2. INTRODUCTION

2.1 LOCATION AND ACCESS

The Golden Bear Mine property is located in northwestern British Columbia in the Atlin Mining Division at latitude 58^{o} 13' north and longitude 132^{o} 17' west (Tulsequah map sheet 104K). The mine is approximately 140 km west of Dease Lake and 160 km southeast of Atlin (Fig. 2.1.1).

The property covers 11662.1 hectares (28817.7 acres) of irregular, glaciated highlands separated by rugged, deeply incised valleys on the east side of the Chechidla Range in the Coast Mountains. Elevations range from 600 to 2200 m and most of the property is above tree line.

The claim block is south of Tatsamenie Lake and roughly centered on Bearskin Lake (Fig. 2.2.1). Bearskin Lake, locally known as "Muddy Lake", is within the northeast flowing Bearskin Creek drainage, a tributary of the Samotua River.

Access to the mine is by road, fixed wing aircraft or helicopter. The private, 155 km all-weather mine access road joins the Dease Lake - Telegraph Creek road. A 1070 m (3500 ft) gravel landing strip and the 1500 m (4920 ft) long lake accommodate fixed-wing aircraft. Float planes can operate on Bearskin Lake between early June and late October. Ski-equipped aircraft can be used on the lake between late November to early May. A heli-pad is situated just west of the camp.

2.2 CLAIM STATUS

The Golden Bear property consists of 27 claims (408 units covering 10,200 hectares) and one mining lease (covering 1462.1 hectares) held in the name of North American Metals (B.C.) Inc. (Fig. 2.2.1). The claim groups and their present expiry dates are listed in Table 2.2.1.

The Tan 7, Bear 1N, Bear, Bear 3S, and Totem claims were converted to Mining Lease #40, effective October 30, 1989. The primary term of the lease is 30 years and subject to an annual rental fee.

The Mining Lease and the Bear 4, Totem 2, Bear 2, Bear 3N, Bear 1S, and Sam 1 claims were last grouped on February 15, 1990 as the "Bears" group.

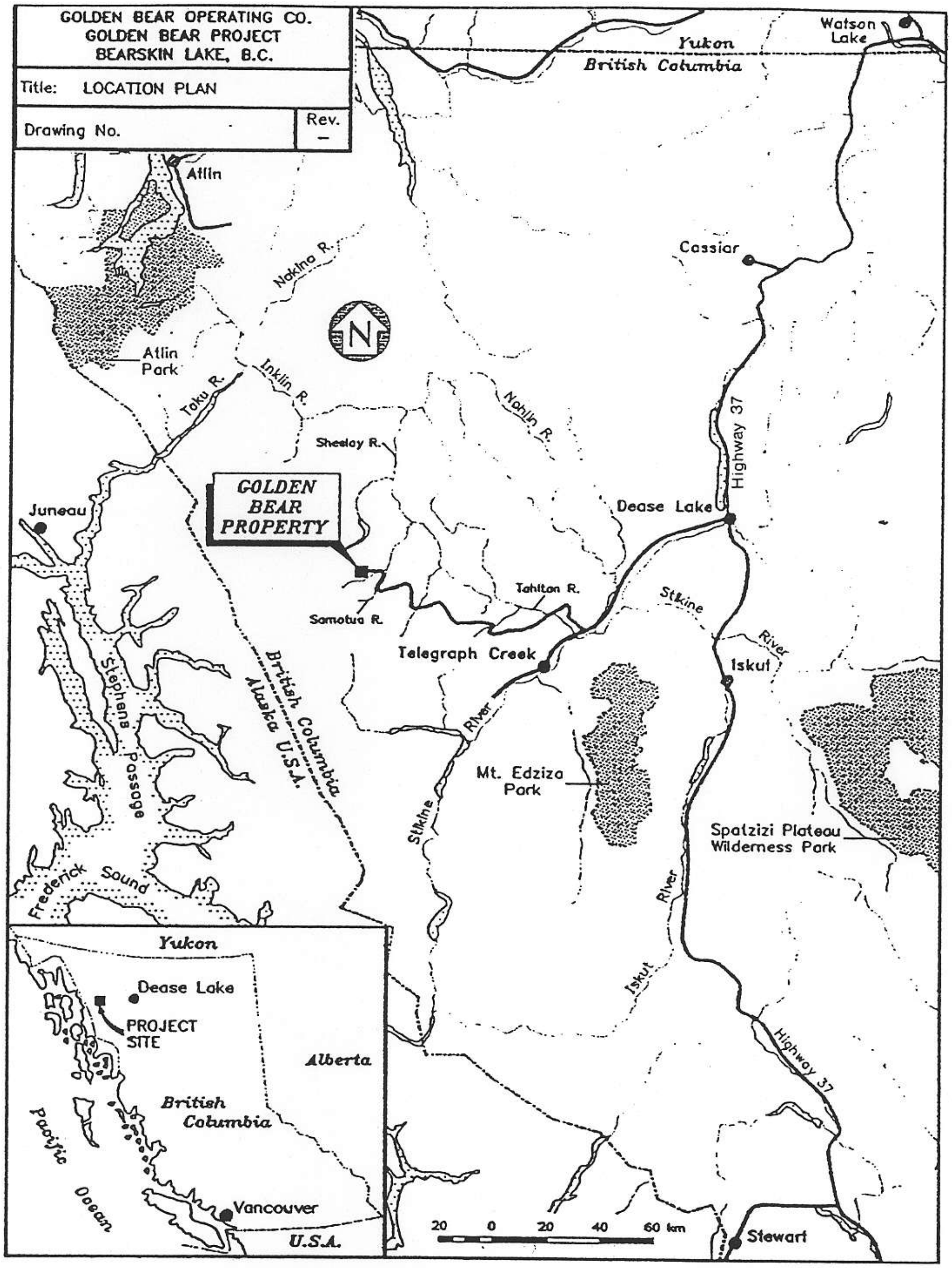

Figure 2.1.1 Location map of northwestern British Columbia showing the Golden Bear Mine property, the mine access road and proximity to Highway #37.

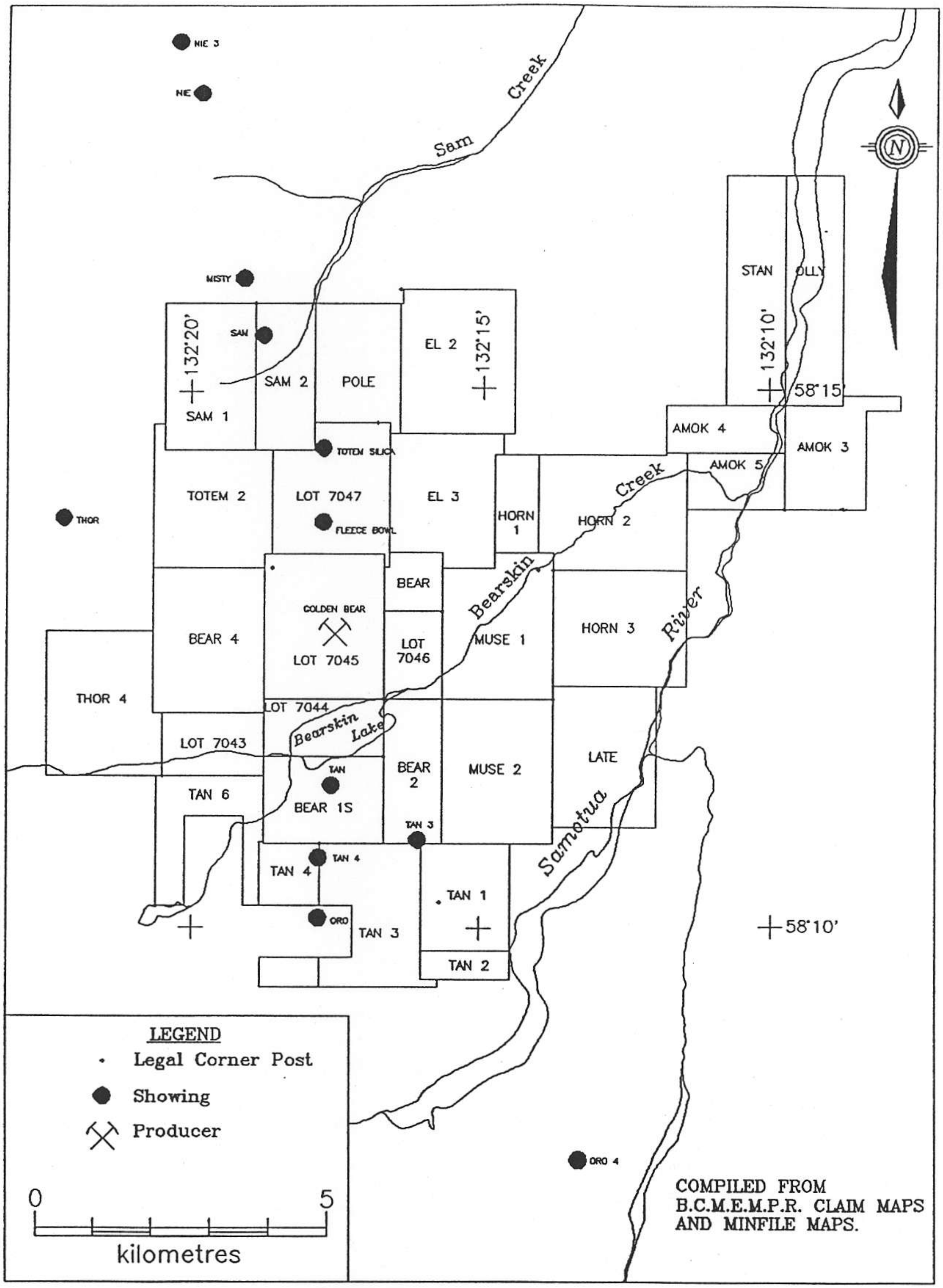

Figure 2.2.1 Claim location map for the Golden Bear property, showing Minfile mineral showings and prospects.

2.3 PROPERTY GEOLOGY

The Golden Bear property is underlain by complexly folded and faulted Permo-Triassic rocks of the Stikine Terrane (Fig. 2.3.1). The stratigraphic units are intruded by foliated Triassic to non-foliated Jurassic Coast Plutonic Complex diorite stocks, Cretaceous to Tertiary Sloko Group felsic dykes,and Recent Level Mountain Group basalt dykes.

Episodes of folding, faulting and greenschist facies metamorphism have affected the entire package of stratigraphic rocks exposed in the area. Rocks proximal to major faults have typically been carbonatized or silicified and are locally associated with precious and base metal mineralization.

More recent Quaternary deposits, glaciation and slope movements have created some extreme features such as the Bearskin Creek landslide and the present topographic surface.

Geology

The oldest rock unit that occurs within the map area is a slice of ultramafic rock of tectonic origin (Fig. 2.3.1). Otherwise, the Golden Bear area is dominated by a conformable stratigraphic succession of carbonate rocks and mafic volcanic rocks of the Stikine Terrane.

Rock names used in property-scale geological mapping and core logging have been reduced to four letter codes (McDonald and Reddy, 1990; Appendix C). General lithologies are described from oldest to youngest in the following paragraphs. Property specific four letter rock codes are indicated in bold type in parentheses following general rock names.

Ultramafic rocks (pre-Permian), largely serpentinite, occur along deep-seated, steeply-dipping fault zones just north of the central portion of the property. These rocks have been tectonically emplaced and do not fit conformably into the local stratigraphy. Age is unknown, but is possibly Permian (Souther, 1971). The major fault structures that contain the slices of ultramafic rock cut across the property, but no ultramafic rock is exposed within the claim block.

The **carbonate unit** (Permian) is the oldest stratigraphic unit on the property and is at least 300 m thick. Lithologies comprising this unit include limestone **(LMST)**, dolomite **(DOLO)**, and chert **(CHRT)** (Figs. 2.3.1 and 2.3.2). The carbonates form a massive, resistant ridge that outcrops on the western edge of the claim block. Permian fusulinids, crinoids and minor coral fossils in the

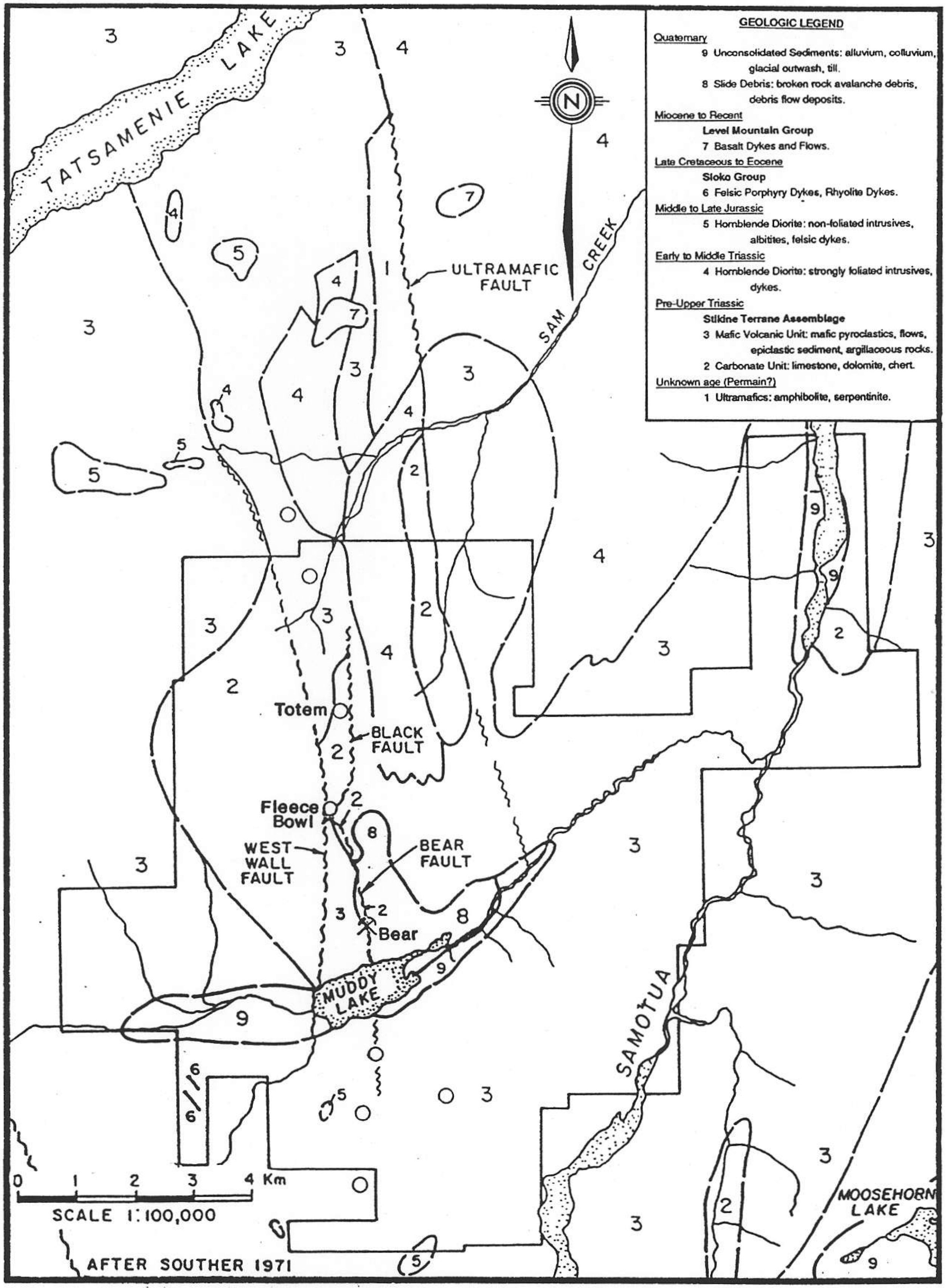

Figure 2.3.1 Generalized geology map of the Golden Bear property.

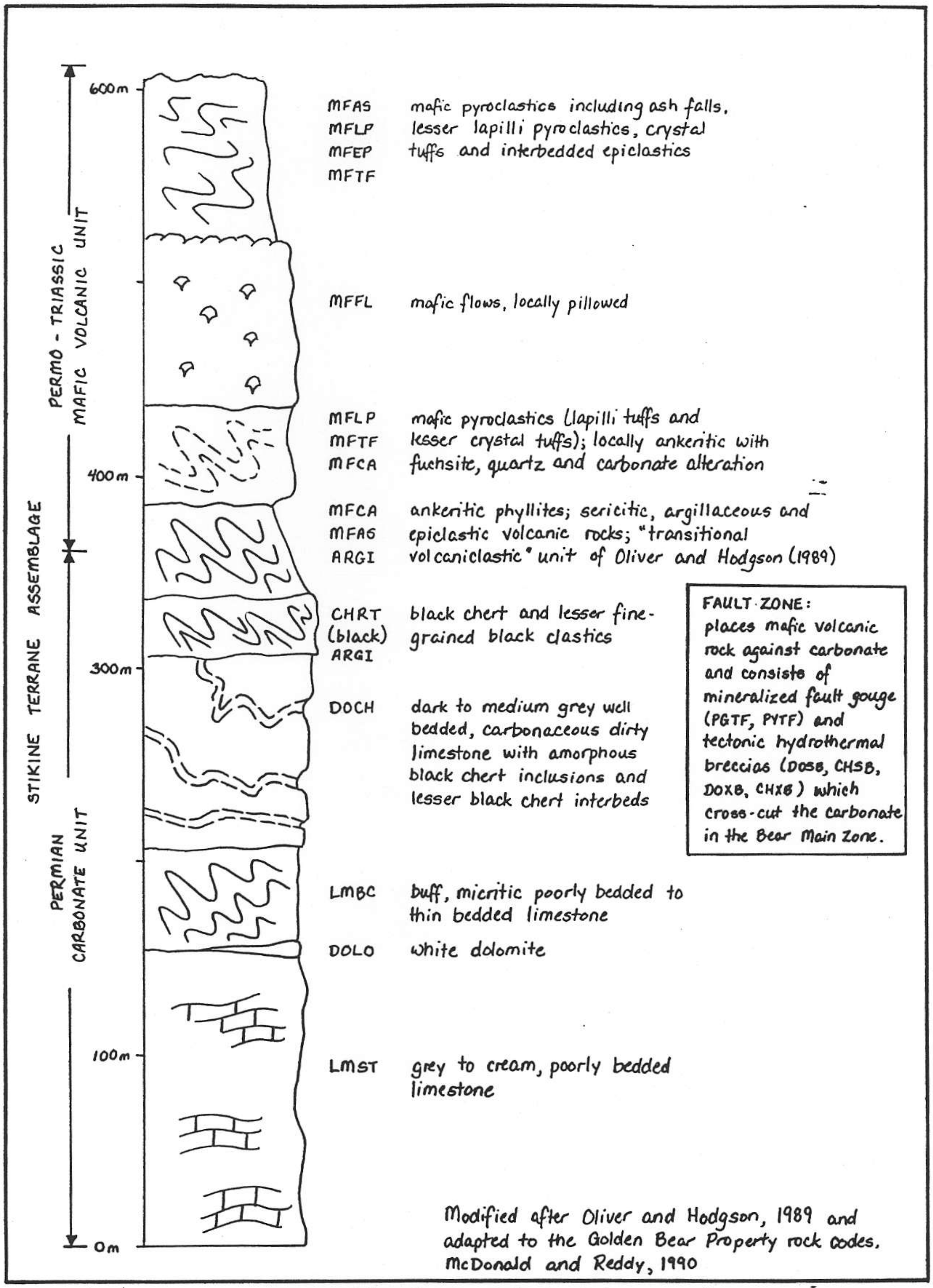

Figure 2.3.2 Generalized stratigraphic section of the main lithologies on the Golden Bear property.

limestone indicate a shallow marine, carbonate bank depositional environment. Fossil ages define a Permian age for this unit (Monger and Ross, 1971).

Within the carbonate unit is a poorly bedded, cream coloured limestone (approximately 150 m thick) that forms the base of the carbonate succession. This is locally overlain by a thin (less than 5 m) white dolomite bed. Thin bedded, buff-weathering crinoidal limestone (**LMBC**) overlies these two units. The crinoidal unit is up to 50 m thick and is a useful marker horizon on the property (Oliver and Hodgson, 1989). Up to 100 m of carbonaceous, "dirty" limestone with local amorphous silica inclusions and black chert interbeds (**DOCH**) overlies the marker unit. The carbonate succession is capped by a distinct black ohert unit up to 30 m thick.

A variety of breccias and brecciation textures have been observed in the carbonates including: intraformational beds of monolithic sedimentary breccia (Wober and Shannon, 1985), crackle brecciation where carbonate beds are tightly folded, karst solution collapse breccias (Lowey 1986: Read 1986) and tectonic-hydrothermal breccias related to mineralization (**DOSB**, **CHSB**, **DOXB**, **CHXB**).

The change from deposition of biogenic limestone to chert possibly reflects increasing amounts of silica added to seawater by submarine hotsprings associated with the onset of mafic volcanism (Lehrman and Caddey, 1989). Oliver (Oliver and Hodgson, 1989) mapped a 50 m thick unit that they described as "transitional volcaniclastics" at the contact between the carbonate unit and the overlying mafic volcanic unit. This transitional unit includes ankeritic phyllites (**PHYL**), epiclastics (**MFEP**), and argillaceous (**ARGI**) rocks. The transition from limestone to chert to mafic volcanic rock is considered conformable on a regional scale.

The **mafic volcanic rock unit** (Permo-Triassic) is at least 200 m thick. This unit consists of mafic flows with local pillows (**MFFL**), pyroclastics ranging from ash (**MFAS**) to lapilli-sized fragments (**MFLP**), and epiclastic sediments (**MFEP**). Mafic volcanics dominate the central and southern portions of the property (Fig. 2.3.1). The unit is a generally monolithologic succession that was deposited in a back-arc environment. Mafic volcanics are relatively unaltered, except near major fault zones where they can be extensively carbonatized (**MFCA**) and silicified.

Four main units that intrude the stratigraphic rocks within the Golden Bear area are as follows: (1) gabbro sills; (2) granodiorite and diorite stocks; (3) felsic dykes; and (4) basalt dykes. These units are described from the oldest to youngest in the following paragraphs.

Contact relationships between **gabbro sills** (**GBRO**) and the overlying mafic flows and pyroclastic rocks suggest that the gabbro may be, in part, subvolcanic and coeval with the lower Triassic mafic volcanic rocks (Oliver and Hodgson, 1990). These sills intrude the mafic volcanic rocks and form dark, resistant ridges at the top of East Bowl but do not appear on a property scale map. The contacts of the gabbroic intrusives are often marked by chilled margins or by clay gouge zones. Gabbro forms the majority of the slide material that has blocked the Bearskin Creek valley forming Bearskin Lake.

Granodiorite and diorite intrusions of the Coast Plutonic Complex are Triassic (foliated; **GRDF**) and Jurassic (non-foliated; **GRDI**) in age (Souther, 1971). Foliated hornblende diorite intrudes the mafic volcanic rocks in the north central part of the claim block. The strong metamorphic foliation and alteration in these intrusives resulted from middle Triassic tectonic activity (Souther, 1971).

Non-foliated hornblende diorite intrusives are relatively uncommon. A middle to late Jurassic age (156 Ma to 171 Ma) has been assigned to these intrusives based on dates obtained from similar rocks in the surrounding area (Hewgill, 1985; Schroeter, 1987).

Titley (1987) describes felsic dykes, that he equates to the non-foliated diorite, on the TOTEM claim and felsic stocks south of Bearskin Lake where they intrude the pre-Upper Triassic mafic volcanic rocks.

Tho mineralized felsic dyke in the Fleece Bowl Zone is hydrothermally altered adjacent to the mineralized Fleece Fault. This dyke has not been successfully dated, but seems to predate mineralization. The relationship with the hydrothermal system is not known (Titley, 1987).

Felsic volcanic rocks (**RHDY**; Late Cretaceous to Early Tertiary) of the Sloko Group, cut the Stikine greenstones. These rhyolite dykes also occur as part of a dyke swarm that parallels the contact of a large body of Sloko Group felsic extrusives 2 km west of the property (Titley, 1987).

Basalt dykes (**BSDY**; Miocene to Recent) of the Level Mountain Group are minor in extent but they intrude all units including mineralization. These dykes trend north-south and are steeply inclined, roughly parallel to the main fault structures. Level Mountain Group volcanic rocks form large shield volcanoes east of the property. Basalt flows outcrop 4 km north of the property.

Structure

Three deformational events have affected the rocks in the Golden Bear area. The first two events are the most significant. The first phase of deformation occurred during the Tahltanian orogeny (middle Triassic) and resulted in tightly folded north-trending isoclinal folds with thinned limbs and axial planes that dip steeply to the east. Fold axes plunge shallowly to the south. Greenschist facies metamorphism accompanied the deformational event and a regional axial planar foliation was developed.

As the first phase of folding progressed, early ductile folding gave way to brittle faulting which developed a variety of faults and fractures. Large north-trending structures such as the precursor to the "Ophir Break" were developed at this time. These large scale faults later became host to district mineralization.

A second phase of deformation (early to middle Jurassic) resulted in refolding of the stratigraphy into broad, open northwest-trending, moderately southeast-plunging folds. A complex fold interference pattern resulted (described in detail in Lehrman and Caddey, 1989).

During the second phase of deformation, brittle structures were also developed. Earlier structural features were modified and reactivated during the second event. Renewed movement on major faults probably produced the structural dilations along the Ophir Break. Golden Bear mineralization was coincident with this second event of deformation.

The third phase of deformation has been described as a middle Tertiary extensional event which developed block fault structures that penetrate the youngest Tertiary rocks (Souther, 1971).

Quaternary deposits

Quaternary deposits within the Golden Bear area include landslide debris and unconsolidated sediments.

Souther (1971) described the main rock avalanche that impounds Bearskin Lake in the Bearskin Valley. Slide debris extends over 2 square kilometres in area (volume approximately 100 million cubic metres) on the east side of the BEAR claim (Titley, 1987). This slide is speculated to have occurred as a catastrophic rock avalanche that descended onto a wasting glacier in Bearskin Creek valley about 10,000 years ago, thus as the glacier moved, the avalanche debris was carried farther down the valley than otherwise seems possible (Titley, 1987).

Slope movements directly affect the Bear Main Zone. The uppermost part of the Bear deposit has locally been displaced by mass wasting forming the Slide Base Zone and several other small anomalous horizons within the slide material. Rock avalanche debris has been drilled to 40 m depth in some surface drill holes and in underground workings the slide base has been encountered in cross-cuts in the hanging wall of the Bear Main Zone.

Titley (1987) describes the unconsolidated Quaternary sediments on the claim group as:

> consist(ing) of alluvium, glacial outwash, till, alpine moraine, colluvium and felsenmeer. Some broad alluvial or outwash deposits occur in the Samotua River and Bearskin Creek valleys. These form the only large flat areas on the property and are subject to annual floods. Glacial till occurs as thin, scattered, widespread deposits. Alpine moraine forms low ridges and thick accumulations in local areas such as at the top of East Bowl. Thin deposits of colluvium and felsenmeer cover much of the claim block and often obscure bedrock geology.

2.4 MINERALIZATION

Golden Bear is a shear zone hosted, enigmatic gold-silver telluride deposit with epithermal affinities. The Bear Main Zone is a high grade, structurally controlled ore shoot with a vein-like geometry.

Ore grade material is localized along an intermittently mineralized north-trending structure known as the **Ophir Break**. This structure is at least 20 km in length, about 9 km of which is on the Golden Bear Mine property.

On a property scale, the Ophir Break is made up of several major, steeply east-dipping faults which bifurcate and merge to form an anastomosing shear system. Within this zone of sheared rock distinct structures have been identified (Fig. 2.4.1).

On the deposit scale, the **Bear Main Fault** occurs along the eastern margin of the Ophir Break. This fault juxtaposes carbonatized mafic volcanic rock on the hanging wall, against carbonate rock in the footwall. Further west, the **Footwall Fault** is the western boundary of the carbonate rock package and places carbonate in the hanging wall against mafic volcanio rock in the footwall. The result is a fault-bounded sliver of carbonate rock central to the Ophir Break. The main carbonate lens outcrops over part of the Bear Main Zone and pinches out at depth and along strike to the north.

This lens of carbonate rock is, itself, cut by the **Internal Sliver Fault** (Fig. 2.4.1). The Internal Sliver Fault is a riedel shear structure which is en echelon and at a low angle to the direction of relative movement on the Bear Main and Footwall Faults. The Internal Sliver Fault connects the Bear Main and Footwall Faults due to a moderate east dip. This fault separates the carbonate into two lenss and displaces them such that the east lens "rides up" onto the west lens in a reverse sense of fault movement.

The Internal Sliver Fault splits into two faults; the **Internal Sliver Footwall Fault** and the **Internal Sliver Hanging Wall Fault**, which follow the volcanic/carbonate contacts. The Internal Sliver Footwall Fault merges up section, with the Footwall Fault, where the west lens of carbonate pinches out. The Internal Sliver Hanging Wall fault merges up section with the Bear Fault, where the east lens of carbonate pinches out.

Foster's Fault is a large fault zone in mafic volcanic rock and argillaceous tuffs west of the Footwall Fault, near the western margin of the Ophir Break. The **West Wall Fault** (Fig. 2.3.1) places mafic volcanic rock in the hanging wall against a footwall of limestone. At present, significant mineralization has not been identified in association with these westerly structures.

Mineralization is associated with the fault structures that bound and/or shear the dolomite lozenges. Preferential mineralization, or thickening of a zone, occurs at the confluence of these major fault structures (Fig. 2.4.2). Deposit-scale structural control is also expressed by preferential mineralization along and within right-handed strike deflections and flatter east dipping segments in the Bear Main Fault. Locally, lesser mineralized zones follow splits and splays off the main fault structures.

Ore grade material is commonly, but not invariably, associated with up to 3% pyrite in sheared mafic tuff and is locally accompanied by bleaching and chlorite-sericite-ankerite-fuchsite(?) alteration of the mafic volcanic rocks.

Golden Bear is not typical of epithermal type deposits in that there are no well-defined veins or vein systems. Although the overall geometry is vein-like, the deposit is better described as a mineralized fault zone in contact with hydrothermally cemented chert/carbonate breccia along a structural dilatancy.

Alteration, characteristic of epithermal systems is weak to absent and the prominent alteration minerals;

chlorite, fuchsite, sericite and ankerite, are more typical of mesothermal systems (Lehrman and Caddey, 1989). Local kaolinite and illite alteration may be supergene.

Several characteristics of the deposit support an epithermal classification:

(1) mineralization consists largely of open space fillings and is strongly structurally controlled;

(2) gangue mineralogy is dominantly dolomite-quartz-ankerite;

(3) a typical epithermal geochemical signature occurs with elevated Au, As, Te, Ag, Sb, Hg, Bi, S values and low base metals;

(4) Au/Ag ratios are low (generally 1:1 or 1:2); and

(5) limited fluid inclusion data indicates 180°C and ~1 to 3 weight percent NaCl equivalent salinities.

Regardless of depth of origin, mineralization is believed to have occurred during a single stage event. Hydrothermal quartz is inconspicuous and, where present, does not show sequential depositional features. Furthermore metallic mineral grains are very small (less than 0.5 to 5 microns) and are typically anhedral.

Lehrman and Caddey (1989) infer that the mineralizing event was a brief, catastrophic, single episode that did not involve significant sustained boiling. Mineralization was associated with hydrofracturing or hydro-tectonic breccia formation. The hydrothermal fluids contained very high metal concentrations (this is required by the high grade system which was not enhanced by multi-episode mineralization) and relatively little silica. Under such conditions a mineralized, non-crustified, gangue-supported dilational breccia, largely devoid of tabular veins or veinlets could be developed.

A conceptual genetic model for the formation of and mineralization in the Bear Main Zone is discussed in detail in Lehrman and Caddey (1989).

2.5 WORK HISTORY

The remote and rugged nature of northwestern British Columbia has restricted mineral exploration to coastal areas until fixed wing aircraft and helicopters made inland access easier. The first claim staked near Bearskin Lake was in 1956 by K.A. Gamey (Nicko No. 30, Record No. 3077, Tag No.