Recommendations for Exploration in the Kirkland Lake District

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NAME OF PROPERTY OR AREA:
Follow-up to Cross Lake Mineral's Base Metal Discovery in Sheraton Township
AREA WHERE LOCATED: SW and S of Matheson
COMMODITIES OF INTEREST: zinc, copper, lead, silver and gold

DESCRIPTION:
The recent discovery of massive sulfide mineralization by Cross Lake Minerals Ltd. in Sheraton Township, 25 km SW of Matheson, prompted a staking rush covering available volcanic rocks in the area. The discovery is within the Timmins Resident Geologist's region, however, the eastern strike extension of the volcanic rocks, hosting the discovery, is in the Kirkland Lake Resident Geologist's region. According to the most recent mapping in the area (Pyke, 1976), the discovery is located on the south side and at the stratigraphical top of a mafic tuff and lapilli-tuff unit within unsubdivided mafic metavolcanic rocks. A synclinal fold axis, apparently plunging to the east, has been interpreted from top determinations on pillow lava flows to occur approximately in the middle of Sheraton Township. The pyroclastic unit wraps around the nose of the fold at the southeastern part of Night Hawk Lake. This unit, interlayered with unsubdivided mafic volcanic rocks, has been interpreted to continue, as part of the north facing southern limb of the fold, to at least as far east as the southeastern quadrant of Sheraton Township. Tracing the continuity of the pyroclastic rocks farther to the east is complicated by several large felsic intrusions. The mafic pyroclastic unit of the northern limb has been traced eastwards as far as the common boundary of Sheraton and Egan townships. Where a NNW trending sinistral fault is shown as cutting off this unit. On the eastern side of this fault, three kilometers to the north, an intermediate to felsic tuff and lapilli-tuff unit occurs. This unit, also shown on the Timmins-Kirkland Lake Geological Compilation Series, Map 2205, continues to the east for more than 30km to Cook Township. The discontinuity of the felsic and mafic pyroclastic unit on opposite sides of the fault suggests that it is the same rock unit. If so, a stratigraphical horizon, "favorable" to massive volcanogenic massive sulfide deposits, can be explored for a strike length of 45 km along the northern limb. The "favorable" horizon of the southern limb has a minimum strike length of 15 km and may continue farther to the east and possibly south in disjointed, irregularly shaped remnant blocks of volcanic rocks wrapping around felsic intrusions.

A volcanic base metal deposit occurs in Robertson Township approximately 18 km south of the Cross Lake discovery. Considering the distribution and configuration of the volcanic rocks and the intrusions, it is conceivable that the two occurrences may be at the same stratigraphical horizon. If this were the situation, then the length of the "favorable" base metal horizon would increase substantially.

Some of the townships near the Cross Lake discovery have been subjected only to limited exploration. Airborne geophysical survey coverage and detailed geological mapping are required in some locations. As part of mapping projects, rock geochemistry would aid in localizing hydrothermal alteration zones potentially associated with massive sulfide deposits.

REFERENCES:

Pyke, D.R., 1976. Watabeag River Area, District of Timiskaming and Cochrane; Ontario Division of Mines, Preliminary Map P. 1078, Geol. Ser., Scale 1:63,360 or 1 inch to 1 mile. Geology and compilation, 1974

NAME OF PROPERTY OR AREA:

Shining Tree, NE Ontario, Canada

AREA WHERE LOCATED:

Connaught, Churchill, MacMurchy, Tyrrell, Asquith, Fawcett & Leonard

COMMODITIES OF INTEREST:

Gold

DESCRIPTION:

New highway construction northeast of Shining Tree has identified three green carbonate zones. These rocks, likely the hydrothermal alteration products of ultramafic rocks, are significant host rocks to gold mineralization in areas such as east of Kirkland Lake and Matheson. Temiskaming conglomerates and sediments have been identified by Glen Johns* 17 km to the east in Tyrrell and Leonard townships. These rocks are also considered significant and are either host rocks or occur proximal to gold deposits in other areas. The green carbonate and Timiskaming sediments are located west and east of each other, respectively. This eastern or western trend is also the same for the Timmins and Kirkland Lake gold camps.

The alteration, rock types and the Tyranite Mine, a past producer at the northern boundary of Tyrrell Township, make the Shining Tree area attractive for gold exploration.

*(G.W. Johns, 1997, Project Unit 96-03. Reappraisal of the geology of the Shining Tree area (Tyrrell Township), districts of Sudbury and Timiskaming, Summary of Field Work and Other Activities 1997, Ontario Geological Survey, Miscellaneous Paper 168)

NAME OF PROPERTY OR AREA: PGE - Cr Potential in Nordica, McEvay and Sheba Townships

AREA WHERE LOCATED:
45 km WNW of Kirkland Lake, Ontario – Nordica, McEvay and Sheba townships

COMMODITIES OF INTEREST: Platinum, palladium and chromium

DESCRIPTION:
The Windward PGE – Cr showing in Nordica Township is described under property visits in this report. Both the platinum-palladium and chromite showings are adjacent to each other in leucocratic gabbro. The chromite, which is a distinct band, strikes north-northwest and is terminated to the south by granodiorite. The Pt – Pd mineralized zone is assumed to be likewise cut off by granodiorite. The granodiorite intrusion may have locally deformed the layering in the grabbroic rocks and the strike direction may be different away from the contact. According to Pyke's (1976) mapping, four small outcrops, north of the showing, are massive, mafic metavolcanic rocks. These outcrops need to be re-examined to determine if they are not perhaps fine-grained phases of gabbroic intrusive rocks.

The leucocratic gabbro in the showing area does not display any appreciable signs of assimilation or granitization at the contact with the granodiorite. It appears that the gabbroic rocks were cut and displaced by the granodiortite. With such a displacement, gabbroic rocks would be expected to occur on the "other side" of the granodiorite intrusion, provided movement was more or less in a horizontal direction.

Several granodiorite intrusions occur in the general area of the showing (Map 2205). The granodiorite intrusions stand out as aeromagnetic lows on maps 294G & 290G and the gabbroic rocks, in the showing area, as a moderate magnetic high. The known gabbroic rocks and possible other mafic rocks pinch out to the east and are terminated against granodiorite to the north, south and east. The Kasaba Lake Granodiorite occurs to the north (Pyke 1976). Aeromagnetic signatures may be one of the few aids to locate displaced parts of the gabbroic rocks due to the lack of bedrock exposure. Aeromagnetic contoured data (Map 294G), flanking the Kasaba Lake intrusion, shows several moderate magnetic highs of similar intensity to the showing area. In particular, a magnetic high, pinching out to the south, occurs in McEvay Township 3 km northeast of the Nordica showing. Rocks associated with this magnetic high apparently do not outcrop. They may represent a displaced block of gabbroic rocks.

To the south of the Nordica showing, the distribution of the granodiorite is more haphazard (Map 2205) and numerous north-trending Matachewan diabase dykes complicate the aeromagnetic data (Map 290G). Samples of ultramafic, mafic and more felsic intrusive rocks from the G. Dunn property, in Sheba Township, may be part of a gabbroic intrusive complex. At the present, it is too early to determine if these rocks can be linked to the chromite – PGE bearing leucocratic gabbroic rocks in Nordica Township.

The PGE mineralization in Nordica Township is associated with minor sulphide (chalcopyrite, pyrite, pyrrhotite and possibly pentlandite) minerals in what appears to be a feldspathic pegmatitic intrusive rock, similar to the PGE ore at Lac Des Isles near Thunder Bay. Such rocks should be prospected for wherever gabbroic rocks might be expected to occur in the general area. Chromite and magnetite rich bands in gabbroic rocks may also be good indicators for nearby PGE mineralization.

REFERENCES:

Map 290G (Rev.). Airborne Magnetometer Survey, Raddison Lake, Timiskaming District, Department of Energy, Mines and Resources, scale 1:63 360 or 1 inch to 1 mile.

Map 294G (Rev.). Airborne Magnetometer Survey, Watabeag River, Cochrane &Timiskaming Districts, Department of Energy, Mines and Resources, Scale 1:63 360 or 1 inch to 1 mile.

Map 2205. Timmins-Kirkland Lake Geological Compilation Series, scale 1:253 440 or 1 inch to 4 miles.

Pyke, D.R. 1976. Watabeag River Area, Districts of the Timiskaming and Cochrane; Ontario Div. Mines, Prelim. Map P.1078, Geol. Ser., scale 1:63 360 or 1 inch to 1 mile. Geology and compilation, 1974.

NAME OF PROPERTY OR AREA:

Untested Gold Potential of the North Branch of the Destor-Porcupine Fault Zone

AREA WHERE LOCATED:

50 km NE of Kirkland Lake, Ontario, in Frecheville, Lamplugh and Holloway townships

COMMODITIES OF INTEREST: Gold

DESCRIPTION:

Jensen (1982) interpreted the existence of a deformation zone extending from the Abitibi Indian Reserve No. 70 in the west to the Ontario – Quebec boundary in the east. This deformation zone, which he refers to as the North Branch, Destor-Porcupine Fault Zone, has a minimum length of 40 km. In Frecheville Township this fault zone, located 5 km north of the Holloway Mine and striking at an azimuth of approximately 100° , is nearly coincident with a linear airborne magnetic low (Map 80 590). The magnetic low, apparently associated with the North Branch of the Destor-Porcupine Fault Zone, coalesces with a magnetic low zone of the Destor-Porcupine Fault Zone near the Ontario/Quebec inter-provincial boundary. The magnetic low for the north branch can be traced as far west as Warden Township. The magnetic low response may suggest extensive hydrothermal alteration and the consequent destruction of magnetite. Such an explanation would provide an ideal setting for gold deposits.

Another linear magnetic low feature, sub-parallel to the North Branch of the Destor Porcupine Fault Zone, is located approximately 3 km north of the Holloway Mine and flanks the north side of a magnetic high associated with mafic and ultramafic rocks of the Ghost Range. This magnetic anomaly is very low indeed and at present there is no explanation for it. If the magnetic low is partly due to hydrothermal alteration, then there is probably another deformation zone in coincidence with it.

Sub-parallel structures to major deformation zones are known to have high mineral potential. Most significant gold deposits in the Timmins gold camp occur up to several kilometers north of the Destor-Porcupine Fault Zone on sub-parallel splays. An example is the McIntyre gold mine, which occurs 5 km north of this fault zone. In the Kirkland Lake gold camp, most of the larger gold deposits occur north of the Larder Lake Break excepting for the Kerr Mine. The Pipestone Fault Zone, which splays off the Destor-Porcupine Fault Zone in Garrison Township, towards the west, also has several gold deposits associated with it, such as the Croesus, Maude Lake and Montclerg deposits. These deposits occur up to 7 km north of the Destor-Porcupine Fault Zone and together with the other situations described, perhaps, give credence to the gold potential postulated for the North Branch of the Destor Porcupine Fault Zone and the other postulated deformation zone north of the Ghost Range in Frecheville and Lamplugh townships.

Another factor to consider is the clustered distribution of significant gold deposits proximal to and along the major deformation zones such as the Destor-Porcupine Fault Zone and the Larder Lake Break. Where clustering occurs, the gold deposits are associated with sub-parallel auriferous structures over limited strike distances. Two separate gold-bearing structures, hosting the Holloway Mine and Holt-McDermott Mine gold ore deposits, occur in Holloway Township. This in itself is evidence of clustering of gold deposits in this area and provides sufficient justification to explore the two interpreted sub-parallel deformation zones in the southern part of Frecheville Township and the southeastern part of Lamplugh Township.

The two possible deformation zones north of the two operating mines in Holloway Township coincide with areas virtually devoid of outcrop. A review of assessment work overlay maps at the Kirkland Lake Resident Geologist's office indicate that the potential deformation zones have not been explored for their gold potential. Since the ore deposits in Holloway Township are associated with disseminated pyrite zones, one would expect gold mineralization on other sub-parallel auriferous structures to have similar associations. IP surveys are the most effective tool to detect disseminated sulphide mineralization and commonly associated silicification. Such surveys in conjunction with ground magnetometer and EM-16 surveys, the latter of which should detect the location of structural deformation zones, are recommended for initial exploration of the area of low outcrop density across the southern part of Frecheville Township and the south eastern part of Lamplugh Township. Also, the few outcrops which do occur should be mapped and examined for evidence of possible hydrothermal alteration and mineralization. Several strong east trending airborne EM conductors occur between the two magnetic low areas in the southern part of Frecheville Township. A weak conductor is centered on the southern magnetic low trend about 3 km north east of the Holloway Mine and another weak conductor occurs close to the Northern Branch of the Destor-Porcupine Fault Zone another 3 km to the northeast. These two weak EM conductors should be part of the initial exploration efforts in this area.

REFERENCES:

Jensen, L.S. 1982. Precambrian Geology of the Lightning River Area, Cochrane District; Ontario Geological Survey, Map P.2433, Geological Series – Preliminary Map, scale 1:63 360 or 1 inch to 1 mile. Geology 1973.

OGS 1984. Airborne Electromagnetic and Total Magnetic Survey, Matheson-Black River Area, Frecheville Township, District of Cochrane; by Questor Surveys Limited for the Ontario Geological Survey, Map 80590 Geophysical/Geochemical Series, Scale 1:20 000, Survey and Compilation March to July 1983, scale 1:31 680.

Temagami Area Copper-Nickel-PGE Mineralization

Recent successes in the exploration for PGE mineralization in the Sudbury area (i.e. East Bull Lake, River Valley) warrant another look at the potential for similar deposits in the Temagami area. Following is the Recommendations for Exploration from the 1994 Report of Activities (Ireland, 1995). References cited can be referred to in that publication.

Numerous Copper-Nickel-PGE occurrences, showings and deposits are documented in the Temagami area of northeastern Ontario. Most are associated with Archean extrusive and intrusive rocks (i.e. the Copperfields mine, Phyllis Township; the Kanichee deposit, Strathy Township). To a lesser extent copper-nickel occurrences appear to be associated with Proterozoic intrusive rocks, notably Nipissing diabase dikes and sills (i.e. Cooper Lake occurrence, Eldridrige Township).

Documentation of copper-nickel mineralization in Proterozoic mafic intrusives is minimal (R. Thompson, 1968; E.W. Todd, 1925, 1926; Assessment Files Cobalt; R. Thompson notes, Cobalt). Much of the available information is based upon work done prior to 1970, and some observations were made only in connection with silver exploration activities carried out is the early 1900's. Some of the more accessible

showings along the Highway 11 corridor, in Best and Gillies Limit townships, were under evaluation when the Temagami Land Caution was initiated in 1973. Little additional work was done prior to reopening of the peripheral lands in 1991 and the lifting of the Caution from Strathy, Cassels and Best townships in 1992. Copper-nickel mineralization is well documented within the Archean rocks of the Temagami greenstone belt (O. Bennett 1978; W.W. Moorhouse; 1942; R. Thompson, 1968; P.S. Simony, l964).

At the Copperfields mine, copper-nickel mineralization is associated with semi-massive to disseminated pyrite at the lower contact between an altered felsic gabbro and rhyolite volcanic rocks. The gabbro is steeply dipping, approximately 250 m thick and has a strike extent of at least 5 km. The intensity of mineralization varies greatly but is present over most of the defined strike length of the gabbro. Copper is associated with chalcopyrite. Nickel is associated with millerite, gersdorffite, linnaeite and cobalt-nickel sulpharsenides.

At the Kanichee mine, copper-nickel mineralization occurs within a northwest trending extension of a larger gabbroic Intrusion. The extension is about 240 m long by 90 m wide and plunges 23° to the southeast. The extension is altered to serpentine and amphibole, while the main gabbroic intrusion is relatively unaltered. Pyrite, pyrrhotite and chalcopyrite are the primary minerals present, occurring as semi-massive to massive veins within the extension zone. Significant gold, silver and platinum-palladium occur with the sulphides.

Several copper-nickel sulphide occurrences are documented in the vicinity of Granite Lake in Best Township and west of Rib Lake in Gillies Limit Township. The majority of these occurrences are hosted in mafic to ultramafic intrusive rocks or their extrusive equivalents. One showing, located south of Granite Lake in Best Township, occurs in a hybrid mafic dike intruding granite. Significant platinum and palladium is associated with copper-nickel sulphides concentrated along the east contact of the dike. Approximately 500 m south of the copper-nickel-PGE showing the dike is feldspathic, suggesting a possible anorthositic phase (see Chitaroni (Acana No. 5) showing under "Property Descriptions").

West of Cooper Lake in Eldridge Township, copper-nickel mineralization occurs within a quartz diorite intrusion of possible Proterozoic age. Semi-massive chalcopyrite, pyrite and pyrrhotite occur within a brecciated, feldspathic phase of the quartz diorite across widths that vary from a few centimeters to over 3 meters (see Goddard (Cooper Lake) showing under "Property Descriptions").

The presence of numerous and widely distributed metalliferous mafic and ultramafic intrusives, and their extrusive equivalents, within and adjacent to the Temagami greenstone belt, is significant. Prospecting for copper-nickel mineralization should be directed to known areas of mafic, ultramafic or anorthositic intrusion. Prospective areas include areas adjacent to Archean basement-Proterozoic sediment contacts (i.e. west of Rib Lake, east of Mountain Lake, northeast of Rabbit Lake, north of Cassels Lake) and generally, along the Highway 11 corridor north of Strathcona Township to Cobalt.

Additional prospective areas not currently open to staking or prospecting are located in northern Chambers Township, along the Northeast Arm of Lake Temagami, central Banting Township, most of Strathcona Township, and the east part of Cynthia and Joan townships.
Since 1994, many areas referred to above have been reopened to staking and exploration. Significant results from recent exploration programs include 1500 ppb Au, 1900 ppb Pt and 1390 ppb Pd from samples on the Granite Lake property in Best Township (held by G. Chitaroni). Anomalous PGE values have been obtained from properties on the Northeast Arm Deformation Zone in Strathcona Township (Diadem and O’Connor).

Potential "New Gold Camp" in Lake Abitibi Area

A number of auriferous quartz boulder occurrences along the shore of Lake Abitibi, the well documented Milligan gold–bearing quartz boulders and esker sand and gravel with high gold grain content in the NW part of Lake Abitibi indicate the potential for gold deposits in the up glacial direction(s). Auriferous sand and gravel occur in the vicinity of the common four corners of Milligan, Warden, Kerrs and Chesney Bay townships (Kirkland Lake Assessment File KL 0199) and the western shore of Long Point in Lake Abitibi. The present known minimum east – west distribution of auriferous glacial material is 30 km. The dispersal is far too large to suggest a single source for the gold, suggesting multiple sources, in the up-glacial direction(s). Multiple sources suggest the potential for a new, yet to be discovered, gold camp.

The source of the gold is in the up glacial direction to the north and is most likely associated with an east – west trending suite of rocks comprised of clastic metasedimentary rocks, chemical metasedimentary rocks, mafic intermediate metavolcanic rocks/intrusions and ultramafic intrusive and extrusive rocks. Two sub-parallel sedimentary belts are separated from each other and are each bounded at the southern contact by major deformation zones (Ayer, J. A., et. al. 1999). The sedimentary belts stretch, on the Ontario side, from Hepburn Township at the Quebec border, for more than 100 km to the west. A section of these belts occur north of Lake Abitibi and are partly covered by the Northeast Bay. Adjacent to, and underlying the Northwest Bay of Lake Abitibi, the favourable stratigraphy exhibits a flexture similar to the flexture on the Larder Lake Fault Zone in the Kirkland Lake – Virginiatown gold camp that hosts significant gold deposits.

The most likely source areas for the glacially dispersed gold is extensively overburden and partly lake covered. These factors, as well as limited access in some areas, are the main deterrents to conventional outcrop prospecting. New exploration tools, meaningful in this difficult to explore terrain, are required. Technologies such as reverse circulation drilling, sonic drilling, IP surveys, walking magnetometer surveys, VLF-EM surveys, vegetation and soil/overburden sampling, enzyme leach testing need to be applied.

The following is proposed for follow-up exploration:

1. Compile literature and Assessment File data on auriferous quartz boulders and gold-bearing glacial material in the Lake Abitibi area
2. Summer (best when lake at low level) – by boat

a. search and document occurrences of quartz boulders and sulphide-bearing boulders along the shore of the NW part of Lake Abitibi and analyze them for gold
b. pan gravel/sand for gold and other heavy mineral concentrates all along the shore of the NW part of Lake Abitibi - the best starting point is perhaps along the western shore of Long Point (for location see Timmins – Kirkland Lake Geological Compilation Sheet, Map 2205)

1. Winter – Based on Summer results, lay out reverse circulation and/or sonic drill program – this program would be designed to follow up on gold dispersion fans in the up glacial direction to determine the approximate source area(s)

Using Operation Treasure Hunt Data to Search for Kimberlite Pipes

The availability of Operation Treasure Hunt airborne geophysical data in a digital format and a freeware viewer (Oasis Montaj by Geosoft Inc.) has given prospectors new tools for their exploration endeavours. This is a technological leap forward from the paper maps traditionally used by prospectors. Magnetic data can be viewed in traditional colour formats or transformed into shaded three dimensional views. The data has been manipulated to search for circular magnetic anomalies using the pattern recognition technique of Keating (1995) and the results saved on CD-ROM in DXF format. Keating anomalies are possible kimberlite pipe (k-pipe) targets. Many, but not all, of the known k-pipes have associated Keating anomalies. Many of the earliest k-pipes found in the area are magnetic highs within areas relatively low and flat in magnetic responses. Maps can be printed on small printers and at a variety of scales.

The technique developed by Keating (1995) identifies targets from the residual magnetic intensity data, based on the identification of roughly circular anomalies. This procedure is automated by using a known pattern recognition technique, which consists of computing, over a moving window, a first-order regression between a vertical cylinder model anomaly and the gridded magnetic data. The results are depicted as circular symbols, scaled to reflect the correlation value. The most favourable targets are those that exhibit a cluster of high amplitude solutions. Correlation coefficients with a negative value correspond to reversely magnetised sources. Other magnetic sources may correlate well with the vertical cylinder model, whereas some k-pipes of irregular geometry may not. Geographic coordinates of Keating anomalies are easily attained from the viewer software by moving the computer cursor onto them. UTM co-ordinates are displayed in the lower right corner of the screen. Coordinates systems used are NAD83 and NAD27 although Keating and EM data, in DXF format, is only available in NAD27.

Sage (1996) notes that kimberlites of Kirkland Lake and Cobalt - New Liskeard are often spatially associated with northwest-trending Lake Timiskaming structures and oblique trending cross structures. The western portion of the Kirkland Lake Resident Geologist district has received little exploration for its k-pipe potential. The Matheson k-pipes are located proximal to the Porcupine-Destor Deformation Zone and the Kirkland Lake k-pipes, though less so, are proximal to the Larder Lake-Cadillac Shear Zone. Both the Matheson and Kirkland Lake k-pipes are within northwest-trending subparallel structures. The majority of the New Liskeard k-pipes lie between the northwest-trending Lake Timiskaming West Shore Fault in the east and the Montreal River Fault to the west. These structures cross the Larder Lake-Cadillac Shear Zone and the Porcupine-Destor Deformation Zone well west of Kirkland Lake and Matheson k-pipes. This would suggest the western portion of the Kirkland Lake Resident Geologist District between the northwest-trending structures and near the major east-trending structural zones would have a high potential of hosting k-pipes.

Some interesting clues can be found in past exploration programs. A 1993 overburden drilling program on a magnetic high in Davidson Township returned 10 garnets in the till above bedrock. Electron microprobe analyses determined that 9 were G9 garnets and 1 fell on the G9-G10 boundary. The 0.255-carat Jarvi diamond was found on an esker in Sheraton Township in 1971. The source of the diamond is unknown but Keating anomalies are located to the north within the area of interest.

References:

Keating, P.B. 1995. A simple technique to identify magnetic anomalies due to kimberlite pipes; Exploration and Mining Geology, vol. 4, no. 2, p. 121-125.

Sage, R.P. 1996. Kimberlites of the Lake Timiskaming Structural Zone; Ontario Geological Survey, Open File Report 5937, 435p