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Report on the Geological and Mineral Occurrence Map of the Mazenod Lake-Lou Lake Area, Northwest Territories

S.S. Gandhi

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REPORT ON THE GEOLOGICAL AND MINERAL OCCURRENCE MAP OF THE MAZENOD LAKE-LOU LAKE AREA, N.W.T., SCALE 1 : 50 000

(NTS 85 N / 10 and parts of 6, 7, 8, 9, 11, 14, 15 and 16)

Map Compilation for

Hudson Bay Exploration & Development Co. Ltd.

June 1999

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INTRODUCTION

The Mazenod Lake-Lou Lake area has been the focus of intensive exploration since 1994. The exploration was prompted by the metallogenic studies carried out by the Geological Survey of Canada since 1987, which brought to light the potential for large tonnage polymetallic deposits of Olympic Dam-type in the region. Additional major incentive was provided by an airborne multiparameter geophysical survey of the map area, on scale 1:100 000, released in 1994. The follow-up exploration has outlined of two economically significant polymetallic deposits, namely the Sue-Dianne and Lou Lake (NICO) deposits, and has led to the discovery of several promising prospects and a number of new mineral occurrences. The exploration work and continuing researches have led to major advances in understanding of the metallogenic evolution of the area, and of its mineral resource potential.

In light of these advances, early in 1999 Hudson Bay Exploration & Development Co. Ltd. took a keen interest in the area, and launched a systematic compilation of data base, and conducted preliminary studies in order to formulate an exploration strategy. The company arranged a staff meeting in Vancouver on April 9, at which the writer made an oral presentation on the metallogeny and exploration potential of the region. After the meeting the company commissioned compilation of a geological map on scale 1 : 50 000, of the area covered by the published 1994 geophysical survey. The writer compiled the map in May and early June. This report is intended to accompany the map as 'explanatory notes', and includes a brief review of the mineral occurrences and metallogeny, and provides some guides to further exploration.

TOPOGRAPHIC BASE MAP

The map boundary was selected to allow an additional strip all around the published geophysical survey area (Hetu et al., 1994), mainly to include the major Wopmay fault zone in the east, Rayrock mine in the south, and all of Ketcheson Lake in the north (Fig. 1). The topographic base map used is an enlargement of the digitized map on scale 1 : 250 000, purchased from the

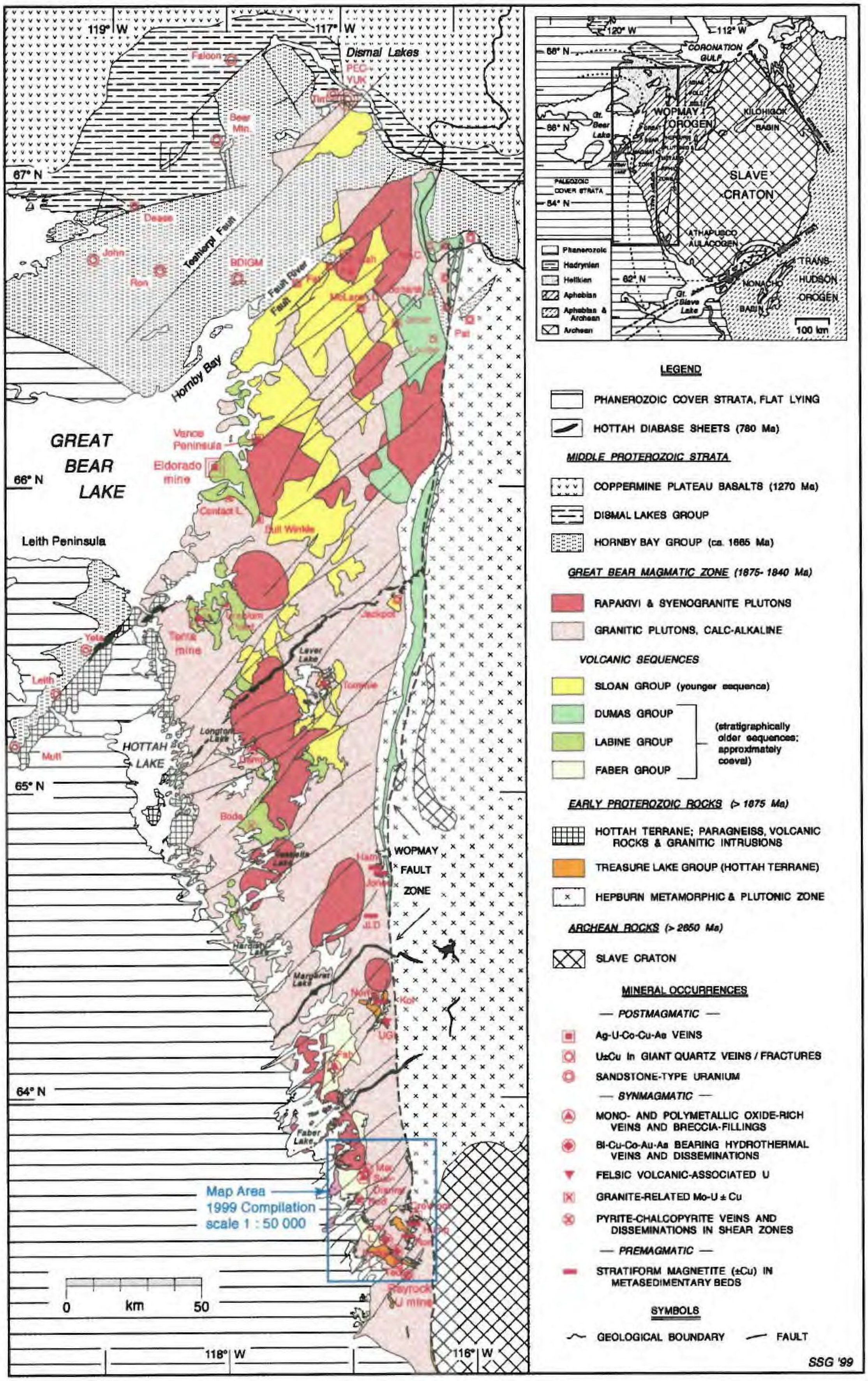


Fig.1. General geology and mineral occurrences of the Great Bear magmatic zone, N.W.T.

Federal Surveys and Mapping Branch. Parts of the base map are more detailed, drawn from scans of NTS sheets on scale 1: 50 000, and of airphotos, and utilized for earlier publications and reports by the writer. Enlargement, reduction and rotation of these were done on computer on the basis of 'best possible fit'. Scale of the resulting base map is accurate within 0.5 per cent as indicated by measurements of long distances in various directions.

Small streams and swamps are excluded to simplify the map, but the two major drainages, namely the 'Marian River' flowing south and the Camsell River flowing north, are retained. The topographic and geological compilations were done on Macintosh G3 computer owned by the writer, using the Adobe Illustrator application (versions 6.0 and 8.0). The final map was converted into the TIFF format, and submitted on a Zip disk for printing at the company's digital map centre in Vancouver. The Adobe version of the map is 3.2 MB in size, and the condensed TIFF version is 7.6 MB.

REGIONAL TECTONIC SETTING

The map area is located in the southern part of Great Bear magmatic zone (GBmz; Fig. 1). The magmatic zone is a 1870-1840 Ma old continental, calc-alkaline magmatic arc related to the Wopmay orogen that culminated ca. 1890 Ma ago (Hoffman, 1980; Hildebrand et al., 1987). The orogen is situated on the west side of the Slave craton. Its four tectonic zones are well preserved in the north. The core or internal zone of the orogen is the Hepburn metamorphic and plutonic zone, east of which are the Asiak fold and thrust belt and the zone of relatively little disturbed platform sequence. The GBmz is west of the internal zone, and boundary between them is marked by the prominent north-trending Wopmay fault zone or 'median zone' (Hildebrand et al., 1990). The chrono-stratigraphy and the inter-relations between its various tectonic elements are well defined in the north (Fig. 2). In brief, the orogen evolved with the deposition of a lower passive margin sequence of the Epworth Group and the upper flysch and mollasse fades of the Recluse Group during the interval 1970 to 1890 Ma, followed by eastward (oblique to the north) subduction, and collision of the exotic Hottah terrane with the Slave craton ca. 1890 Ma. The GBmz is late tectonic or post-tectonic with

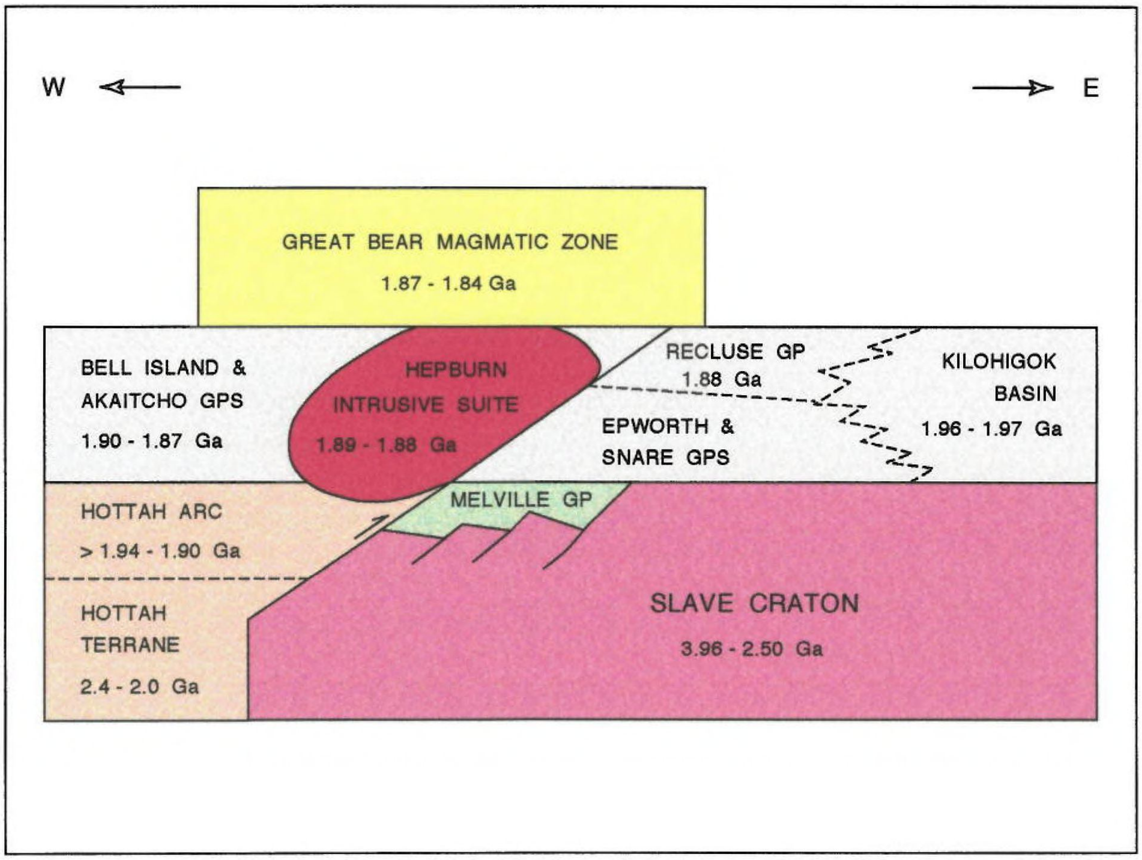


Fig.2. Chrono-stratigraphy and inter-relationships between various tectonic elements of the Wopmay orogeny (after Bowring and Grotzinger, 1992).

respect to the orogenic cycle. It is believed to be the result of subduction of a mid-oceanic ridge in final stages of the orogeny (Hildebrand et al., 1987).

The GBmz comprises assemblages of volcanic and volcaniclastic rocks, subvolcanic intrusions and granitic batholiths (Fig. 1). Early stages of the magmatic activity were dominated by areally extensive volcanism and subvolcanic intrusions. Geochronological data indicate a time range for the volcanic activity from 1870 to 1860 Ma (Hoffman and Bowring, 1984; Bowring, 1985; Gandhi et al., 1998). Aggregate thickness of the volcanic assemblages preserved in the north is 10 km, and in the south it is 5 km. The oldest assemblage in the north, namely the LaBine Group, ranges from basalt to rhyolite. An apparently coeval assemblage in the south, namely the Faber Group, ranges from rhyodacite to rhyolite (Fig. 1; Gandhi, 1994). Both assemblages are intruded by a distinctive suite of quartz monzonitic high level plutons. These plutons also occur in the east arm of Great Slave Lake, where they form a chain of laccoliths (inset map; Hoffman et al., 1977; Hoffman, 1988). In the northern part of the GBmz, these intrusions are unconformably overlain by the Sloan Group, which is dominated by dacites, rhyodacites and rhyolites. A narrow belt of bimodal volcanic and volcaniclastic rocks along the eastern part of the GBmz, namely the Dumas Group, is probably coeval with the LaBine Group. Chemistry of the volcanic rocks show calc-alkaline to marginally alkaline character (Hildebrand et al., 1987; Gandhi, 1994). There is also a considerable variation in Na/K ratio in them, due to alkali exchange during cooling and later mineralizing fluids.

The volcanic activity was followed by extensive granitic plutonism. Geochronological data indicate that most of the granitic batholiths were emplaced during the period 1860 to 1840 Ma. In general, the earlier ones are calc-alkaline in character, and the later ones are potassium-rich to rapakivi-type (Gandhi et al., 1998). A set of northeast-trending right lateral brittle faults transact the whole of GBmz. The faulting is believed to be the result of collision of a micro-continent in the west with the Hottah terrane (Hoffman, 1980). They predate the deposition of the ca. 1685 Ma old Hornby Bay Group in the north (Bowring and Ross, 1985). The region was tectonically stable except for the episodes of mafic magmatic activity during the Neoproterozoic time. Paleozoic marine transgression covered a large part of the region.

GEOLOGY OF THE MAZENOD LAKE-LOU LAKE AREA

Legend for the map shows 48 units, which are grouped under the following headings: Archean rocks of the Slave craton; Snare Group; Hepburn intrusive suite; Treasure Lake Group; Great Bear magmatic zone comprised of early granitic intrusions; Faber Group volcanic assemblages; younger Great Bear intrusions; Giant quartz veins; Diabase dykes and Cambrian platform strata. Some of these groups include several units. The following comments are directed towards the broad groups rather than individual units. Emphasis is placed on their field relations, structure and metamorphism in order to outline the geological evolution of the area. Some references are made to other parts of the GBmz where appropriate.

Archean rocks of the Slave craton

Rocks of the Yellowknife Supergroup (unit 1) are exposed in the southeastern corner of the map area east of the Wopmay fault zone (Lord, 1942). These rocks have been variably metamorphosed to amphibolite facies, and include biotite schists, and cordierite and garnet-bearing gneisses.

Archean granitic plutons (unit 2) intrusive into the Yellowknife Supergroup are not readily distinguishable in the field from those of the Hepburn suite and of the GBmz. Generally concordant and/or gradational boundary of the plutons with the strata of the Yellowknife Supergroup are indicative of their Archean age.

Snare and Treasure Lake groups

Metasedimentary strata of these two groups were regarded earlier as correlative because both are early Proterozoic platform-type sequences that were deformed and metamorphosed prior to the onset of Great Bear magmatic activity. They are, however, distinguished here in view of the implications of the new geochronological data and regional geological considerations. They are discussed here together to emphasize these points.

The Snare Group (units 3 and 4) was defined by Lord (1942) as an early Proterozoic sequence deposited unconformably on the Archean rocks in the Snare River region northeast of the map area. He also applied the term to other metasedimentary rocks west of the Wopmay fault zone, including some siltstones that are now recognized as volcaniclastic. His nomenclature viz., Snare Group equivalents, was followed by McGlynn (1968, 1979), and Gandhi and Lentz (1990), although no stratigraphic correlation between the sequences on two sides of the Wopmay fault zone was established. On the other hand a possibility was raised by Gandhi (1994) that they may be unrelated despite some lithological similarities, and the sequence west of the fault zone may belong to the exotic Hottah terrane that collided with the Slave craton. The new geochronological data obtained since supports this contention as discussed below. Hence the name 'Treasure Lake Group' is introduced here for it for the first time. A stratigraphic section was measured at the west-northwest end of Treasure Lake, across a prominent northwest-trending ridge from Rayrock mine to Lou Lake. The section is regarded here as the type stratigraphic section for the group (Fig. 3). The strata strike northwest and have moderate to steep dips to the northeast. Ripple marks and current bedding observed at a few places in sandstone indicate that the sequence is right side up. The basement on which it was deposited is not exposed.

A generalized stratigraphy of the Snare Group is presented with the section of the Treasure Lake Group for comparison (Fig. 3). The stratigraphy is based on the reports by Lord (1942) and Saylor and Grotzinger (1992), and the writer's observations on the north-northeast extension of units 3 and 4 into the Labrish Lake region adjacent to the east boundary of the map area. The strata here are tightly folded in some places. It is apparent from the two stratigraphic sections that the Snare Group is upward fining, whereas the Treasure Lake Group is upward coarsening. Stratiform concentrations of iron oxide (mostly magnetite) are common in the Treasure Lake Group, whereas none have been noted in the Snare Group. Age of the Snare Group is constrained by the Hepburn intrusives emplaced ca. 1890 Ma, and by the correlative strata of the Coronation Supergroup to the north (Fig. 2; Hoffman, 1984; Bowring and Grotzinger, 1992). Minimum age of the Treasure Lake Group is constrained by an older Great Bear granite intrusion near Lou Lake, which gave a U-Pb zircon age of 1873 ± 2 Ma (Gandhi et al., 1998). This age is

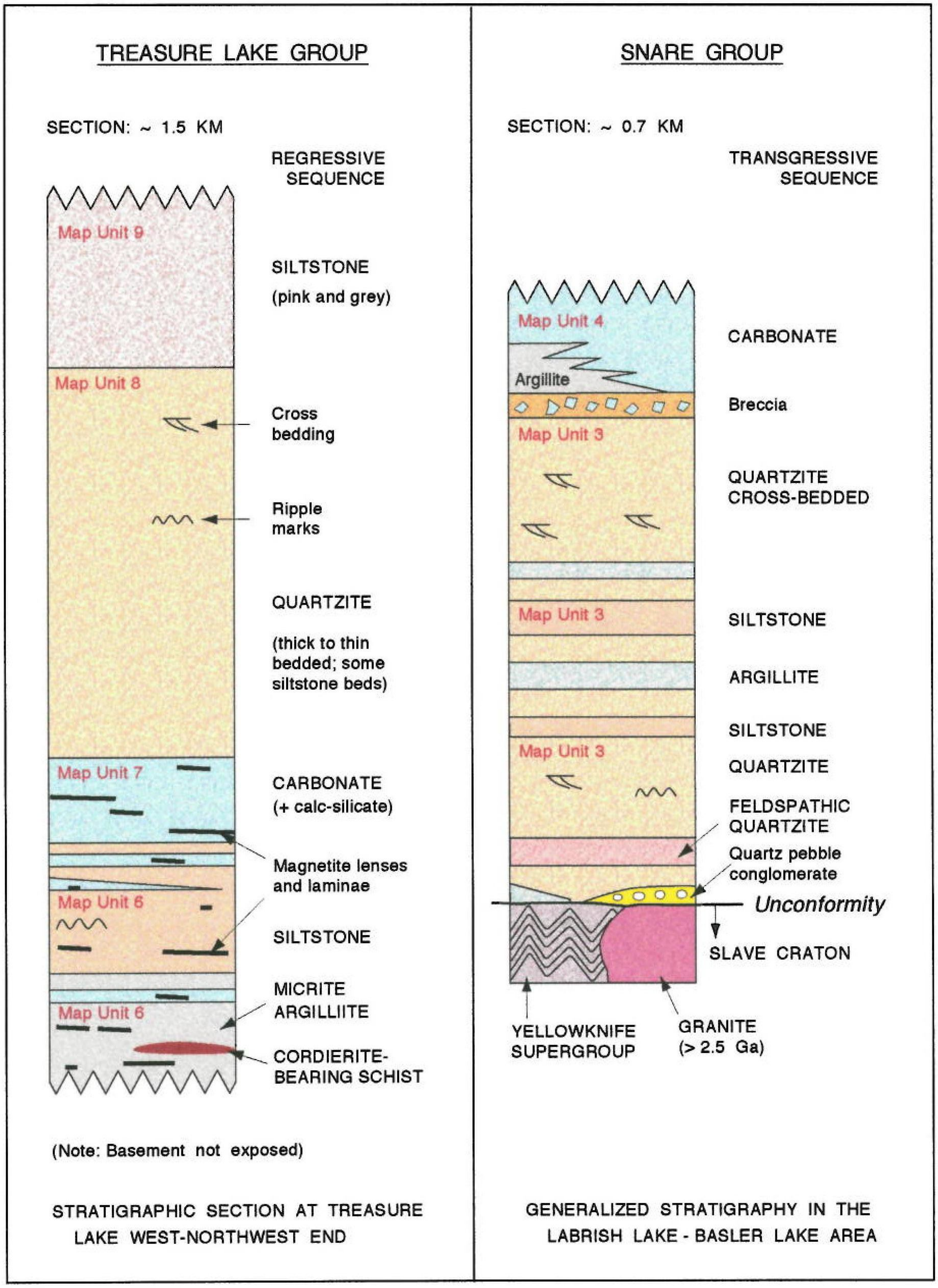


Fig. 3. Stratigraphic section of the Treasure Lake Group, and generalized stratigraphy of the Snare Group (after Lord, 1942 and Saylor and Grotzinger, 1992).

permissive of a correlation with the Snare Group, but the lack of the Archean basement, and of the intrusion related to the Hepburn suite as discussed later, make it unreliable. On the other hand the Hottah terrane in the type area of Hottah Lake (south of Great Bear Lake) also contains some metasedimentary rocks. They are intruded by 1914-1902 Ma old granites (Hildebrand, 1984; Hildebrand et al., 1987), which in turn are overlain by a basalt to rhyolite assemblage of a continental arc dated at 1898 Ma (Reichenbach, 1991). The regional tectonic setting indicates that the Hottah terrane may extend to the southern GBmz. The Treasure Lake Group can thus be regarded as a part of it. The terrane is largely concealed by the younger rocks in the region between Hottah Lake and the map area.

East of the Rayrock mine-Lou Lake ridge, the Treasure Lake Group strata are increasingly more deformed and metamorphosed towards the Wopmay fault zone, where garnetiferous amphibolitic beds have been encountered in some places. Strata carrying garnet, biotite and cordierite are also found along the margins of the Marian River batholith. Field observations by the writer on the intrusion near Lou Lake, dated at 1873 ± 2 Ma, indicate that the host siltstone unit was dipping steeply at the time of the intrusion and the elongate inclusions of it in the pluton have comparable dip. Furthermore the unconformity between the metasedimentary units and the overlying gently to moderately dipping volcanic units is angular, with a discordance of more than 25°. It is thus apparent that at least some deformation of the unit predated the Great Bear magmatic activity. Metamorphic effect of the batholith and other intrusions on the volcanic and volcaniclastic assemblages is negligible. This suggests that the metamorphism of the Treasure Lake Group predated the Great bear magmatic activity, and may have been modified by the contact effects of the batholith.

Hepburn intrusive suite

This intrusive suite (unit 5) is little studied in the map area. Its distinction from the older and younger granitoid plutons is based largely on the premise that it occurs in the internal or core zone of the orogen east of the Wopmay fault zone, and is intrusive into the Snare Group (Lord, 1942;

Hoffman, 1984). Studies in the north have shown that the collision of the Slave craton and the Hottah terrane ca. 1890 Ma ago formed an allochthonous metamorphic internal zone, in which plutons of the Hepburn peraluminous suite were intruded into, and thrusted with the rocks of Epworth Group, and also of the Akaitcho Group that comprises bimodal volcanic and immature marine elastic sedimentary rocks. The tectonic shortening culminated in the detachment and thin-skinned eastward thrusting of the imbricate basinal rocks, and the transport and emplacement of the Hepburn plutons onto the Slave craton. Emplacement of hot plutons in this manner resulted in the inverted metamorphic isograds that cut across the basal décollement. This is not evident in the map area as remnants of the Snare Group are scarce.

The Wopmay fault zone is a fundamental tectonic break. It apparently had a long and complex history. Rocks of the GBmz on its west side are little deformed and virtually unmetamorphosed, and in this regard contrast sharply with those in the internal zone. This indicates that an overall late stage movement on the fault zone is west side down (Hoffman, 1980, 1984; Hoffman and Hall, 1993). On the other hand the rocks along the fault zone show features of mylonitization and nearly horizontal lineation, as reported in the north and also observed near Koropchuk Lake 55 km north of the map area. The fault zone at this locality is 75 m wide in a coarse porphyritic granite, which grades from protomylonite to mylonite in the core of the fault zone. The kinematic indicators suggest mainly a right lateral movement.

In the Crowfoot Lake area, the Wopmay fault zone has a well-defined S-shape, 45° deviation in its north-south trend, which is informally referred to here as the 'Crowfoot kink'. Here the Archean rocks are juxtaposed with the rocks of the internal zone of the Wopmay orogen and the rocks of the GBmz. The geology of the area is further complicated by numerous brittle faults. A few observations made by the writer in the area were focused mainly on the Crowfoot uranium showing, and on the rocks west of the Wopmay fault zone. The host gneissic granite of the Crowfoot giant quartz vein, is difficult to distinguish from the gneissic granites west of the Wopmay fault zone. It is possible that some rocks of the GBmz occur near the showing. North of it, the exposures on the east shore of Cole Lake and the islands close to the shore, are of granodiorite with some amphibolitic xenoliths.

Older Great Bear granitic intrusions

One of the unexpected results of the recent geochronological studies (Gandhi et al., 1998) is the recognition of granitic intrusions (unit 10) that predate the Great Bear volcanism in the map area. The leucocratic granite pluton south of the Lou Lake deposit is intrusive into the metasiltstones of the Treasure Lake Group, and is dated at 1873 ± 2 Ma. It represents the earliest manifestation of the Great Bear magmatic activity in the region. A part of this pluton is strongly sodic in character. Other small plutons, which are chemically and texturally comparable, are recognized northwest of Crowfoot Lake in the metasedimentary rocks of the group. It is possible that several others occur in the map area but have not been distinguished from the leucogranite bodies that post-date the volcanic rocks of the Faber Group. In addition, small granitic bodies characterized by tourmaline veins occur near Treasure Lake, and are intrusive into the metasedimentary rocks. Their age relative to the other small granitic bodies remains uncertain.

Faber Group volcanic assemblages

Volcanic rocks of the southern GBmz comprise the Faber Group. It is exposed mainly along a north-northwest trending belt 75 km long and 10 km wide. South end of the belt is at Lou Lake, where the volcanic rocks overlie unconformably on the previously folded Treasure Lake Group (Gandhi and Lentz, 1990; Gandhi et al., 1996). The volcanic and associated volcaniclastic rocks of the Faber Group are relatively little deformed, and show well preserved primary volcanic and volcaniclastic textures and structures. Small open or moderately tight folds are observed in some places. There is no penetrative foliation seen in the rocks, except locally along a few shears. Their aggregate thickness is in the order of 5 km. They are broadly subdivided into three assemblages, namely the Lou Lake, Mazenod Lake and Bea Lake assemblages. The predominantly rhyolitic Lou Lake assemblage (units 11 to 20) is the oldest. The Mazenod Lake assemblage (units 21 to 33) to the north is dominated by rhyodacite ignimbrites. The Bea Lake assemblage (units 33 and 34) is the youngest, and is exposed on the west side of the other two assemblages. The geochronological data show that the assemblages were formed 1870 to 1866 Ma ago. These data also suggest that the Faber Group is coeval with the LaBine Group (Fig. 2; Bowring et al., 1984), but it lacks the andesites and basaltic andesites that form a significant part of the LaBine Group. Petrochemical data on the Faber Group and related intrusive rocks in the map area show overall calc-alkaline character consistent with the remainder of the GBmz (Hildebrand et al., 1987; Gandhi, 1994; Gandhi et al., 1998). Variation in relative proportion of Na and K in the volcanic rocks is considerable, due to the primary alkali exchange in the volcanic piles and later processes of mineralization.

Lou Lake assemblage

In the type area of Lou Lake, this assemblage is approximately 1.5 km thick and dips gently to moderately to the northeast. Seven units (11 to 17) are recognized in the vicinity of Lou Lake (Gandhi and Lentz, 1990), followed by undivided rhyolites to the north-northwest as far as Mazenod Lake. In addition the sub-assemblages at Dianne Lake and Cole Lake are included in the Lou Lake assemblage on the basis of their rhyolitic composition, proximity to or unconformable relation with the Treasure Lake Group, and their structural relations with the Mazenod Lake and Bea Lake assemblages. Their precise stratigraphic relation to the type assemblage at Lou Lake is not certain. They are, however, located close to or unconformably overlie the Treasure Lake Group. Hence they are likely to be equivalents of the lower units of the Lou Lake assemblage.

At Lou Lake the basal unit is a lithologically variable agglomerate-lithic tuff (unit 11), which is commonly fragmental but contains tuffaceous beds and lenses that are well bedded. It was deposited on an uneven surface of the folded metasedimentary rocks, and subrounded to rounded clasts of these rocks are found in the basal part of the unit. The tuff is overlain by a massive to flow laminated subporphyritic rhyolite (unit 12). It is in turn overlain by a well bedded tuff-volcaniclastic siltstone with agglomerate lenses and thin rhyolite flows (unit 13). The next unit in the sequence is a flow laminated or banded, lithophysae-bearing subporphyritic rhyolite (unit 14), overlain by well banded to massive subporphyritic grey rhyolite (unit 15). The next two units in the sequence occur northwest of the Lou Lake fault; one is an aphanitic to subporphyritic rhyolite (unit 16) and the other is a porphyritic rhyolite in part ignimbritic in character (unit 16). The overlying rhyolites (unit 17), commonly aphanitic in character, are areally extensive to the north. These are not mapped in detail and are grouped here as 'undivided rhyolitic rocks'.

The Dianne Lake sub-assemblage comprises massive porphyritic rhyolite (unit 19a), a volcaniclastic conglomerate-siltstone (unit 19b), rhyolite ignimbrite (unit 19c), and a mixed unit of volcaniclastic siltstone and rhyolite flows (unit 19d). It is bounded to the east by Marian River batholith and a sliver of garnetiferous biotite-bearing metasediments, and to the west by the north-trending Kemaz fault (Ketcheson Lake-Mazenod Lake fault). It is gently folded about north-northeast trending axes (Gandhi, 1998a).

The Cole Lake sub-assemblage, exposed on hills, comprises areally extensive volcaniclastic siltstones (unit 20a), and associated volcaniclastic conglomerate-agglomerate and sandstone beds (unit 20b), and some subporphyritic rhyolites to the northeast (unit 20c). Distinction between the siltstones of this assemblage and those of the Treasure Lake Group that underlie a large area to the south is based on limited fieldwork. The criteria used here are the association of volcaniclastic beds (unit 20b) in the upper part and significant deviations in attitude from the general northwest strike and steep dips of the Treasure Lake Group.

Mazenod Lake assemblage

This assemblage (units 21 to 33) is more than 2 km thick, and is dominated by rhyodacite ignimbrites or cooling units, which show well developed flowage/ compaction foliation in the lower part, grading into massive part and the upper lithic fragmental part. The assemblage includes a massive rhyodacite and a volcaniclastic unit (units 25 and 26). Distribution of these units is restricted to the area from Mazenod Lake northeast arm to the west side of Dianne Lake. Attitude of the units is indicated by flow contacts, flow banding, ignimbritic textures, and bedding in associated volcaniclastic siltstones. The dips range from nearly horizontal to moderately steep to the northeast and north (Gandhi, 1994). Minor folds, including flow folds, are common, and larger scale folds are open to moderately tight. Tops have been determined at several places from the flow top features, and from graded bedding and cross bedding in siltstones and fragmental strata (unit 25).

The east trending units of the Mazenod Lake assemblage are truncated by the north-trending, brittle Kemaz fault along Dianne Lake, an important fault that juxtaposes the assemblage with the older, north-northeast trending Dianne Lake sub-assemblage (unit 19). The fault movement is thus west side down. This is further supported by juxtaposition of the older Marian River batholith east of the fault with the younger Faber Lake rapakivi granite to the west in the Ketcheson Lake area (Gandhi, 1998a).

Isolated occurrences of rhyodacite ignimbrite near Sarah Lake indicate western extension of the Mazenod Lake assemblage. At Ketcheson Lake rhyodacite ignimbrite (unit 33) is interlayered with volcaniclastic siltstone, and is part of an extensive, gently dipping assemblage to the north, mapped by the writer as the Fire Tower Hill assemblage on the east side of Faber Lake. It is regarded here as an extension of the Mazenod Lake assemblage, separated from it by abundant intrusives of the area. It may be suggested here that the Mazenod Lake assemblage represents the caldera facies, and the Fire Tower Hill assemblage the related outflow facies.

Bea Lake assemblage

The Bea Lake assemblage (units 33 and 34) is exposed on the west side of the other two older assemblages. It comprises an extensive volcaniclastic unit overlain by a thick and extensive quartz-feldspar porphyritic massive rhyodacite unit, which is in part intrusive (Gandhi, 1998b). The lower unit includes abundant bedded tuff/tuffaceous siltstone, and some agglomerate and volcaniclastic conglomerate lenses and beds. Its relationship with the Lou Lake assemblage is seen west of the north end of Lou Lake, where a volcaniclastic polymictic cobble conglomerate (unit 33a) overlies the uppermost rhyolite of the Lou Lake assemblage (Gandhi and Lentz, 1990). The bedded tuffaceous and agglomeratic fades (unit 33b) to the north is areally extensive and is approximately 150 m thick.

The porphyritic rhyodacite (unit 34) is texturally distinctive, and contains 25 to 35 % feldspar phenocrysts 1 to 5 mm long, and 5 % smaller quartz phenocrysts, set in dark grey fine grained matrix. South of Mazenod Lake its lower contact with the bedded tuff unit is essentially parallel with the bedding, and is marked by an aphanitic, buff white rhyolitic zone with quartz eyes less than millimetre in diameter. It also contains elongate fiammé near the rhyolitic contact zone, and these show a consistent northwest trend parallel to the boundary with the bedded tuff. The unit is, however, transgressive to the bedding in the tuff unit on the south shore of Mazenod Lake. Xenoliths of bedded tuff as large as 5 x 50 m, are seen on a peninsula of the north shore, 3 km northwest of the Nod prospect. The inclusions may be of the bedded tuff unit or of the volcaniclastic rocks of the Mazenod Lake assemblage. Further to the northwest, the porphyritic rhyodacite transacts the east-west trend of the Mazenod Lake assemblage at high angle. Large fragments of rhyodacite ignimbrites of the assemblage are seen in it at the contact. These intrusive relations indicate that this area marks the volcanic neck or the feeder zone of the areally extensive unit. It must be noted here that the upper boundary of the unit is nowhere recognized to date.

Younger Great Bear intrusions

The volcanic assemblages of the Faber Group have been cut by a variety of intrusions that include: sub-volcanic felsic to intermediate porphyries (units 38 and 39); small to medium sized bodies of diorite and quartz monzonite-mozodiorite (units 38 and 39); and the younger granitic plutons. The latter comprise the large Marian River granite-granodiorite batholith (unit 40) east of the main exposures of the Treasure Lake and Faber Groups; the undifferentiated granitic plutons (unit 41) to the west of these groups; small bodies of leucocratic granite (unit 42); and the compositionally and texturally distinct Faber Lake rapakivi granite suite (unit 43) to the northwest. The granitic bodies have low relief, and form topographically low level areas.

The Geochronological data show that the porphyries and quartz monzonitic intrusions are close in age to the Faber Group volcanic rocks (1868-1866 Ma). They were followed within a few million years by the calc-alkaline granitic batholiths and plutons (ca. 1866 Ma). After a hiatus some 10 million years the rapakivi granite, rich in radio-elements (K, U and Th), marked the final stage of the Great Bear magmatic activity (Gandhi et al., 1998). The geochronological data point to an overall petrochemical evolution of the magmatic source with time, from the early small sodic intrusions through abundant calc-alkaline volcanic-plutonic activity to highly potassic intrusive activity. These geochronological observations are comparable with those from the northern part of the GBmz where the magmatic evolution from calc-alkaline to potassic is also noted (Fig. 1; Hildebrand et al., 1987).

Subvolcanic porphyries

Two main types of porphyries are the plagioclase porphyritic, magnetite-rich dacite (unit 36), and the feldspar-quartz±hornblende phyric rhyodacite (unit 37). Both have aphanitic matrix. The plagioclase porphyry in the Dianne Lake sub-assemblage is relatively old, because fragments of it are found in the volcaniclastic unit in its vicinity (unit 19b). A larger plagioclase porphyry occurs west of Upper Bea Lake, and is intrusive into the Bea Lake assemblage. It has abundant well developed feldspar phenocrysts. The magnetic susceptibility of the plagioclase porphyry is two to three time higher than other intrusive rocks of the GBmz.

The rhyodacite porphyry (unit 37) is extensive to north and west of Dianne Lake, and smaller bodies of it are widely distributed in the map area. It is characterized by euhedral feldspars and less abundant quartz phenocrysts in pale pink to buff matrix. One variety of the porphyry has feldspar crystals more than 1.5 cm long and are set in pale grey matrix. Several dykes of coarse quartz-feldspar porphyry occur east of the south end of Lou Lake, and a larger body of porphyry to the west of them contains smaller subhedral phenocrysts of quartz, feldspar and hornblende (Gandhi and Lentz, 1990). Some other more felsic or granitic porphyry dykes may be offshoots of the granitic bodies in the map area.

Diorite

Dykes and larger bodies of diorite (unit 38) occur near the west margin of the Marian River batholith and at several localities elsewhere in the map area. Most of them are younger than the Faber Group; a few with weak foliation or lineation, however, may be older than it. Their age relative to the other intrusions of the GBmz is not certain, but the writer has not found any of them that cut the large granite plutons. It is probable that two or more generations of dioritic intrusions occur in the map area. Some of them are aphanitic to porphyritic, with plagioclase and hornblende phenocrysts, and others are medium to coarse grained and equigranular. Some of them display differentiation ranging from gabbro to felsic diorite e.g., the body southwest of Treasure Lake.

Quartz monzonite-monzodiorite

These intrusions (unit 39) are characterized by abundant crystals of coarse euhedral plagioclase in medium grained matrix that contain varying proportion of quartz, feldspar and hornblende. They occur as dykes and irregular bodies in the map area, whereas intrusions of this composition in the northern GBmz and the east arm of Great Slave Lake commonly occur as laccoliths (Hildebrand et al., 1987; Hoffman et al., 1977). Near Lou Lake and Treasure Lake they form a set of easterly trending subparallel dykes, some of which are anastomosing. They are intrusive into the Faber Group, and predate the large granite plutons, but their age relation to the porphyries and diorite is not certain.

Marian River batholith

A large batholith (unit 40) dominates the area between the Wopmay fault zone and the main belt of the Treasure Lake and Faber Groups. The batholith is mostly granodioritic in composition, characterized by euhedral feldspar crystals 2 to 5 cm long, set in medium to coarse grained matrix of feldspar, quartz, hornblende, biotite and accessory minerals. It grades into granitic phases near the margins, where the texture varies from equigranular to seriate. Intrusive contact with the Faber Group and other intrusions of the GBmz is irregular and sharp, but with the Treasure Lake Group it is commonly serrated and gradational.

Weakly developed foliation, defined by streaky aggregates of felsic and mafic minerals is not uncommon along margins of the batholith and in the vicinity of tabular or lenticular xenoliths of the Treasure Lake Group. In the Betty Ray Lake area, however, the foliation is well developed over a large area (subunit 40a) and parallels the trend of the metasedimentary strata of the Treasure Lake Group. This led to its mapping as a separate gneissic granodiorite body, which was interpreted on the structural basis as belonging to the older Hepburn intrusive suite (Gandhi, 1994; Gandhi et al., 1996). U-Pb zircon age on it obtained recently, however, is virtually identical with that on the more typical coarse porphyritic phase east of Dianne Lake viz., 1866 ± 2 Ma and 1866 +3/2 Ma respectively. Hence the gneissic texture is now regarded as due to the emplacement in a high strain zone, and generally parallel to the main trend of the Treasure Lake Group. The gneissic phase grades outward rather abruptly into more mafic granodiorite to monzogranite (subunit 40b), except to the south, where it grades into more typical porphyritic granodiorite.

Marginal parts of this large batholith are well studied but its interior has received little attention. Furthermore its eastern boundary along the Wopmay fault zone needs further study as its field relation with the Hepburn intrusive suite is obscure. In particular the 'Crowfoot kink' in the fault zone is important in this regard. The kink may reflects a long standing high strain zone trending southwest from it, which may have induced the gneissic character seen in the batholith in the Betty Ray Lake region during its emplacement.

Granites, undifferentiated

West of the Faber and Treasure Lake groups, there are several granitic bodies exposed partially in the low ground covered largely by Cambrian cover strata and glacial overburden. Most of these are massive hornblende-biotite granite-granodiorite bodies, but they also include exposures of some gneissic phases. Exposures are not adequate to distinguish individual plutons.

Leucogranite

Small bodies, dykes and sheets of leucogranite (unit 42) are distributed widely in the map area. They are commonly medium to fine grained, and have seriate to equigranular texture. Most of them appear to be differentiates of large granitic plutons in their vicinity, but a few could be older subvolcanic intrusions as could be expected in a rhyolite terrane represented by the Lou Lake volcanic assemblage.

Faber Lake rapakivi granite suite

The youngest intrusive of the southern GBmz is the Faber Lake rapakivi granite (unit 43). A small southern part of this large pluton is located in the northwest corner of the map area (Fig. 1). The granite is dated by U-Pb zircon method at 1856 +2/-3 Ma. It comprises four phases that are texturally distinct, hence is referred to as a granite suite (Gandhi, 1998c). The main two older phases are characterized by the distinctive rapakivi texture in which coarse, zoned phenocrysts of potassium feldspar are rimmed by plagioclase. The oldest phase has 1 to 2 cm long phenocrysts, which are tightly packed and make up approximately 60 per cent of the rock. The second coarse porphyritic phase has fewer but coarser phenocrysts, as much as 2 to 5 cm long, scattered through medium grained matrix. The third phase is volumetrically small, and forms small bodies. It is characterized by equigranular to seriate texture. The youngest phase is fine grained aplite, which occurs as dykes and small irregular bodies, commonly near the margin of the pluton. All the phases are characterized by high radio-element contents as seen from the airborne multiparameter geophysical survey (Hetu et al., 1994), and the spectrometer readings on ground that show contents of Th : 75 to 175 ppm, U : 20 to 50 ppm and K : 5 to 7 per cent. The south boundary of the pluton with the rhyodacite porphyry (unit 37) is clearly defined by the airborne radiometric patterns. The contact is exposed along a ridge top, and is sharp.

The Sarah Lake granite pluton to the south is comparable in radio-element contents with the Faber Lake rapakivi granite, as seen from the airborne survey results, but differs from it in texture. It is medium to coarse grained, quartz-rich hornblende ± biotite granite. It has texture ranging from seriate to potassium feldspar porphyritic. A few bodies of leucocratic granite, pegmatitic to aplitic in texture and believed to be the late phases of the Sarah Lake granite, are exposed on the shore and islands of Mazenod Lake.

Giant quartz veins and Diabase dykes

A set of northeast-trending right-lateral brittle faults that affect the whole of the GBmz hosts giant quartz veins and stockworks. Some of the larger ones are shown on the map (unit 44) e.g., those along the Rayrock fault and the northwest-trending Crowfoot fault (complementary to the northeast-trending faults). Individual quartz veins range in thickness from a fraction of metre to a few tens of metres. The vein zones commonly have width in the range of 5 to 100 m, and a strike length in the range of a few hundred metres to a few kilometres.

Small diabase dykes, commonly less than 1 m wide have been observed in some parts of the map area e.g., the Lou lake area (Gandhi and Lentz, 1990). They are not shown on the map; unit 45 is, however, designated for them. The dykes are steep and commonly have trend between north and east. They probably belong to a Neoproterozoic mafic magmatic event; most likely the 723 Ma old Franklin magmatic event, which is distinct from the 779 Ma event that formed the large Hottah diabase sheets dipping gently to the south (Fig. 1; Park et al., 1995).

Cambrian platform strata

Early Paleozoic marine transgression over the Great Bear and Great Slave lakes region deposited Cambrian platform strata that are preserved near the west margin of the GBmz (Fig. 1). They cover a large area in the western part of the map area. They are flat lying, and increase in thickness to the west to 300 m or more (Douglas et al., 1974). In the map area their thickness is generally less than 100 m.

Three units are recognized in the map area: Old Fort Island Formation (unit 46), Mazenod Member of La Martre Falls Formation (unit 47) and La Martre Falls Formation (unit 48). The basal conglomerate with clasts of the rocks of the GBmz occur in all three units, and are observed at several localities in the map area e.g., at the northeast corner of Sarah Lake. Some paleoweathering and a few sandstone dykes occur at the unconformity. The conglomerate grades into sandstones in the Old Fort Island Formation and the lower Mazenod Member of La Martre falls Formation. These are overlain by siltstones, thin bedded argillaceous and silty dolomite, and nodular and oolitic brown dolomite. These beds form the upper part of the Mazenod Member, and much of the La Martre falls Formation.

The outcrop pattern of the cover strata was influenced to some extent, in the writer's opinion, by the northeast-trending brittle faults which were exploited by the glacial ice moving east to west. The ice carved valleys to the crystalline basement, and covered it in part with glacial overburden.

MINERAL OCCURRENCES

Seven types of mineral occurrences are shown on the map. From the metallogenic standpoint, these types can be grouped broadly into the pre-magmatic, synmagmatic and post-magmatic occurrences in relation to the Great Bear magmatic activity. This general classification is applicable to the whole of GBmz, which includes a few additional types of occurrence that are not yet found in the map area, notably the classic Ag-Co-Cu-U-As vein-type deposits of the Echo Bay-Camsell River mining district in the northern part of the GBmz (Fig. 1). These deposits produced U, Ag and Cu during 1940s to 1970s. On the other hand, example of the large Lou Lake-type polymetallic deposit is not yet found in the northern GBmz. The mineral occurrences in the map area are briefly reviewed below in groups. Description of individual occurrences is beyond the scope of this report. It is, however, available from the selected references cited.

Pre-magmatic occurrences

Stratiform concentrations of iron as oxides, mainly magnetite, in the metasedimentary rocks of the Treasure Lake Group comprise the most important type of pre-magmatic occurrences in the map area. The best examples are the Hump Lake north and Ron showings, both located north of Betty Ray Lake, and also the magnetite-rich beds that host the Lou Lake deposits. In these examples, the magnetite beds dominate the stratigraphic sections that are a few metres to a few tens of metres thick and have strike length of a few hundred metres (Gandhi, 1994). Minor folds and crenulations are common in them. In addition, thinner magnetite beds and laminae occur in siltstones and carbonate beds. In addition to these there are a number of siltstone and sandstone beds that contain 5 to 15 per cent disseminated magnetite as grains and aggregates.

It may be noted here that stratiform concentrations of pyrite and copper sulphide, commonly with magnetite, are known elsewhere in the GBmz but are not found in the map area. Near Lou Lake, hydrothermally formed pyrite, arsenopyrite and copper sulphides in some localities have an appearance of stratiform distribution. It is apparent that these metasedimentary strata have served as favourable host rocks for the hydrothermal mineralization.

Syn-magmatic occurrences

Mineral occurrences genetically related to the Great Bear magmatic activity are varied; in the map area, however, the most important are the Olympic Dam-type and the related polymetallic deposits exemplified by the Sue-Dianne and Lou Lake (NICO) deposits. In addition there are magnetite-apatite-actinolite veins of Kiruna-type. The granite-related occurrences found in other parts of the GBmz are rare in the map area, although some of the vein type occurrences of uncertain origin may be granite-related. One of these, a small molybdenite showing on an island in Mazenod Lake is, however, clearly related to a late phase leucogranite. It is placed into the Late or post-magmatic vein-type sulphide occurrences in the map legend in order to focus here on the Olympic Dam-Kiruna type mineralization (Gandhi and Bell, 1996), which is important from the stand points of the resource potential and further exploration.

The term Olympic Dam-type occurrence or deposit as used here implies breccia created by a hydrothermal system, and cemented by the matrix of mainly iron oxides viz., magnetite and hematite-specularite, that hosts minerals carrying Cu, Ag, Au, U and other minerals. Some veins of iron oxide are commonly associated with the breccia, but they form a minor component of the occurrence or deposit. The term Kiruna-type veins as used here is broader than the mineralogical association of magnetite, apatite and actinolite, with little or no sulphides that it connotes. The reason is that many occurrences in the map area are magnetite veins with pyrite and copper sulphides, but little or no apatite or actinolite, and yet they are part of the hydrothermal systems genetically related to the Great Bear magmatic activity. Transition from the clusters of veins to breccia zones may occur laterally or vertically, a notion that is important in exploration strategy. Polymetallic disseminations and veins that are important in the resource potential of the map area (viz., Lou Lake deposit), are regarded here as variants of the Olympic Dam-type deposits because brecciation is not the main feature of these occurrences or deposits

Kiruna-type veins of magnetite±apatite±actinolite±Cu±U

The main examples of these in the map area are the Tan showing, a large part of the Nod prospect, the clusters of veins in the Brooke zone and in the areas west of Upper Bea Lake and north of Ketcheson Lake, and a few other isolated occurrences e.g., near Burke Lake. A few veins of this type also occur in the vicinity of the Mar prospect.

The Tan showing is a small zone of magnetite-apatite-actinolite veins that carry some uranium concentrations. They are hosted by metasedimenary rocks of the Treasure Lake Group. A quartz monzonite intrusion occurs in the vicinity. It was explored in 1950s during the uranium exploration boom that led to the discoveries of the Rayrock mine, and the Ted, Crowfoot and Net uranium showings (Gandhi, 1994).

The Nod prospect is at a large and strong magnetic anomaly, the order of magnitude of which is comparable with that of the Lou Lake deposit (Hetu et al., 1994). Much of the anomaly is covered by overburden and the Cambrian cover strata. Exposure in the western part shows numerous actinolite-magnetite veins, with some apatite, pyrite and copper sulphides, in rhyolitic rocks of the Lou Lake assemblage (Gandhi, 1994). Preliminary drilling done recently on the eastern high magnetic zone has revealed long intersections of low grade copper in magnetite-actinolite veins (Gandhi, 1998b).

The Brooke zone was discovered in 1996 by prospecting and trenching on an outcrop ridge believed to be barren during earlier exploration (Eveleigh, 1997a and b; Gandhi, 1998a). The reason for the belief was the lack of surface indications of copper sulphide or pyrite on glacially polished surface of the rhyolite ridge. Trenching, however, revealed some magnetite-bearing high grade copper veins, with notable values of Bi, Co, Ag and W.

West of Upper Bea Lake a number of small magnetite veins were discovered last year (Gandhi, 1998c). Some of them contain notable concentration of copper sulphides and pyrite. Some others contain tourmaline in addition to the sulphides and magnetite, especially those to the northeast. Furthermore there are a few veins of magnetite-apatite-actinolite to the west, adjacent to a small quartz monzonite intrusion, and a rare vein containing copper sulphide, pyrite and arsenopyrite.

A set of parallel magnetite-epidote-quartz veins occurs on the north-northwest side of Ketcheson Lake. The veins trend northwest. They were noted by the writer in 1992 during mapping around the previously explored Art copper showing. The showing is a vein-type occurrence with chalcopyrite, pyrite and some magnetite, in diorite host. It strikes north-northwest and is more than 100 m long and less than a metre wide. The proportion of magnetite in it is lower, and that of sulphides is higher, than in the veins of Kiruna-type. Despite this difference in the mineralogy, the whole vein cluster is regarded here as of the Kiruna-type.

At Burke Lake, a group of magnetite-apatite-actinolite veins occurs in the metasedimentary beds of the Treasure Lake Group. In this regard the veins are comparable with those of the Tan showing. It must also be noted that magnetite veins, with or without sulphide and arsenide occur in the Lou Lake deposit both in the metasedimentary rocks and the overlying volcanic rocks (Gandhi and Lentz, 1990; Gandhi et al., 1996). The main source of iron in these veins is regarded by the writer as the host iron-rich strata, although some iron may have been introduced from a distal source.

Kiruna-type veins are found in other parts of the GBmz, most notably in the vicinity of quartz monzonite plutons e.g., in the Echo Bay-Camsell River mining district in the north (Fig. 1; Hildebrand, 1986) and at the Fab prospect in the southern part of the GBmz (Gandhi, 1994). In terms of mineral resource potential the Kiruna-type veins have so far not been as attractive as the other two types of syn-magmatic deposits. This may, however, change with further exploration of the Nod and Fab prospects, which represent products of large hydrothermal systems that formed the veins as well as the associated small breccia zones.

Olympic Dam-type-Au-Ag-Fe oxide breccia deposits

Two most important examples of the Olympic Dam-type deposit in the GBmz are the Sue-Dianne deposit and the smaller Mar prospect, both located in the map area (Gandhi, 1994; Gandhi and Bell, 1996). Recently completed drilling of total 61 holes on the Sue-Dianne deposit has outlined global reserves of 24.3 million tonnes averaging 0.56 % Cu and 2.2 g/t Ag, of which 10.6 million tonnes average 0.95 % Cu, and 3.3 g/t Ag (Goad, 1998; Fortune Minerals Ltd., 1998 Annual Report). Some parts of the deposit contain noteworthy amounts of Au and U. The deposit is hosted by a breccia zone 450 m long, 300 in wide with a steep plunge to northeast. The depth extent tested by drilling is 350 m. The host rock is the rhyodacite ignimbrite (map unit 32). Angular to subrounded fragments of it are set in magnetite-rich matrix that locally predominates over the fragments, and contains veinlets and aggregates of pyrite, chalcopyrite, bornite and chalcocite some places specularite occurs in place of magnetite. The deposit is surrounded by a broad zone of quartz±epidote veins that are related to the giant quartz veins along the northeast-trending Dianne Lake brittle fault.

At the Mar prospect a nearly vertical breccia zone, approximately 150 m in diameter, straddles the contact between ignimbritic rhyolite of the Dianne Lake sub-assemblage (map unit 19c) and a diorite intrusive. Its core contains several dyke-like bodies of nearly massive magnetite that contain scattered fragments of the host rhyolite. The diorite on the west side is strongly brecciated and epidotized. Epidote also occurs as paragenetically late veins elsewhere in the breccia. The Mar breccia is tested by one drill hole, 127 m long and vertical, which encountered short intersections carrying copper sulphides. The drill core and the surface exposures show associated minerals pyrite, chlorite, amphibole and some quartz, epidote and uraninite/ pitchblende, in varying amounts.

There are few other occurrences in the map area that qualify as of the Olympic Dam-type breccia. The Nod prospect is, however, noteworthy in that a part of it can qualify as a breccia, but it is not explored sufficiently to determine its character as a whole. This also true of the Fab prospect north of the map area. The only other unequivocal example is the Damp prospect in the central part of the GBmz (Fig. 1). It is a polymetallic breccia with fragments of host rhyodacite and hematitic matrix (Gandhi and Prasad, 1995).

Au-Bi-Co-Cu-W-As disseminations and veins

The polymetallic occurrences of the Lou Lake deposit, the Burke Lake showings and other smaller occurrences are located at or close to the unconformity between the metasedimentary rocks of the Treasure Lake Group and the volcanic rocks of the Lou Lake assemblage. The Lou Lake deposit contains drill indicated 128.6 million tonnes averaging 0.54 g/t Au, 0.07 % Co, 0.08 % Bi, 0.05 % Cu, based on 222 drill holes (Goad, 1998; Fortune Minerals Ltd., 1998 Annual Report). Of these 41.4 million tonnes are of higher grade, averaging 1.03 g/ t Au, 0.124 % Co, 0.133 % Bi and 0.053 % Cu. The deposit also contains a notable amount of tungsten. Much of the resources are in the 'Bowl zone' which is poorly exposed. Smaller, well exposed zones occur in its vicinity to the east, and these were drilled in 1960s (Gandhi and Lentz, 1990). They are so close to the Bowl zone that for practical purposes they may be regarded as connected to it. The large tonnage potential of the

Lou Lake deposit came to light after an airborne multiparameter geophysical survey revealed a very strong and large K anomaly, and the related Th/K ratio anomaly, as coincident with a strong magnetic anomaly (Hetu et al., 1994; Gandhi et al., 1996).

The main minerals in the deposit are arsenopyrite, pyrite, magnetite, chalcopyrite and bismuthinite. Minor amounts of cobaltite, cobaltian arsenopyrite, pyrrhotite, emplectite, loellingite, wittichenite, tennantite, molybdenite, scheelite, wolframite, native bismuth, and native gold are also present (Gandhi and Lentz, 1990; Mulligan, 1995). Their proportions vary widely. Bismuthinite, native bismuth, native gold and scheelite occur mainly as inclusions in arsenopyrite. Hematite, biotite (Fe-rich annite), chlorite, and potassium feldspar are the principal alteration minerals. The economic minerals are contained in 5 to 10 % sulphide-arsenopyrite fraction. The main host rocks are the magnetite-rich metasiltstones and argillaceous beds. Some of the veins cross the unconformity with the overlying volcanic rocks. It is difficult to be certain how high the system may have extended above the unconformity. The Kim showing and a few other showings that contain arsenopyrite, and are hosted by the volcanics at higher stratigraphic levels, may represent a higher level manifestation of this type of mineralizing system (Gandhi, 1998c).

Late and post-magmatic occurrences

Pb-Zn±Cu in quartz or calcite veins

There are a few small vein-type Pb-Zn±Cu occurrences in the map area. The main one is the Carbonate Mountain showing which was drilled recently (R. Goad, personal communication, 1997). It is hosted by folded carbonate beds. Another occurrence is located southwest of Lou Lake, which is in a stock work of quartz veins (Gandhi and Lentz, 1990). In addition to these, minor amounts of sphalerite are noted in the drill core of the Nod prospect (Gandhi, 1998b). Overall the Pb and Zn are scarce in the map area, although carbonate beds in the Treasure Lake Group are favourable for occurrences of these metals. Anomalous amounts of these metals occur in the polymetallic concentrations in the area southwest of Treasure Lake as noted below.

U-Cu occurrences in fractures and giant quartz veins

Pitchblende veins and fracture fillings, with or without copper sulphides, are found in many of the rock units of the map area. The most readily visible are those in the giant quartz veins along the northeast-trending right lateral faults and their subsidiary faults e.g., the Rayrock mine, Crowfoot, Ted and Net prospects, all of which were drilled during the uranium boom of 1950s. The Rayrock mine produced 150 t U from 63 500 tonnes of ore during the period 1957-'59 (Gandhi, 1994). In addition there are occurrences in fractures, which are not associated with the giant quartz veins e.g., in the Lou Lake area.

There are at least two generations of quartz veins in the 'giant quartz veins': the early milky white, massive, fine to medium grained veins, and late coarse crystalline quartz veins, often with well developed quartz crystals pointing inward from the walls. Other minerals are scarce, although in some places notable concentrations of pyrite, copper sulphides, pitchblende, specularite and hematite have been noted. Chlorite, epidote and hematite are common as alteration products in the wall rock.

Occurrences of molybdenite, pyrite, chalcopyrite and other minerals

This group includes a variety of small occurrences that are not readily assignable to other groups described above. The main minerals or metals in them are indicated on the map. They are mostly vein-type occurrences, but include minor breccias and some that appear to have stratiform enrichment of various metals.

The clusters of occurrences southwest of Treasure Lake mentioned above is the most important of the group. The occurrences are characterized by gossans due to pyrite and pyrrhotite, and by magnetite, amphibole, epidote, potassium feldspar alteration minerals and veins. Notable amounts of Cu, Pb, Zn, Bi, Co, Au and Ag have been reported from the selected samples of these occurrences (Neale and Mulligan, 1996). Some of these occurrences are comparable with the polymetallic veins and disseminations near Lou Lake and Burke Lake.

Other occurrences include pyrite and/or chalcopyrite, some black tourmaline veins near Upper Bea Lake, and a molybdenite occurrence on an island in Mazenod Lake. There are also a few copper occurrences reported in the area of a metasedimentary band near the Wopmay fault zone north of Cole Lake (T. Teed, personal communication, 1998).

METALLOGENIC OVERVIEW

The pre-magmatic concentration of metals occur in the Treasure Lake Group. The most apparent one is that of iron as seen in the stratiform magnetite beds. Relatively less conspicuous but metallogenically important enrichment is that of Cu, Bi, Co, Au and Ag in the argillaceous beds, which is of the type commonly associated with the black shales.

The stratiform magnetite is considered by the writer as synsedimentary in origin, based on the stratiform character from megascopic to microscopic scale, world wide occurrences of iron formations in the early Proterozoic platform sequences, and the deformation and metamorphism of the host Treasure Lake Group along with iron-rich beds prior to the onset of Great Bear magmatic activity (Gandhi, 1994). The iron oxide has remained largely confined to the original host strata, although local mobilization is observed in intensely crenulated parts and in zones that have undergone intense alteration. Lean iron formations, especially the siltstones with disseminated magnetite are associated with them. Miller (1982) suggested that they may be xerogenic (deposited in lake environment).

The synmagmatic mineralization of Olympic Dam-Kiruna type (Hildebrand, 1986; Gandhi and Bell, 1996), and the related polymetallic disseminations and veins, are the most important from the metallogenic and exploration stand points. The former are exemplified by the Sue-Dianne deposit and the Mar, Nod, Fab, Brooke and Kim prospects, all of which are hosted by the volcanic rocks of the GBmz. They contain abundant iron oxide, with copper sulphides and pyrite, as breccia-fillings and veins. The arsenopyrite-chalcopyrite-magnetite-pyrite veins and disseminations, as seen at the Lou Lake deposit and the Burke Lake showings, are hosted mainly by the magnetite-rich metasediments at the unconformity with overlying volcanic rocks, although some mineralization straddles the unconformity. Tourmaline and scheelite are common in the occurrences of both groups; arsenopyrite, cobaltite and bismuthinite are relatively more abundant in the latter than in the former, and actinolite, apatite and epidote are more abundant in the former than in the latter. Both styles of mineralization postdate the volcanic activity and subvolcanic intrusions. The timing of mineralization relative to the emplacement of major granitic plutons, however, remains uncertain. It is observed that potassium enrichment is associated with all the occurrences except for the Nod prospect, which is unusual in that part of it is characterized by abundant actinolite veins and sodium enrichment (Gandhi et al., 1996; Gandhi, 1998b).

Field observations and the features of mineral occurrences lead to the postulation that the mineralization related to the Great Bear magmatic activity is episodic. The type represented by the Sue-Dianne deposit occurred early, during the transition from calc-alkaline to relatively more potassic magmatism. The Lou Lake style of mineralization occurred during the later stages of magmatism and is probably related to a potassium-rich intrusion at depth (Gandhi et al., 1998). Some of the metals in the latter type, in particular Bi, Co and Au, may have been scavenged by the mineralizing fluids from the argillaceous beds of the Treasure Lake Group through which they ascended. Deposition of the metals occurred as the mineralizing fluids reached the unconformity, where the volcanic assemblage above served as the cap rock.

Minor variations in mineralogy are observed in some of the deposits, the most important of these being the Lou Lake deposit. The variations occur laterally and vertically. It is conceivable that vertical mineral zoning exists on a larger scale at the individual deposits and for the district or region as a whole. The available data base is, however, inadequate to confirm this.

The late or post-magmatic occurrences are mainly of vein-type. The most important ones in the past have been the U-Cu occurrences in the giant quartz veins along the brittle faults. The faults displace all the rocks of the GBmz. Their formation has been attributed to the collision of the Hottah terrane with a continental block to the west (Hoffman, 1980; Hildebrand et al., 1987). They pre-date the Hornby Bay Group deposited ca. 1685 Ma. They were reactivated repeatedly. Preliminary fluid inclusion studies show generally low temperature of formation of the quartz veins (in the order of 150 to 225° C) in contrast to the higher temperatures visualized for the syn-magmatic mineralization. U--Pb isotopic ages on pitchblende in the giant quartz veins are in the order of 500-600 Ma (Miller, 1982). The reason for these young ages is the resetting of isotopic equilibrium in the open system of this type.

GUIDES TO FURTHER EXPLORATION

Virtually all the mineral occurrences of the map area were discovered by prospecting, with the main exception of the Sue-Dianne deposit, which was located by a regional airborne radiometric survey carried out by the Geological Survey of Canada in 1974 (Gandhi, 1994). The major Lou Lake deposit was known to the prospectors as far back as late 1930s from the well exposed eastern zones, and its potential as a large tonnage target became evident after the detailed field work for metallogenic studies and an airborne multiparameter geophysical survey (Hetu et al., 1994; Gandhi et al., 1996). Diligent prospecting since then has been rewarded by the discovery of the Brooke zone, Kim showing and several other promising targets. It is still an important tool, along with trenching, for this region where despite good exposures the surface expression of mineralization is often negligible.

The principal geological guides are the unconformity between the Treasure Lake Group and volcanic rocks of the GBmz, and the alteration haloes, especially of the strong potassium alteration, in magnetite-enriched zones. It should be noted that the unconformity is controlled by an irregular paleosurface of the folded metasedimentary strata. Its subsurface projection is complicated by later folds and faults. It must also be pointed out here that small magnetite veins, which in themselves are not of economic interest, may indicate proximity to a larger deposit, as seen at the Mar prospect.

Airborne and ground geophysical anomalies, especially the magnetic anomalies, and coincident potassium anomalies, accompanied by low Th/ K ratio anomalies, are very important exploration tools. Sufficient data are now available to screen these semi-quantitatively or quantitatively. It may be noted that magnetic anomalies are subdued under the Paleozoic cover strata, and along the northeast-trending brittle faults. It should also be kept in mind that the Olympic Dam deposit in South Australia is under 300 m of flat-lying Paleozoic beds. The larger magnetic anomalies deserve further testing by gravity survey. It may be added that there was a regional lake sediment geochemical survey of the GBmz (Garrett, 1975, 1990), but to date there has been little use of geochemical surveys in exploration of the map area.

Since the mineralization is highly variable, and in some cases erratic, sufficient drilling should be allowed to test the target adequately. The maximum depth to which the targets have been tested by drilling (Sue-Dianne and Lou Lake deposits) is less than 350 m. There is no geological reason to believe that the mineralization would end at this depth; on the contrary the opposite is likely to be true. There is also a large potential for blind targets in the area, which is virtually untested.

SELECTED REFERENCES

Bowring, S.A.

1985: U-Pb zircon geochronology of early Proterozoic Wopmay orogen, N.W.T., Canada: an example of rapid crustal evolution. Ph. D. thesis, University of Kansas, Kansas, U.S.A., 138 p.

Bowring, S.A. and Grotzinger, J.P.

1992: Implications of new chrono-stratigraphy for tectonic evolution of the Wopmay orogen, northwest Canadian Shield; American Journal of Science, v. 292, p. 1-20.

Bowring, S.A. and Ross, G.M.

1985: Geochronology of the Narakay Volcanic Complex: implications for the age of the Coppermine Homocline and Mackenzie igneous events; Canadian Journal of Earth Sciences, 22, p. 774-780.

Douglas, R.J.W., Norris, A.W. and Norris, D.K.

1974: Geology, Horn River, District of Mackenzie, Northwest Territories; Geological Survey of Canada, Map 1372A, scale 1 : 500 000.

Eveleigh, A.J.

1997a: Report on prospecting, ground geophysics, airborne geophysics and gravity survey, July-December 1996; Dianne Lake property, IRR 2 (F495099) and BROOKE (pending) claims, Mazenod Lake area, Mackenzie District, Northwest Territories, Canada, N.T.S. 85 N/10 and 85 N/15, 116° 54' 00" longitude and 63° 44' 40" latitude; Avalon Ventures Ltd./Starcore Resources Ltd., unpublished report, 23 p.

1997b: Report on the drilling April, 1997; Dianne Lake property, IRR 2 (F495099) and BROOKE (pending) claims, Mazenod Lake area, Mackenzie District, Northwest Territories, Canada, N.T.S. 85 N/10 and 85 N/15, 116° 54' 00" longitude and 63° 44' 40" latitude; Avalon Ventures Ltd./Starcore Resources Ltd., unpublished report, 21 p. and diamond drill logs.

Gandhi, S.S.

1994: Geological setting and genetic aspects of mineral occurrences in the southern Great Bear magmatic zone, Northwest Territories; in Studies of Rare-Metal Deposits in the Northwest Territories, (ed.) W.D. Sinclair and D.G. Richardson; Geological Survey of Canada, Bulletin 475, p. 63-96.

1998a: Geology and genesis of the felsic volcanic-hosted Brooke magnetite-copper sulphide vein zone, Dianne Lake, southern Great Bear magmatic zone, IRR 2 and BROOKE claims, District of Mackenzie, Northwest Territories; Report to Avalon Ventures/Starcore Resources Joint Venture, unpublished report, 58 p.

1998b: Exploration of the Mazenod Lake-Squirrel Lakes Property in 1998 Prospecting, Geological Mapping, Ground Magnetic and Radiometric Surveys, and Prospect Evaluation; report to Alberta Star Mining Corp., unpublished report, 55 p.

1998c: Regional Geological Setting and Mineral Potential of the Sarah Lake property, southern Great Bear magmatic zone, Northwest Territories; report to Alto Minerals Inc., unpublished report, 28 p.

Gandhi, S.S. and Bell, R.T.

1996: Kiruna/Olympic Dam iron-copper-uranium-gold; *in* Geology of Canadian Mineral Deposit Types, (ed.) O.R. Eckstrand, W.D. Sinclair, and R.I. Thorpe; Geological Survey of Canada, Geology of Canada, no. 8 (also Geological Society of America, The Geology of North America, v. P-1), p. 513-522.

Gandhi, S.S. and Lentz, D.R.

1990: Bi-Co-Cu-Au-As and U occurrences in the Snare Group metasediments and felsic volcanics of the southern Great Bear magmatic zone, Lou Lake, Northwest Territories; *in* Current Research, Part C, Geological Survey of Canada, Paper 90-1C, p. 239-253.

Gandhi, S.S., Mortensen, J. K, Prasad N., and van Breemen 0.

1998: U-Pb zircon geochronology of the southern Great Bear magmatic zone and its implications to the metallogenic evolution; *in* Program and Abstracts of Talks and Posters, 26th Yellowknife Geoscience Forum, 25-27 November, 1998; Department of Indian and Northern Affairs, p. 42-46.

Gandhi, S.S., and Prasad, N.,

1995: Geological setting of Bode copper and Damp polymetallic prospects, central Great Bear magmatic zone, Northwest Territories; *in* Current Research 1995-C; Geological Survey of Canada, p. 201-212.

Gandhi, S.S., Prasad, N., and Charbonneau, B.W.

1996: Geological and geophysical signatures of a large polymetallic exploration target at Lou Lake, southern Great Bear magmatic zone, Northwest Territories; *In* Current Research 1996-E; Geological Survey of Canada, p. 147-158.

Garrett, R.G.

1975: Copper and zinc in Proterozoic acid volcanics as a guide to exploration in the Bear Province; *in*. Geochemical Exploration 1974, (ed.) I.L. Elliot and W.K. Fletcher; Association of Exploration Geochemists Special Publication No. 2; Elsevier Publishing Company, Amsterdam, p. 371-388.

1990: Lithogeochemical digital data release: Proterozoic acid volcanic rocks, southern Wormy belt, Northwest Territories (NTS 85 N; 86 C, D, E, F); Geological Survey of Canada, Open File 2257 (2 files; 7753 and 219432 bytes).

Goad, R. E.

1998: The NICO and Sue-Dianne Proterozoic iron oxide-hosted polymetallic deposits, southern Great Bear magmatic zone, Northwest Territories - a summary of current work and deposit model development in global mineral exploration; *in* Program and

Abstracts of Talks and Posters, 26th Yellowknife Geoscience Forum, 25-27 November, 1998; Department of Indian and Northern Affairs, p. 4649.

Hetu, R.J., Holman, P.B., Charbonneau, B.W., Prasad, N. and Gandhi, S.S.

1994: Multiparameter airborne geophysical survey of the Mazenod Lake area, Northwest Territories, 1993 (NTS 85N/10 and parts of 85N/11, 14, 15); Geological Survey of Canada, Open File 2806.

Hildebrand, R.S.

1986: Kiruna-type Deposits: Their Origin and Relationship to Intermediate Subvolcanic Plutons in the Great Bear Magmatic Zone, Northwest Canada; Economic Geology, v. 81, no. 3, p. 640-659.

Hildebrand, R.S., Bowring, S.A. and Housh, T.

1990: The medial zone of Wopmay orogen, District of Mackenzie; *in* Current Research, Part C, Geological Survey of Canada, Paper 90-1C, p.167-176,

Hildebrand, R.S., Hoffman, P.F. and Bowring, S.A.

1987: Tectono-magmatic evolution of the 1.9-Ga Great Bear magmatic zone, Wopmay orogen, Northwestern Canada; Journal of Volcanology and Geothermal Research, v. 32, p. 99-118.

Hoffman, P.F.

1980: Wopmay Orogen: a Wilson cycle of Early Proterozoic age in the northwest of the Canadian Shield; *in* Continental Crust and its Mineral Deposits; editor, D.W. Strangway; Geological Association of Canada, Special Paper 20, p. 523-549.

1984: Geology, Northern Internides of Wopmay Orogen, District of Mackenzie, Northwest Territories; Geological Survey of Canada, Map 1576 A, scale 1 : 250 000.

1988: Geology and tectonics: east arm of Great Slave Lake, Northwest Territories. Geological Survey of Canada, Map 1628A, sheet 1, scale 1 : 250 000, and sheet 2, scale 1 : 500 000.

Hoffman, P.F. and Bowring, S.A.

1984: Short-lived 1.9 Ga continental margin and its destruction, Wopmay orogen, northwest Canada; Geology, v. 12, pp. 68-72.

Hoffman, P.F., Bell, 1.R., Hildebrand, R.S. and Thorstad, L.

1977: Geology of Athapuscow aulacogen, east arm of Great Slave Lake, District of Mackenzie; *in* Report of activities, part A, Geological Survey of Canada, Paper 771A, pp. 117-129.

Hoffman, P. and. Hall, L.

1993: Geology, Slave craton and environs, District of Mackenzie, Northwest Territories; Geological Survey of Canada, Open File 2559, scale 1 : 1 000 000.

Lord, C.S.

1942: Snare River and Ingray Lake map-areas, Northwest Territories; Geological Survey of Canada, Memoir 235, 35 p.

McGlynn, J.C.

1968: Tumi Lake, District of Mackenzie, Geological Survey of Canada Map 1230A, scale 1 : 63 360.

1979: Geology of the Precambrian rocks of the Rivière Grandin and in part of the Marian River map areas, District of Mackenzie; *in* Current Research, Part A, Geological Survey of Canada, Paper 79-1A, p. 127:131.

Miller, R.G.

1982. The geochronology of uranium deposits in the Great Bear batholith, Northwest Territories; Canadian Journal of Earth Sciences, v. 19, p. 1428-1448.

Mulligan, D.C.

1995: Proterozoic iron oxide and As-Co-Bi-Cu vein mineralization at the NICO property, N.W.T.; BSc. thesis, University of Western Ontario, London, Ontario, 77 p.

Neale, K.L. and Mulligan, D.C.

1996: A report on the geology of the Treasure (F49508) and Island 1 (F51395) grids, Marian River area, Mackenzie (south) District, Northwest Territories (NTS 85 N / 7 and 10); report to GMD Resource Corp., unpublished report, 36 p.

Park, J.K., Buchan, K.L. and Gandhi, S.S.

1995. Paleomagnetism of 779 Ma Hottah gabbro sheets of the Wopmay Orogen, Northwest Territories. *In* Current Research 1995-C; Geological Survey of Canada, pp. 195-200.

Reichenbach, I.G.

1991: The Bell Island Bay Group, remnant of an early Proterozoic ensialic marginal basin in Wopmay orogen, District of Mackenzie; Geological Survey of Canada, Paper 88-28, 43 p.

Saylor, B.Z. and Grotzinger, J.P.

1992: Reconnaissance of the structure and stratigraphy of the Basler Lake area, southern Wopmay Orogen, Northwest Territories; *in* Current Research, Part C, Geological Survey of Canada, Paper 92-1C, p. 259-268.

Statement of Qualifications

I, Sunil S. Gandhi of 48-3205 Uplands Drive, Ottawa, Ontario make the following declaration:

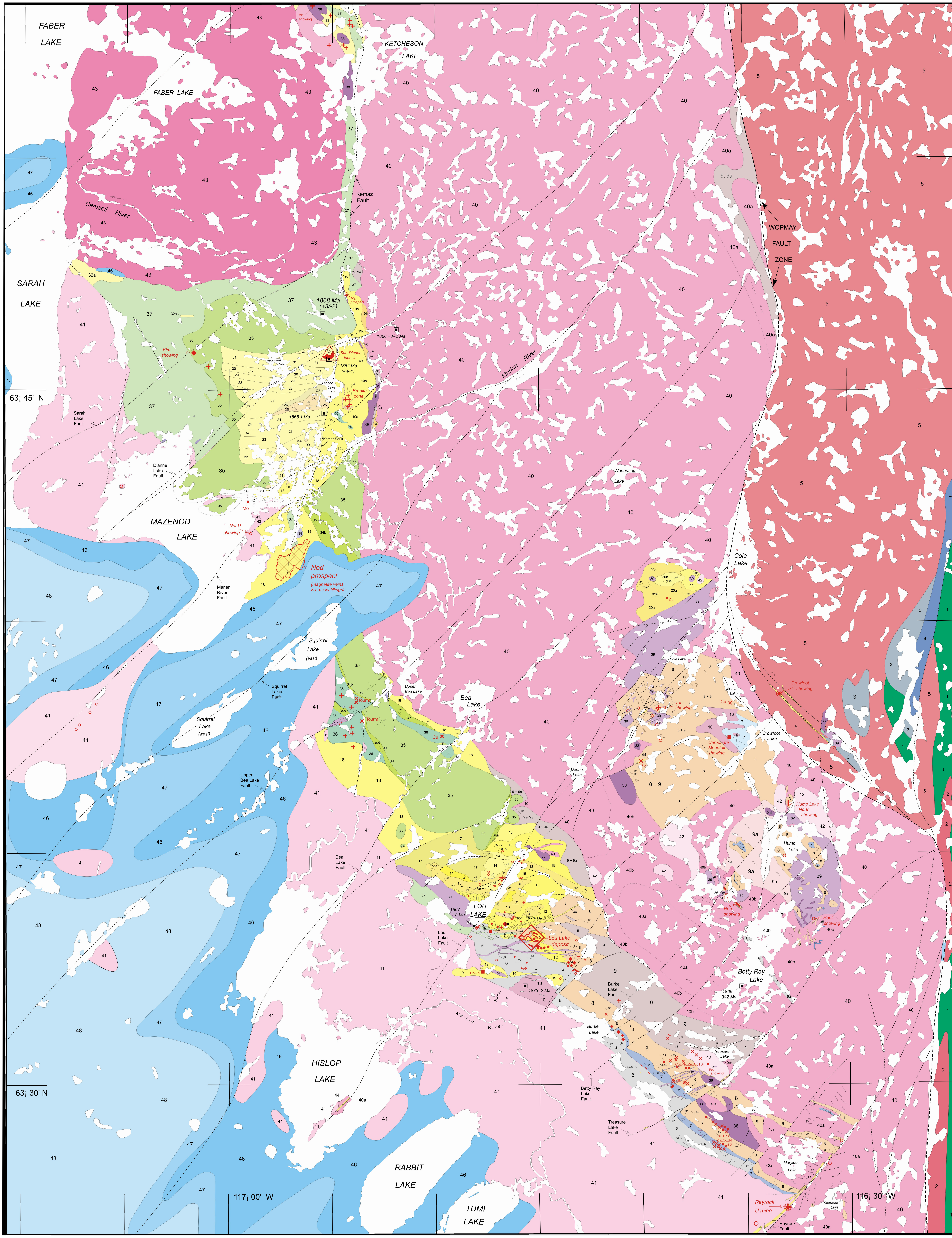
1) I graduated as a Master of Science, Applied Geology at McGill University, Montreal, Quebec in 1960, and received Ph. D. degree in Geology from the same university in 1967.

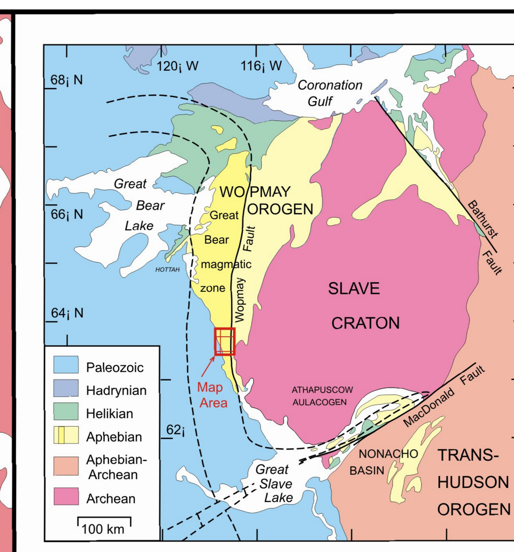
2) I have been involved in all aspects of mineral exploration since that time in the Provinces of Newfoundland and Labrador, and British Columbia as a Project Geologist for British Newfoundland Exploration Limited, based in Montreal, from 1965 to 1976.

3) From November 1976 to March 1997, I served as a Research Scientist in the Mineral Resources Division of the Geological Survey of Canada, Ottawa, contributing to the assessment of Canada's uranium resources and of the mineral resource potential of areas proposed as National Park, and concurrently conducting researches in the metallogeny of selected regions in the Northwest Territories and. Labrador.

4) I am a Fellow of the Geological Association of Canada, and a member of the Mineralogical Association of Canada, Canadian Institute of Mining and Metallurgy, Society of Economic Geology and Geological Society of India.

June 15, '99





General geology of the northwestern Canadian Shield and location of the map area

LEGEND

Cambrian platform strata (flat lying)

- 48 — La Martre Falls Formation; green and red shale; thin bedded argillaceous and silty dolomite; salt crystal clasts
- 47 — Mazenod Member, La Martre Falls Formation; basal polymict conglomerate; quartzose sandstone; nodular and oolitic brown dolomite
- 46 — Old Fort Island Formation; sandstone, white & grey, fine grained (may include basal La Martre Falls Formation in some places)

------------- *Unconformity* -------------

- 45 — Diabase dykes (commonly < 1 m wide; not shown); Proterozoic, more than one generation
- 44 — Giant quartz veins & stockworks; early Proterozoic, related to brittle faults (mainly NE trending)

Great Bear magmatic zone (1870 - 1840 Ma)

Great Bear intrusions

- 43 — Faber Lake rapakivi granite suite (1856 +2/-3 Ma); coarse potassium feldspar porphyritic, with equigranular granitic and aplitic phases
- 42 — Leucogranite, epizonal plutons and sheets, medium to fine grained, seriate to porphyritic
- 41 — Granitic plutons, undifferentiated; granodioritic to felsic; massive to gneissic
- 40 — Marian River granite-granodiorite batholith; coarse feldspar porphyritic (1866 ± 2 Ma), grades into gneissic (40a) & monzonitic phases (40b) near Wopmay fault & Betty Ray Lake (1866 +3/-2 Ma)
- 39 — Quartz monzonite-monzodiorite plutons and dykes (1867 ± 1.5 Ma, U/Pb zircon age)
- 38 — Diorite, irregular bodies & dykes (two generations or more; relative ages not certain)
- 37 — Rhyodacite porphyry; subvolcanic intrusions and dykes; feldspar-quartz-hornblende phyric, with aphanitic matrix (1867.9 +2.9/-2.4 Ma)
- 36 — Plagioclase porphyry, dacitic; magnetite-rich

Faber Group (volcanic assemblages, 1870-1866 Ma)

Bea Lake volcanic assemblage

- 35 — Rhyodacite, quartz-feldspar porphyritic, massive, grey aphanitic matrix; in part intrusive
- 34 (b, a) — 33a: Conglomerate, volcaniclastic, clasts cobble to pebble size; 33b : Tuff, siltstone, rhyolite

Mazenod Lake volcanic assemblage

- 33 — Rhyodacite ignimbrite, flow textured to massive; unit of sub-assemblage extending to the north
- 32 — Rhyodacite ignimbrite, flow textured to massive (1861.5 +8.7/-1.3 Ma); 32a : Lithologically comparable outliers near Sarah Lake
- 31, 30, 29, 28, 27 — Rhyodacite ignimbrite units (cooling units); lower part of each characterized by well developed flowage foliation; gradation to massive zone above; top part commonly contains abundant lithic fragments; volcaniclastic siltstone lenses and inclusions occur in some places
- 26 — Rhyodacite, coarse feldspar porphyritic, massive; flowage foliation at base
- 25 — Volcaniclastic unit; basal heterolithic fragmental zone, overlain by conglomerate and lapilli tuff
- 24 — Rhyodacite ignimbrite, flow textured to massive (1868.6 +1.3/-1.2Ma; U/Pb zircon age)
- 23 — Rhyodacite ignimbrite, massive to flow textured
- 22 — Rhyodacite ignimbrite, flow textured to massive; 22a - associated volcaniclastic siltstone lenses
- 21 — Rhyodacite ignimbrite, flow textured to massive; 21a - associated volcaniclastic siltstone lenses

Lou Lake volcanic assemblage

- 20 — Cole Lake sub-assemblage: 20a - Siltstone; 20b - Conglomerate-agglomerate, with sandstone lenses; 20c - Rhyolite, subporphyrytic
- 19 — Dianne Lake sub-assemblage: 19a - Rhyolite, coarse porphyritic, massive; 19b - Siltstone, volcaniclastic; 19c - Rhyolite ignimbrite; 19d - Volcaniclastic siltstone and rhyolite
- 18 — Rhyolitic rocks, undivided; commonly aphanitic; massive to subporphyritic
- 17 — Rhyolite, quartz-feldspar porphyritic; massive, in places showing ignimbritic flowage texture
- 16 — Rhyolite, aphanitic to subporphyritic
- 15 — Rhyolite. porphyritic to subporphyritic, grey, flow banded to massive
- 14 — Rhyolite, subporphyritic, flow banded, in places lithophysae-bearing; buff white to light grey
- 13 — Tuff, volcaniclastic siltstone & agglomerate, with thin rhyolite flows; commonly bedded/layered
- 12 — Rhyolite, subporphyritic, massive to flow banded, buff white to pink (1851 +18/-16 Ma)
- 11 — Agglomerate-lithic tuff; heterolithic; in part thinly bedded; fragments angular to lensoid; basal conglomerate lenses with quartzite clasts

------------- *Unconformity* -------------

- 10 — Granite-leucogranite; in part sodic; early phase of the Great Bear magmatic activity (1873±2 Ma)

Treasure Lake Group (west of Wopmay fault zone)

- 9 — Metasiltstone; variable magnetite content; with beds & lenses of arkosic quartzite, calcsilicate, argillite and biotite-garnet±cordierite gneiss; 9a : Feldspar-biotite gneiss, medium grained
- 8 — Quartzite, interbedded with metasiltstone (unit 9) and calcareous beds (Unit 7)
- 7 — Calcareous unit (marble, calcsilicate), with sandy, silty and magnetite-rich beds
- 6 — Metasiltstone; variable magnetite content; with black argillite beds; 6a : Quartzo-feldspathic paragneiss, contorted, with some amphibolite

Hepburn intrusive suite (1900 - 1890 Ma)

- 5 — Granite, granodiorite & related rocks of the core zone of the Wopmay orogen; synkinematic intrusions, undifferentiated

Snare Group (east of Wopmay fault; 1900 - 2000 Ma)

- 4 — Dolomite, limestone; thin to thick bedded
- 3 — Conglomerate, arkose, quartzite, shale, argillite, cherty argillite and phyllite

------------- *Unconformity* -------------

Archean rocks of the Slave craton (> 2500 Ma)

- 2 — Granite, granodiorite; undifferentiated Archean and early Proterozoic plutons
- 1 — Metagreywacke, slate, phyllite, quartzite, quartz-mica schist and paragneiss of the Yellowknife Supergroup

Mineral Occurrences

- × Molybdenite, pyrite etc. (note abbreviations)
- ○ U-Cu (fracture-fillings & in giant quartz veins)
- ■ Pb-Zn±Cu (in quartz or calcite veins)
- ◆ Au-Bi-Cu-Co-W-As (disseminations and veins; K enrichment)
- ▲ Cu-Au-Ag±U in breccia, magnetite-matrix, Olympic Dam-type
- + Magnetite ± apatite ± actinolite veins ± Cu ± U; Kiruna-type
- ▬ Fe (stratiform in meta-sedimentary beds)

Symbols

- Fault, major/ minor
- Lineation; plunge (10)
- Minor folds; plunge (15)
- Antiform, Synform
- Foliation (penetrative), schistosity, gneissosity: Vertical, Inclined (75)
- Bedding, volcanic flowage foliation and banding: Vertical, Inclined (75); Inclined; top direction (45)
- Inferred boundary
- Geological boundary

0 — 2 km

Geology and mineral occurrences of the Mazenod Lake-Lou Lake area, Northwest Territories

NTS 85 N / 10 and parts of 6, 7, 8, 9,11, 14, 15 and 16

Scale: 1 : 50 000

Compilation by Sunil S. Gandhi, June 1999,

for Hudson Bay Exploration & Development Co. Ltd.