CIM District 6 Meeting, Oct 29 [illegible], Vancouver
PAPER 1

GEOLOGY AND MINERALIZATION OF THE GOLDEN BEAR DEPOSIT

by

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ABSTRACT

Golden Bear mineralization consists of a series of mesothermal deposits on a 15km long north-trending fault system. Brecciated, pyritized, quartz-carbonate altered Permo-Triassic limestone and metavolcanic rock of the Stikine Terrane host the gold mineralization. Alteration associated with mineralization is Early to Middle Jurassic. Known, in-situ geological reserves total 1,635,000 tonnes at 10.85 grams Au/tonne, which includes proven minable reserves of 625,390 tonnes at an average grade of 18.63 grams Au/tonne in the Bear zone. A 360 tonnes per day underground and open-pit gold mine is planned. Annual gold production is forecast at 64,000 ounces.

INTRODUCTION

Gold was discovered on the Golden Bear property in 1981 by a Chevron Minerals Ltd. regional soil geochemical program. To date, Chevron and joint venture partner North American Metals Corp., have spent $20 million on the project and completed 2000 metres of underground excavation and 25,000 metres of diamond drilling.

The property is 135 km west of Dease Lake, British Columbia on the eastern edge of the Coast Range Mountains near the Stikine Plateau (Fig. 1). Rugged alpine terrane and deeply incised

valleys in the area range in elevation from 600 m to 2600 m. Access to the property is by charter aircraft to the 900 m gravel airstrip or to Muddy (Bearskin) Lake. A 153 km all weather access road is planned.

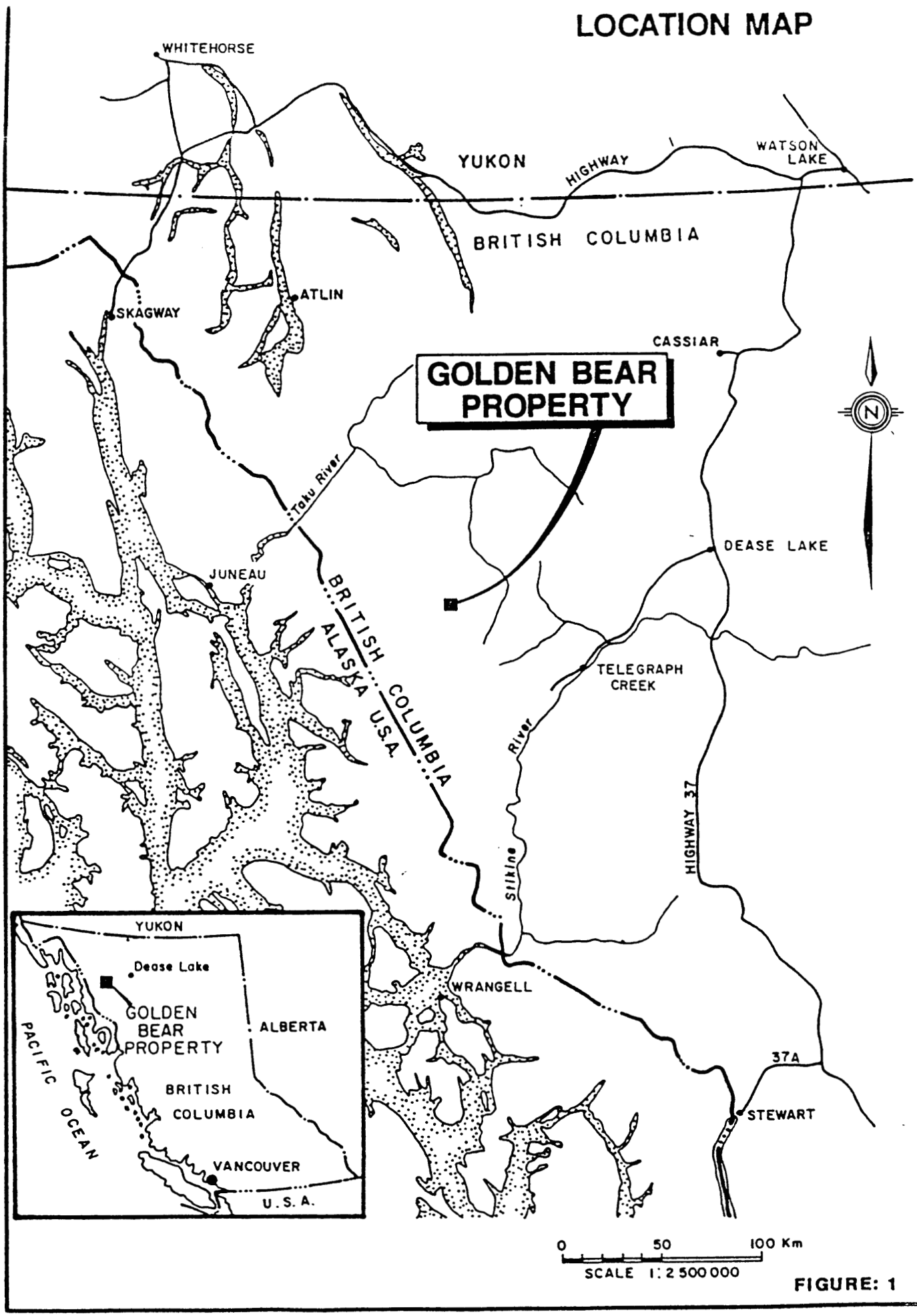

LOCATION MAP
WHITEHORSE
YUKON
HIGHWAY 1
WATSON LAKE
BRITISH COLUMBIA
ATLIN
SKAGWAY
CASSIAR
GOLDEN BEAR PROPERTY
N
Taku River
DEASE LAKE
JUNEAU
BRITISH COLUMBIA
ALASKA U.S.A.
TELEGRAPH CREEK
Stikine River
HIGHWAY 37
YUKON
Dease Lake
GOLDEN BEAR PROPERTY
ALBERTA
PACIFIC OCEAN
BRITISH COLUMBIA
VANCOUVER
U.S.A.
WRANGELL
37A
STEWART
0 50 100 Km
SCALE 1:2 500 000

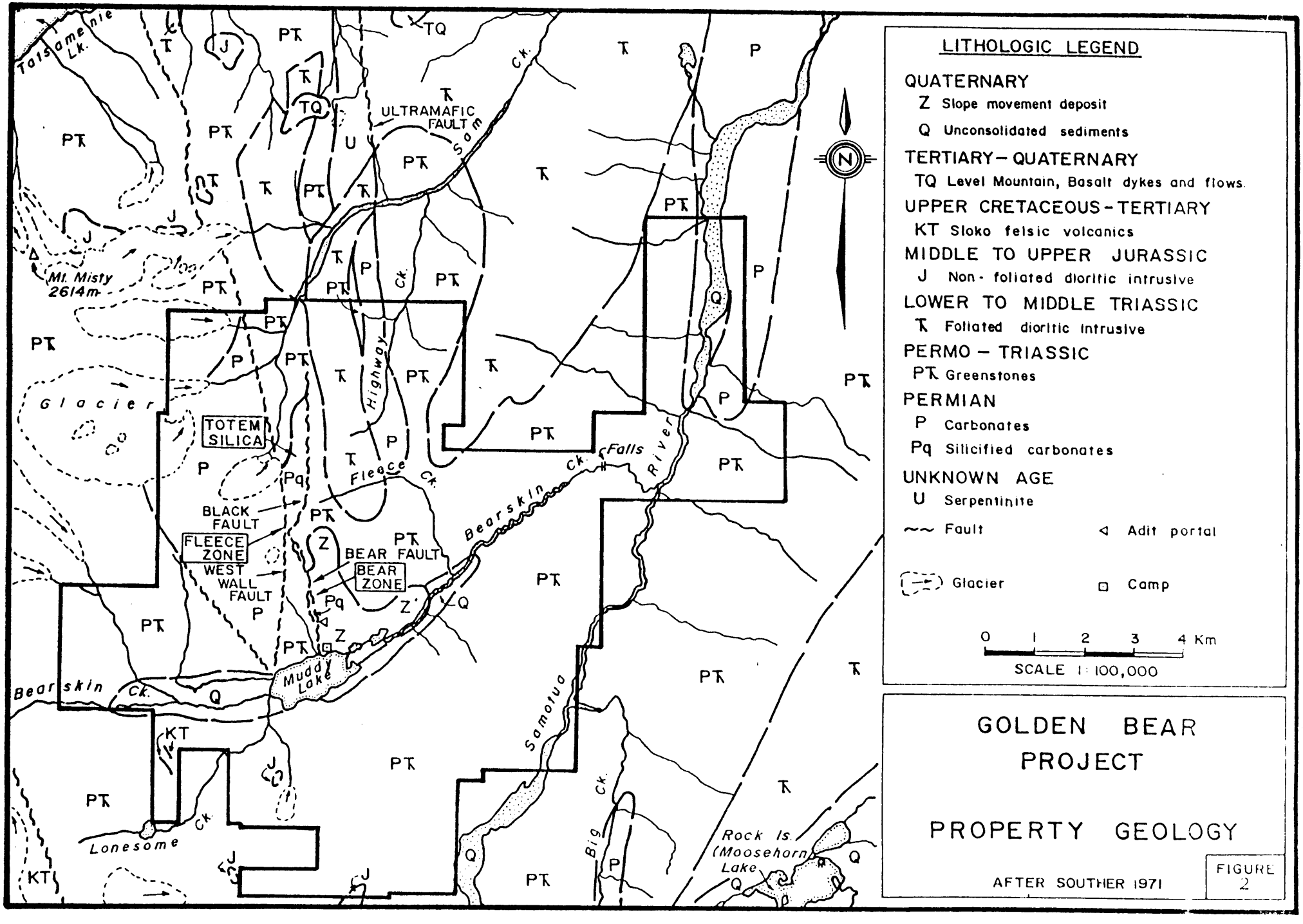
FIGURE: 1

GEOLOGY

The project area is at the western end of the Stikine Arch and incorporates elements of the Coast Plutonic Complex and the Intermontane Belt. The eugeosynclinal arc-type sedimentary and volcanic rocks range in age from Permian to Recent. Three major tectonic episodes and periods of plutonic activity took place throughout the region from middle Triassic to Tertiary (Souther, 1971).

Rocks of the Stikine Terrane Assemblage underlie much of the project area (Fig. 2). Stikine rocks consist of Permian carbonates and Permo-Triassic metavolcanics. They are intruded by various phases of the Coast Plutonic Complex, Sloko Group and Level Mountain Group Dykes. Episodes of folding, faulting, metamorphism, alteration and mineralization chronicle the history of the property (Table 1). More recently, glaciation and slope movements have given the topography its present shape.

Stikine rocks consist of Permo-Triassic limestone, mudstone and metavolcanic rock. The limestone is typically massive to well-bedded, fine to medium-grained and medium grey. At least two phases of folding are seen in the limestone. Monger and Ross (1971) assigned a Permian age to the limestone on the basis of fusilinids. Fauna in the limestone are indicative of a shallow marine carbonate bank environment. Mudstone is often found as


LITHOLOGIC LEGEND
QUATERNARY
Z Slope movement deposit
Q Unconsolidated sediments
TERTIARY – QUATERNARY
TQ Level Mountain, Basalt dykes and flows.
UPPER CRETACEOUS – TERTIARY
KT Sloko felsic volcanics
MIDDLE TO UPPER JURASSIC
J Non-foliated dioritic intrusive
LOWER TO MIDDLE TRIASSIC
T Foliated dioritic intrusive
PERMO – TRIASSIC
PT Greenstones
PERMIAN
P Carbonates
Pq Silicified carbonates
UNKNOWN AGE
U Serpentinite
Fault
Adit portal
Glacier
Camp
0 1 2 3 4 Km
SCALE 1:100,000
GOLDEN BEAR PROJECT
PROPERTY GEOLOGY
AFTER SOUTHER 1971
FIGURE 2
Talsamenie Lk.
Mt. Misty 2614m
Glacier
TOTEM SILICA
BLACK FAULT
FLEECE ZONE
WEST WALL FAULT
BEAR FAULT
BEAR ZONE
ULTRAMAFIC FAULT
Highway
Fleece Ck.
Bearskin Ck.
Falls River
Mudd Lake
Samotua
Big Ck.
Rock Is. (Moosehorn Lake)
Lonesome Ck.
N

GOLDEN BEAR PROJECT

GEOLOGIC CHRONOLOGY OF THE GOLDEN BEAR PROPERTY

TABLE 1

Time Period	Ma	Event	Feature
Quaternary	0-2	Sedimentation	Alluvium, glacial deposits, landslide debris
Upper Tertiary to Quaternary	0-25	Vulcanism	Level Mountain Group Dykes and Flows
Middle Tertiary to Quaternary	0-38	Erosion	Glacial and Stream Dissection
Lower Tertiary	38-65	Tectonism	Uplift and Extensional Block Faulting
Lower Cretaceous to Upper Tertiary	38-98	Vulcanism	Sloko Group Dykes
Jurassic	150-200	Alteration	Golden Bear Mineralization?
Middle Jurassic	163-181	Intrusion	Non-Foliated Diorite F-1 Dykes
Middle Triassic	231-243	Tectonism	Tahltanian Orogeny
Middle To Lower Triassic	231-248	Intrusion	Foliated Diorite
Permo-Triassic	231-286	Vulcanism	Stikine Terrane Volcanics (± 2600m)
Permian	248-286	Sedimentation	Stikine Terrane Carbonates (± 750m)
Permian or Older	248+	Intrusion?	Serpentinite

a transitional unit between the limestone and volcanic rock. It is generally tan-brown to black, well-laminated with interbedded layers of limestone and tuff.

The metavolcanic package consists of mafic pyroclastics and related rocks, metamorphosed to the greenschist facies. Laminated tuffs, lapilli tuff, tuff with bomb-size pyroclastics and crystal tuff are common in the area of the deposits.

Underground and surface exploration programs have focussed on the Bear zone which has been the scene of major slope movements in recent geologic time. A rockslide with a volume of about 200 million m^3 travelled up to 3.5 km along the valley of Bearskin Creek and left a pile of mainly gabbro rubble up to 75 m in depth that dammed up the valley and formed Muddy Lake.

ALTERATION

Large areas of alteration and brecciation which occur in the Stikine rocks correspond with a major structural break known as the Bear Fault zone. Intense alteration and mineralization occur along steeply dipping, north-trending fault contacts between Permian limestone and Permo-Triassic metavolcanic rocks in this zone. The limestones have undergone quartz-dolomite $\pm$ pyrite alteration. Dolomite-kaolinite $\pm$ chlorite and

dolomite - illite ± pyrite alteration has developed in the metavolcanic rocks. Alteration occured along fractures and open spaces in extensive brecciated zones adjacent to fault structures, particularly within the limestone package. Dolomite and silica alteration took place initially. The deposition of silver and trace elements and the remobilization of some dolomite and silica occured later. It is likely that the gold-bearing sulphide-rich phase occured in the final stages of alteration.

MINERALIZATION

Mineralization is concentrated in altered Stikine Terrane rocks. Three zones known as Bear, Fleece and Totem have been discovered. The Bear deposit contains all of the known proven minable reserves. There is excellent potential to expand the reserve base in this zone to the north, at depth and in parallel structures. Figure 3 shows an idealized cross-section in the main part of the Bear zone. Tectonically emplaced slivers of limestone are situated within altered tuffs. Mineralization occurs at or near the contact between pyritized tuffs and pyrite-rich brecciated silicified dolomitized limestone. Gold mineralization is typically evenly disseminated within certain areas of strong sulphide (mostly

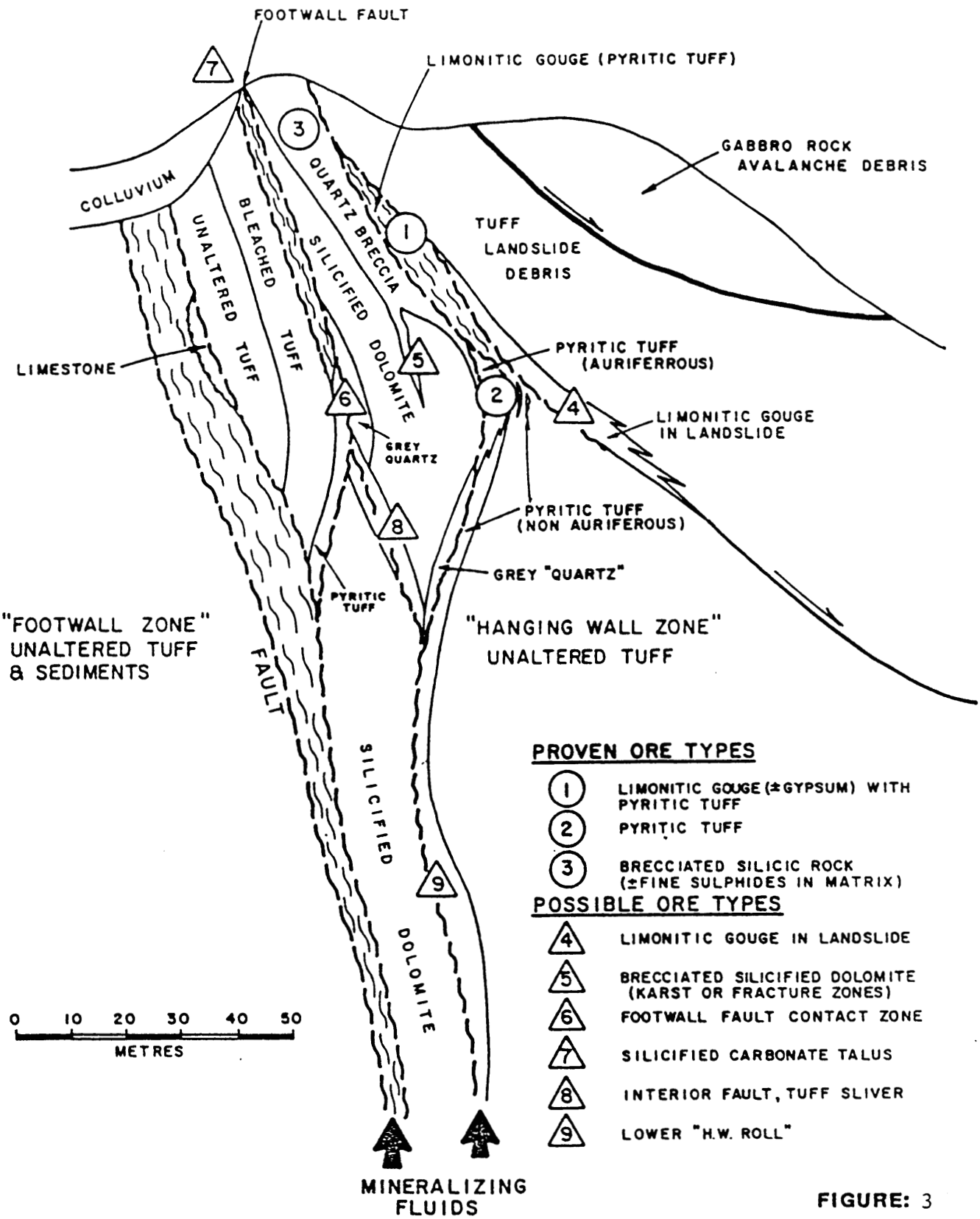
pyrite) replacement and breccia matrix filling. Most of the gold is sub-micron size. Visible gold is seen in one location in the Bear zone. This may be due to supergene enrichment in this area.

Within the Fleece zone a tectonically emplaced sliver of tuff is surrounded by altered limestone. Alteration and mineralization is similar to the Bear zone. A mineralized felsic dyke which appears to be closely related to mineralizing events is also seen in the Fleece zone. The Fleece zone contains drill indicated reserves of 362,000 tonnes of 9.4 grams Au/tonne.

BEAR MAIN ZONE

IDEALIZED CROSS-SECTION SHOWING MINERALIZATION

(LOOKING NORTH)



PROVEN ORE TYPES

1. LIMONITIC GOUGE (±GYPSUM) WITH PYRITIC TUFF
2. PYRITIC TUFF
3. BRECCIATED SILICIC ROCK (±FINE SULPHIDES IN MATRIX)

POSSIBLE ORE TYPES

4. LIMONITIC GOUGE IN LANDSLIDE
5. BRECCIATED SILICIFIED DOLOMITE (KARST OR FRACTURE ZONES)
6. FOOTWALL FAULT CONTACT ZONE
7. SILICIFIED CARBONATE TALUS
8. INTERIOR FAULT, TUFF SLIVER
9. LOWER "H.W. ROLL"

FIGURE: 3

The Totem zone has structural and lithologic similarities to the Bear and Fleece deposits. More work is required to evaluate the Totem zone.

Golden Bear mineralization is primarily epigenetic although supergene enrichment is important in some parts of the Bear zone, notably where mineralized rock is in contact with the base of a large rock avalanche. The deposit is characteristic of a low to medium temperature, low salinity, mesothermal system (Wober and Shannon, 1985).

Age dates from five drill core samples of altered tuff from the Bear, Fleece and Totem zones range from 177 Ma to 205 Ma. These sericite dates are presumed to represent the age of alteration and perhaps mineralization (Schroeter 1987). Two other dates from a mineralized hornblende feldspar porphyry and an albitite body north of the property gave dates of 156 Ma and 171 Ma respectively. The dates suggest a genetic association with an early to middle Jurassic event. Intrusive activity, alteration and mineralization occured along the Bear Fault system over a 50 million-year period.

REFERENCES

Hewgill, W.V. (1985); Geochronology and Rare Earth Element Geochemistry of a Metasomatic Albitite in Northwestern B.C., B.Sc. Thesis U.B.C. Vancouver.

Monger, L.W.H. and Ross, C.A. (1971); Distribution of Fusilinareans in the Western Canadian Cordillera, Canadian Journal of Earth Sciences, Vol. 8 p. 259-278.

Schroeter, T.G. (1987); Golden Bear Project (104 K/1W) British Columbia Ministry of Energy Mines and Petroleum Resources, Geological Fieldwork 1986. Paper 1987-1.

Souther, L.G. (1971); Geology and Mineral Deposits of Tulsequah Map-Area British Columbia Geological Survey of Canada, Memoir 362-1971, p. 81.

Wober, H.H. and Shannon, K. (1985); Bear-Totem Status Report December 1985, Chevron Canada Resources Limited, Minerals Staff, p. 127.