CHAPTER 5  
ECONOMIC GEOLOGY

INTRODUCTION

The Forrest Kerr - Mess Lake area lies within an important base and precious metal-rich part of Northwestern British Columbia, termed the “Golden Horseshoe” (Lefebure, 1991). The Horseshoe extends north from Alice Arm to the Taku River, east of the Coast Belt, and wraps back around the northwestern edge of the Bowser basin as far east as the Toodoggone River (Figure 5-1). This metallocentre is underlain predominantly by Late Paleozoic and Mesozoic volcanic and plutonic rocks of the Stikine terrane and is characterized by metal deposits related to island-arc volcanic centres. Mineral deposits commonly found in island arc settings include porphyry, intrusion-related (i.e. mesothermal) vein, metasomatic skarn, epithermal vein and volcanogenic massive sulphide deposits of the Kuroko type. Regional examples of these deposit types are found in northwestern Stikinia (Figure 5-1). Porphyry copper deposits in the area include both the alkaline copper-gold-silver (Galore Creek) and calcalkaline copper-molybdenum-gold (Schaft Creek) types. Early Jurassic intrusion-related, gold-silver quartz veins are shear-hosted at the Snip gold mine and extensional vein structures at the past producing Stonehouse deposit (Johnny Mountain Gold Mine). The largest epithermal silver-gold deposit in the province is the Premier mine, formerly the Silbak Premier mine in the Stewart area. Tulsequah Chief is a Kuroko type volcanogenic gold-silver-zinc-copper-lead massive sulphide deposit located in the Tulsequah area of northwestern Stikinia. In 1996, the volcanogenic massive sulphide Eskay Creek mine was the sixth largest silver producer in the world, and one of the highest grade gold and silver deposits ever discovered in North America (Schroeter, 1997). At the Golden Bear property (Carlin-type deposit) 6780 kg of gold was recovered from underground and open-pit mining between 1989 and 1994; and in 1997 began producing gold from heap leach pads on site 75 km northwest of Telegraph Creek.

No past production is recorded for the map area although large copper, gold and molybdenum mineral inventories are defined at Schaft Creek (971 495 000 tonnes grading 0.298 %Cu, 0.033 %MoS2, 0.14 g/t Au and 1.20 g/t Ag; Spilsbury, 1995 ) and Galore Creek (Central zone: 233 900 000 tonnes grading 0.67 %Cu, 0.35 g/t Au and 7.0 g/t Ag; Enns et al., 1995) porphyry deposits.

Mineral deposits and prospects in the Forrest Kerr - Mess Lake area can be grouped into four main categories: calcalkaline Cu-Mo-Au and alkaline Cu-Au porphyries; Cu- and Cu-Au skarns; subvolcanic Cu-Au-Ag (As-Sb) fault and shear-hosted veins and carbonate hosted replacement; and stratiform volcanogenic massive sulphide and carbonate hosted (?Irish-type) Zn-Pb-Ag deposits. The distribution of mineral occurrences in the map area (except stratiform types) shows a direct correlation with north and northeast striking faults and Late Triassic to Early Jurassic intrusive rocks (Figure 5-2). Porphyry deposits, subvolcanic veins and carbonate hosted replacements are centered around the Loon Lake Stock, in the Schaft and Mess creeks area, and north of More Creek. Skarn occurrences are distributed along northeast trending faults west of the Forrest Kerr Pluton (FKP). Fault and shear hosted vein showings are localized along the prominent, north-trending Forrest Kerr Fault zone between More and Forrest Kerr creeks, and northeast of McLymont Creek east of the FKP, and along the northeast-trending bounding structures of the Newmont Lake Graben, west of the FKP. The stratiform massive sulphide deposits are hosted in Devonian to Mississippian volcanic rocks located near the headwaters of Mess Creek. These types of deposits can be modeled into one generalized hydrothermal system; each represent different sites (from deep, intermediate to near surface) and ore-forming environments within it.

Mineral occurrences from the map area are classified according to these four main deposit types: porphyry, skarn, subvolcanic vein and stratiform. Important subgroups are described below and individual occurrences are summarized in Table 5-1.

Figure 5-1. Location of map area relative to the major tectonostratigraphic features of the northwestern Cordillera (modified from Wheeler and McFeely 1991), showing regionally significant mineral occurrences.
COPPER-GOLD PORPHYRY DEPOSITS

Alkalic porphyry copper-gold deposits occur throughout the length of the Intermontane Belt in both Stikinia and Quesnellia. They are restricted to Late Triassic and Early Jurassic volcanic island arc assemblages of the Nicola, Takla and Stuhini groups and form a class distinct from the calcalkaline porphyry deposits with which they are interspersed. The alkalic-suite deposits are copper-gold resources enriched in silver and deficient in molybdenum (Sinclair et al., 1982; McMillan et al., 1995). In contrast, calcalkaline porphyry deposits are copper-molybdenum with generally low gold. However, both types may carry significant gold values (Sillitoe, 1989a,b). Schaft Creek with reserves of almost 1 billion tonnes, contains 120 tonnes gold and is one of these gold-rich calcalkaline porphyry deposits.

The alkalic-suite deposits are associated with subalkaline to alkaline and shoshonitic volcanic rocks and comagmatic, high-level alkaline intrusions (Barr et al., 1976; Panteleyev, 1976). Crowded feldspar porphyritic textures are characteristic of both the intrusives and the volcanics; pyroxene-phyric basalts are typical. The calcalkaline suite deposits are associated with deep-seated to high-level felsic intrusions of calcalkaline affinities.

Porphyry deposits in the map area include both the calcalkaline Cu-Mo-Au (Schaft Creek) and alkaline Cu-Au-Ag (Galore Creek) types. To the east, in the Coast belt, the Ben deposit is a calcalkaline Mo-only type (Brown et al., 1996). These deposits are hosted in the Late Triassic, Stikine Plutonic Suite; the Late Triassic to Early Jurassic, Copper Mountain Suite; and the Eocene, Hyder Plutonic Suite respectively (Woodsworth et al., 1991; Anderson, 1993). Schaft Creek and Galore Creek deposits have characteristics of the Volcanic-type porphyry copper deposit classification of Sutherland Brown (1976); the Ben is a Classic (stock-related) type.

CALCALKALINE PORPHYRY Cu-Mo-Au

SCHAFT CREEK (MINFILE 104G/15)

The Schaft Creek porphyry copper-molybdenum deposit is situated at the western edge of the map area, at an elevation of 1000 metres on the west-facing slope above Schaft Creek (Figure 5-2, Photo 5-1). Access is by fixed wing aircraft to a 1000 metre long gravel airstrip in Schaft Creek valley. Since its discovery in 1957, successive drill programs by Silver Standard Mines Ltd., American Smelting and Refining Company, Hecla Mining Company and Teck Corporation, the present owner, have tested the property. The deposit is classified as a high-level calcalkaline volcanic porphyry (Linder, 1975; Fox et al., 1976). Reserves are 971 495 000 tonnes grading 0.298 %Cu, 0.033 %MoS₂, 0.14 g/t Au and 1.20 g/t Ag (Spilsbury, 1995).

The geology of the deposit is complex and it is poorly exposed. Regional mapping enabled us to trace stratigraphy along ridges from the north and south into the deposit area, but the reader is directed to Linder (1975) and Fox et al. (1976) for detailed discussions of the stratigraphy and gene-
**TABLE 5-1**

**SUMMARY OF MINERAL OCCURRENCES**

<table>
<thead>
<tr>
<th>MINFILE</th>
<th>NAME</th>
<th>NT59</th>
<th>UTM Zone 09</th>
<th>HOST ROCKS</th>
<th>COMMODITY</th>
<th>DESCRIPTION</th>
<th>REFERENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>104G/06</td>
<td>SCHAFT CREEK</td>
<td>104G</td>
<td>104G/06</td>
<td>104G/06</td>
<td>CALCALKALINE PORPHYRY Cu-Mo-Au</td>
<td>Disseminated and fracture-controlled chalcopyrite, molybdenite, gold and silver mineralization is related to a high-level intrusive complex of felsic to intermediate dike swarms and a breccia pipe. Mineralization is discordant to volcanic stratigraphy. Movable reserves of 971 million tonnes grading 0.298% Cu, 0.033% Mo, 0.14 g/t Au and 1.20 g/t Ag.</td>
<td>Linder (1975), Fox et al. (1976), Spitsbury (1995)</td>
</tr>
<tr>
<td>104G/07</td>
<td>RUN MIX, RUN NORTH</td>
<td>104G</td>
<td>104G/07</td>
<td>104G/07</td>
<td>Calcalkaline porphyry Cu-Mo-Au</td>
<td>Chalcopyrite, magnetite and pyrite disseminations and molybdenum in fractures, selvages and in quartz veinlets and cut crowded plagioclase porphyries and mafic volcanic rocks. Steep fracture and breccia zones control mineralization.</td>
<td>EMPR ASS RPT # 3,093 (Gutrath 1971) EMPR ASS RPT # 6,162 (Cloutier 1976) Panteleyev (1973)</td>
</tr>
<tr>
<td>104G/07</td>
<td>BB 5, BB 37</td>
<td>104G</td>
<td>104G/07</td>
<td>104G/07</td>
<td>Cu</td>
<td>Trace amounts of disseminated chalcopyrite, magnetite, pyrite and bornite occur in fractured and sheared propylitic andesite, augite porphyritic diorite and monzodiorite.</td>
<td>EMPR ASS RPT # 3,640 (House 1971)</td>
</tr>
<tr>
<td>104G/02</td>
<td>BISKUT, VOIGTBERG</td>
<td>104G</td>
<td>104G/02</td>
<td>104G/02</td>
<td>Alkaline Porphyry Cu-Au</td>
<td>Disseminated and fracture-controlled chalcopyrite mineralization in a pyritic-propylitic alteration zone (300m x 50-100m wide) associated with feldspar porphyritic stocks and feldspar megacrystic dikes. Original textures obliterated by supergene leaching. Contains up to 5% pyrite, minor galena and arsenopyrite. Narrow, quartz-carbonate breccia veins containing Ag-Cu with Zn and Pb occur peripheral to the main gossan. 1996 Drilling (3 holes, 456m) intersected potassium feldspar-carbonate-sericite-pyrite altered volcanic rocks containing an average of 0.26 g/t Au.</td>
<td>EMPR ASS RPT # 19,605 (Brown, 1990) EMPR ASS RPT # 23,117 (Smith, 1993) EMPR ASS RPT # 24,189 (Kemp, 1995) EMPR ASS RPT # 24,937 (Gunning, 1996) Wojdak (1997)</td>
</tr>
<tr>
<td>104G/02</td>
<td>LUCIFER</td>
<td>104G</td>
<td>104G/02</td>
<td>104G/02</td>
<td>Cu</td>
<td>Structurally controlled propylitic alteration zone (1 x 2 km) coincident with potassium feldspar porphyry syenite dike swarm. Mineralization includes chalcopyrite, galena and gold in quartz-carbonate pyrite veins.</td>
<td>EMPR ASS RPT # 21,091 (Baerg and Wong, 1991)</td>
</tr>
</tbody>
</table>
## TABLE 5-1 CONTINUED
### SUMMARY OF MINERAL OCCURRENCES

<table>
<thead>
<tr>
<th>MINFILE</th>
<th>NTS</th>
<th>UTM Zone 09</th>
<th>HOST ROCKS</th>
<th>COMMODITY</th>
<th>DESCRIPTION</th>
<th>REFERENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu SKARNS</td>
<td>3</td>
<td>DON, DON 12, DON 40</td>
<td>IPSc, LDd</td>
<td>CuAg</td>
<td>Skarn mineralization occurs near the contact between Lower Permian carbonate and a Late Devonian diorite intrusion. Mineralization includes disseminated pyrite, chalcopyrite, and tetrahedrite.</td>
<td>EMPR ASS RPT # 443 (Gutrath, 1962) EMPR ANNUAL RPT 1963 (Bapty, 1964)</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>MAG</td>
<td>IPSc, LDd</td>
<td>Cu</td>
<td>Magnetite skarn occurs near the contact between Lower Permian carbonate and a Late Devonian diorite intrusion. Mineralization consists of massive magnetite with minor pyrite and chalcopyrite.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>27</td>
<td>KEN, DIRK, GLACIER, ROPE</td>
<td>uCScg, mCSc, Cu, Ag, Au</td>
<td>A 1m up to 9m wide, NE-trending, SE-dipping conformable skarn zone developed in upper Carboniferous volcanic rocks. Skarn is comprised of alternating garnet and epidote-rich layers mineralized with massive magnetite, chalcopyrite and pyrite. A north-trending, crosscutting garnetite zone structurally below the main skarn may represent a feeder zone. Drilling in 1972 (Ken), intersected 15.2 m assaying 1.5% Cu and 1.3m assaying 7.5 g/t Au. 1988 Drilling (6 holes, 456m) Ken: intersected 5.4m averaging 2.81 g/t Au and 0.83% Cu.</td>
<td>EMPR ASS RPT # 4,150 (Costin, 1973) EMPR ASS RPT # 18,506 (Kiesman and Ikona, 1989)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>137</td>
<td>DUNDEE, GLA</td>
<td>uCScg, mCSc</td>
<td>Cu, Ag, Zn, Au</td>
<td>Iron-copper skarns developed where feldspar-porphyritic andesite dikes intrude Early Mississippian granite and carbonate pendant rocks. Mineralization comprises magnetite and lesser pyrite, pyrrhotite, chalcopyrite, sphalerite, and gold.</td>
<td>EMPR ASS RPT # 20 625 (Tennant and Buchholz, 1990)</td>
</tr>
<tr>
<td>Cu (AU) SKARN</td>
<td>367</td>
<td>TIC</td>
<td>ImDSc, LdD</td>
<td>Fe, Ag, Cu, Fe</td>
<td>A zone of magnetite up to 7 m thick occurs along the contact between Devonian marble and mafic tuff, and a Late Devonian quartz diorite. Maximum assays from two grab samples are 0.98% As, 0.31% Cu, 2.9 g/t Au and 1.6 g/t Ag.</td>
<td>Ray and Webster (1997)</td>
</tr>
<tr>
<td>AU SKARNS / MANTOS</td>
<td>281</td>
<td>NORTHWEST, MYCLYMONT, WARRIOR 4</td>
<td>uCScg, mCSc, uCScb</td>
<td>Au, Ag</td>
<td>Retrograde-altered garnet-magnetite skarn. Host rocks are mid Carboniferous marbles, cherty siltstone and younger volcanic conglomerates. Flat-lying and steeply dipping mineralized zones consist of pyrite and magnetite with subordinate chalcopyrite and trace galena, sphalerite and gold in carbonate-quartz-chlorite gangue. Silicic and dolomitic alteration envelop the skarn. The zone strikes ~025° and dips 65 degrees east toward the McLymont fault.</td>
<td>EMPR ASS RPT # 16 932 (Grove, 1987) Ray et al. (1991)</td>
</tr>
</tbody>
</table>
### TABLE 5-1 CONTINUED

**SUMMARY OF MINERAL OCCURRENCES**

<table>
<thead>
<tr>
<th>MINFILE</th>
<th>NT5</th>
<th>UTM</th>
<th>Zone 09</th>
<th>HOST ROCKS</th>
<th>COMMODITY</th>
<th>DESCRIPTION</th>
<th>REFERENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>282, 333</td>
<td>GAB NW</td>
<td>104B/15</td>
<td>381534</td>
<td>uClSss, mClSc, uClScg</td>
<td>Au</td>
<td>Adjoins McLymont NW zone. Drilling in 1988 (5 holes, 854m) and 1990 (5 holes, 2523m) intersected the same mid Carboniferous stratigraphy that is mineralized on the NW zone, 500m to the southwest. Best gold values intersected in 1990 drilling include 11.0 g/t and 4.0 g/t, over 1m. Higher values are associated with pyrite below a 200 m-thick stratabound, silica-dolomite-sericite alteration zone.</td>
<td>EMPR ASS RPT # 17210 (Todoruk and Ikona, 1988); EMPR ASS RPT # 21 152 (Montgomery et al., 1991)</td>
</tr>
<tr>
<td>144</td>
<td>GOZ/RDN</td>
<td>104G/02</td>
<td>398225</td>
<td>IJHv, IJHr</td>
<td>Au, Ag, Zn, Cu, Pb</td>
<td>Au- and Ag-enriched chalcopyrite, sphalerite, galena, pyrite and arsenopyrite-bearing veins hosted in silicified and pyritized Lower-Middle Jurassic rocks. Mineralization and alteration are related to coeval subvolcanic feldspar porphyry monzonite intrusives. Potential for exhalative deposits.</td>
<td>EMPR ASS RPT # 20,769 (Savelle, 1990); EMPR ASS RPT # 22,003 (Savelle and Grill, 1991)</td>
</tr>
<tr>
<td>70</td>
<td>Bu</td>
<td>104G/02</td>
<td>379644</td>
<td>uTSvt</td>
<td>Au, Cu</td>
<td>Mineralization includes; podiform, Ag-bearing massive chalcopyrite veins (up to 0.5m wide) and Au-bearing, base metal quartz-carbonate and/or calcite veins (generally less than 5cm wide). Grades of 112.4 g/t Au and 9.58% Cu are reported from a 5cm wide quartz-carbonate veinlet.</td>
<td>EMPR ASS RPT # 20,540 (Termeunde and Termeunde, 1990); EMPR ASS RPT # 21,868 (Ronning, 1991); EMPR ASS RPT # 22,623 (Bond, 1992)</td>
</tr>
<tr>
<td>SUBVOLCANIC VEINS Cu-Ag-Au (As,Sb)</td>
<td>144</td>
<td>Carcass Creek</td>
<td>104G/02</td>
<td>398225</td>
<td>IJHv, IJHr</td>
<td>Au, Ag, Zn, Cu, Pb</td>
<td>Au- and Ag-enriched chalcopyrite, sphalerite, galena, pyrite and arsenopyrite-bearing veins hosted in silicified and pyritized Lower-Middle Jurassic rocks. Mineralization and alteration are related to coeval subvolcanic feldspar porphyry monzonite intrusives. Potential for exhalative deposits.</td>
</tr>
<tr>
<td>378</td>
<td>FORGOLD</td>
<td>104B/15</td>
<td>398979</td>
<td>uTSvt</td>
<td>Au, Cu</td>
<td>Mineralization occurs within mesothermal quartz veins and an iron carbonate breccia zone. Veins contain pyrite, tetrahedrite, chalcopyrite, sphalerite, trace arsenopyrite, galena, gold and have prominent iron-carbonate alteration envelopes. Northeast-trending quartz veins crosscut strata, iron carbonate breccia is stratiform. Placer gold occurs in creeks below the showing.</td>
<td>EMPR ASS RPT # 20,540 (Termeunde and Termeunde, 1990); EMPR ASS RPT # 21,868 (Ronning, 1991); EMPR ASS RPT # 22,623 (Bond, 1992)</td>
</tr>
</tbody>
</table>

**QUARTZ-CARBONATE VEINS Cu-Au-Ag (As)**

<table>
<thead>
<tr>
<th>MINFILE</th>
<th>NT5</th>
<th>UTM</th>
<th>Zone 09</th>
<th>HOST ROCKS</th>
<th>COMMODITY</th>
<th>DESCRIPTION</th>
<th>REFERENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>Bu</td>
<td>104G/02</td>
<td>379644</td>
<td>ImDSgs, EDs</td>
<td>Au, Cu, Pb, Zn, Ag</td>
<td>Mineralization occurs within mesothermal quartz veins and an iron carbonate breccia zone. Veins contain pyrite, tetrahedrite, chalcopyrite, sphalerite, trace arsenopyrite, galena, gold and have prominent iron-carbonate alteration envelopes. Northeast-trending quartz veins crosscut strata, iron carbonate breccia is stratiform. Placer gold occurs in creeks below the showing.</td>
<td>Holbek (1988); EMPR ASS RPT # 14,982 (Folk, 1986); EMPR ASS RPT # 9,692 (Holbek, 1982)</td>
</tr>
</tbody>
</table>
### TABLE 5-1 CONTINUED
#### SUMMARY OF MINERAL OCCURRENCES

<table>
<thead>
<tr>
<th>MINFILE</th>
<th>NTS</th>
<th>UTM Zone 09</th>
<th>HOST ROCKS</th>
<th>COMMODITY</th>
<th>DESCRIPTION</th>
<th>REFERENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>379</td>
<td>NEW</td>
<td>104G/15</td>
<td>LDg</td>
<td>Au, Ag</td>
<td>Narrow, irregular quartz-carbonate veins cut quartz-carbonate-chlorite altered quartz monzonite. The veins pinch and swell. They contain pyrite, chalcopyrite and sporadic gold and silver values.</td>
<td>EMPR ASS RPT # 20,666 (Toduruk and Ikona, 1990a); EMPR ASS RPT # 21,340</td>
</tr>
<tr>
<td>126</td>
<td>McLYMONT CAMP ZONE</td>
<td>104B/15</td>
<td>LDg</td>
<td>Au,Ag,Cu</td>
<td>1) Narrow (&lt;30cm), NW-trending en echelon, Au-bearing pyrite-chalcopyrite-quartz veins cut quartz-rich Late Devonian granite and 2) NW- and NE-trending pyritic quartz-ferrocyanide veins. 1998 Drilling results include 7.9 g/t Au over 1.5 m; trench samples assayed 15.6-57.9 g/t Au.</td>
<td>EMPR ASS RPT # 16,932 (Grove, 1987); Grove (1989)</td>
</tr>
<tr>
<td>332</td>
<td>McLYMONT NE ZONE</td>
<td>104B/15</td>
<td>LDg, ImDSs</td>
<td>Au,Zn</td>
<td>Au-bearing massive pyrite and sphalerite hosted in a hornfelsed, pyritic altered graphitic siltstone pendant in Late Devonian diorite.</td>
<td>EMPR ASS RPT # 16,932 (Grove, 1987)</td>
</tr>
<tr>
<td>347</td>
<td>EGG, VERJOY RET 7</td>
<td>104B/15</td>
<td>DSn, LDg</td>
<td>Au</td>
<td>Quartz-barite veins infilling shear or fracture systems are mineralized with pyrite, chalcopyrite, galena, hematite, magnetite and malachite; gold values are low but silver, cobalt and copper values are elevated above background. Assays from massive pyrite veins up to 5.0cm wide containing chalcopyrite, hematite and magnetite returned 4.15% Cu.</td>
<td>EMPR ASS RPT # 17,469 (Ikona, 1988); EMPR ASS RPT # 18,515 (Dewonck and Raven, 1988)</td>
</tr>
<tr>
<td>350</td>
<td>ADRIAN</td>
<td>104B/15</td>
<td>DSn, LDg</td>
<td>Au,Ag,Cu</td>
<td>Nine grab samples from the property returned gold values ranging from 2.7 g/t to 30.0 g/t.</td>
<td>George Cross Newsletter, #165, 1988 (p.3)</td>
</tr>
</tbody>
</table>

#### FAULT AND SHEAR HOSTED VEINS: Cu-Ag-Au and Ag-Zn-Pb

<table>
<thead>
<tr>
<th>MINFILE</th>
<th>NTS</th>
<th>UTM Zone 09</th>
<th>HOST ROCKS</th>
<th>COMMODITY</th>
<th>DESCRIPTION</th>
<th>REFERENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>BAM 10</td>
<td>104G/02</td>
<td>Emd, Emd,ImDSst</td>
<td>Au, Ag, Bi</td>
<td>Gold and fine-grained pyrite occupy quartz and carbonate veinlets in fractured Early-Mississippian in the granite. Discontinuous mineralization occupies NE-trending silicified and sericitized shear zones in the granite. Gold values range from 8.57 g/t over 18.9m in trench 86-1 to 1.72 g/t over 2.43m in DDH 87-1, drilled in 1987 to test the ground beneath Trench 86-1. 1997 Drilling intersected no significant Au values in 6 holes.</td>
<td>EMPR ASS RPT # 17,570 (Diner, 1987); EMPR ASS RPT # 15,827 (Hewgill and Walton, 1986a); EMPR ASS RPT # 14,859 (Walton, 1986); Wojdak (1997)</td>
</tr>
<tr>
<td>334</td>
<td>CUBA,GAB 8</td>
<td>104B/15</td>
<td>IPSc, uCscg, uTBlvat</td>
<td>Ag,Pb,Zn,Ba,Cu</td>
<td>Silver-rich mineralization occurs as quartz-barite-sulphide fractures (1-2cm wide) and as matrix to crackle-breccia zones (up to 4m wide) in fault dissected and brecciated Permian limestone adjacent to the east bounding fault of the Newmont graben. Mineralization consists of sphalerite galena and tetrahedrite interstitial to calcite and coarse crystalline barite. 1988 Drilling (2 holes, 143m) intersected 7.5m averaging 56.2 g/t Ag and 0.488% Zn. A grab sample from surface trenchs returned 125 g/t Ag, 5.88% Zn and 0.05% Cu.</td>
<td>EMPR ASS RPT # 18,506 (Kiesman and Ikona, 1989); Logan et al. (1990b)</td>
</tr>
<tr>
<td>MINFILE</td>
<td>NAME</td>
<td>UTM Zone 09</td>
<td>HOST ROCKS</td>
<td>COMMODITY</td>
<td>DESCRIPTION</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
<td>-------------</td>
<td>------------</td>
<td>------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>335</td>
<td>GAB 12, SW</td>
<td>104B/15</td>
<td>LiTriz, Psiz</td>
<td>Ag, Zn, Pb</td>
<td>Arseno/sulphide zone: consists of 2 vertical, subparallel mineralized fault zones which strike 030. Ferrocarbonate alteration extends 10-15m beyond the shear zones. Mineralized quartz veins varying from a few cm up to 1.5m in width, contain pyrite, arsenopyrite and chalcopyrite.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Rusty shear zone: Ferrocarbonate alteration zone developed along a 040 trending fault structure. Mineralization consists of fine pyrite and arsenopyrite in 090 trending vertical ferrocarbonate veins (several cm to 0.5m wide) that cut the alteration zone. 1988 Drilling (7 holes, 856m): Arseno: 74.0 g/t Au over 0.65 m; Rusty shear: 2.4 g/t Au over 0.5m. 1990 Drilling (7 holes, 638m): Arseno: 3.6 g/t Au over 0.5m; Sulphide: 5.0 g/t Au over 2.2m.</td>
<td></td>
</tr>
<tr>
<td>336*</td>
<td>GAB 11, SE</td>
<td>104B/15</td>
<td>380487 6298490</td>
<td>uCScg, uCSb</td>
<td>Au, Cu, Pb, Zn Massive fine-grained pyrite occurs within sedimentary rocks of upper Carboniferous to Early Permian age; grab samples of talus from a pyritized zone returned values of 23.5 g/t Au and 16.9 g/t Ag.</td>
<td></td>
</tr>
<tr>
<td>337*</td>
<td>GAB 12 NE</td>
<td>104B/15</td>
<td>38005 6300541</td>
<td>uCScg, uCSb</td>
<td>Au, Cu, Pb, Zn A gossanous zone several hundred meters wide in upper Carboniferous volcanic and sedimentary rocks. Adjacent McLymont NW zone. Talus samples contain massive and disseminated magnetite, chalcopyrite, sphalerite and galena; with gold values as high as 26.7 g/t Au.</td>
<td></td>
</tr>
<tr>
<td>380</td>
<td>FORREST 1-15</td>
<td>104B/15</td>
<td>395221 6297511</td>
<td>uDSt, Csst</td>
<td>Au, Ag, Cu</td>
<td>Triple Creek/Creek/Canyon Shear zones: NE-trending, en echelon shear zones, characterized by pervasive ferrocarbonate alteration, mineralized with chalcopyrite and contain Ikona (1995).</td>
</tr>
<tr>
<td></td>
<td>Creek/Canyon</td>
<td></td>
<td></td>
<td>Pb, Zn</td>
<td></td>
<td>Gold Pan/Falls: E-trending, narrow (5-50cm wide) quartz veins; contain pyrite, arsenopyrite, chalcopyrite and locally visible Au.</td>
</tr>
<tr>
<td>147</td>
<td>MAL</td>
<td>104G/02</td>
<td>400727 6341284</td>
<td>uTEs, uTEs</td>
<td>Au, Ag</td>
<td>Gold and silver mineralization occurs in silicified and pyritized shears in volcanics and sediments. Gold and silver soil anomalies define a 200 metre wide zone below the sediment hosted gossan. Known mineralization is discontinuous and low grade.</td>
</tr>
<tr>
<td>MINFILE</td>
<td>NAME</td>
<td>NTS</td>
<td>EAST</td>
<td>NORTH</td>
<td>ROCKS</td>
<td>COMMODITY</td>
</tr>
<tr>
<td>---------</td>
<td>----------</td>
<td>-------</td>
<td>------</td>
<td>-------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>104G/B</td>
<td>COT &amp; BULL</td>
<td>383075</td>
<td>6371290</td>
<td>mCSc</td>
<td>Ag, Cu, Au</td>
<td>Disseminated blebs of tetrahedrite, chalcocite and pyrite occupy fractures and breccia zones in a bedding-parallel, east-trending fault cutting limestone. Mineralization either pre-dates or is synchronous with a north-trending basalt dike swarm.</td>
</tr>
<tr>
<td></td>
<td>BAM ARCTIC</td>
<td>384815</td>
<td>6341514</td>
<td>PSIm, lHcgl</td>
<td>Cu, Ag, Zn</td>
<td>Disseminated blebs and veins of tetrahedrite, minor chalcopyrite, pyrite, sphalerite and galena occupy fractures and breccia zones in limestone, sandstone and conglomerate. Mineralization and carbonate alteration follow NE-trending splay faults related to N-trending regional structures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>104G/02</td>
<td>BIK</td>
<td>378840</td>
<td>6342134</td>
<td>mCSc, ?PSIm</td>
<td>Cu, Ag, Zn, Pb</td>
<td>Disseminated replacements and thin fracture-fillings of tetrahedrite occupy fractured and silicified limestone. Mineralization is controlled by subvertical and flat north-trending joints. A grab sample of mineralization returned 819.0 g/t silver, 13.0% copper, 2.8% zinc and 0.2% lead.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MINFILE</th>
<th>NAME</th>
<th>NTS</th>
<th>EAST</th>
<th>NORTH</th>
<th>ROCKS</th>
<th>COMMODITY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>104G/02</td>
<td>FOREMORE</td>
<td>378966</td>
<td>6326593</td>
<td>ImDSst,ImDSc,ImDSgs</td>
<td>Zn, Pb, Cu, Ag</td>
<td>Laminated sphalerite and galena occur in tectonic volcanic horizons within a foliated package of graphic schist, argillite and intermediate to mafic volcanics of Lower Devonian age. Mineralized boulders include pyrite, sphalerite and chalcopyrite-rich varieties.</td>
<td>EMPR ASS RPT # 18,105 (Mawer, 1988)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EMPR ASS RPT # 19,379 (Barnes, 1989)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Boulder Type</th>
<th>Cu %</th>
<th>Pb%</th>
<th>Zn%</th>
<th>Ag g/t</th>
<th>Au g/t</th>
<th>Fe%</th>
</tr>
</thead>
<tbody>
<tr>
<td>chalcopyrite-rich (n=12)</td>
<td>2.3</td>
<td>0.5</td>
<td>6.2</td>
<td>186</td>
<td>1.5</td>
<td>16</td>
</tr>
<tr>
<td>sphalerite-rich (n=29)</td>
<td>0.22</td>
<td>3.5</td>
<td>10.2</td>
<td>96</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td>pyrite-rich (n=112)</td>
<td>trace</td>
<td>trace</td>
<td>6.2</td>
<td>78</td>
<td>nil</td>
<td>23</td>
</tr>
</tbody>
</table>

Diamond drilling of geophysical conductors in 1990 (5 holes, collared on the glacier) and one hole in 1996 (663.9m) intersected several horizons of variably graphitic mudstone.

The source of the boulders remains undiscovered and presumably under the glacier.

* mineral occurrence not plotted on map
sis of the deposit. Spilsbury (1995) provides a detailed description of mineral paragenesis, zonation patterns and a synopsis of the current knowledge of the deposit.

Our observations of the Upper Triassic stratigraphy in the area of the deposit agree with those of Fox et al. (1976). They note that 90 per cent of the deposit is hosted by plagioclase-phyric and aphyric basalt flows (UTSvb) and associated subvolcanic intrusions, massive tuffs, and bedded green and purple epiclastics (UTSvt). The epiclastic rocks are overlain by weakly mineralized mixed purple and green flow breccias and tuff (UTSpp). Dike swarms of plagioclase porphyry, pyroxene plagioclase porphyritic diorite, felsite (aplite and quartz-eye feldspar porphyry) and hornblende porphyry, in order of abundance, cut the Upper Triassic volcanic rocks (GS-Map). The aplite and quartz-eye feldspar porphyry intrusives are bleached, altered and mineralized with disseminated and fracture-controlled sulphides.

Early workers distinguished between the purple volcanics and mineralized green andesitic volcanic rocks, and postulated the presence of an unconformity or disconformity separating the two units (Fox et al., 1976). No simple lithologic or stratigraphic difference was recognized during the current mapping. The colour difference may reflect alteration related to the Hickman or Yehiniko plutons, or proximity to the north-trending mineralizing and alteration system which produced the deposit. Clasts of probable mafic pumice that have been completely replaced by epidote, and volcanic and intrusive fragments that are variably replaced by epidote occur within purple volcanic flow and tuff of units UTSvt and UTSpp. Epidote alteration occurs within the propylitic alteration zone marginal to mineralization. South of the deposit, this stratigraphic package is unconformably overlain by quartz-eye felsic tuffs and quartz-bearing Lower Jurassic conglomerates that contain epidotite clasts and clasts of epidotized volcanic rocks.

In the areas south and east of the deposit, the overall strike of bedding is north-northwesterly with easterly and westerly dips that average 70 degrees. Locally strikes vary to northeast, also with steep dips, suggesting tight folds. Other workers describe gentle east dips for bedding in the western part of the deposit, suggesting a simple synclinal structure (Fox et al., 1976; Linder, 1975).

A prominent north-striking fault truncates the Main zone on its western side. The West Breccia and Paramount zones occupy other northerly-striking faults. Northeast-trending and northwest-dipping normal faults truncate the deposit and produced a mosaic of fault blocks with varying internal structure and stratigraphy.

The deposit consists of three distinct zones: the Liard or Main zone, a fracture-controlled zone of mineralization; the West Breccia zone, which is a fault-bounded breccia characterized by a tourmaline sulphide matrix; and a linear intrusive breccia, the Paramount zone (Spilsbury, 1995). The Liard zone is hosted in andesite flows and epiclastic rocks. The volcanic rocks at the Paramount zone are intruded by granodiorite to quartz monzonite bodies, possibly non-porphyritic equivalents of the quartz-feldspar porphyry dikes that cut the Liard zone.

Mineralization includes chalcopyrite, pyrite, bornite and molybdenite. Alteration assemblages in the Main zone
define a well-developed central potassic zone (biotite and potassium feldspar) which is bounded by a broad propylitic zone, characterized by epidote, chlorite and pyrite. Silica alteration is limited to breccia zones, and phyllic (sericite-rich) zones are confined mainly to felsic porphyry dike swarms. Spilsbury (1995) provides a succinct discussion of mineral zonation and paragenesis for the Liard zone.

The deposit is hosted by Upper Triassic volcanic rocks of the Stuhini Group adjacent to the eastern contact of the coeval Hickman pluton, and the east-trending Middle Jurassic Yehiniko pluton. The ages of intrusive bodies are approximately constrained by K-Ar and Rb-Sr dating methods (Holbek, 1988) and in addition the host volcanic rocks have sedimentary interbeds which contain the Late Triassic (Norian) bivalve Monotis Subcircularis (C-207971, Appendix 1). However, the timing of copper-molybdenum mineralization at Schaft Creek is not tightly constrained.

A whole-rock K-Ar date of 185±5 Ma (Panteleyev and Dudas, 1973) for hydrothermal biotites falls within the range of dates for the Middle Jurassic Yehiniko pluton and in addition, leucocryn syn-mineralization dikes were thought to be derived from the quartz monzonite to granite phases of the Yehiniko pluton. A lower limit on the age of mineralization is provided by a Late Triassic (216.6 ± 2 Ma) U-Pb date obtained from an altered and mineralized quartz-feldspar porphyry dike from the Liard zone (Table 5-1). This new age constraint suggests that these dikes are comagmatic with the Hickman pluton. These leucocratic, porphyritic dikes are spatially and apparently temporally associated with the mineralizing event. The whole-rock K-Ar date of 185±5 Ma (Panteleyev and Dudas, 1973) for hydrothermal biotites probably reflects argon loss related to intrusion of the Yehiniko pluton.

**RUN (MINFILE 104G/40)**

The Run property is located approximately 10 kilometres southeast of the Schaft Creek deposit. It is within a large iron-stained alteration zone that outcrops for over 15 km along the east side of Mess Creek (Figure 5-2). Access to the property is by helicopter; small float planes have landed on Loon Lake, but the lake is too short to take-off with heavy loads. Diamond drilling in 1972 (4 holes, 563m), tested a quartz-rich polymictic breccia zone located 2 km east of Loon Lake returned 155ppb Au, 165 g/t Ag, 1.07% Cu, 0.18% Zn, 0.10% As and 0.66% Sb.

**BISKUT, VOIGTBERG (MINFILE 104G/146)**

Midway between the Lucifer and Little Les showings, about 8.5 km south of Hankin peak, is a substantial limonitic gossan that is clearly visible from the air. This alteration zone lies at the centre of the Biskut - Voigtberg property (Figure 5-2). Lac Minerals Ltd. recorded the first prospecting and rock sampling work in 1988 and assessment by various companies continued unabated until 1996, when Hayden Resources Ltd. conducted a 456 m drilling program.

The property is underlain by a thick succession of Upper Triassic Stuhini Group rocks belonging to the More Creek sedimentary facies. These include well bedded feldspathic sandstone, limestone-bearing conglomerate with thin bedded siltstone layers, interbedded volcanic flow and augite-bearing volcaniclastic rocks, and argillaceous limestone. The layered rocks are intruded by northeast-trending megacrystic orthoclase porphyry syenite dikes and a mafic-poor biotite monzonite stock. The latter is...
believed to underlie much of the gossan. The gossan area was mapped by Souther (1972) as a Late Cretaceous to Tertiary felsite dike. Bobyn (1990) interpreted the felsite as Early Jurassic, and correlative with the Mount Dilworth Formation. The monzonite is probably Early Jurassic or older in age, and part of either the Copper Mountain or Texas Creek plutonic suites.

Bedding measurements show the rocks strike northwesterly on the property, but regional scale north-trending, upright open folds and faults and younger east-trending chevron folds are known to occur in the vicinity.

The northeast-trending gossan, 300 metres long by 50 to 100 metres wide, consists of an argillic alteration assemblage of predominantly limonite, clay, sericite, pyrite and quartz. Oxidation of sulphides and acid generation has obliterated all the original textures. Epidote-chlorite-carbonate alteration assemblages are present in volcanic rocks peripheral to the main zone. The gossan contains up to 5 per cent disseminated pyrite and traces of arsenopyrite and galena. Rock geochemical results (Kemp, 1995) suggest metal zoning peripheral to the main intrusion/alteration zone. Silicified, pyritic argillic zones in volcanic rocks adjacent to the porphyry intrusions carried anomalous values only in gold (1.38 g/t and 1.43 g/t from 2.0m and 1.6m chip samples), while sedimentary-hosted carbonate breccia veins, located upslope from these, are characterized by silver-rich base metal mineralization containing anomalous values of gold, arsenic and antimony.

Two grab samples collected from the gossan and one from a pyritic tuff located upslope are listed below (Table 5-2). Samples of the pyritic feldspar porphyry contain only slightly elevated copper values. A single grab sample from the gossan returned 16.1 grams per tonne gold (Bobyn, 1990).

Diamond drilling in 1996 cut a total of 456 m in 3 holes. Drilling was conducted from a single setup located in altered volcanic rocks, approximately 500 m north of the main gossan. All 3 holes intersected potassium-feldspar-carbonate-sericite-pyrite altered volcanic rocks. The rocks contain anomalous values of gold over the entire 456 m drilled, averaging 0.26 g/t Au (Gunning, 1996). The best intersection was 2.01 g/t Au over 2.43 m at the bottom of hole 96-3. Arsenic values show a weak correlation with gold values. Copper, molybdenum, antimony, lead and zinc show no enrichment or correlation with higher gold values.

### ALKALINE PORPHYRY Cu-Au

**LUCIFER (MINFILE 104G/145)**

The Lucifer property is located 2 km north of More Creek, on the eastern side of the map area (Figure 5-2). The first work recorded was conducted by Noranda Exploration Company Limited (NPL) in 1990. This comprised airborne EM-Mag surveys and on-the-ground follow-up mapping, and soil, rock and heavy mineral sampling. Limited drilling is reported to have been completed later that same year.

Upper Triassic tuffaceous sediments, reworked tuffs and minor limestones of the More Creek sedimentary facies underlie the claims. Further north green tuff and epiclastic rocks are interlayered with augite-phryic basalt flows and sills. Maroon ash tuffs and tuffaceous conglomerates containing coarse potassium feldspar crystal fragments crop out high on the ridge west of the alteration zone. These lithologies are intruded by northerly trending megacrycstic potassium feldspar porphyry dikes.

The area of interest occupies the headwall and steep upper reaches of a south-draining tributary of More Creek. It consists of a large (1000 x 2000 m) northerly trending limonite-carbonate-pyrite alteration zone. Narrow quartz stringer zones and veiinets crosscut this chiefly propylitic alteration zone. The alteration zone lies west of a northeast-trending fault and coincides with a northeast-striking swarm of megacrycstic potassium feldspar porphyry dikes. Pyritic and propylitically altered and unaltered dires crosscut the zone and indicate complex and episodic intrusive and mineralizing events. Mineralization consists of quartz-carbonate-pyrite veins containing chalcopyrite and galena. Results from the two 1991 diamond drill holes do not explain the anomalous gold soil geochemistry of the alteration zone (R. Baerg, personal communication, 1991).

**LITTLE LES (MINFILE 104G/179)**

The Little Les-Two More showing is situated on a limonitic gossan located 9 km north of the confluence of More and South More creeks and about 7 km south of Hankin peak, on the Arctic claims (Figure 5-2). The property has received limited exploration work. Newmont Mining Corporation conducted geological mapping and drilled 2 holes totaling 52 m in 1970 and Teck Exploration Ltd. continued mapping and completed a rock and soil sampling program over the area in 1980. More recently, Keewatin Engineering Inc. carried out mapping and sampling of the area (Bobyn, 1991).

### Table 5-2

<table>
<thead>
<tr>
<th>Map Number</th>
<th>Au ppm</th>
<th>Ag ppm</th>
<th>Cu ppm</th>
<th>Pb ppm</th>
<th>Zn ppm</th>
<th>As ppm</th>
<th>Sb ppm</th>
<th>Mo ppm</th>
<th>Ni ppm</th>
<th>Fe %</th>
<th>SAMPLE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>91JLO3-27</td>
<td>30</td>
<td>5</td>
<td>127</td>
<td>84</td>
<td>68</td>
<td>136</td>
<td>12</td>
<td>5</td>
<td>18</td>
<td>9.21%</td>
<td>pyritic feldspar porphyry, 1-2 % py</td>
</tr>
<tr>
<td>91JLO3-28</td>
<td>&lt;5</td>
<td>1</td>
<td>550</td>
<td>28</td>
<td>45</td>
<td>17</td>
<td>1</td>
<td>47</td>
<td>12</td>
<td>3.80%</td>
<td>pyritic feldspar porphyry, 1-2 % py</td>
</tr>
<tr>
<td>91JLO3-21</td>
<td>40</td>
<td>1</td>
<td>65</td>
<td>36</td>
<td>38</td>
<td>81</td>
<td>5</td>
<td>30</td>
<td>13</td>
<td>5.21%</td>
<td>grab pyritic limy tuff</td>
</tr>
</tbody>
</table>
Upper Triassic volcaniclastic rocks of the More Creek Sedimentary facies underlie the area. Coarse grained to cobble sized, polymeric intraformational conglomerates, green feldspathic sandstone and thin bedded black shales and limestone dominate the succession, but there are also plagioclase phryic and aphyric basalt flows, and lithic tuff horizons; and the flows and tufts host the copper mineralization. Intruding these rocks is a series of medium grained, equigranular, green, chloritic diorite sills, megacrystic orthoclase porphyry syenite dikes and a larger body of medium grained chloritized monzonite. Younger biotite lamprophyre and biotite feldspar porphyry dikes cross-cut all the other rocks.

The dominant trend of the strata is north-northwest with moderate northeasterly dips. Sedimentary structures indicate upright-facing stratigraphy, but isoclinal folding and faulting is recognized on the property. Some of this may be linked to intrusion of the diorite and monzonite bodies, but regional scale north-trending, upright open folds and faults and younger east-trending chevron folds deform Upper Triassic rocks elsewhere in the area.

The gossan mantles a pyrite-rich alteration envelope which flanks a 200 by 50 metre zone of propylitically altered andesite flows and tuffs. Alteration minerals include chlorite, biotite, pyrite and carbonate. Mineralization consists of 2 to 5 percent disseminated and fracture-filling chalcopyrite and traces of galena and molybdenite (Folk, 1981). A chip sample across 5.4 m averaged 2.57 g/t Au, 10.2 g/t Ag and 1.65% Cu (Bobyn, 1991). A grab sample of disseminated and fracture-controlled chalcopyrite and pyrite-mineralized tuffaceous silstone returned 1.12 g/t Au, 4 g/t Ag and 0.95% Cu (Logan et al., 1992b).

Alteration and mineralization are related to syenite porphyry dikes. Alteration and the best mineralization is developed within volcanic and volcaniclastic rocks. The variety and number of intrusive bodies indicate that the area was a focus of igneous activity; the preponderance of sedimentary strata over volcanic and lack of coarse volcanic breccia suggests a volcanic flank-setting rather than a vent-proximal position.

SKARN DEPOSITS

Skarns in the Iskut River area typically fall into either the copper or iron-copper skarn classification, but they are sporadically enriched in gold. The Ken and Dundee occurrences are typical copper skarns. Another potentially important type in the area are gold-skarns. Mineralization of this type is present at the Northwest zone on the McLymont property and on the Gab-NW occurrence (Figure 5-2). Copper and iron-copper skarns are more typical of other skarns in the Iskut River area, while the gold skarns are unique. Another difference between the two groups is the age of mineralization. The Dundee Skarn is probably Late Devonian to Early Mississippian in age and related to one or more intrusive phases of the More Creek pluton into a mixed sequence of volcaniclastic and carbonate rocks. In contrast, the skarns in the Newmont Lake area are related to structurally controlled intrusions of relatively small, felsic to potassic bodies of probable Late Triassic to Early Jurassic age which altered and mineralized mid-Carboniferous carbonate rocks.

Many of the skarns in the Iskut River area have recently been studied by Gerry Ray. He described, classified and tabulated them in Ray and Webster (1997). The skarn deposits described below are therefore only briefly summarized, the property descriptions taken primarily from Webster and Ray (1991) or Ray and Webster (op.cit).

COPPER SKARNS

KEN (MINFILE 104B/27)

The Ken showing is exposed on several nunataks approximately 3 km northwest of Newmont Lake (Figure 5-2). Well-bedded siltstone, sandstone and polymeric conglomerate with interbedded mafic lapilli tuff and coarse breccia horizons of probable Upper Carboniferous age underlie the area. A quartz diorite of unknown age intrudes the package. The showing consists of at least 4 separate easterly to northeast-trending, southeast-dipping conformable skarn horizons developed in carbonate and volcaniclastic rocks. A north-trending, crosscutting garnetite zone, located structurally below the main skarn, may be a structurally controlled feeder zone (G. Ray, personal communication, 1997).

The skarned horizons vary from 1 m up to 9 m in thickness and comprise alternating garnet and epidote-rich layers mineralized with massive magnetite, chalcopyrite and pyrite. Skarn minerals are coarsely crystalline garnet, epidote and calcite and the zones contain pods of massive magnetite with veins and disseminations of chalcopyrite and coarse pyrite. The rocks are overprinted by later ferrocarbonate alteration which occupies northeast-trending fractures.

Drilling below the surface trenches in 1988 (6 holes, 456 m) intersected an unaltered augite porphyry sill and a weakly altered syenite dike (Kiesman and Ikona, 1989). The skarn intersections and most of the better Cu-Au values occur in strata above the augite porphyry sill. Intersections include 5.4 m of 2.81 g/t Au and 0.83% Cu in hole 88PG-1 and 6.0 m of 2.61 g/t Au and 0.94% Cu in hole 88PG-5 (Kiesman and Ikona, 1989).

DUNDEE (MINFILE 104G/137)

The Dundee showing straddles the south fork of More Creek 13 kilometres southwest of its confluence with More Creek (Figure 5-2). The property is underlain by hornfelsed and silicified Lower Devonian rocks and monzonite to biotite granite of the Early Mississippian More Creek Pluton (MCP). Mineralization is concentrated along the southwest trending intrusive contact and in pendant rocks within the MCP. Three types of mineralization occur: quartz-carbonate-pyrite veins; silicified and pyritized structural zones; and at least two stages of skarn alteration, one related to the main intrusion in which the pendant occurs and a second related to the later dikes. Skarn mineralization is apparently the only type with economic potential. Mineralized skarns are developed where younger feldspar-porphyrritic andesite dikes crosscut limestone bodies and the main intrusive body.
The following is a summary from Webster and Ray (1991). Four zones of skarn alteration occur within or near the southwestern margin of the More Creek Pluton. Three of the four zones occur east of More Creek at between 1220m and 1520m elevation along the contact of the main pluton (Figure 2-10-2, op. cit). These zones consist of massive garnetite, garnetite-epidote or banded garnet-epidote skarn assemblages. They are variably crosscut by veins of magnetite and pyrite, and epidotized diorite sills and/or veins of garnetite, illustrating prograding fluid interactions with country rock (Photo 5-2). Mineralization comprises massive and veined magnetite with variable amounts of pyrite, pyrrhotite, chalcopyrite, sphalerite and gold.

Webster and Ray (1991) report assays of samples from a chalcopyrite and pyrite mineralized sheared contact zone between the MCP monzonite and an andesite dike enriched in Au, Ag, Cu and Zn. A grab sample of magnetite-epidote-diopside-pyrite rock collected during regional mapping returned very low base and precious metal values (Appendix 10).

The fourth zone occurs in intermediate tuffaceous and volcaniclastic rocks of Devonian-Mississippian age, at 760m elevation. Mineralization consists of semimassive pods and lenses of pyrrhotite up to 5m long in silicified and epidotized andesite. Garnetite zones are characterized by reddish-brown garnet, and contain coarse radiating magnetite crystals intergrown with minor pyrite, and semimassive pods of pyrite.

The local pyrrhotite-rich mineralization in the Dundee skarns distinguishes them from other skarns in the area. However, similar coarse radiating magnetite crystals are present in the McLymont skarn.

COPPER (GOLD) SKARN

TIC (MINFILE 104B367)

The Tic showing (Figure 5-2) is a zone of magnetite up to 7m thick developed along the intrusive contact between interlayered Lower Devonian marble and metavolcanic rocks and a mafic quartz diorite border-phase of the Late Devonian Forrest Kerr pluton. The massive magnetite zone, trends northeast and dips steeply southeast, it follows a sharp footwall contact in the marble. The lower contact zone of the magnetite is marked by either a 1m zone of ferrocarbonate alteration or irregular pods of pyrite in the marble. Endoskarn alteration comprised of epidote, garnet, pyrite and potassium feldspar is developed within the diorite proximal to its margins and forms the hangingwall. Lenses and veinlets of pyrite, carbonate and locally euhedral quartz occur within the magnetite unit. Ray and Webster (1997) report the highest assays from two grab samples to be 0.98% As, 0.31% Cu 2.9g/t Au and 1.6 g/t Ag.

GOLD SKARN / MANTOS

 McLymont (NW zone) (MINFILE 104B/281)

The McLymont Creek property straddles the headwaters of McLymont Creek, about 2 kilometres south of Newmont Lake (Figure 5-2). Gold-enriched skarns were discovered by Gulf International Minerals Limited at the northwest corner of the property (NW zone) in 1987. The NW zone contains stratabound chimney and manto-type skarn mineralization hosted in a mid Carboniferous and younger volcaniclastic sequence consisting of green tuffaceous siltstone, sandstone, polylithic conglomerate and volcanic breccia with lesser interbedded marble beds.

Mineralization is developed in marble beds and along contacts between tuffaceous sandstones and marble where faults and fractures have provided permeability for the hydrothermal solutions.

The deposit plunges north and has been traced by drilling for over 300 m in a northeast direction. It lies immediately west of and parallels the trend of the McLymont Fault. The dip of the fault is steep, but the direction is unknown. It truncates easterly-trending structures in the older rocks to the west, with bedding dips generally rotated down into the fault plane. East of the fault, bedding in the younger rocks is rotated up relative to the fault. The fault is itself cut by northerly-trending splay structures and steep east-dipping fractures. Dikes displaced along these structures indicate subhorizontal dextral movement (progressive northward displacement). Bedding attitudes in the vicinity of the mineralized zone suggest the presence of a north striking and plunging fold (Figure 2-11-3, Ray et al., 1991). The 1989 drilling tested mineralization to a depth of 200 metres below the surface. Mineralization is in semi-conformable replacement zones in crinoidal marble and calcareous tuffaceous sediments and also in steep, fracture controlled zones. The shallow southeast dipping mineralized strata are truncated at depth by the McLymont fault. If this regional structure was open during the Early Jurassic it could have acted as a conduit for mineralizing solutions to travel upward and outward into the permeable and chemically reactive carbonates.

Ray et al. (1991) classify the skarn as a retrograde-altered gold-rich skarn. Sulphides include pyrite, chalcopyrite, sphalerite and galena with a gangue of barite,
calcite and gypsum. Oxides are coarse-grained magnetite and specular hematite. Other skarn minerals include dolomite, siderite, jasper and potassium feldspar. The best gold mineralization is associated with coarse euhedral pyrite (E.W. Grove, personnel communication, 1989). Polished section studies show that most of the gold is fine grained (<15 micrometres) and occurs within chlorite, coarse pyrite and late stage fine grained pyrite (Ray et al., 1991). The mineralized zones are surrounded by irregular envelopes of silicification and later ankerite-dolomite alteration envelopes up to 25 metres wide. Both these stages of mineral deposition/alteration appear to post date mineralization.

The gold occurs together with silver and copper and trace amounts of antimony and arsenic. Drill intersections show high-grade but erratic gold values over the entire deposit. Drillhole 87-29 returned values of 55.05 g/t Au, 39.78 g/t Ag and 0.97 % Cu over an 11.1 metre intersection (Grove, 1989).

Well developed structures, proximity to intrusive bodies and the chemically reactive stratigraphy have all contributed to localizing this deposit. Galena-lead from galena and sphalerite veins located peripheral to the NW zone give Pb-Pb model ages of Early Jurassic or older. These veins are interpreted to represent a distal part of the hydrothermal system that is responsible for deposition of the NW zone.

GAB 9 (MINFILE 104B333)

The Gab 9 occurrence adjoins the McLymont NW zone (Figure 5-2). The property is bisected by the north-east-trending extensional McLymont fault. West of the fault are mid-Carboniferous carbonate and younger sedimentary and volcanioclastic rocks. East of the fault, within the Newmont Lake Graben, are Upper Triassic Stuhini Group volcanic and sedimentary rocks and coeval to probably younger Newmont Lake intrusive bodies. The latter are maaron hornblende-plagioclase porphyritic andesite breccia flows, lapilli tuff and epiclastic rocks, with lesser rhyolite and limestone beds. West of the fault is a thick (>500m) epiclastic sequence dominated by polymeric volcanic conglomerate, sandstone, lesser cherty siltstone and interlayered mafic lapilli tuff and coarse breccia. This succession conformably overlies approximately 30 m of Early(?!) to mid Carboniferous limestone. The limestone is massive to thickly bedded, locally interlayered with maroon and green tuffaceous sandstone and irreguarly bleached and stained by oxidized ferrocarbonate-altered breccia zones. Large angular blocks of carbonate (up to 5 X 10m) as well as carbonate-clast dominated beds are common at various horizons within the conglomerate. The unit resembles Upper Triassic conglomerates described above Forrest Kerr Creek (Read et al., 1989), and north of the Chutine River (Brown et al., 1992b), but bedding-top directions, conformable contacts, and the mid Carboniferous age of the limestone clasts suggest a Late Paleozoic age for this unit.

Exploration to date has been focused west of the fault in the older rocks. The intended target being extensions to the carbonate-hosted gold mineralization present on the McLymont NW zone. Mineralization at the NW zone lies immediately west of the McLymont fault in green, thin bedded ash and crystal tuff, tuffaceous siltstone and grey crystalline-bearing marble.

West of the fault, the northeast-trending McLymont fault truncates easterly-trending structures in the older rocks. Mineralization, alteration and monzonite bodies that are either potassium feldspar porphyritic or equigranular that lie along the structure suggest it acted as a locus for intrusion and mineralization.

Diamond drilling in 1988 (5 holes, 854m) and in 1990 (5 holes, 2523m) tested a small area, in the southwestern corner of the property, located immediately adjacent to the projected extension of the McLymont NW zone. All holes intersected interbedded coarse and fine grained epiclastic rocks and a crinoidal limestone unit. The strata dip gently southeast. Below the limestone unit intersected in the 1990 drilling is a semi-concordant pervasive alteration zone up to 200 m thick (Montgomery et al., 1991). The alteration consists of a quartz-sericite-dolomite mineral assemblage containing disseminated and stringer pyrite, with minor chalcopyrite and magnetite. This overprints well bedded tuffaceous sandstone, siltstone and volcanic conglomerate units. Widely-spaced, anomalous gold values occur in hole J90-2; these include, 11.35 g/t, 4.66 g/t and 4.04 g/t from 1.0 m samples (Montgomery et al., 1991). These occur within or below the alteration zone.

SUBVOLCANIC (INTRUSION-RELATED) VEIN DEPOSITS Cu-Ag-Au (As, Sb)

Vein mineralization occupies brittle to semi-brittle fracture, fault and shear zones crosscutting all but the most recent Pleistocene age rocks in the map area. The veins are commonly less than 1 m wide and vary in morphology, mineralogy and precious metal content. They can be divided into two main groups: foliation-parallel, metamorphogenic veins and discordant, subvolcanic veins. Pre-Mesozoic rocks host foliation-parallel, chieflly barren quartz veins related to an early greenschist metamorphism. These veins are deformed, often recumbently folded and predate the main regional Late Triassic to Early Jurassic precious metal mineralizing event.

Crosscutting structures host veins characterized by Cu-Au-Ag (As-Sb) metal assemblages. The mineralization reflects a transition from porphyry copper to epithermal conditions and typifies the subvolcanic classification of Panteleyev (1995). Mineralization occurs as stockworks (Forrest), vein sets (Run), breccia bodies and replacements (Bam), in fault structures (Photo 5-3) and adjacent to porphyritic subvolcanic intrusive bodies (Table 5-3). Subvolcanic veins can be sub-divided into five groups based on the predominant sulphide mineral and metal assemblage. They consist of: (I) chalcopyrite only; (II) tetrahedrite with minor chalcopyrite and sphalerite; (III) pyrite only; (IV) arsenopyrite and chalcopyrite; and (V) chalcopyrite, sphalerite, galena, pyrite and minor arsenopyrite. Associated with each vein group are different metal and gangue assemblages, which seem to be primarily controlled by the lithology hosting the structure (Table 5-3). Distinction between groups is not always clear.
The chalcopyrite-only veins occupy narrow zones following fractures and joint planes primarily in massive tuff or basalt of the Upper Triassic volcanic rocks. Gangue minerals include chlorite, epidote, calcite and quartz and rarely pyrite. Assays generally detect only copper and no precious metals. Massive chalcopyrite veins from the Forgold property show typical low gold and base metal values but substantial silver enrichment (Malensek et al., 1990).

Tetrahedrite occupies quartz veins and siliceous breccia zones in mid Carboniferous and Early Permian carbonate rocks at the Bam 8, Bik and Cot and Bull mineral occurrences. Tetrahedrite in these veins is accompanied by minor chalcopyrite, pyrite, sphalerite and galena. Analyses give anomalous values for Cu-Sb-As-Zn±Pb and appreciable silver, but gold values are rare.

Group III, auriferous quartz and quartz-carbonate veins occur at the Bam 10, Camp Zone (McLymont) and BJ mineral occurrences. Pyrite is typically the only sulphide present. At the Bam 10 and Camp zone the veins cut sericite altered, silicified and pyritized granite, at BJ the veins are hosted by diorite. Argillic alteration envelopes the vein/stockwork zones. Ferrocarbonate alteration locally overprints the argillic alteration zones. Assay results from these veins return anomalous values for gold only.

 Arsenopyrite and chalcopyrite mineralized quartz veins and quartz-carbonate veins occupy shear zones on the Gab 12 and Forgold mineral occurrences. Ferrocarbonate alteration envelopes extend beyond the shear zone into the country rock, but may reflect later fluids than the vein mineralizers. The veins contain pyrite, arsenopyrite and chalcopyrite. Assays return anomalous values for gold, silver, arsenic and copper. Arsenopyrite is generally an indicator of gold enrichment in these veins.

Polymetallic Ag- and Au-enriched quartz veins are hosted in Early Jurassic volcanic rocks at the GOZ/RDN and quartz-carbonate veins occur in Paleozoic rocks at the BJ. Host lithologies control alteration assemblages. At the GOZ/RDN, felsic volcanics and intrusives are altered to sericite and argillite assemblages, at the BJ greenstones are ferrocarbonate altered.

Analyzing the strike and dip of 42 veins selected from throughout the map area showed a wide variation and no preferred orientations. Figure 5-3 shows the strike and dip measurements and distribution of the veins. Also shown are equal-area projections of poles to vein orientations for the Forrest Kerr map area, and the More Creek and Mess Lake map areas. After, separating the data into mineralized (n=23) and barren (n=19) subsets and two domains, the Forrest Kerr map area, and the More Creek and Mess Lake map areas, some general trends become apparent. First, there is no simple correlation between vein orientation and mineralization. In the Forrest Kerr map area mineralized veins strike northeasterly and northwesterly, barren veins strike easterly and northeasterly. In the More Creek and Mess Lake map areas mineralized veins strike northerly, easterly and northwesterly, but equally as many barren veins strike northerly and easterly. In general barren bull quartz veins trend easterly but exceptions are common. Visible gold is reported from east-trending veins at the Gold Pan and Falls showings on the Forrest property (see below) and auriferous veins occupy east-trending tension gashes in a northeast-trending shear zone at the Gab 12 mineral occurrence. In addition, no correlation could be made between vein orientation and the different metal assemblages described above.

In most cases the relative ages from crosscutting relationships show an early silica±sulphide±precious metal event followed by a ferrocarbonate±silica±sulphide±precious metal vein mineralizing event. These relationships are consistent at a local scale and probably represents single

<table>
<thead>
<tr>
<th>Group</th>
<th>Sulphide Mineral</th>
<th>Gangue Minerals</th>
<th>Anomalous Metals</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Chalcopyrite</td>
<td>Epidote, calcite, quartz</td>
<td>Cu (locally Ag)</td>
</tr>
<tr>
<td>II</td>
<td>Tetrahedrite</td>
<td>Quartz, specular hematite</td>
<td>Cu-Sb-As-Zn±Ag±Pb</td>
</tr>
<tr>
<td>III</td>
<td>Pyrite</td>
<td>Quartz, sericite, chlorite</td>
<td>Au</td>
</tr>
<tr>
<td>IV</td>
<td>Arsenopyrite &amp; Chalcopyrite</td>
<td>Quartz, pyrite, chlorite, ferrocarbonate</td>
<td>As-Cu-Au-Ag</td>
</tr>
<tr>
<td>V</td>
<td>Polymetallic</td>
<td>Quartz, sericite, chlorite, ferrocarbonate</td>
<td>Au-Ag-Cu-Zn±As±Sb-Pb</td>
</tr>
</tbody>
</table>

**TABLE 5-3**

**SUBVOLCANIC VEINS GROUPED BY DOMINANT SULPHIDE**

![Photo 5-3. Characteristic ferrocarbonate altered north-east-trending, shear zone. The 1 meter wide shear crosscuts Late Devonian hornblende diorite and granite, approximately 3 kilometers south of Forrest Kerr airstrip. The zone is comprised of a ferrocarbonate replacement and pyrite-quartz-chlorite-calcite veinlets which contain in the order of 100 ppb gold (two grab samples).](image-url)
evolving and cooling fluids which deposited silica early from higher temperature fluids, and carbonate-silica later from lower temperature fluids.

**GOZ/RDN (MINFILE 104G/144)**

The GOZ/RDN property is located about 5 kilometres south of the confluence of South More and More creeks, in the headwaters of Downpour Creek (Figure 5-2). The RDN claims were staked in 1987 to cover a prominent gossan in Downpour Creek (Photo 5-4). Noranda Exploration optioned the claims and explored them together with the GOZ claims from 1989 through to 1991. Extensive soil and rock geochemical surveys, mapping and geophysical surveys were completed on the property. Diamond drilling in 1990 consisted of 1545 m in 15 holes. A second program in 1991 totaled 1519 m of drilling in 10 holes. The exploration target was a precious metal enriched polymetallic massive sulphide deposit similar to Eskay Creek. Noranda concluded the claims had been adequately tested and allowed them to lapse in 1994.

The property lies predominantly east of the Forrest Kerr Fault, within fault-bound panels of Upper Triassic volcanic and clastic rocks and Lower to Middle Jurassic volcanic and sedimentary rocks. The layered rocks are intruded

---

**Figure 5-3.** Distribution and orientation of selected veins in the study area. Equal area projections of poles to mineralized and barren veins in the Forrest Kerr map, and the More Creek and Mess Lake map areas.

**Photo 5-4.** Dark ferricrete gossan and surrounding light colored argillic alteration at the main Gossan Zone on the GOZ/RDN. Zone is located on southeast-facing slopes of Downpour Creek, view is to the west.
by Early and Middle Jurassic sills, stocks and plugs. The Upper Triassic rocks are massive green volcanic flows and maroon feldspar and hornblende crystal tuffs and volcanioclastic rocks. Structurally above is a Lower Jurassic succession of siltstone and sandstone, and grey and pink felsic to intermediate flows and crystal tuffs, which is either overlain or interlayered with a Middle Jurassic succession of thin-bedded siltstone, basalt flow breccia and tuff. The host rocks are age equivalents of the Mount Dilworth Formation and the Eskay Creek facies of the Salmon River Formation. Mineralization consists of gold-enriched polymetallic quartz veins hosted in silicified and pyritized rhyolite, felsic tuff, and subvolcanic porphyritic monzonite intrusive rocks.

Three areas of mineralization received the most attention on the claims; the Wedge zone, the main Gossan zone and the South Boundary zone (Figure 5-4).

Although less important, the Marcasite zone was the main reason the original RDN claims were staked. It is situated in the valley of Downpour Creek midway between the Wedge and South Boundary zones (Figure 5-4). The gossan consists of silicified porphyritic rhyolite containing 10 to 20% marcasite (after pyrite) in stringers of chalcedonic quartz and minor pyrobitumen (Savell, 1990). Gold and base metal values are negligible but erratic silver values up to 208 g/t have been reported.

The South Boundary zone was described as a narrow silicified zone containing chalcopyrite and significant gold values (Savell, 1990). It was drilled in 1991 and the results released in the Northern Miner (September 16, 1991) reported an 11.6-metre drill intersection grading 23.9 g/t Au and minor amounts of base metals. The drill hole (RG-91-16) was collared in Upper Triassic plagioclase porphyritic andesitic rocks that are intruded by porphyritic syenite dikes at the south end of the property.

The wedge of felsic volcanics and subvolcanic intrusives in the centre of the property host the Wedge and Gossan zones respectively. The Wedge zone is located in the steep cliffs above where the highest-grade auriferous polymetallic boulders are located in Carcass Creek. Stratabound mineralization consists of massive to brecciated quartz veins and stringer zones hosted in silicified felsic volcanics. The gold-enriched quartz veins strike north and generally dip easterly parallel to the stratigraphy. The veins are chiefly narrow (about 1 metre) and contain from 5 to 10 per cent sulphides of copper, zinc, lead and arsenic in a quartz gangue. Drilling indicates the felsic succession is underlain by maroon, feldspar-porphyritic volcanioclastics and black siltstones. Alteration and mineralization are related to coeval(?) subvolcanic porphyritic monzonite intrusions. Drilling in the Carcass creek area in 1991 followed up a 1990 intersection of 11.8 g/t Au over 4.4m (Hole RG90-7) and a soil geochemical anomaly. Drilling the former revealed several narrow high-grade, quartz-sulphide breccia mineralization structures. Hole RG91-21 intersected two veins which assayed 137.8 g/t Au over 0.85 m and 101 g/t Au over 0.95 m (Savell and Grill, 1991). Testing these structures along strike and down dip did not show appreciable continuity of grades or structure.

Figure 5-4. Generalized geology of the GOZ/RDN area, showing the locations of the Wedge, Gossan, Marcasite and South Boundary zones and the Forgold mineral occurrence. Unit designation corresponds to legend on GS-Map 1997-3.
Two holes tested the multi-element soil anomaly located 500 m north of the Carcass Creek zone. Narrow quartz-sulphide breccia veins were intersected within variably altered felsic volcanic rocks.

The Gossan zone is located 2 km south of the Wedge zone on the south facing slopes of Downpour Creek. It is a large, spectacular ferricrete gossan and argillic alteration zone associated with a subvolcanic monzonite intrusion. Drilling in 1991 tested 2 geophysical targets on the zone (Savell and Grill, 1991). The first, RG91-18 intersected argillic altered pyritic feldspar porphyry, with a 9.9 m zone which assayed 0.18% Cu, 0.135% Pb, 0.429% Zn, 1.17 g/t Ag and 0.07 g/t Au. Hole RG91-19 intersected 125m of alternating quartz-sericite and argillic altered feldspar porphyry containing 5 to 25% pyrite. No significant assays were returned.

Regionally, gold and copper porphyry and subvolcanic vein deposits are spatially and genetically associated with Late Triassic to Early Jurassic volcanic centres and porphyritic monzo-syenitic intrusions. The Wedge and Gossan zones contain gold and silver enriched polymetallic vein and disseminated mineralization in Lower Jurassic felsic volcanic rocks and subvolcanic intrusions. The extensive hydrothermal alteration and presence of porphyritic intrusions suggests this area may be an exposed root system of a volcanic centre (Savell and Grill, 1991). Mineralization discovered to date on The GOZ/RDN appears to represent a synvolcanic Early Jurassic event. The Middle Jurassic rocks to the east and south may have potential to host exhalative deposits (i.e. Eskay-type).

FORGOLD (MINFILE 104B/378)

The Forgold claims are located approximately 20 km north of the confluence of Forrest Kerr Creek and the Iskut River, immediately south of the GOZ/RDN property (Figure 5-2). The claims were staked in 1989. Prospecting and rock chip sampling was carried out in 1990; mapping, soil sampling and diamond drilling in 1991. The drill program cut a total of 935.7 m in five holes (Bond, 1992).

The property is divided into eastern and western halves by the north-trending Forrest Kerr Fault. The west side is underlain by penetratively polydeformed Paleozoic Stikine assemblage metavolcanic and metasedimentary rocks and the Late Devonian Forrest Kerr Pluton, the east side by fault-bounded panels of Upper Triassic volcanic and sedimentary rocks and Lower (?) to Middle Jurassic volcanic rocks. The Mesozoic rocks are intruded by Early and Middle Jurassic sills, stocks and plugs and host the known vein-style mineralization.

Rock and silt geochemical sampling discovered base and precious metal mineralization in highly leached, sericite altered lapilli tuff and crystal tuff west of Downpour Creek, just south of the GOZ/RDN claims (Termeunde and Termeunde, 1990). The mineralization is hosted in maroon lapilli and tuffaceous feldspar crystal-rich rocks. Proximal stocks of monzonite may be associated with the quartz-sericite and carbonate alteration, as it appears to be to the north on the GOZ/RDN claims.

Malensek et al. (1990) divided the vein mineralization into three types; all appear to be structurally controlled by the Forrest Kerr fault. The vein types are: steeply dipping chalcocylite veins containing minor galena and sphalerite; quartz-carbonate stockwork veins containing sphalerite, galena and chalcopyrite; and silicified zones containing disseminated chalcopyrite. All the significant mineralization is hosted in Triassic rocks and only the first two types of veins are well mineralized. The majority of the veins trend northeast and have steep dips.

The massive chalcopyrite veins are typically podiform. They pinch and swell from 0 to 50 cm over a few metres of strike length. While the chalcopyrite veins are silver-rich and generally low in gold and base metal values, the quartz-carbonate veins contain chalcopyrite, variable amounts of sphalerite and galena and are gold-bearing. These veins are typically narrow veined or stockworks. Grades of 112 g/t Au and 9.8% Cu are reported from a 5 cm wide veinlet (Malensek et al., 1990).

Five holes were drilled in 1992 on the northern portion of the Forgold 1 claim. Drill holes FG1 to FG4 were laid out to test the possible extension of the 1991, high-grade drill intersection made by High Frontier Resources Ltd. on the southern boundary of the GOZ/RDN. That intersection included 73.74 g/t Au over 3.7 m in a 11.6 m zone averaging 23.9 g/t Au (The Northern Miner, Sept. 1991). On the Forgold, two significant zones of gold mineralization were outlined; 3.9 g/t Au over 1.58 metres in drill hole FG-2 and 19.2 g/t Au over 0.82 metres in drill hole FG-3 (Bond, 1992). The drilling also encountered wide sections of alteration and sulphide mineralization. Drill hole FG-4 intersected extensive graphitic fault gouge and breccia zones (components of the FKF zone). Two narrow zones of copper mineralization were intersected in hole FG-5, located about 1 km south of the other 4 holes. Based on this drilling Bond (1992) concluded that the gold mineralization is narrow and discontinuous.

QUARTZ-CARBONATE VEINS Cu-Au-Ag (As)

BJ CLAIM GROUP (MINFILE 104G/70)

The BJ claim group is located at the headwaters of Mess Creek (Figure 5-2). The property was staked in 1980 on the basis of anomalous stream sediment geochemistry. Geological mapping, rock and soil sampling was carried out in 1980, 1981 and 1982 by Teck Explorations. Follow-up mapping and detailed sampling was completed over two areas; an iron carbonate breccia zone and an area containing anomalous gold values in soils (Folk, 1986).

The claims are underlain by a polydeformed and metamorphosed volcanic and sedimentary succession of Paleozoic, probable Lower to middle Devonian age rocks consisting of quartz sericite schists, intercalated mafic flows and tuffaceous rocks, and a lower unit of graphitic schist and siltstone. Foliated to equigranular Early Devonian diorite intrudes these units. Farther west, Upper Triassic volcanic and sedimentary rocks are in faulted contact with these penetratively deformed Paleozoic rocks.
The area has undergone four phases of folding (Holbek, 1988). Dominant foliation, is bedding parallel and axial planar to regional phase 2 folds. It is north to north-west-trending. East-trending third phase structures crenulate the dominant foliation and younger open, upright, north-trending folds deform all the earlier structures.

Mineralized structures on the BJ claims include; concordant, foliation-parallel quartz veins and discordant, fault-hosted quartz veins and iron-carbonate breccia zones. Foliation parallel bull quartz and pyritiferous quartz veins are common throughout the Paleozoic strata. They contain minor pyrite but no precious metals, are often recumbently folded, and predate or are synchronous with early deformation. These are metamorphogenic veins and formed during the greenschist metamorphism which accompanied early deformation.

Younger discordant mineralized structures trend north-east to east across the dominant early foliation. These are chiefly quartz and quartz-carbonate breccia veins. Brown, limonitic-weathering ferrocarbonate alteration envelopes are associated with these structures. The veins contain disseminated to locally massive pyrite, arsenopyrite, less tetrahedrite, chalcopyrite, and sphalerite and traces of galena, hemaitite and gold. Potassium-argon determinations on chromium-bearing muscovite associated with quartz-carbonate sulphide vein mineralization gave a date of 194±6 Ma, an Early Jurassic age (Holbek, 1988). It is this second vein-type, with its precious metal potential, that has received the most exploration attention. A zone of east-erly-trending quartz veins is localized along the faulted contact between metadiorite and chlorite sericite schist on the Windy claim. The main vein has a strike length of 500m and widths to 6m. Gold values from the main vein average 0.034 g/t with a single sample assaying 0.136 g/t (Folk, 1986).

GOLD VALUES AND ASSAY RESULTS

Gold values are associated with pyrite-rich sections, and indicated by crosscutting relationships (Holbek, 1988). Two types of veins were recognized. The first is an early quartz-pyrite-chalcopyrite vein set that trends 120 to 140 degrees. The veins pinch and swell from less than one centimetre to greater than one metre widths. They contain variable amounts of pyrite and chalcopyrite, and gold values tend to follow the sulphides. Quartz-carbonate-chlorite alteration zones within the granite, envelop the better mineralized veins (Todoruk and Ikona, 1990, 1991). Drilling below the surface exposures showed poor continuity of the vein structures and metal grade. The en echelon, pinch and swallow, arcuate and anastamosing character of the veins seen on surface suggests they occupy irregular and discontinuous structures. Later faults and shearing have further complicated their distribution.

McLymont (Camp Zone) (MINFILE 104B/126)

The McLymont Creek property straddles the headwaters of McLymont Creek, about 2 kilometres south of Newmont Lake (Figure 5-2). Early exploration on the McLymont property tested the base metal potential of the copper-iron skarn deposits in the area. It was not until the early 1980’s that Du Pont of Canada Exploration Limited located and explored precious metal-bearing quartz veins present in the area (Kowalchuk, 1982). The property was restaked in 1986 by Gulf International Minerals Ltd. and drill tested. Diamond drilling continued in 1987, with a total of 2185m drilled in 11 holes (Grove, 1987) and in 1988 with 721m drilled in 9 holes (Grove, 1989).

The Camp zone is located at the 90° bend in McLymont Creek, 3 km south of Newmont Lake. Veins crop out on both the north and south sides of the creek. Mineralization occurs in auriferous quartz veins that fill fractures in a quartz-rich granite (quartz porphyry). The host unit is tentatively correlated with the Late Devonian FKP. Feldspar porphyritic monzonite intrusions crop out nearby to the north and may have generated the mineralization.

Two types of veins were recognized. The first is an early quartz-pyrite-chalcopyrite vein set that trends 120 to 140 degrees. The veins are narrow, generally less than 30cm. Mineralization comprises minor sphalerite, galena, and free gold (Grove, 1987). Grove (1989) shows a vertical section at 030° azimuth containing drill holes 88-1, 5 and 6...
Figure 5-5. Generalized plan and longitudinal section through the Camp zone, McLymont Creek property (after Grove, 1989). Assay values are from trench samples and drill intersections of northwest trending quartz-pyrite-chalcopyrite veins hosted in Late Devonian (?) granite.
(Figure 5-5). It shows the variation in width, grade and orientation of one of these quartz veins over a vertical distance of 40 m. The vein dips 70 degrees northeast. Diamond drill hole 88-1 cut 0.61m of 82.32 g/t Au, the vein had narrowed to 0.21m with values of 20.0 g/t Au in hole 88-5, and in 88-6 the structure widened to 1.5 m but the grade dropped to 6.9 g/t Au. Samples from trenches assayed from 15.6 up to 57.9 g/t Au.

The second vein type consists of northwest or north-east-trending en echelon vein swarms that postdate the earlier quartz veins. These are ankerite-quartz-pyrite replacement veins and contain sparse chalcopryite and erratic gold values.

FAULT AND SHEAR HOSTED VEINS
Cu-Ag-Au and Ag-Zn-Pb

BAM 10 (MINFILE 104G/110)

The Bam 10 occurrence is located 1 kilometre southwest of Bam 8, at the southwest end of the Arctic Plateau (Figure 5-2). The potential for gold-bearing quartz veins was recognized by Chevron Canada Resources Ltd. during mapping and sampling in 1985. Follow-up work in 1986 included detailed mapping, soil sampling, VLF-EM16 geophysical survey and trenching (Hewgill and Walton, 1986a). Radcliffe Resources Ltd. drilled 837 metres in 9 holes the following year (Diner, 1987). Diamond drilling in 1997 intersected no significant gold values in the 6 holes drilled (Wojdak, 1997).

Strongly schistose flows, tuffs and subordinate carbonates of probable Devonian age underlie the claims. Early Mississippian granite and diorite intrude these metavolcanic rocks. The contact, which is in part structural, dips moderately westward. Auriferous quartz veins are hosted in the Upper Paleozoic granite. North, northeast and northwest striking structures cross the property. Northerly-trending structures, generally west side-down listric normal faults, produced the Mess Creek valley and are part of the Mess Creek Fault zone. Northwest-trending fractures were identified as the pyrite-gold bearing structures (Hewgill and Walton, 1986a). The mineralization intersected in 1986 and airborne magnetic and electromagnetic-VLF surveys, suggesting a steeper dip than exposed at surface, if these are the same structures.

Mineralization occurs in two zones located approximately 600m apart (Kiesman and Ikona, 1989). The showings lie adjacent to the east-bounding fault of the Newmont Lake Graben, a northeast-trending regional extensional structure. The McLymont, Gab NW and Gab SE occurrences are situated along a parallel structure to the southwest. Mineralization at the Cuba showings occurs as narrow cm wide fracture fillings, as matrix to crackle-breccia zones and as replacements up to 4m wide in easterly-trending shear zones (Kiesman and Ikona, 1989). Sulphide minerals include galena, sphalerite and tetrahedrite in a gangue of calcite and locally coarse crystalline barite. A grab sample taken from a trench in the south zone returned values of 125 g/t Ag, 5.88% Zn and 0.05% Cu.

Drilling in 1988 tested the southern zone with 2 holes, totaling 133 m. The holes were drilled at 160° azimuth from the same setup, 88PG-9 at -45° and 88PG-10 at -60°. Hole 88PG-10 intersected 7.5m averaging 56.2 g/t Ag and 0.488% Zn; hole 88PG-9 intersected ferrocarbonate altered and oxidized carbonates with sporadic silver values (Kiesman and Ikona, 1989). The mineralization intersected in the lower hole (88PG-10) lies nearly vertically below the trench exposures, suggesting a steeper dip than exposed at surface, if these are the same structures.

CUBA (MINFILE 104B/334)

The silver-rich Cuba showing is located 3 kilometres northeast of Newmont Lake (Figure 5-2). Mineralization is hosted in fault dissected and brecciated blocks of northeast-trending Lower Permian carbonate. In outcrop the carbonate forms spectacular crumbling varicoloured pinacles that weather various hues of white, yellow, orange and brown. The unaltered carbonate is a medium grey, echinoderm skeletal wackestone containing interbedded chert horizons. In the vicinity of mineralization the carbonate is crackle-brecciated, dolomitized and ferrocarbonate altered.

Mineralization occurs in two zones located approximately 600m apart (Kiesman and Ikona, 1989). The showings lie adjacent to the east-bounding fault of the Newmont Lake Graben, a northeast-trending regional extensional structure. The McLymont, Gab NW and Gab SE occurrences are situated along a parallel structure to the southwest. Mineralization at the Cuba showings occurs as narrow cm wide fracture fillings, as matrix to crackle-breccia zones and as replacements up to 4m wide in easterly-trending shear zones (Kiesman and Ikona, 1989). Sulphide minerals include galena, sphalerite and tetrahedrite in a gangue of calcite and locally coarse crystalline barite. A grab sample taken from a trench in the south zone returned values of 125 g/t Ag, 5.88% Zn and 0.05% Cu.

Drilling in 1988 tested the southern zone with 2 holes, totaling 133 m. The holes were drilled at 160° azimuth from the same setup, 88PG-9 at -45° and 88PG-10 at -60°. Hole 88PG-10 intersected 7.5m averaging 56.2 g/t Ag and 0.488% Zn; hole 88PG-9 intersected ferrocarbonate altered and oxidized carbonates with sporadic silver values (Kiesman and Ikona, 1989). The mineralization intersected in the lower hole (88PG-10) lies nearly vertically below the trench exposures, suggesting a steeper dip than exposed at surface, if these are the same structures.

GAB 12-SW (MINFILE 104B/335)

The Gab 12 property is located east of the headwaters of McLymont Creek, approximately 4 kilometres southwest of Newont Lake (Figure 5-2). The claims were staked in 1986 and airborne magnetic and electromagnetic-VLF sur-
veys covering the claims were completed between 1987 and 1988. Geological mapping, prospecting and soil sampling in 1987 identified 3 zones of alteration and mineralization; Gab11-SE, Gab12-NE and Gab12-SW (Todoruk, 1988). Diamond drilling in 1988 tested the Gab12-SW zone with 856 m in 7 holes. A second phase of drilling was completed in 1990 totaling 638 m in 7 holes (Game and Sampson, 1990).

The property is bisected by the northwest trending McLymont Fault and subsidiary parallel and north-trending fault structures. West of the main fault zone, and host to the mineralization is a thick sequence dominated by polymictic volcanic conglomerate, sandstone and cherty siltstone. This same succession conformably overlies Early(?) to mid Carboniferous limestone at the McLymont NW zone and the Gab 9 to the north. East of the fault is a Late Triassic to Early Jurassic hornblende, potassium feldspar porphyritic monzonite. It occupies a fault zone separating Late Devonian(?) Verrett River quartz-diorite to granite intrusion from the Carboniferous conglomerate unit. Detailed mapping along the faulted western margin of the monzonite (Game and Sampson, 1990) shows offset along the McLymont fault indicating at least some post-intrusion fault motion. A 30 m wide east-trending feldspar porphyry dike crosscuts sediments in the conglomerate unit adjacent to the faulted contact with the monzonite.

Mineralization includes the Arseno/sulphide zone, the Rusty shear zone and an auriferous sulphide boulder train (Figure 5-6). The Arseno zone consists of two subparallel auriferous arsenopyrite-pyrite mineralized shear zones which strike 030° and dip vertically. Mineralized quartz veins vary from a few centimetres up to 1.5 metres in width. Sulphide minerals include pyrite, arsenopyrite and chalcopyrite. Ferrocarbonate alteration extends 10 to 15 m beyond the shear zone into the country rock. Four drill holes tested the Arseno zone in 1988. Only 88-1 intersected mineralization, returning 74.0 g/t Au over 0.60 m from a well mineralized section of quartz veins containing pyrite, arsenopyrite and chalcopyrite (Todoruk and Ikona, 1989). Drilling in 1990 totaled 638 m in 7 holes. Holes BRY 90-1 and 2 tested the Arseno zone and the remaining five holes (BRY 90-3 to 7) the Sulphide zone. Results from the 1990 drilling were not encouraging. From the Arseno zone; Hole 90-1 inter-

![Figure 5-6. Generalized geology of the Gab SW area, showing the locations of the Arseno/Sulphide, Rusty Shear and Boulder zones and the McLymont NW Zone. Location of the 1988 drill holes from Todoruk and Ikona (1989). Unit designation corresponds to legend on GS-Map 1997-3.](image-url)
sected 0.5 m assaying 3.6 g/t Au and 90-2 did not intersect significant mineralization. The Sulphide zone is offset by easterly-trending cross faults along its length and truncated by the McGillivray fault at its southern end (Game and Sampson, 1990). Incompetent and open zones in the bedrock caused problems drilling the structure. Intersections of note include an 8.6m wide zone of fractured and weak to moderately carbonate altered siltstone in hole 90-6. The top of the zone contains a 0.20 m quartz vein with massive pyrite, arsenopyrite and trace chalcopyrite. It assayed 3.08 g/t Au. The lower 2.2 m is locally silicified, and cut by carbonate stringers and 1 to 5 cm wide massive pyrite and arsenopyrite veinlets. This mineralized zone averaged 5.07 g/t Au. The intervening section (6.2 m) returned low gold values.

The Rusty Shear zone is located 500 m east of the Arseno zone. It comprises a ferrocarbonate alteration zone developed along a 040° trending fault structure. Mineralization consists of fine pyrite and arsenopyrite hosted in vertical ferrocarbonate veins that strike 090° within the northwest-trending altered structure. The veins vary from several centimetres to 0.5 metre in width. The zone was drill tested in 1988 with three holes totaling 460m. Gold values were generally low; the best value, 2.4 g/t Au over 0.5 m was returned from hole 88-5 where it intersected a 1 to 2 cm wide quartz veinlet containing pyrite (Todoruk and Ikona, 1989). Surface trenching and rock sampling was carried out in 1990. The alteration zone is auriferous and also anomalous in arsenic and zinc (Game and Sampson, 1990).

The boulder train contains three types of auriferous sulphide boulders; massive sulphide, pyrite-arsenopyrite-chalcopyrite-quartz vein material and arsenopyrite-pyrite-quartz-carbonate vein material. Gold values vary from nil to as high as 100 g/t (Game and Sampson, 1990). The boulders are dispersed along the southern lateral moraine of the glacier and can be traced west and then southwest up the Rusty Shear zone structure. The mineral assemblages are similar to the vein-type mineralization in the area and suggest the source is beneath the ice field to the west.

FORREST (MINFILE 104B/380)

The Forrest claims extend approximately 10 kilometres north from the Isktu River along the west side of Forrest Kerr Creek (Figure 5-2). The claims were first staked in 1987, with more added in 1988. Prospecting in 1988 discovered shear-hosted quartz vein mineralization and in 1989 an extensive program of exploration was undertaken. This included: detailed mapping, trenching, and soil geochemical and geophysical surveys. Several targets were defined and trenching and drilled in 1990 (Stammers and Ikona, 1990). Diamond drilling in 1995 totaled 995 m in 8 holes.

The claims are underlain by a structurally inverted succession of variably deformed, fault-bounded panels of Upper Paleozoic rocks. The oldest rocks (Lower Devonian), crop out on the western part of the claims and occupy the highest elevations; the youngest rocks (Upper Triassic) are exposed in Forrest Kerr Creek. The Late Devonian Forrest Kerr Pluton underlies the western part of the claims. It intrudes Devonian rocks and is thrust imbricated with younger (?) metasedimentary rocks. Mineralization is hosted by penetratively deformed Lower and Middle Devonian metavolcanic and metasedimentary rocks, Upper Devonian and Mississippian volcanic rocks and Upper Carboniferous tuffaceous sedimentary rocks. One to two kilometre diameter plagioclase porphyritic diorite stocks intrude a panel of Carboniferous rocks in the center of the property. Another small diorite stock, of probable middle Jurassic age, crops out further north.

More than thirty small, high-grade precious metal mineral occurrences have been discovered on the claims since 1987. These are described in detail in various reports (Ikona and Todoruk, 1988; Stammers and Ikona, 1990 and Todoruk, 1994). Exploration and development of the claims has focused on four main mineralized zones. These are the Creek/Canyon shear, and the Crooked Creek, Forrest and Gold Pan/Falls zones (Figure 5-7).

The Creek shear, Triple Creek and Canyon shear occurrences occupy the steep cliffs on the south side of Gossan Creek (Figure 5-7). They comprise mineralized northeast striking, subvertical shear zones hosted in massive greenstone, interlayered with cherty tuff, phyllite and siltstone. Alteration mineral assemblages include chlorite, sericite and carbonate. The fault structures are pervasively ferrocarbonate altered and oxidized and variably mineralized with auriferous arsenopyrite-bearing quartz veins, stockwork and breccia zones; massive pyrite and chalcopyrite ± gold and silver-rich chalcopyrite-bearing ferrocarbonate-quartz veins. Scott and Ikona (1995) interpret the northerly striking and variably dipping auriferous arsenopyrite quartz veins to be early structures that are cut by the northeast striking, subvertical shear zones, and concluded that the pervasive ferrocarbonate alteration and chalcopyrite-gold mineralization was introduced late in the paragenesis of the shear zones.

Diamond drilling in 1990 tested the Creek shear with nine holes (totaling 813 m) from 3 setups; the Canyon shear with two holes totaling 240 m, and the Triple creek showing with 3 holes from a single setup (Stammers and Ikona, 1990). Results for the Creek shear include; 16.0 m of 4.49 g/t Au and 0.64% Cu from a quartz-brecia intersected in AVD-90-13; and 7.0 m of 3.56 g/t Au, 60.36 g/t Ag and 3.76% Cu in hole AVD-90-5. Results from the Triple Creek were discouraging. In 1995, drilling tested the Creek shear with six holes, and Triple Creek with 2 holes (Scott and Ikona, 1995). Drilling at the projected northeast extensions of the Creek zone, and the mineralization intersected in AVD-90-13 did not intersect significant gold mineralization. Results from drilling on the Triple creek zone include: hole F95-9, abandoned; F95-10, no significant intersections; and F95-11, an eleven metre zone of narrow (1 to 6 cm) arsenopyrite-bearing quartz carbonate veinlets. Assays from the latter returned 3.01 g/t Au with low silver and copper values over a 3.15 m interval.

The Crooked Creek showing is located on the north side of Gossan Creek, about 2 km northeast of the Creek Shear showing (Figure 5-7). Mineralization is hosted within a northeast-trending shear zone crosscutting phyllite and cherty tuff. The structure is on strike with the Creek shear.
Mineralization consists of two assemblages; auriferous arsenopyrite-bearing quartz veins and silver-rich chalcopyrite±gold mineralized quartz-carbonate veins (Todoruk, 1994). Disseminated chalcopyrite hosted in a northeast trending axial planar shear zone was drill tested with two holes (Scott and Ikona, 1995). Assay results from drill core were low in gold and copper values.

The Forrest zone is a 250 x 250m area of weakly to unmineralized quartz stockwork hosted in massive meta-andesite. It is located about one km south of the Creek Shear. The quartz veins have a dominant trend of 130° and moderate southwest dips (Photo 5-5). The stockwork zone was drilled in 1990 with a single 223 m hole. The drill hole did not intersect any significant mineralization.

The Gold Pan/Falls zone is located approximately 5.5 km south of the Creek Shear zone. The two occurrences consist of east-trending quartz veins. The veins range in width from 5 to 50 cm and contain pyrite, arsenopyrite, chalcopyrite and locally visible gold. The veins are narrow and generally discontinuous, but their orientation and gold content constrain orientation of the local stress field during at least some gold deposition.

CARBONATE HOSTED Cu-Ag-Au

BAM 8 (MINFILE 104G/27)

The Bam 8 prospect is located 4 kilometres southwest of Arctic Lake on top of the eastern escarpment of Mess Creek valley (Figure 5-2). In 1967, diamond drilling defined the Southwest zone, containing 299 400 tonnes grading 0.76 per cent copper, and the East zone, containing 4 540 tonnes grading 2.45 per cent copper and 17.83 grams per tonne silver.

The property is underlain by green chlorite schist, purple schistose tuff and flow rocks of the Upper Paleozoic Stikine assemblage. These are intruded by Early Mississippian granite and diorite of the More Creek Pluton and overlain paraconformably by thick-beded Lower Permian carbonate and limonitic brecciated dolomitic carbonate; the latter hosts most of the copper and silver mineralization. Overlying the carbonates are variably altered and mineralized, Upper Triassic, thin-beded limy feld sandstone, siltstone and conglomerate units. These in turn are unconformably overlain by Lower Jurassic maroon polymictic granite-bearing cobble conglomerate. Fine-grained and porphyritic plagioclase-hornblende monzonite dikes cut the...
granite and limestone and are probably related to mineralization. Small, highly fractured serpentinized peridotite bodies occur along northeast-trending fault zones. Mineralization consists of disseminations, stringers and east-northeast-trending veinlets of tetrahedrite, with minor chalcopyrite, pyrite, sphalerite and galena. Secondary minerals include azurite and malachite. Alteration includes dolomitization of limestone, carbonitization of volcanic rocks, sandstone and conglomerate, and hydrothermal alteration and associated quartz veining in the granitic rocks (Gillan et al., 1984). Alteration (limonitic orange cliffs) and mineralization are spatially related to north-trending regional faults and northeast-trending splays off them.

It was previously thought that granitic rocks on the property were responsible for the mineralization, as they were interpreted to intrude the mineralized carbonate rocks. However, subsequent age constraints on the granite (Early Mississippian) and the carbonate (mid Carboniferous) indicate that the contact must be a fault or a disconformity. Probable heat sources for the mineralization are the subvolcanic monzonite plugs associated with Au-Ag mineralization on the Run claim group, a stock of which crops out a few kilometres north of the property.

**STRATIFORM MASSIVE SULPHIDE DEPOSITS**

**VOLCANOGENIC Cu-Zn-Pb (Kuroko) and CARBONATE-HOSTED Zn-Pb-Ag (Irish-Type)**

**FOREMORE (MINFILE 104G/148)**

The Foremore claims are located at the headwaters of the south tributary of More Creek, about 10 kilometres north of Forrest Kerr airstrip (Figure 5-2). The first claims were staked in 1987 by Cominco Ltd. in an area containing auriferous vein quartz boulders. Prospecting and mapping located quartz veins with gold values up to 9 g/t and copper skarn mineralization, but more importantly several hundred cobble to boulder sized clasts consisting of very fine grained pyrite, barite, sphalerite, with minor galena and tetrahedrite (Mawer, 1988). Additional staking was completed that year and the exploration target became the source of the massive sulphide boulders. Mapping, rock sampling and UTEM and Electromagnetic geophysical surveys were successful in locating laminated galena and sphalerite with coincident UTEM conductors in felsic volcanic rock (Barnes, 1989). Electromagnetic conductors located below 120 metres of glacier ice were drill tested in 1990 (Photo 5-6). Four holes were collared, three reached bedrock. Drilling intersected graphitic shear zones interpreted to represent the conductive horizons. A single hole was drilled in 1996 (664 m) from a nunatak located southwest of the 1990 drilling. The two electromagnetic conductors targeted in the 1996 drilling correspond to intersections of graphitic mudstone.

The property is underlain by Stikine assemblage rocks. These comprise a Lower and middle Devonian sequence of intermediate to felsic volcanic rocks, carbonate and graphitic and sericitic schistose sedimentary rocks and an Upper Devonian and Lower Mississippian sequence of primarily volcanic rocks. These sequences are intruded by the Early Mississippian More Creek Pluton and smaller satellite intrusions of quartz-porphyritic biotite granite.

Polyphase deformation has affected all rocks on the property. Strain partitioning led to formation of panels of more deformed rocks interleaved with largely undeformed rocks of the same age. Bedding and dominant foliation planes trend northeastward. Early recumbent folds in carbonate layers plunge shallowly to the northwest and southeast, deformed by later northeast-trending folds. East and northwest-trending crenulation cleavage overprints the dominant foliation. Several thousand mineralized boulders have been found on the Foremore claims. These occur in outwash plains at the eastern and northern lobes of the More glacier. The distribution of polymetallic massive sulphide float suggests the source is beneath the main ice sheet of More glacier. Boulders vary mineralogically, with pyrite-rich, zinc-rich, and copper-rich samples (Table 5-4) and texturally from massive to laminated.

**TABLE 5-4**

**ASSAY RESULTS FOR MINERALOGICALLY DISTINCT BOULDERS, FOREMORE PROPERTY**

<table>
<thead>
<tr>
<th></th>
<th>Cu %</th>
<th>Pb %</th>
<th>Zn %</th>
<th>Ag g/t</th>
<th>Au g/t</th>
<th>Fe %</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Zone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chalcopyrite-rich (n=12)*</td>
<td>2.3</td>
<td>0.5</td>
<td>6.2</td>
<td>186</td>
<td>1.5</td>
<td>16</td>
</tr>
<tr>
<td>Sphalerite-rich (n=29)*</td>
<td>0.22</td>
<td>3.5</td>
<td>10.2</td>
<td>96</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>South Zone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pyrite-rich (n=112)*</td>
<td>trace</td>
<td>1</td>
<td>6.2</td>
<td>78</td>
<td>nil</td>
<td>23</td>
</tr>
</tbody>
</table>

*n= number of samples analysed

data from Barnes (1989)
The mineral and textural variation suggests the boulders from the north and south fields represent two or more distinct styles of mineralization, and those from the north, may indicate a single, zoned occurrence. Pb-isotope values also distinguish between the north and south boulder fields (Godwin, 1993). Boulders from the north field contain metal values comparable with those from ‘in-place’ volcanic hosted laminated sulphides. The boulders are mineralized with pyrite, sphalerite, chalcopyrite, galena and minor tetrahedrite and bornite (Barnes, 1989). In the North Zone, pyritic felsic volcanic horizons host finely laminated and disseminated galena, sphalerite and pyrite mineralization. These felsic (quartz-eye) volcanics occur within a penetratively foliated sequence of graphitic schists, argillites and intermediate to mafic volcanics. Assay results from outcrop sampling average 87 ppb Au, 8 g/t Ag, 0.1% Cu, 0.3% Pb, and 2.7% Zn over an average sample width of 0.4 metres (Barnes, 1989). Boulders from the south field contain very fine grained pyrite and sphalerite with minor galena, chalcopyrite and tetrahedrite. Sulphide textures include massive, laminated, and blebbly disseminations replacing carbonate and siliceous fragments. Limestone boulders host massive sulphide replacements. One such boulder contains probable algal laminations or stromatoporoid Favosites sp. of Late Ordovician to Middle Devonian age (B.S. Norford, personal communication, 1988; Logan et al., 1990a).

Foremore mineralization includes: laminated galena and sphalerite in felsic volcanics that resemble samples of Kuroko volcanic massive sulphide deposit ore, and massive to laminated sulphide replacements in Early Devonian carbonates that are similar to Irish-type carbonate-hosted deposit ore. These data indicate that similar Devonian-Mississippian Stikine assemblage rocks elsewhere are potential VMS exploration targets.

ANTLER PROPERTY (MINFILE 104G?)

Pyrite veins, quartz veins and silicified stockwork zones are hosted in a mafic dominated, bimodal volcanic sequence of Devonian-Mississippian age rocks north of the terminus of Alexander Glacier (Figure 5-2). This occurrence was first described by Gunning et al. (1994a) as a zone more than 100 metres long containing low base metal and variable precious and trace element abundances. It trends northwesterly, concordant with the volcanic host rocks. Follow-up mapping and rock, soil and stream sediment sampling indicated the zone is barren at surface (Gunning, 1995). The trace element association -elevated Cu, As and Sb- resembles some of the Mesozoic subvolcanic/intrusion-related veins and stockworks elsewhere in the area, but the potential for a Noranda-Kuroko-type base metal massive sulphide deposit in these rocks remains high.

NEW PROSPECTIVE HORIZONS

Stratabound pyritic horizons associated with dacitic (?) pyroclastics or altered mafic hyaloclastite horizons crop out discontinuously within cherty siltstones and black carbonaceous argillites in a thick succession of basic pillow and breccia flows north of the Iskut River, 12 kilometres upstream from the mouth of Forrest Kerr Creek (Figure 5-2). Massive fine-grained pyrite and pyrrhotite form bedding parallel layers several centimetres thick and occur as disseminations. Rusty limonitic gossans and white weathering felsic rocks can be traced along the ridge for 1.5 kilometres. These horizons occupy a higher stratigraphic position than the ore horizon at Eskay Creek deposit, nevertheless follow-up is considered to be worthwhile.

GALENA LEAD ISOTOPE RESULTS

Pb-isotope measurements of galena from selected stratabound massive sulphide boulders, skarn and subvolcanic vein deposits, together with feldspar-leads measured from a Late Devonian pluton, provide an exploration framework in which to define newly discovered mineral occurrences in the map area. The data also characterizes the basement and the metallogenic evolution of the Stikine terrane. The isotopic composition of Pb changes systematically over time because of the radiogenic decay of $^{238}$U, $^{235}$U and $^{232}$Th to $^{206}$Pb, $^{207}$Pb and $^{208}$Pb, respectively. At the time galena is formed it freezes the ambient Pb-isotope composition, thus lead in younger deposits is more evolved and lies at progressively more radiogenic positions along the growth curves. The different sources of Pb (mantle, upper crust and lower crust), the heterogeneity of Pb-isotopes in these source areas and mixing of more than one source, make absolute dating of the deposits using Pb-isotopes impossible. Relative ages can be inferred using different growth curves which model the evolution of Pb in various reservoirs (Stacey and Kramers, 1975; Zartman and Doe, 1981; Godwin and Sinclair, 1982). Absolute constraints on the timing of mineralizing events is provided by U-Pb ages and sometimes by biot stratigraphic ages in nearby rocks.

Jurassic and Tertiary clusters of galena lead isotope ratios in the Stewart area were first recognized by Godwin et al. (1980). Subsequent work by Alldrick et al. (1987; 1990) and Godwin et al. (1991) showed that these clusters define two separate, relatively short-lived metallogenic events. Stratigraphic information and other radiogenic dates are consistent with the interpretation that these were Early Jurassic and Tertiary Events. Radiogenic isotopic studies by Godwin (1993) and geochronological and radiogenic isotopic studies by Childe (1995, 1996) of selected VMS deposits within accreted terranes of the Canadian Cordillera provide a means of characterizing the metallogenic sources for this part of the Stikine terrane in Late Devonian time. The Stikine terrane is a product of primitive island arc magmatism, beginning in the Early Devonian and developed in a location removed from continental (evolved) detrital influences.

Pb-isotopes from 5 occurrences in the map area are presented in Figure 5-8, together with the Tertiary and Jurassic clusters of Godwin et al. (1991) and the Middle Jurassic - Eskay Creek, Triassic - Granduc, Mississippian - Tulsequah and the Late Devonian - Ecstall and Forrest Kerr Pluton clusters of Childe (1996). The Jurassic cluster represents synvolcanic gold-silver-copper-zinc-lead mineralization related to Hazelton Group magmatism. There is insufficient resolution to discriminate between Early and Middle Juras-
Figure 5-8. 206Pb/204Pb vs. 207Pb/204Pb and 206Pb/204Pb vs. 208Pb/204Pb for mineral occurrences in the study area. Data compiled from Godwin et al. (1988) and presented with Tertiary and Jurassic clusters of Godwin et al. (1991) and Middle Jurassic, Triassic, Mississippian and Devonian data of Childe (1996).
REGIONAL METALLOGENIC EVENTS

The general stratigraphic sequence, intrusive episodes and mineral deposit types are illustrated on Figure 5-9 for the Forrest Kerr - Mess Creek map area. Metallogenic activity occurred throughout the nearly continuous magmatic activity that spans an approximately 50 Ma period from the Late Triassic (228 Ma) to the Middle Jurassic (175 Ma). The intrusive activity has been divided into the distinctive: Late Triassic Stikine Plutonic Suite; the Late Triassic to Early Jurassic Copper Mountain Suite; the Early Jurassic Texas Creek Suite and the Middle Jurassic Three Sisters Plutonic Suite respectively (Woodsworth et al., 1991; Anderson, 1993).

The potential for separate episodes of mineralization coincided with development of each of the volcano-plutonic arcs, beginning in Late Devonian to Early Mississippian, and including Pennsylvanian, Late Triassic to Early Jurassic, Middle Jurassic and Tertiary events. Mineral occurrences are known for all but the Pennsylvanian episode of volcanism and this maybe due to the fact that no intrusive rocks of this age are recognized in the map area. Early Devonian carbonate and volcanic rocks host conformable, massive polymetallic sulphide occurrences and copper skarns are developed adjacent to the Late Devonian Forrest Kerr and Early Mississippian More Creek plutons. High-level calcalkaline and alkaline synvolcanic porphyry, vein and replacement deposits are hosted in Late Triassic-Early Jurassic volcanic and subvolcanic rocks of the Stuhini and Hazelton groups. The Middle Jurassic back-arc facies rocks of the Iskut River, hence the arc axis lay to the west of the map in the Middle Jurassic. Early Tertiary plutoism in the Coast Belt marks the position of the arc axis through the Early part of the Cenozoic and hosts calcalkaline porphyry Mo and silver-lead-zinc-rich vein deposits. Most precious metal mineralization is related to the latest Triassic and earliest Jurassic island arc, and to early accretion-related magmatic activity. Tertiary, post-accretionary mineralization is related to continental volcanism and epizonal plutonism.

AGES OF MINERALIZATION

Two discrete, and a possible third mineralizing event are evident in the Forrest Kerr and Mess creek area; in the Devonian to Early Mississippian, the latest Triassic to Early Jurassic, and later in the Early Jurassic. Important deposits related to the regionally important Middle Jurassic and Tertiary metallogenic events are postulated but not known to occur in the map area.

The age of the volcanic hosted massive sulphide boulders on the Foremore property is probably close to the age of the host rocks (Lower to Upper Devonian, from fossils and U-Pb constraints). The host metavolcanic rocks are intruded by the Early Mississippian More Creek Pluton. Pb-isotopes from the massive sulphides are primitive and cluster together with the Late Devonian Ecstall massive sulphide deposit and feldspar leads from the Late Devonian FKP.

The age of Cu-Mo-Au porphyry mineralization at Schaft Creek has a 220 +15/-2 Ma lower age constrained by U-Pb dating of synmineralization porphyritic felsic dikes. It also has Pb-isotope ratios which are similar to those of the Late Triassic Granduc copper-zinc deposit.

Metasomatic gold skarn mineralization at McLymont Creek is hosted in mid-Carboniferous to Upper Carboniferous sedimentary and volcaniclastic rocks, but related to Late Triassic or younger structures and intrusions. Alkaline to calcalkaline porphyry copper-gold mineralization south of Hankin Peak and east of Mess Creek are hosted by Upper Triassic volcanics and subvolcanic intrusives. Mineralization is generally believed to be latest Triassic to Early Jurassic in age for both these occurrences. Copper-silver mineralization at the Bam is hosted in Early Mississippian granite, Lower Permian carbonate and Lower Jurassic conglomerates. The epigenetic nature of the mineralization indicates it must postdate the youngest strata. A Late Triassic to earliest Early Jurassic age is also inferred for mineralization on the Run claim group. Vein mineralization appears to be marginally younger than the Triassic-Jurassic porphyry mineralizing event. Lead isotope studies of galena samples from the GOZ/RDN property and a gold-bearing vein on the Foremore properties both plot in the Jurassic cluster (Godwin et al., 1991). An Early Jurassic (194+6 Ma; Holbek, 1988) age for auriferous mineralization is inferred from K-Ar dating of chrome-bearing muscovite from a carbonate-sulphide vein on the BJ property.

Figure 5-9. Summary of stratigraphy, intrusive events and mineralizing episodes by deposit type for the Forrest Kerr-Mess Creek area.
The Middle Jurassic Eskay Creek submarine exhalative base and precious metal sulphide deposit is located approximately 15 kilometers southeast of the map area. Correlative rocks are present in the Forrest Kerr - Mess Lake map area and the potential for exhalative deposits in this area has not been sufficiently tested.

Silver-rich base metal mineralization of Tertiary age is widespread to the east and elsewhere in northwestern British Columbia, but to date none has been recognized in the Forrest Kerr - Mess Creek map area.