlite melt composition and magma ascent. In Chemical Geology, Volume 455, 20 April 2017, pp 44-56. Accessed at https://www.sciencedirect.com/science/article/pii/S0009254116305071

Shigley, J.E., Shor, R., Padua, P., Breeding, Shirey, S.B., Ashbury, D. (2016). Mining Diamonds in the Canadian Arctic: The Diavik Mine. Gems & Gemology, Summer 2016, Vol. 52, No. 2. Retrieved from https://www.gia.edu/gems-gemology/summer-2016-diamonds-canadian-arctic-diavik-mine

Shigley, J.E., Shirey, S.B. (2013). Recent Advances in Understanding the Geology of Diamonds: in Gems & Gemology, Winter 2013, Vol. 49, No.4. Accessed at https://www.gia.edu/gems-gemology/WN13-advances-diamond-geology-shirey

Simandl, G.J., Ferbey, T., Levson, V.M., Robinson, N.D., Lane, R., Smith, R., Demchuk, T.E., Raudsepp, I.M., and Hickin, A.S. (2005). Kimberlite and Diamond Indicator Minerals in Northeast British Columbia, Canada - A Reconnaissance Survey, British Columbia Ministry of Energy, Mines Petroleum Resources GeoFile 2005-25, 25 pages. Accessed at http://www.empr.gov.bc.ca/Mining/Geoscience/PublicationsCatalogue/GeoFiles/Documents/2005/GF2005-25.pdf

Staebler, G., Blauwet, D., Zitto, G., Pohwat, P., Zang, J., Fehr, T. (2008). "Classic Garnets: Almandine", in *Garnet, Great Balls of Fire*, edited by H. Albert Gilg, et al., Lithographie, LLC, East Hampton, Connecticut.

Staebler, G., Pohwat, P. (2008). "Classic Garnets: Spessartine", in *Garnet, Great Balls of Fire*, edited by H. Albert Gilg, et al., Lithographie, LLC, East Hampton, Connecticut.

Stone, R.S., Luth, R.W. (2016). Orthopyroxene survival in deep carbonatite melts: implications for kimberlites. In Contributions to Mineralogy and Petrology, July 2016, 171:63. Accessed at https://link.springer.com/article/10.1007%2Fs00410-016-1276-2

Stripp, G.R., Field, M., Schumacher, J.C., Sparks, R.S.J., Cressey, G. (2006). Post-emplacement serpentinization and related hydrothermal metamorphism in a kimberlite from Venetia, South Africa. Journal of Metamorphic Geology. 24. 515 - 534. 10.1111/j.1525-1314.2006.00652.x. Accessed at https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1525-1314.2006.00652.x

Tardif, N.P. and Crabtree, D.C. (2000). Kimberlite indicator minerals from till samples in the River Valley–Verner area, northeastern Ontario; Ontario Geological Survey, Open File Report 6040, 61p.

The Gazette Montreal (1906, Thursday July 26, pp 5). Stone Sent to New York: New Ontario Diamond Declared to be Real Thing

The Jewelers' Circular-Weekly. (1906, August 1). Report of a Diamond Find Near Lake Nipissing in Canada. pp. 55.

The Mining Journal (1906, Sept 22). pp333. Accessed at https://archive.org/stream/canminingjournal1906donm/canminingjournal1906donm_djvu.txt

The Montreal Herald (1906, Monday Nov 12). *The Diamond Find in Temiskaming*

Thomson, R. (1960-1). Preliminary Report on the Geology of North Part Lorrain Township (Concessions 7-12) District of Temiskaming. Ontario Department of Mines, P.R. 1960-1.

Thomson, R. (1960-2). Preliminary Report on Bucke Township District of Timiskaming. Description of Ministry Properties. Ontario Department of Mines, P.R. 1960-2.

Thomson, R. (1960-3). Preliminary Report on part of Coleman Township and Gillies Limit to the South and Southwest of Cobalt, District of Timiskaming. Ontario Department of Mines, P.R. 1960-3.

Thomson, R. (1961). Preliminary Report on parts of Coleman Township, Concessions III, Lots 1 to 3 and Gillies Limit, Blocks 1 and 2; Claims A 48 to 58 and A 88 to 100, District of Timiskaming. Ontario Department of Mines, P.R. 1961-7.

Tschauner, O., Huang, S., Greenberg, E., Prakapenka, V.B., Ma, C., Rossman, G.R., Shen, A.H., Zhang, D., Newville, M., Lanzirotti, A., Tait, K. (2018). Ice-VII inclusions in diamonds: Evidence for aqueous fluid in Earth's deep mantle. In Science 09 Mar 2018: Vol 359, Issue 6380, pp. 1136-1139

United States Geological Survey, Dept of the Interior (1906). Mineral Resources of the United States-Canada. Government Printing Office, Washington, 1907, pp 1220. Accessed at https://babel.hathitrust.org/cgi/pt?id=mdp.39015035039117;view=1up;seq=9

Veillette, J.J. (1989). Ice Movements, till sheets and glacial transport in Abitibi-Timiskaming, Quebec, and Ontario: in Drift Prospecting, ed. R.N.W. DiLabio and W.B. Coker; Geological Survey of Canada, Paper 89-20. pp 139-154.

Ward, C. Slide 16 of 34 Glaciers as Landforms 2% of all water 88% of FW Covers Antarctica and Greenland avg 2.5 km thick Max 4 km thick During Pleistocene 20% of water on. Published by Chrystal Ward. Accessed online at Google Images

Webb, K.J., Scott Smith, B.H., Paul, J.L., Hetman, C.M. (2004). Geology of the Victor Kimberlite, Attawapiskat, Northern Ontario, Canada: cross-cutting and nested craters. Accessed online at http://www.kwgresources.com/_resources/McFadyen/v762004Webb-geol_of_Victor_kimberlite_Attawapiskat_Ont.pdf

Wolbach, W.S., Gilmour, I., and Anders, E. (1990). Major wildfires at the Cretaceous/Tertiary boundary, *in* Sharpton, V.L., and Ward, P.D., eds, Global catastrophes in Earth history: An interdisciplinary conference on impacts, volcanism, and mass mortality: Geological Society of America Special Paper 247, 1990.

Yirka, B (2012). New research explains how diamond rich kimberlite makes its way to Earth's surface in Earth / Earth Sciences, January 19, 2012 Accessed online at https://phys.org/print246180331.html

Acknowledgements

To the following individuals (alphabetically listed) who provided geological, technical, historical, and other important help relating to Claim L 4282402: Chloë Bishop, Graeme Bishop, Jesse Bishop, Shelley Bishop, David Crouch, Gary Grabowski, Patrick Harrington, Mike Leahy, Doug Robinson, and the staff of the K.L. MNDM.

Appreciation is expressed also to staff at MNDM Sudbury for their assistance with completing MNDM forms and procedures.

Thank you.