DESCRIPTIVE NOTES

This map was compiled from the field observations made during the metallogenic studies of the southern Great Bear magmatic zone under the Canada-Northwest Territories Mineral Development Agreement (1986-'90) and the subsequent Minerals Initiative Program (1991-'96). It incorporates the results of earlier mapping by Lord (1942) and McGlynn (1968), and also of the mineral exploration in the area (Gandhi, 1994; Gandhi et al., 1996). In addition the geophysical data from an airbotne magnetic-radiometric-VLF-EM survey (Hetu et al., 1994) have been useful in the interpretation of the geology and mineralization of the map area.

The most prominent topographic feature in the map area is a northwest-trending ridge of metasedimentary and volcanic rocks. It rises as much as 100 m above nearly flat granitic terrain on both sides with numerous, generally shallow lakes and some isolated hills and ridges in the northeast. Marian River flows southwest from Bea Lake and enters the north end of large Hislop Lake a short distance outside the map area, and flows southeast from the lake in the map area to reach eventually the Great Slave Lake. The river has a number of rapids, but it is navigable by canoe and small boats. The area is sparsely wooded, although thicker growths are found in several places. A winter road from Yellowknife to Rae Lakes settlement passes through the Hislop Lake region. The glacial movement in the map area was from east to west.

The map area is located in the southern part of the Great Bear magmatic zone, which is a continental, 1870-1840 Ma old, calc-alkaline volcano-plutonic zone on the western margin of ca. 1900 Ma old Wopmay orogen (Fig. 1). General geological setting of the map area comprises an early Proterozoic metasedimentary sequence, intruded by granitic plutons during the Wopmay orogeny and overlain unconformably by a relatively gently dipping rhyolitic volcanic assemblage, which was emplaced during the Great Bear magmatic activity ca. 1865 Ma ago and was intruded by related granitic plutons (Lord, 1942; Hoffman, 1984, 1989; Hildebrand et al., 1987; Frith, 1993; Bowring and Grotzinger, 1992; Gandhi, 1994). The unconformity between the metasedimentary and volcanic rocks is exposed near Lou Lake. A set of northeast-trending faults, commonly with right- lateral displacement, traverses the map area as well as the rest of the Great Bear magmatic zone. These faults merge with or terminate at a major north-south fault zone, namely the Wopmay fault zone or medial zone that marks the eastern boundary of the Great Bear magmatic zone (Hoffman, 1984; Hildebrand et al., 1990), and has a local deviation in southeasterly direction near Crowfoot Lake. The Proterozoic rocks are covered by flat-lying Cambrian strata in the southwest (Douglas, 1974).

The oldest rocks in the map area are the metasedimentary rocks (McGlynn, 1968), which are regarded as equivalents of the Snare Group defined by Lord (1942) in the type area to the northeast. The Snare Group is correlatable with the Coronation Superggroup in the northern part of the Wopmay Orogen (Frith, 1993; Saylor and Grotzinger, 1992). The supergroup forms the passive margin sequence deposited during the period 1970-1880 Ma (Bowring and Grotzinger, 1992). In the map area, the metasedimentary rocks occur as remnants in the granitic terrain, and the basement on which these strata were deposited is not exposed (McGlynn, 1968; Gandhi, 1994). They form the southern part of the main northwest-trending ridge, where the sequence is 1.5 km thick comprised of four units deposited in a regressive cycle. The beds dip 50° to 70° to the northeast, facing right side-up.They impart a cuesta-like form to the ridge. Deformation and metamorphism are progressively more intensive in the rocks to the northeast, reaching amphibolite grade near the Wopmay fault zone.

The basal siltstone (unit 1) is approximately 1 km thick, and is fine grained, quartzofeldspathic, bedded on a centimetre scale, and commonly light grey, gark grey and buff white. It includes some argillaceous beds and some weakly to strongly magnetic beds as much as 5 cm thick. The overlying calcareous beds (unit 2) have an aggregate thickness of 100 m and form a marker unit. They include carbonate, calcareous argillite and calc-silicate beds, and also some thin beds and lenses of magnetite. Much of the unit is thinly bedded, but thicker carbonate beds and lenses, irregularly distributed and metamorphosed to marble, occur throughout the unit. The quartz arenite (unit 3) is 300 to 550 m thick, medium grained, and massive to well bedded on a decimetre scale. Graded bedding, crossbedding and ripple marks, observed at several places, show that the beds are right side up. The unit includes beds of pale pink to buff quartzofeldspathic siltstone, which are as much as 10 m thick in some places. It grades upward into a siltstone assemblage (unit 4), which exceeds 300 m in thickness. The siltsones are mainly grey biotite-rich, interbedded with buff white to pale pink, mafic-poor quartzofeldspathic beds. Magnetite is common in grey siltstones as finely disseminated grains and locally forms beds as much as a few centimetres thick. The unit includes beds of quartz arenite, argillite and calcareous rocks. Some of the argillaceous beds have distinctive spotted texture due to altered or retrogressed cordierite a few millimetres to a cm in diameter. Northeast of the ridge, most of the metasedimentary rocks are tentatively assigned to the four units, except for the biotite-rich quartzofeldspathic paragneiss (unit 5), well exposed at Hump Lake, and highly contorted biotite-hornblende quartzo-feldspathic banded gneiss (subunit 1a), which has some remnants of amphibolitic rocks and resembles some of the Archean gneisses to the east (Gandhi, 1994; Gandhi et al., 1996).

The metasedimentary rocks were folded about northwest axes and have been intruded by syntectonic granodiorite gneiss of the Betty Ray Lake region (unit 6). Foliation and lineation in this hornblende-biotite-bearing pluton trends northwesterly. The pluton grades into a monzonitic marginal phase (unit 7). Both phases apparently grade into more massive varieties south and north of Betty Ray Lake, and and these are difficult to distinguish in the field from compositionally similar, younger intrusions formed during the Great Bear magmatic activity. Small leucogranitic bodies, with associated tourmaline-rich veins, common near Treasure Lake, are regarded here as part of the older granitic suite coeval with the syntectonic Hepburn intrusive suite east of the Wopmay fault zone (Hoffman, 1984; Frith, 1993).

Following the uplift and erosion of these rocks, felsic volcanic activity formed the Lou Lake assemblage, which has an aggregate thickness of approximately 1.5 km and dips gently to moderately to the northeast. It comprises ten units (units 8 to 16) and some undivided rhyolitic rocks grouped as unit 17 (Gandhi and Lentz, 1990). The basal unit is a lithologically variable agglomerate-tuff, commonly fragmental but locally well bedded. It was deposited on uneven surface of tilted metasedimentary rocks. The unit is overlain by a massive to banded subporphyritic rhyolite (unit 9), which in turn is overlain by a well bedded tuff-volcaniclastic siltstone (unit 10). The next units in the sequence are flow laminated, lithophysae-bearing subporphyritic rhyolite (unit 11), and grey, well banded to massive subporphyritic dacite (unit 13). A massive to ignimbritic rhyodacite (unit 14) occurs to the west, and is in part intrusive. A volcaniclasitic conglomerate (unit 15) may grade to the northwest into tuff, siltstone and rhyolite (unit 15a). The overlying coarse, quartz-feldspar porphyritic, massive rhyodacite, with grey aphanitic matrix (unit 16) is areally extensive and is in part intrusive. The undivided rhyolitic rocks are commonly subporphyritic and in some places have ignimbritic texture. The Lou Lake assemblage as whole is cal-alkaline in composition and shows considerable variation in alkalies (Gandhi and Lentz, 1990; Gandhi, 1994). It is part of the Faber Group in the southern Great Bear magmatic zone which is bracketed by U-Pb zircon geochronology between 1870 and 1860 Ma (Gandhi, 1994)

The rocks intrusive into the volcanic assemblage include diorite of more than one generation (unit 18), subvolcanic quartz-feldspar porphyritic and feldspar-porphyritic dacite (unit 19 a and b), quartz-feldspar porphyry dykes (unit 20), quartz monzonite-monzodiorite (unit 21), which are close in age to the volcanic rocks (Gandhi, 1994). Large younger granite plutons are areally extensive (units 22-24). The granite-granodiorite of Bea and Dennis lakes area (unit 22) is the southern part of the Marian River batholith. The southwestern part of the map area is underlain by a variety of granitic rocks ranging from hornblende-biotite-rich to leucocratic (unit 23), which are poorly exposed. Medium to fine grained leucocratic bodies (unit 24) are probably phases of these granitic plutons.Some of these, however, belong to a distinctive sodium-rich suite (unit 25) that contain little or no potassium feldspar as those at the west end of Crowfoot Lake. A larger body southeast of Lou Lake is feldspar porphyritic.

The Great Bear magmatic activity was followed by brittle faulting that formed the northeast-trending faults, some of which host giant quartz veins (unit 26). The faults and the veins have excellent topographic expression. A number of small diabase dykes (unit 27) of unknown age occur in the area. Most of them are too small to show on the scale of this map. The Cambrian strata are poorly exposed and less than 100 m thick. They include sandstones of the basal Old Fort Island Formation and sandstone and dolomitic beds of the La Martre Falls Formation (Douglas et al., 1974).

The mineral occurrences in the map area can be grouped into the pre-, syn- and post-Great Bear magmatic activity (Gandhi, 1994). The metasedimentary rocks have stratiform iron concentrations as magnetite with minor hematite, which form beds and lenses as much as several metres thick and a few hundred metres long, e.g. the occurrences near Hump Lake.

The mineral occurrences genetically related to the Great Bear magmatic activity are of two main types: i) magnetite-apatite-actinolite±pitchblende veins and breccia-fillings, and ii) Au-Bi-Co-Cu-W bearing pyrite-arsenopyrite-chalcopyrite-magnetite veins and disseminations. The first one is the Kiruna/ Olympic Dam-type, and the examples of it in the map area are small compared with those elsewhere in the Great Bear magmatic zone (Gandhi, 1994; Gandhi and Bell, 1996). They are commonly associated with the quartz monzonite plutons, although in some cases such an association is not certain. The second type is the most important of all types of occurrences in map area, because the deposit 2 km southeast of Lou Lake has drill indicated resources of 41.6 million tonnes averaging 0.85 g/t Au, 0.11 % Bi, 0.10 % Co, 0.05 % Cu and 0.03 % WO_3 based on trenching and drilling including 25 holes drilled during 1995-'96 (Fortune Minerals Limited, London, Ontario; News Release, Jan. 20, 1997). The mineralization is concentrated along four zones, namely No. 1, 2, 3 and Bowl zones (Fig. 2), which are subparallel to the bedding in the host metasedimentary rocks and extends into the volcanic assemblage that overlies them unconformably (Gandhi and Lentz, 1990). A genetic process visualized by Gandhi et al. (1996) is that of a large hydrothermal system generated by a pluton at depth, and the ascending fluids scavenged various elements from the metasedimentary rocks they traversed and eventually deposited the metals as they encountered the unconformity. The rhyolite (unit 9) at the unconformity is strongly enriched in potassium and depleted in sodium (9 to 12 % K; < 1 % Na). This alteration is extensive over an area 3x4 km as detected by airborne survey (Hetu et al., 1994), which led to the subsequent intensive exploration. Presence of magnetite veins and breccia-fillings in and around the deposit indicates some remobilization of iron from the host strata or addition from a distal source.

There are a number of veins and fracture-fillings in the map area that contain uranium±copper. Most of these are controlled by brittle fractures related to the northeast-trending faults. Some of them contain little or no quartz, and others are hosted by the giant quartz veins. The most important deposit is hosted by a giant quartz vein at the Rayrock mine, which produced 150 tonnes of uranium during 1957-1959 (Gandhi, 1994). The Crowfoot and Ted showings are other examples of this type of vein zones. Lead-zinc±copper bearing veins occur in some calcareous metasedimentary beds, and rarely in the quartz stockworks.

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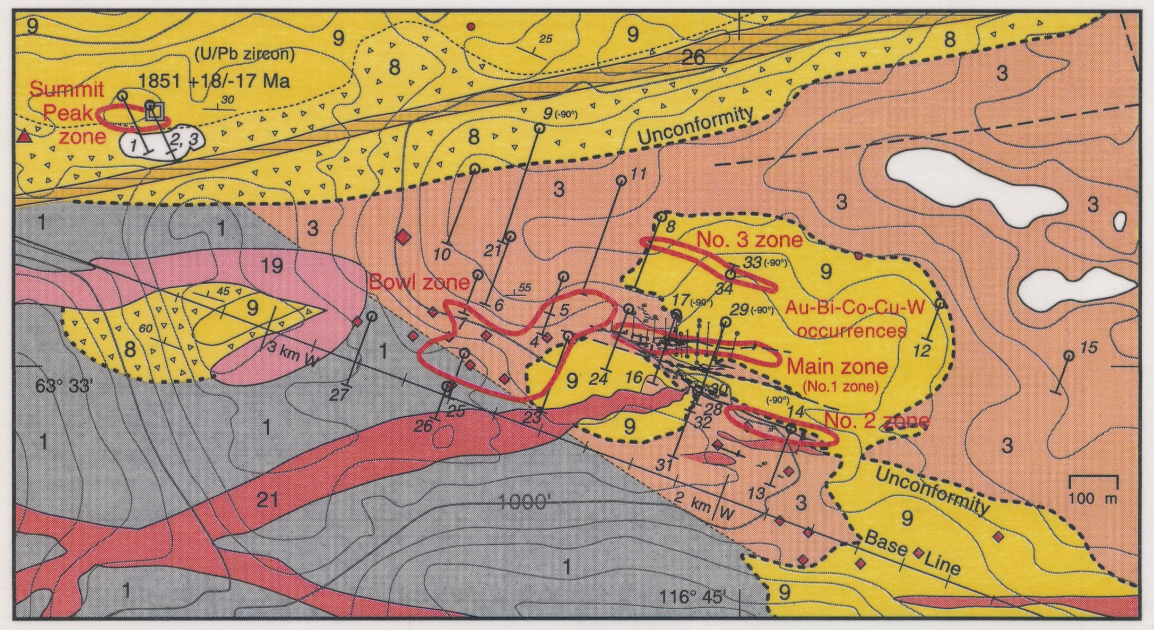
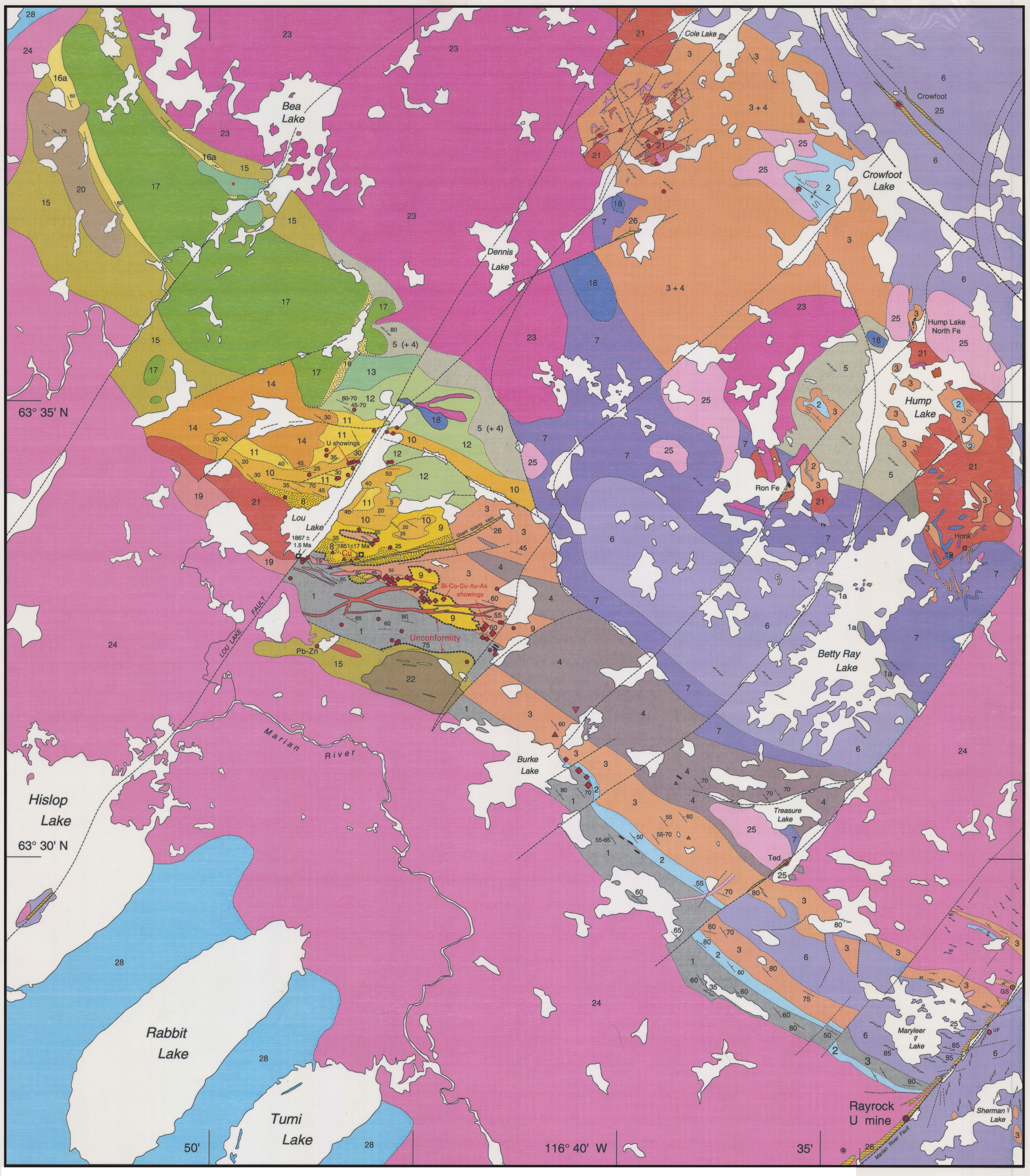


Fig. 2. Geology, diamond drill holes and surface projection of ore zones of the Lou Lake Au-Bi-Co-Cu-W-As deposit. Note: Contour interval: 50 feet (15.24 m);1995-'96 drill holes numbered in italics; more detailed plan of the Main zone trenches and shorter holes drilled during 1968-'69 in Gandhi and Lentz (1990).



Geology of parts of the Tumi Lake and Bea Lake sheets (NTS 85-N/7 and 85-N/10), Northwest Territories

Scale: 1 : 30 000

0 1 km 2 3

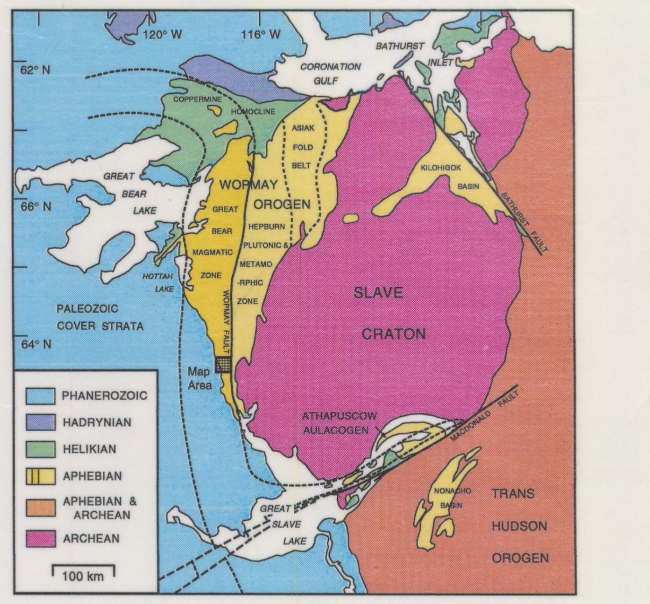


Fig. 1. General geology of the northwestern Canadian Shield

LEGEND

28	Cambrian La Martre Falls Formation, flat-lying conglomerate, sandstone, dolomite and shale
27	Diabase dykes (not shown)
26	Giant quartz vein, stockwork
	Great Bear intrusions (1870-1840 Ma)
25	Leucogranite, epizonal plutons and sheets, medium to fine grained, seriate to porphyritic
24	Granitic plutons, hornblende-biotite-rich to leucocratic (poorly exposed in the west)
23	Granite-granodiorite (Marian River batholith)
22	Granite, sodic, leucocratic, coarse porphyritic, and smaller finer grained bodies
21	Quartz monzonite-monzodiorite (1867 ± 1.5 Ma, U/Pb zircon age)
20	Dacite, subvolcanic intrusion
19	Quartz feldspar porphyry, feldspar porphyry
18	Diorite, irregular bodies and dykes (2 or 3 generations)
	Great Bear volcanic assemblage (1870 - 1860 Ma)
17	Rhyodacite, quartz-feldspar porphyritic, massive, grey aphanitic matrix; in part intrusive
16	Conglomerate, volcaniclastic, cobble to pebble size clasts; 16a : Tuff, siltstone, rhyolite
15	Rhyolitic rocks, undivided
14	Rhyolite, quartz-feldspar porphyritic, massive to ignimbritic flowage texture
13	Rhyolite, aphanitic to subporphyritic
12	Rhyolite, porphyritic, grey, well banded to massive
11	Rhyolite, subporphyritic, flow laminated, lithophysae-bearing
10	Tuff-volcaniclastic siltstone, agglomerate, with thin rhyolite flows
9	Rhyolite, subporphyritic, massive to flow banded, buff to pink (1851 ± 17 Ma, U/Pb zircon age)
8	Agglomerate-lithic tuffs, fragmental, locally well bedded, fragments commonly lensoid; basal conglomeratic lenses with quartzite clasts
	Unconformity
	Syntectonic intrusions (Wopmay orogeny, ~ 1900 Ma)
7	Monzonite-granodiorite, foliated to massive, grades into unit 6
6	Granite-granodiorite gneiss, coarse, biotite and less abundant hornblende, grades into unit 7
5	Dacite porphyritic, foliated, biotite-rich (paragneiss?)
	Snare Group metasediments (> 1900 Ma)
4	Metasiltstone, with variable amount of magnetite, interbedded with thin beds of quartzite, meta-arkose, carbonates and argillite
3	Quartzite, interbedded metasiltstone
2	Calcareous beds (marble, calcsilicate), interlayered with sandy and silty beds
	Magnetite-rich beds and lenses interbedded with parts of units 1, 2 and 3
1	Metasiltstone with variable amount of magnetite, interbedded with argillite; 1a : Paragneiss, contorted, with amphibolite remnants (Archean ?)

SYMBOLS

Antiform
Synform
Minor folds, plunge 5
Lineation, plunge 10
Foliation, inclined, vertical 85
Bedding, inclined, vertical 75
Bedding, tops known, inclined 45
Unconformity
Fault
Geological boundary

Mineral Occurrences :

U-Cu (giant quartz veins . . .
Pb-Zn (veins) . . . . . .
U ± Cu (veins) . . . . .
Cu±Pb-Zn (veins) . .
Au-Bi-Cu-Co-W (veins, diss.). . . . . .
Magnetite-apatite veins (± U) . . . .
Fe (stratiform) . .

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