CHAPTER 4 MINERAL OCCURRENCES: GEOLOGICAL AND GEOCHEMICAL CHARACTERISTICS

INTRODUCTION

The Babine Lake region is an important copper-producing area in the province, having supported two large open pit copper mines (Bell and Granisle mines) and containing several other large, porphyry copper, developed prospects and numerous other prospects and showings. Copper-gold porphyry mineralization is hosted in the Eocene Babine intrusives and in adjoining country rocks. Major deposits occur at the Bell and Granisle mines and there are a number of undeveloped prospects, including the Morrison, Hearne Hill, Nak, and Trail Peak porphyries. A detailed description of these properties is beyond the scope of this report but a brief discussion of selected mineral occurrences is provided, particularly emphasizing their surficial geochemical characteristics. Further information on these mineral occurrences is provided by Carter et al. (1995), Ogryzlo et al. (1995), MacIntyre et al. (1996, 1997, 1998) and in numerous Ministry of Energy and Mines assessment reports (e.g. Fraser, 1980; Plicka, 1981; Fox, 1993; O’Brien and Weary, 1997; Sampson, 2000). The surficial geology and geochemistry of the Bell, Lennac, Hearne Hill, Wolf, Babs and Nak properties were previously described by Stumpf et al. (1996a) and Levson et al. (1997). These descriptions are not reproduced in their entirety but a summary and new information is provided.

BELL MINE

The Bell mine (MINFILE 093M 001) is situated on Newman Peninsula on Babine Lake, about 8 kilometres northeast of Granisle (Figure 3). Country rocks include the Early Cretaceous Rocky Ridge volcanics, Kitsumkalum shales and mid-Cretaceous rhyolites to rhyodacites (MacIntyre, 2001a). These rocks are intruded by Eocene porphyritic granodiorite of the Babine Suite. The orebody at the Bell mine is a high-level porphyry copper-gold deposit containing symmetrical zones of biotite-magnetite and propylitic alteration associated with multiple phase Babine intrusions (Carter, 1981; Carter et al., 1995). Copper and gold occur within the intrusive rocks at the intersection of the Newman fault and an east to northeast-trending fault. The intrusive rocks are overprinted by pervasive quartz-sericite alteration with chalcopyrite, pyrite, and minor bornite. Pyrite and chalcopyrite occur as disseminations and fracture fillings in the main stockwork and in the propylitic and biotite alteration zones. Bornite and minor molybdenite are also present in the biotite-altered porphyry.

The Newman Peninsula has been intensely glaciated. Well-formed flutes and striae are exposed on bedrock surfaces. Predominant ice flow in the area was south-southeasterly (120° to 180°). Locally, ice flow directions deviate toward the southwest (220° to 240°), due to either topographic control of ice flow or to late migration of the interior ice divide (Figures 19 and 20; Levson et al., 1998; Stumpf et al., 2000). Variable thicknesses of glacial sediments are exposed at the Bell mine property. Along the Babine valley and in topographic lows, sediment thicknesses are commonly a few to several metres. On bedrock ridges, sediment usually occurs as a thin veneer on the tops and northwest sides and generally thickens to the southeast. A thick sequence of lacustrine and glaciolacustrine sedi-
ments locally underlie the till in the Bell mine area (Harington et al., 1974). These sediments are relatively rare and occur mainly in small bedrock basins where minimal glacial erosion occurred subsequent to their deposition. Deformed laminated clays and silts were exposed at only one location in the Bell mine area, along the east side of the open pit. Approximately 5.5 metres of grey to dark brown clayey, very dense and fissile basalt overlies this unit. Locally, dense basalt till is capped by supraglacial till, colluvium or glacifluvial sediments. Along the Babine valley, mainly below the 750-metre level, glaciolacustrine deposits drape older sediments and bedrock.

Regional till samples collected at the Bell mine contain >98th percentile concentrations of silver, arsenic and antimony, >95th percentile levels of copper, lead, zinc, gold, chromium and cobalt, >85th percentile molybdenum and mercury, and >70th percentile nickel. Till geochemical data from the Bell mine area show a well developed, southeast-erly (down-ice) dispersal pattern for several elements including copper (Figure 22), molybdenum, zinc and mercury (Stumpf et al., 1997; Levson and Stumpf, 1998). Elevated concentrations of these elements occur in tills southeast of the Bell mine whereas background concentrations occur directly northwest (up-ice) of the mine. Copper concentrations decrease to regional background (median) levels (40-45 ppm) within about 4 to 5 km of the main pit (Figure 23). The same is true for zinc, molybdenum and mercury but other elements such as cadmium and nickel, drop to background levels within 1 to 2 km. Greater than 95th percentile concentrations of copper, molybdenum, zinc, lead and mercury occur within about 1.5 km of the mine. (See subsequent section on glacial dispersal patterns for detailed discussion of till geochemistry at the Bell mine).

**GRANISLE MINE**

The Granisle mine (MINFILE 093L 146) is located on an island about 7 kilometres northeast of the town of Granisle (Figure 3). The property is underlain by Early Jurassic Telkwa Formation volcanics. Most of the area is mapped as andesitic tuffs and flows but amygdaloidal basalt flows and flow top breccias occur at the northern end of the island (MacIntyre, 2001a). Copper mineralization at the mine is associated with Eocene Babine Intrusions including several phases of biotite-feldspar porphyry that overlap the period of mineralization. The largest and oldest is a wide northeasterly trending dike that is bounded by two parallel block faults and intrudes into the western edge of a quartz diorite pluton. A zone of potassic alteration with secondary biotite is coincident with the ore zone and grades outward into a quartz-sericite-carbonate-pyrite zone. Pyrite occurs in greatest concentrations peripheral to the orebody as disseminations or as fracture-fillings. Beyond the pyrite halo, propylitic alteration occurs in the volcanics with chlorite, carbonate and epidote in the matrix and carbonate-pyrite in fractured zones (MINFILE 093L, 1987).

Mineralization consists of coarse-grained chalcopyrite in quartz-filled fractures and veins up to 0.3 metres wide, which also host coarse-grained bornite, biotite and apatite. Gold and silver were recovered from the copper concen-

![Figure 23. Bell mine area, dispersal curve showing copper concentrations in basal till (-63 µm fraction) versus distance down-ice from the mine (thick solid curve). A selection of regional samples from a till covered prospective area north of Hatchery Arm (thick dashed curve; see Area 5, Fig. 28 for site locations) are plotted for comparison. Although only a few regional till samples were collected in the Hatchery Arm area, the similarity of the two curves suggests that the area has good exploration potential. R2 is the square of the Pearson product moment correlation coefficient. See text for discussion (after Levson, 2001b).](image-url)
MORRISON

The Morrison porphyry copper deposit (MINFILE 093M 007) occurs at the southeast edge of Morrison Lake (Figure 3) within a north-trending graben. Around the deposit the graben is occupied by argillites and silts of the Middle to Late Jurassic Ashman Formation while, farther south, unidentifed Skeena Group sediments occur within the graben. A stock of biotite hornblende feldspar porphyry of the Eocene Babine Intrusions, and associated dikes, intrude sediments of the Ashman Formation. Mineralization occurs within and adjacent to the porphyry. Chalcopyrite, pyrite and minor bornite and molybdenite occur as fracture coatings, disseminations, and quartz veinlet stockworks. Reserves are estimated at 190 million tonnes grading 0.4% Cu and 0.2 g/t Au using a cutoff grade of 0.3% Cu (Ogryzlo et al., 1995). A central zone of potassic alteration with intense secondary biotite and magnetite is surrounded by a zone of propylitic alteration with chloride and carbonate. Phyllic and argillic alteration occurs in some of the dikes. The main stock is offset by a north-trending shear zone with marcasite, sphalerite and arsenopyrite in quartz-carbonate veinlets and vugs (MacIntyre et al., 1997). Trenching and drilling (Sampson, 2000) were carried out on the property in the late 1990’s.

The Morrison deposit occurs in a low-lying area with a discontinuous glaciolacustrine surficial cover. Outcrops are limited mainly to resistant hornfelsed and silicified rocks. Regional till samples located in the vicinity of the Morrison contain greater than 98th percentile concentrations of copper (230 ppm), lead (44 ppm), silver (0.6 ppm), mercury (375 ppb), antimony (4.0 ppm) and arsenic (122 ppm). Till near the deposit also has >90th percentile nickel and >85th percentile molybdenum. Concentrations of most elements decrease in the down-ice direction as expected. At distances of 1-2 km from the deposit, concentrations of gold and antimony decrease to near background levels but copper and silver values still exceed the regional 70th percentile and arsenic concentrations exceed the 95th percentile. Arsenic therefore, may create a larger dispersal plume than other elements. Although high concentrations of arsenic are not observed in tills around the Bell and Granisle mines, they do occur at other copper porphyries such as the Nak and Trail Peak occurrences. Arsenic, therefore, may be a useful pathfinder for copper-gold mineralization in the region.

DOROTHY

The Dorothy developed prospect (MINFILE 093M 009) is located about 5 kilometres east of Nakinilerak Lake (Figure 3). The property was worked in the early 1970s and has an inferred resource of 45 million tonnes averaging 0.25 percent copper and 0.01 percent molybdenum. Excellent access to the area is now available due to new logging road construction. Mineralization occurs as disseminated and fracture-controlled pyrite and chalcopyrite within a multiphase stock of biotite feldspar porphyry and granodiorite or quartz diorite (MacIntyre et al., 1997). Secondary biotite alteration is overprinted by quartz-sericite-pyrite alteration. The stock has been dated at 51.9 +/- 0.54 Ma (MacIntyre, 2001a) and is part of the Babine Intrusive Suite.

Regional till geochemical samples were collected directly down-ice of the Dorothy stock but a case study was conducted in the area (Levson et al., 1997). The average copper concentration of 19 till samples collected over- and down-ice of the deposit is 101 ppm, i.e. in the 97th percentile range of the regional data set. Of the 19 samples, 6 have copper concentrations in excess of the regional 98th percentile, 14 exceed the 95th percentile, and all exceed the 90th percentile. In contrast, the copper concentration of an additional four till samples, collected up-ice of the Dorothy prospect, ranged from 54 to 61 ppm, i.e. in the 70th-90th percentile range for the regional data. Copper concentrations up-ice of the prospect, elevated in relation to the regional data set, may reflect the distal end of a dispersal plume from the Nak prospect about 4 km to the northwest.

NAK PROSPECT

The Nak prospect (MINFILE 093M 010) is located about 3 kilometres east of Nakinilerak Lake (Figure 3). Country rocks are Early Jurassic Telkwa Formation basalts in fault contact with Late Jurassic Trout Creek sedimentary rocks to the west. Early to Middle Jurassic Saddle Hill volcanics of the Hazleton Group occur to the east. Numerous dikes and sills cut layered rocks south, west and north of the main stock which is a hornblende quartz diorite extending across an area of about 1.8 km². The stock has an Ar-Ar date on biotite of 51.7 +/- 0.5 Ma and the associated biotite-feldspar porphyry dikes are typical of the Eocene Babine Intrusions (MacIntyre, 1998, 2001a).

Copper mineralization is spatially associated with biotite-feldspar porphyry dikes that cut both volcanic and sedimentary rocks and the quartz diorite stock. Two main zones of economic mineralization occur just west of the stock in hornfelsed sedimentary rocks of the Trout Creek Formation. The rocks show potassic alteration with disseminations and veinlets of chalcopyrite, bornite, and molybdenite. The northern zone also shows fracture controlled ore minerals, phyllic alteration and magnetite. Late, fault controlled, argillic alteration is superimposed on earlier potassic alteration and ore mineralization. Resource estimates are 54 million tonnes grading 0.17% Cu and 0.254 g/t Au for the south zone and 217 million tonnes grading 0.187% Cu and 0.0398 g/t Au for the north zone (Bridge, 1977). High grade copper occurs locally in veins or tabular zones, 2.614% Cu and 0.143 g/t Au over 12.5 m. Significant gold grades also occur locally, 0.704 g/t Au and 0.439% Cu over 24.69 m.

Regional till samples collected around the Nak prospect contain >98th percentile concentrations of copper, lead, zinc, gold, molybdenum, arsenic and antimony as well as >95th percentile cobalt, >90th percentile silver, and >70th percentile mercury and nickel. Basal till samples overlying or down-ice of the porphyry, collected from a diamond drill core during a case study at the property (Levson et al. 1997b; Levson 2001a), contain copper concentrations above the regional 70th percentile (48 ppm). Several samples yielded copper values higher than the regional 98th per-
centile. There is a spatial relationship between copper in till and copper in the underlying bedrock. The highest concentrations of copper in till occur down-ice of copper enriched bedrock areas (see discussion of glacial dispersal patterns for detailed information on the surficial geochemistry of the Nak area).

HEARNE HILL

The Hearne Hill developed prospect (MINFILE 093M 006) lies 2 kilometres east of Morrison Lake and 32 kilometres north of Granisle (Figure 3). The area is underlain by the Saddle Hill volcanics of the Hazleton Group (Figure 10). These rocks have been intruded by a small quartz diorite stock (Topley Plutonic Suite), and a northeast-trending biotite feldspar porphyry plug and dikes of the Eocene Babine Intrusives (Ogryzlo, 1990). The western flank of Hearne Hill is apparently the escarpment of the southeast-trending Morrison fault (Ogryzlo, 1990). West of the fault, younger Jurassic to Cretaceous Bowser Lake Group and Skeena Group sediments occupy the downthrown block. The Morrison deposit (see above) occurs west of the fault in association with biotite feldspar porphyry of the Babine Suite which intrudes the Ashman Formation.

Chalcopyrite, bornite and molybdenite mineralization at Hearne Hill occurs as fracture fillings and is disseminated throughout the intrusive and country rocks. This mineralization is related to a weakly developed porphyry copper system (Ogryzlo, 1990) carrying between 0.1 and 0.2% Cu but much higher copper grades (2.75%) occur in steeply dipping breccia pipes which cut the system. Breccia clasts are cemented with interstitial chalcopyrite, subordinate pyrite, malachite and azurite. Host volcanic rocks are strongly silicified. Alteration of intrusive rocks includes replacement of plagioclase phenocrysts by sericite, and biotite by chlorite. Pyrite mineralization is associated with sericite alteration. The most intense alteration is found in the breccia pipe and adjacent wallrock. Work on the property in recent years has included extensive trenching and diamond drilling in an effort to locate small high grade breccia-pipe targets (O’Brien and Weary, 1997).

The Hearne Hill deposit occurs on a steep, southwest-facing hillside dominated by talus and colluvium. Glacial deposits are less common. Talus consists of coarse, angular rubble derived from subaerially weathered outcrops. Hill-slope colluvium comprises poorly consolidated, massive or stratified, clast-supported diamictites. Prominent southeast-trending troughs and ridges occur along the crest of Hearne Hill. Fluted bedrock and striae exposed on trough walls and ridges, indicate ice flow between 120° and 160°. Striae near the summit locally crosscut this direction and indicate secondary flow at 240° into the Morrison valley.

Greater than 98th percentile concentrations of copper, lead, gold, silver and antimony, >95th percentile cobalt and chromium, and >85th percentile molybdenum occur in regional till samples down-ice of the Hearne Hill developed prospect. In addition, a linear boulder train extends about 2.5 kilometres down-ice from the property (Stumpf et al., 1996a). One boulder sampled from this train assayed 591 ppm copper. These erratics most likely are derived from the property but alternatively they may be sourced from an undiscovered zone of mineralized outcrop on the southwest flank of Hearne Hill. Copper values, in conventional soil geochemical surveys conducted on the property, primarily reflect down-slope transport of weathered bedrock and surficial deposits.

LENNAC LAKE

The Lennac Lake property (MINFILE 093L 190, 191), also known as the Thezar East and Thezar West occurrences, is located approximately 20 kilometres south-southwest of Granisle (Figure 3). The area is characterized by undulating to hummocky topography. Many of the hills in the area are bedrock cored and most are draped by a veneer or blanket of glacial sediment (Stumpf et al., 1996a). Country rocks are Early Jurassic volcanic and volcaniclastic rocks of the Telkwa Formation (MacIntyre et al., 1996). Intrusions are hornblende-biotite-feldspar and quartz-hornblende-biotite-feldspar porphyries with a granodiorite composition, related to the Late Cretaceous Bulkley Plutonic Suite (Plicka, 1981). One intrusion yielded an argon-argon date on biotite of 78.3 +/- 0.8 Ma (MacIntyre, 2001a).

Sulphide mineralization (pyrite, chalcopyrite, molybdenite and minor sphalerite) borders the main porphyry bodies and is related to a hydrothermal system active during emplacement of the Bulkley intrusive rocks. Azurite, malachite and bornite mineralization occur locally and felsic volcanics in one area carry up to 6000 ppb gold (Plicka, 1981). Well-developed propylitic alteration zones occur in Telkwa Formation rocks to the north of the Lennac Lake area (Plicka, 1981). Intrusive rocks contain some quartz-sericite-pyrite alteration.

In the property area, glacial flutings indicate that the last major ice flow was toward the east-southeast (090° to 120°). A southeast-trending erratics train of maroon, andesitic lapilli tuff and agglomerate was identified in the area (Plicka, 1981). A surficial sediment cover up to several metres in thickness has hampered exploration efforts. At several sites, supraglacial or resedimented till overlies compact clay-rich basalt till. The upper till unit, although visually similar to the underlying basalt till, is less compact and much sandier in texture (Stumpf et al., 1996a).

Greater than 98th percentile copper concentrations (110 ppm) occur in basal till at a till site directly down-ice of the Lennac prospect. In addition, >95th percentile gold, >90th percentile antimony, >75th percentile silver and >70th percentile arsenic occur in till directly down-ice of the prospect. At a site directly west of the prospect (site 6618), the till has >98th percentile arsenic and antimony, >90th percentile gold, >75th percentile silver, and >70th percentile zinc, lead, and chromium, suggesting that there may be undiscovered mineralization northwest of that area.
WOLFPROMPT

The Wolf property (MINFILE 093M 008), also known as the Saddle Hill occurrence, occurs about 36 kilometres north of Granisle (Figure 3). The property is largely till covered and occurs on a large southeast-trending ridge west of Morrison Lake. The area is underlain by Early to Middle Jurassic Saddle Hill volcanics and sediments of the Middle Jurassic Smithers Formation. Country rocks are intruded and hornfossilled by an Eocene composite biotite granodiorite stock about 700 metres in diameter which is part of the Babine Plutonic Suite (Fox, 1993). The stock yielded an argon-argon date on biotite of 52.4 +/- 0.5 Ma (MacIntyre, 2001).

Mineralization is associated with biotite feldspar porphyry dike which intrude both the granodiorite stock and the country rocks. Pyrite and chalcopyrite occur as fine-grained disseminations or fracture coatings. Up to 2% disseminated pyrite and 3% fracture-coating chalcopyrite is reported in granodiorite (Fox, 1993). In granodiorite and dike rocks, quartz veins and thin, sulphide-rich veins carry disseminated chalcopyrite, molybdenite and pyrite. Weak to intense argillic alteration zones, up to 10 metres wide, occur adjacent to fractures and quartz veins. Biotite and hornblende phenocrysts are destroyed and sericite is present along fracture surfaces. Hornblende is replaced by secondary biotite associated with copper mineralization (Fraser, 1980).

Glacially streamlined ridges and striae in the area indicate ice flow between 140° and 167° (Stumpf et al., 1996a). Crosscutting striae on west-facing valley walls indicate later, local flow between 180° and 195°, probably reflecting local topographic control. Tills are confined to lower valley sides where they form an undulating to rolling moraine mantling bedrock. Valley floors are blanketed by up to 5 metres of cobble-rich glaciofluvial sediments. On steeper slopes and over the hill crest, bedrock may be covered by hill-slope colluvium or sandy supraglacial till. High values for copper (from 1000 to 3000 ppm), molybdenum (up to 80 ppm) and zinc (up to 2500 ppm) were reported in thin B-horizon soil samples collected over the stock (Fraser, 1980), probably in colluvium.

Till at one regional sample site directly down-ice of the Wolf prospect contains the highest recorded concentration of molybdenum (38 ppm) in the entire map area as well as >98th percentile copper (230 ppm). Till at other regional sites in the vicinity of the prospect contain >98th percentile concentrations of gold (84 ppb) and arsenic (38 ppm), >92th percentile chromium, >90th percentile silver and >70th percentile lead, zinc, antimony and mercury. The possibility of undiscovered mineralization west of the Wolf showing is indicated by high concentrations of nickel, cobalt, chromium, and zinc in tills in that area (see Highlights of Geochemical Results, Area 65).

BABS PROSPECT

The Babs prospect (MINFILE 093L 325) occurs on the east side of Babine Lake about 12 kilometres southeast (down-ice) of Granisle mine (Figure 3). Underlying rocks are mainly granodiorites to monzonites of the Topley Plutonic Suite and some Saddle Hill volcanics (MacIntyre, 2001a). Outcrops are rare and much of the property is mantled by till which is locally fluted, indicating regional ice flow toward 150° (Stumpf et al., 1996a).

An erratics train, of mineralized, angular, biotite-feldspar porphyry cobbles and boulders, about 1 kilometre long occurs on the property (Kemp and Robertson, 1994). Most boulders (>80%) occur in a southeast-trending area about 300 metres long and 150 metres wide. Boulders contain abundant chalcopyrite as disseminations and fracture fillings, and grade up to 0.9% Cu and 1.3 g/t Au. One biotite feldspar porphyry boulder with chalcopyrite-pyrite mineralization, found beyond the southeastern limit of the train, analyzed at 10 491 ppm copper and 411 ppb gold (MacIntyre et al., 1996). Greater than 98th percentile copper concentrations (129 ppm) occur in basal till at a regional till site (1075) directly down-ice of the Babs prospect. This suggests that the source of mineralization is nearby, and that a local source for the boulder train is more likely than a source from the Granisle Mine, about 15 km to the northeast, as has been previously suggested. However, mineralized boulders locally appear more abundant and more angular on the surface than in the subsurface, suggesting possible englacial/supraglacial transport. Therefore, a more distal source for the erratics has not been precluded. The regional till site with high copper also contains >90th percentile concentrations of gold, >85th percentile molybdenum and >70th percentile lead and arsenic.

Glaciofluvial sediments, washed till and numerous small eskers and meltwater channels occur on this property suggesting that meltwater flow should be considered when interpreting geochemical dispersal patterns in soils. Copper values up to 467 ppm are reported from B-horizon soil samples (Kemp and Robertson, 1994). Copper values in soil above 40 ppm, define an area about 1.5 km long flanking the boulder train. The soil anomaly is interpreted as a linear plume reflecting southeasterly glacial dispersal and possibly secondary southwest dispersal by meltwater (Stumpf et al., 1996a).

Pervasive, sericite-clay altered, quartz phryic tuffs containing minor disseminated pyrite, chalcopyrite and malachite are exposed on the property. Tuffaceous rocks have iron and malachite staining on fracture surfaces and contain anomalous values of 726 ppm copper and 16 ppm silver at surface, and up to 0.19 percent copper over 77.3 metres in core from limited drilling (Kemp and Robertson, 1994). Similar rocks occur as large angular blocks or subcrop within the area of the boulder train. A small northeast-trending biotite feldspar porphyry dike with sparsely disseminated pyrite cuts the pink Topley monzonite (MacIntyre et al., 1996). These outcrops further suggest a local undiscovered source for the mineralized erratics and the geochemical anomalies.

TRAIL PEAK PROPERTY

The Trail Peak porphyry copper prospect (MINFILE 093M 011) is located on a small mountain about 15
kilometres north of Morrison Lake (Figure 3). The area has a relatively thin overburden cover, mainly colluvium and thin till. The prospect is underlain by hornfelsed, gossanous, cherty siltstones with disseminated pyrite of the Middle to Late Jurassic Ashman Formation. Intruding the layered rocks is a small biotite granodiorite stock with an Ar-Ar date on biotite of 52.1 +/- 0.6 Ma (MacIntyre, 2001a). Both the stock and the sedimentary rocks are cut by altered biotite-feldspar porphyry dikes. Mineralization occurs as chalcopyrite and minor bornite in fracture controlled disseminations and in quartz-tourmaline veinlets near the dikes and along fault zones. Potassic alteration comprised of secondary biotite, K-feldspar and sericite occurs with the copper mineralization and retrograde clay alteration is associated with late-stage faults.

Regional till geochemical samples around the porphyry show greater than 98th percentile concentrations of copper (116 ppm Cu), zinc (202 to 847 ppm), lead (27 ppm), arsenic (36 ppm) and cobalt, as well as >95th percentile silver, and >90th percentile gold and antimony. Element concentrations generally decrease in the down-ice direction with the main exception of one site (6265) about 1 km down-ice (SE) containing 322 ppm copper in till. The site may reflect another source of mineralization in that area (see Highlights of Geochemical Results, Area 4).

BEAR HILL PROPERTY

The Bear Hill property (MINFILE 093M 137) is located about 5 kilometres north of the Northwest Arm of Takla Lake (Figure 3). The area contains undivided Early Cretaceous felsic and intermediate volcanic rocks (MacIntyre, 2001a). Bear Hill is one of a series of topographic knolls aligned along a 20 km long, north-trending uplifted fault block that extends northward to Takla Lake where Middle Jurassic Smithers Formation sediments occur. The fault block is up to 4 km wide and bounded to the east and west by chert pebble conglomerate of the Late Cretaceous Tango Creek Formation. The volcanic rocks at Bear Hill include subaerial porphyritic flow rocks and fragmental volcanioclastics. Silicification of both volcaniclastic and flow rocks occurs along the east face of the knoll.

Mineralization occurs as grains, blebs and stringers of chalcopyrite, bornite, galena and sphalerite in zones with barite and quartz veining (MacIntyre, 1998). There is also small amounts of tetrahedrite, cuprite, chalcocite, mala-

FRIDAY PROPERTIES

The Friday Green (MINFILE 093M 163) and Friday Red (MINFILE 093M 164) mineral properties occur about 5 km and 7 km, respectively, northeast of the Nak porphyry copper occurrence (Figure 3). They are underlain by Early Jurassic sedimentary and volcanic rocks of Hazelton Group. Mudstones and siltstones of the Nlîkitkwa Formation underlie the Friday Green property and basalts of the Telkwa Formation underlie the Friday Red property (MacIntyre, 1998). Dikes of biotite feldspar porphyry related to the Eocene Babine Intrusions occur at both properties. Mineralization occurs as disseminated chalcopyrite. Adjacent sediments are hornfelsed and pyrite occurs on fractures at the Friday Green property. A larger dike of magnetite felsspar porphyry occurs in the volcanics at the Friday Red property.

No regional till geochemical samples were collected in the vicinity of the Friday Red property but one site with greater than 90th percentile copper in till occurs about 2 km south of the Friday Green property. Tills at this site and/or at others in the area contain >98th percentile gold, >97th percentile molybdenum, >95th percentile zinc and cobalt and >90th percentile lead.

FIREWEED

The Fireweed property (MINFILE 093M 151) is located about 20 kilometres northeast of Granisle (Figure 3). A number of stratified sulphide zones occur within a several kilometre long graben of Early Cretaceous Skeena Group sediments of the Red Rose Formation bounded by Jurassic and Triassic volcanic rocks (MacIntyre, 2001a). Mineralization consists of massive pyrite-pyrhotite, sphalerite-galena and chalcopyrite and disseminated pyrite, marcasite, sphalerite, galena, and minor tetrahedrite. Coarse sandstones contain the best grades (e.g. 635 g/t Ag, 2.26% Pb and 3.02% Zn over 7.9 m) suggesting that hydrothermal fluids moving through the most permeable beds produced the sulphide mineralization (MacIntyre et al., 1997). Heat for the epithermal system was probably supplied by intrusions of the Eocene Babine Suite.

Glaciolacustrine clays occur in the area south of Babine Lake and have hampered exploration. Several regional till geochemical sites southeast (down-ice) of areas of mineralization contain elevated (>70th percentile) concentrations of silver, lead, zinc, arsenic and antimony. One site (1054) contains greater than 90th percentile silver, zinc and copper and greater than 98th percentile molybdenum. The site is not located directly down-ice of any known sulphide zones (MacIntyre, 2001a). Numerous angular, oxidized and limonitic clasts with disseminated pyrite occur in the till at site 1054. The general paucity of highly anomalous till sites may reflect the diluting effect of glaciolacustrine sediments incor-
porated in the tills. Ice moving down the upper Babine Lake valley would undoubtedly have eroded older glaciolacustrine sediments and deposited them south of the lake. As a consequence, lower levels of metals in tills in this area may be more significant than in other areas.