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The Katie copper-gold porphyry deposit, southeastern British Columbia

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ABSTRACT

The Katie Cu-Au deposit is situated in southeastern British Columbia, 425 km east of Vancouver. The deposit is a member of the alkaline group of porphyry Cu-Au deposits associated with potassically and propylitically altered andesitic volcanic rocks.

The Katie porphyry system occurs in mafic to intermediate alkaline volcanic rocks of the Lower Jurassic Elise Formation of the Rossland Group. Host metavolcanic rocks include andesitic to basaltic flows, flow breccia, massive fine tuff and crystal tuff. Gabbroic intrusions alternate with the volcanic rocks in drill core. The lack of chilled margins and shear contacts, as well as their similar composition to the volcanic rocks, suggest that the gabbro was synvolcanic.

Alteration exhibits a zonal pattern spatially related to zoned porphyry-style mineralization. Propylitic alteration is common and assemblages consist of epidote, chlorite, sericite and calcite. Potassic alteration zones are accompanied by elevated copper-gold grades and are composed of K-feldspar, plagioclase, quartz, biotite and chlorite. Narrow drillhole intervals of secondary magnetite, generally less than 2 m across, occur above the potassic alteration zones. A thick oxidized cap lies above the mineralized zones, although only local supergene enrichment has been identified. The lack of supergene enrichment is perhaps due to intense near-surface fracturing and leaching from a high energy groundwater environment.

Sulphide mineralization consists mainly of pyrite within the propylitic halo, and pyrite and chalcopyrite with trace pyrrhotite, sphalerite, tetrahedrite, bornite and molybdenite within the potassic alteration core. Malachite, azurite and traces of chalcocite occur within the oxidized cap.

Discovery and exploration techniques have included airborne geophysics, regional stream sediment sampling, prospecting, geological mapping, ground geophysical surveys, soil sampling surveys, and diamond drilling.

Two primary targets of porphyry copper-gold mineralization have been identified by exploration. The Main zone strikes northwest, has an apparent true thickness ranging from 70 m to 135 m, and is a minimum of 500 m in length. The 17 zone strikes northwest, has an apparent true thickness of 90 m, and is a minimum of 300 m in length. The two zones are defined by grades that generally exceed 0.2% Cu and 0.25 g/t Au. Both zones are open along strike and to depth.

Introduction

The Katie deposit, owned by Yellowjack Resources Ltd., is the easternmost example of the alkaline porphyry Cu-Au deposit class found in the Canadian Cordillera. It is located at latitude 49°08′00″N and longitude 117°19′50″W, approximately 6 km southwest of the town of Salmo, British Columbia (Fig. 1). The deposit occurs in an area of moderate to steep uplands ranging in elevation from approximately 1200 m to 1700 m. Outcrop in the vicinity of the deposit and along its trend is less than 3%.

Katie is a relatively new discovery in the Rossland Group; the porphyry deposit approach to exploration commenced in 1985. There are no published ore reserves for the two mineralized areas on the Katie property. The Main and 17 zones, however, are defined by grades generally exceeding 0.2% Cu and 0.25 g/t Au across widths of 60 m and greater. Other significant geological features include: (1) an association of copper minerals with microfracture-controlled and pervasive potassic alteration; (2) the association of copper-gold mineralization with secondary magnetite; and (3) the location of the deposits within the north end of an 8 km by 2 km, 250 gamma aeromagnetic anomaly.

The primary zoning of gold-enriched copper minerals and alteration minerals, as well as geological setting, is somewhat similar to those of the alkaline porphyry copper deposits described by Barr et al. (1976) which includes Galore Creek, Afton and Copper Mountain. Similar showings in the Nelson-Salmo area include the Shaft (Andrew and Hoy, 1989) and the Star (Dawson et al., 1989).

Other minor mineralization occurs as shear and mylonite-hosted gold ± copper ± molybdenum ± arsenic zones within the Katie deposit and to the south in carbonate-sericite-silica alteration zones located within the aeromagnetic anomaly.

History

Unrecorded work in the area includes trenching on the Swift and Gus claims and evidence of a placer gold operation (1950s vintage) on Tillicum Creek, all south of the Katie deposit.

Government-sponsored exploration includes an airborne magnetic survey flown in 1969 to 1970 (GSC Map 8479G). Aside from locating magnetic signatures for the Bonnington Pluton in the north and Wallack Creek Pluton to the south, the airborne survey produced a kidney-shaped magnetic high located over the Katie deposit in the north and arcing to the southwest. Widely-spaced stream sediment sampling by the National Geochemical Reconnaissance Survey conducted in 1977 (GSC Open File 514) yielded copper ± zinc ± nickel ± cobalt anomalies from creeks draining the Katie deposit area.

Amoco Canada Petroleum Company Limited completed a soil geochemical survey over the Jim (now Katie) claims in 1980. Results indicated a greater than 100 ppm Cu anomaly over an area of 1200 m by 300 m to 4000 m in the later-discovered Katie deposit area (MacIsaac, 1980). Amoco, however, was exploring for molybdenum mineralization and the claims were allowed to lapse.

From 1982 to 1990 exploration immediately south of the Katie claims on the Swift, Gus and Lisa claims was conducted by Falconbridge Ltd. Work consisting of soil geochemistry, ground geophysics, trenching and minor drilling focussed on carbonate-sericite-silica altered shear-hosted gold targets (Burge, 1986; von Fersen and Hendrickson, 1986; Clemmer, 1988). From 1984 to 1986 Corona Corporation undertook airborne geophysical surveys and ground reconnaissance follow-up in the Tillicum, Swift, and Kelly Creek drainages (Elise Claims). This work established the presence of weak coincident copper-gold soil anomalies.

The Amoco copper soil anomaly was restaked in 1985 by local prospector Ken Murray (Murray, 1987). Follow-up soil surveying established coincident single-station gold geochemical highs over the copper anomaly. In 1988, the Katie property was optioned to Balloil Lassiter Petroleum Limited, who conducted geological and in the development of the large pr al copper-gold-rich MBX zone and the more distal gold-rich 66 zone.

Mineralogical zoning is well-developed within the deposits. A biotite-rich subzone of the potassic alteration zone forms the core of the deposit and is surrounded by a propylitic alteration zone. Most of the copper and gold occurs in the biotite-rich subzone. The composition of biotite in the biotite subzone varies and the proportion of the chlorite component in biotite is higher in the gold-rich, copper-poor 66 zone peripheral to the Mt. Milligan Main deposit. Iron-rich biotite, which is due to the chlorite component, is associated with elevated gold values.

Acknowledgments

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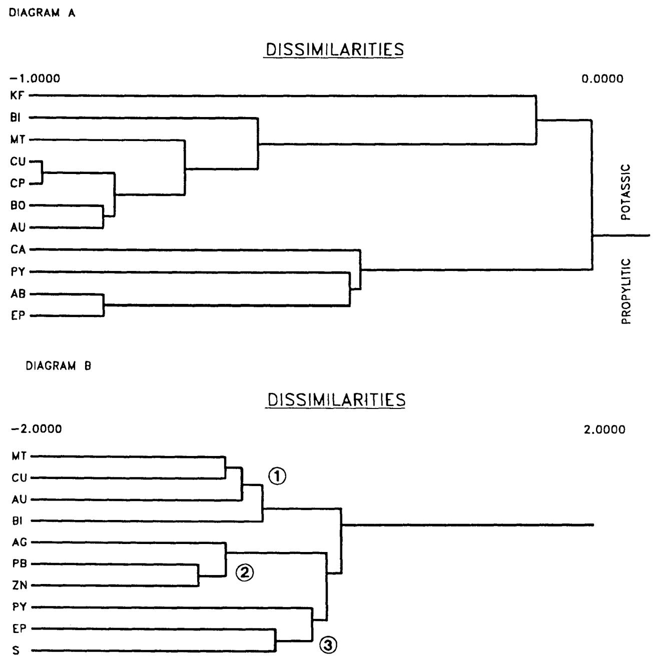

FIGURE 15. Tree diagram (dendrogram) with mineral and element associations: Length of horizontal line joining pairs or groups of minerals and elements is inversely proportional to the similarity with which the relative abundances vary. Dendrogram A illustrates the separation of the alteration into potassic and propylitic alteration assemblages. Dendrogram B illustrates trace element geochemistry associations. Increased amounts of magnetite and biotite are strongly associated with elevated copper and gold concentrations; silver, lead, and zinc are strongly associated; and increased amounts of pyrite and epidote are strongly associated with sulphur concentrations. The first association reflects copper-gold mineralization and potassic alteration; the second the transition between the potassic and propylitic zones where the polymetallic veins are (Esker and Creek vein systems); and the third, propylitic alteration.

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ground geophysical surveys, and complet 5 m of diamond drilling. The best drill intersection returned 0.24% Cu, 0.20 g/t Au across 6.0 m (DDH KT-89-4; McIntyre and Bradish, 1990).

Yellowjack Resources Ltd. acquired Balloil's interest in the Katie property and subsequently formed a joint venture with Hemlo Gold Mines Inc. and Brenda Mines Limited in 1990 to further explore the property. Noranda Exploration Co. Ltd. acted as project operator. Geological, geophysical, and geochemical surveys, as well as diamond drilling totalling 8260 m in 34 holes, were completed by the end of 1991 (McIntyre and Bradish, 1990; McIntyre, 1991; and Kemp, 1992). Yellowjack took over as operator in 1992 and completed an additional 4477 m of diamond drilling in 18 holes.

Two areas of copper-gold mineralization within potassically-altered host rocks have been identified as the Main and 17 zones.

Regional Geology

The regional geology of an area centred on the Katie deposit is shown in Figure 2. The Katie property is underlain mainly by Lower Jurassic Rossland Group volcanic epiclastic and sedimentary rocks. These rocks are separated from Paleozoic Kootenay terrane rocks to the southeast by the Waneta Thrust Fault. The Rossland Group rocks have been intruded by the Upper Jurassic to Lower Cretaceous Wallack Creek and Bonnington plutons to the south and north, respectively. All of the above rocks have been intruded by Tertiary lamprophyre, feldspar porphyry and syenite dikes.

The Rossland Group in the Katie area includes a basal unit of fine-grained clastic rock of the Archibald Formation, a middle unit of volcanic and epiclastic rocks of the Elise Formation mixed with Elise-equivalent intrusive rocks, and an upper unit of fine-grained sedimentary rocks belonging to the Hall Formation. The area of drilling on the Katie property is underlain almost entirely by Elise Formation mafic to intermediate volcanic rocks intruded by syn-Elise, sub-volcanic gabbro to monzonite dikes and sills.

Geological characteristics are well described by Hoy and Andrew (1988, 1989, 1990a, 1990b), Andrew and Hoy (1989, 1990), and Dunne and Hoy (1992). Syn-Elise, sub-volcanic intrusions are described in detail by Cathro et al. (1993).

Rossland Group rocks in the Katie area are generally weakly deformed. The regional metamorphic grade in this area is lower greenschist facies.

Penetrative deformation is most apparent near the Waneta Fault (i.e., the boundary between Quesnellia and North America), where tight folding, intense shearing and thrusting are evident in the overturned, east-dipping Hellroaring Creek syncline. The Hall Formation is exposed in its core and the Elise Formation in its limbs (Hoy and Andrew, 1990a).

North-northeast trending thrust and normal fault structures post-date shearing along the Waneta Fault. They include the Archibald Creek Thrust west of the Katie, the Tillicum Creek Thrust southwest of the Katie, and several carbonate-sericite-silica altered shear structures south of the Katie. A northwest-trending, quartz-dolomite healed mylonitic zone, interpreted from Katie drill core, may be syntectonic with an apparent northwest disruption between the north-trending Archibald and Tillicum Creek Thrusts.

Property Geology

Local rock types are summarized from Cathro et al. (1993) and Getsinger (1992). They are described from drill core and listed in order from oldest to youngest.

Lower Jurassic Rossland Group

Unit lJev: Andesitic to Basaltic Flows and Tuffs

The area drilled is underlain mainly by variably altered rocks of the Elise Formation. They are mottled dark green-grey, weakly to moderately magnetic and generally massive. Though regional alteration is weak, local alteration (propylitic and potassic) obliterates primary textures. However, large subhedral to euhedral pyroxene and feldspar phenocrysts are discernible in hand specimen. The prevalence of pyroxene and feldspar-phyric rocks suggests that this unit is part of the lower Elise Formation (Hoy and Andrew, 1988). Primary pyroxene is rare; most phenocrysts have been altered to actinolite, chlorite, epidote and biotite. Plagioclase is commonly saussuritized and/or sericitized.

FIGURE 1. General location map.

Unit lJev is further subdivided into flow and flow breccia, pyroclastic breccia, and lapilli, crystal, and fine tuff.

Unit lJga: Katie Intrusions

Intrusive rocks at Katie are mottled grey-green, weakly to moderately magnetic, and medium- to coarse-grained. Compositionally, they range from gabbro to monzonite and consist of relatively equal proportions of subhedral green-grey feldspar and subhedral dark green hornblende and pyroxene. The variation in composition from gabbro to monzonite is locally due to the increase in K-feldspar and quartz related to potassic alteration (Getsinger, 1992).

In drill core, the intrusive rocks of unit lJga alternate with volcanic rocks, suggesting that they occur as possible sills or dikes. The intrusive rocks are generally heterogeneous with partially assimilated clasts of gabbroic and volcanic material, indicating hybrid border phases. However, a lack of sharp intrusive contacts and chilled margins, and a petrographic composition that is similar to the volcanic rocks, suggests that these are synvolcanic intrusions.

Unit lJh: Black Argillite and Siltstone

Black carbonaceous argillite and siltstone of the Hall Formation crop out on the east side of the property. Similar Hall Formation rocks occur northeast of the Main zone in drill hole NKT-91-25.

Unit lJsk: Feldspar Porphyry

Pale grey and beige-grey plagioclase porphyry is a minor constituent in drill core. It is generally foliated and mottled, consisting of 5% to 7% feldspar phenocrysts, 5% to 15% chloritized hornblende laths and 1% to 4% poikilitic magnetite. This unit commonly exhibits quartz and K-feldspar alteration, and may originally have been a dacite dike. The feldspar porphyry may be correlative

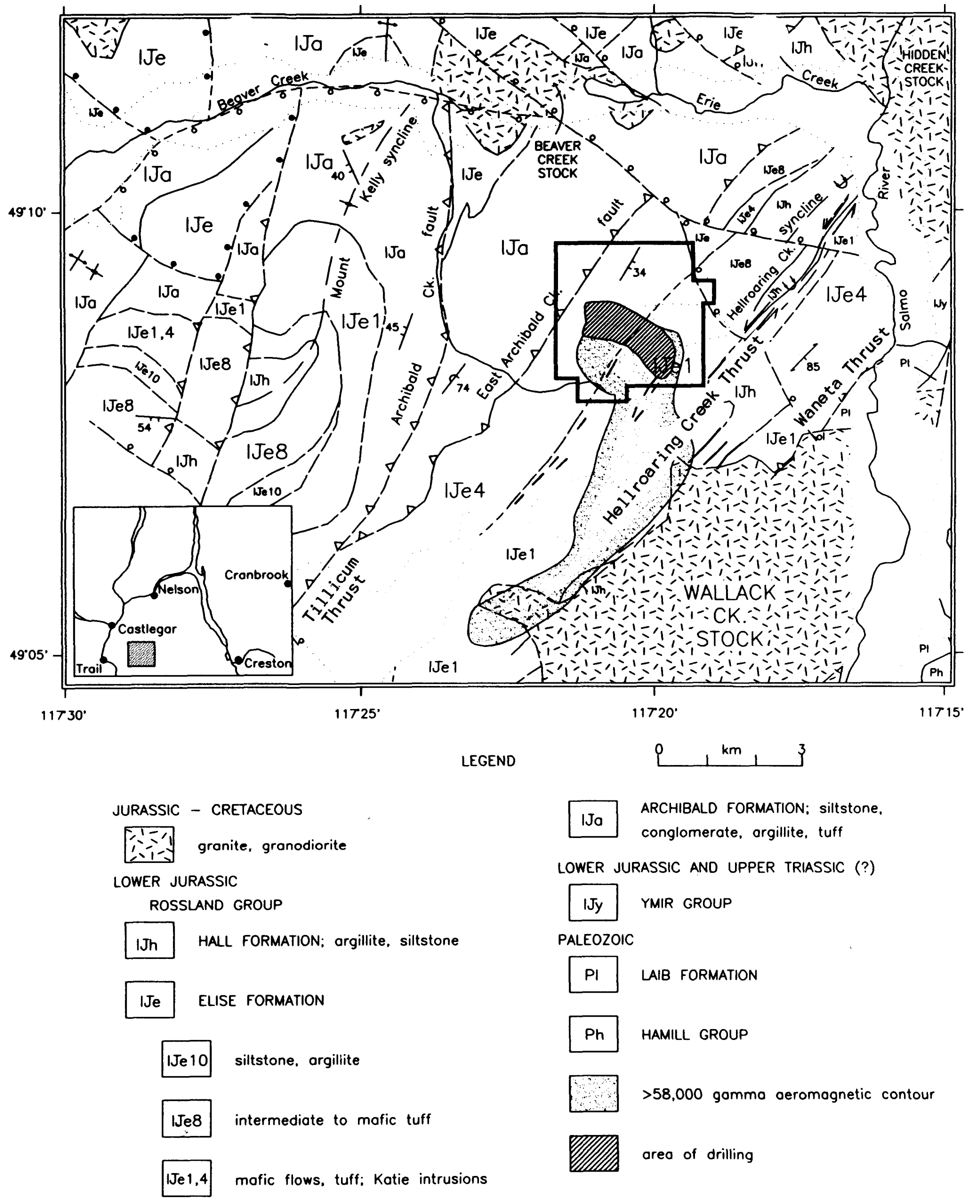

FIGURE 2. Location and regional geology of the Katie claims (modified from Hoy and Andrew, 1990a). Katie claim group is shown by the bold outline. Magnetic data is from GSC Map 8479G.

with the Silver King intrusive suite described by Dunne and Hoy, 1992 (Hoy, pers. comm., 1994).

Late Dikes

Late dikes include lamprophyre, microdiorite, feldspar porphyry, syenite, and rhyolite. They are generally unmineralized and weakly altered. They are likely postmineralization and related to the Nelson (Middle Jurassic) or Coryell (Middle Eocene) plutonic suites.

Structure

The Katie property lies within a panel of lower Elise Formation rocks on the western limb of the Hellroaring Creek syncline which has a regional northeast strike and southeast dip. However, correlation of gross lithological features in the Main zone suggests a local northwest strike and northeast dip. Further structural interpretations are hindered by the lack of outcrop, alteration and the lack of clear contact features due to the hybrid nature of contact areas.

Quartz-carbonate-sericite shear zones, which locally incorporate mylonitized units, have been intersected in the Main zone (Figs. 3 and 4) and west of the Main zone. They are up to 20 m in drill core length and crosscut porphyry-style mineralization. Drillhole correlations indicate that at least one set of shearing strikes northwest and dips steeply northeast. The mylonitic shear structures are discussed in further detail below.

A northwest-trending normal fault mapped by Hoy and Andrew (1990b) may be related to a fault intersected in NKT-91-25 which juxtaposes Elise Formation andesite against Hall Formation argillite.

Mineralization and Alteration

Two stages of mineralization and alteration are present on the Katie property. Zoned propylitic to potassic alteration hosting porphyry-style copper-gold mineralization comprises the alkaline copper-gold porphyry stage. This stage is cut by locally mylonitic shears containing gold ± silver ± copper ± antimony ± molybdenum ± arsenic mineralization. Although near-surface oxidation is intense, significant supergene enrichment has only been identified in the area of drillhole NKT-91-37. This may be due to intense near-surface fracturing, subsequent pervasive oxidation, and a topographically influenced high groundwater flow regime. An alteration-mineralization chronology chart is shown in Table 1.

Alkaline Porphyry Stage

Regional greenschist metamorphism consists of weak chloritization, minor silicification, and local epidote alteration. Propylitic assemblages in the Katie deposit area are characterized by saussuritization of feldspars to a mixture of chlorite, epidote, sericite and calcite.

Pyroxenes are typically altered to chlorite, actinolite, and sericite (Getsinger, 1992). Mineralization consists mainly of up to 3% disseminated pyrite, trace chalcopyrite, and trace copper oxides. Albite is locally developed adjacent to sulphides. Propylitic alteration is most prominent in a 1200 m long arc, 1600 m west of the Main zone.

Potassic alteration is directly coincident with pyrite-chalcopyrite mineralization (Fig. 5). To date, it has been best delineated in two zones, the Main and 17 zones. It is characterized by a mottled grey-maroon rock (locally salmon pink), consisting of K-feldspar, plagioclase, quartz, biotite, and calcite. Potassic alteration is destructive; protolith textures are obliterated. Getsinger (1992) reports that K-feldspar locally replaces the groundmass and forms rims on plagioclase crystals. Coarse secondary biotite booklets, visible with a hand lens, are well developed in the 17 zone (Fig. 6). K-feldspar is commonly found in veinlets with quartz ± epidote in areas up- and down-section from pervasive potassic alteration.

Sulphide mineralization within the potassic zone consists mainly of pyrite and chalcopyrite. Traces of pyrrhotite, bornite, sphalerite, and tetrahedrite occur irregularly throughout the zone. Chalcocite has been identified in the top 47 m of drill hole NKT-91-37, which may indicate local supergene enrichment. Correlation coefficients suggest that gold occurs with chalcopyrite, though no gold was identified by opaque petrography (McDonald, 1992). Malachite and azurite are common along near-surface fractures; oxidation has been observed at over 100 m in depth.

Evidence of brittle deformation, in the form of microfracturing, is ubiquitous in the potassic-altered zones and was critical to sulphide emplacement. Chalcopyrite is commonly found along microfractures (Fig. 7). It also occurs with pyroxene which is locally altered to actinolite (McDonald, 1992). Pyrite-chalcopyrite aggregates can be up to 5 cm wide in higher grade zones, though sulphides disseminated along microfractures are more common. Total sulphide content can range up to 30% across a 3 m sample width; the average content through a typical 60 m to 80 m mineralized intercept would be approximately 2% to 4%. Sulphide mineralization is best developed in volcanic protoliths but also occurs in subvolcanic intrusive rocks. Grades within altered volcanic and intrusive rocks reach 1% Cu and 0.5 g/t Au.

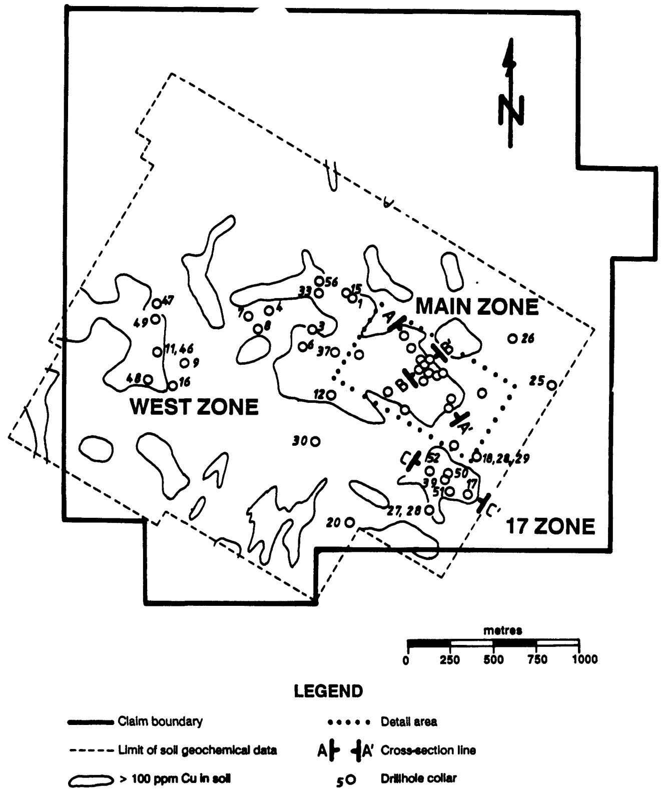

FIGURE 3. Katie property drillhole plan (after Cathro et al., 1993). The location of Figure 4 is shown by the dotted line. Figure 10 is along L106N. The locations of sections shown in Figure 10 are also indicated.

Magnetite appears to be common in altered Elise Formation rocks, with the exception of potassically-altered rocks where it is absent. It occurs mainly as disseminations, irregular aggregates, and breccia fillings. Breccia with secondary magnetite as fracture fillings occur in zones up to 2 m thick, mainly above mineralized intercepts within the Main zone. Analysis of a surface grab sample of this material returned results of 14 200 ppm Cu and 2800 ppb Au. Rutile, sphene, ilmenite and leucoxene are other accessory miner-

TABLE 1. Chronology of alteration and mineralization

Early				Late
quartz-sericite-chlorite alteration pyrite alteration				
	quartz-feldspar overgrowths minor pyrite-chalcopyrite			
		potassic alteration suite secondary biotite loss of primary textures alteration of ferromagnesium minerals increased chalcopyrite-pyrite k-spar flooding		
			quartz-dolomite alteration mylonitization pyrite-chalcopyrite remobilization(?) pyrite-tetrahedrite-molybdenite -arsenopyrite emplacement	
				retrograde suite sericite-chlorite alteration carbonate alteration calcite-epidote veinlets

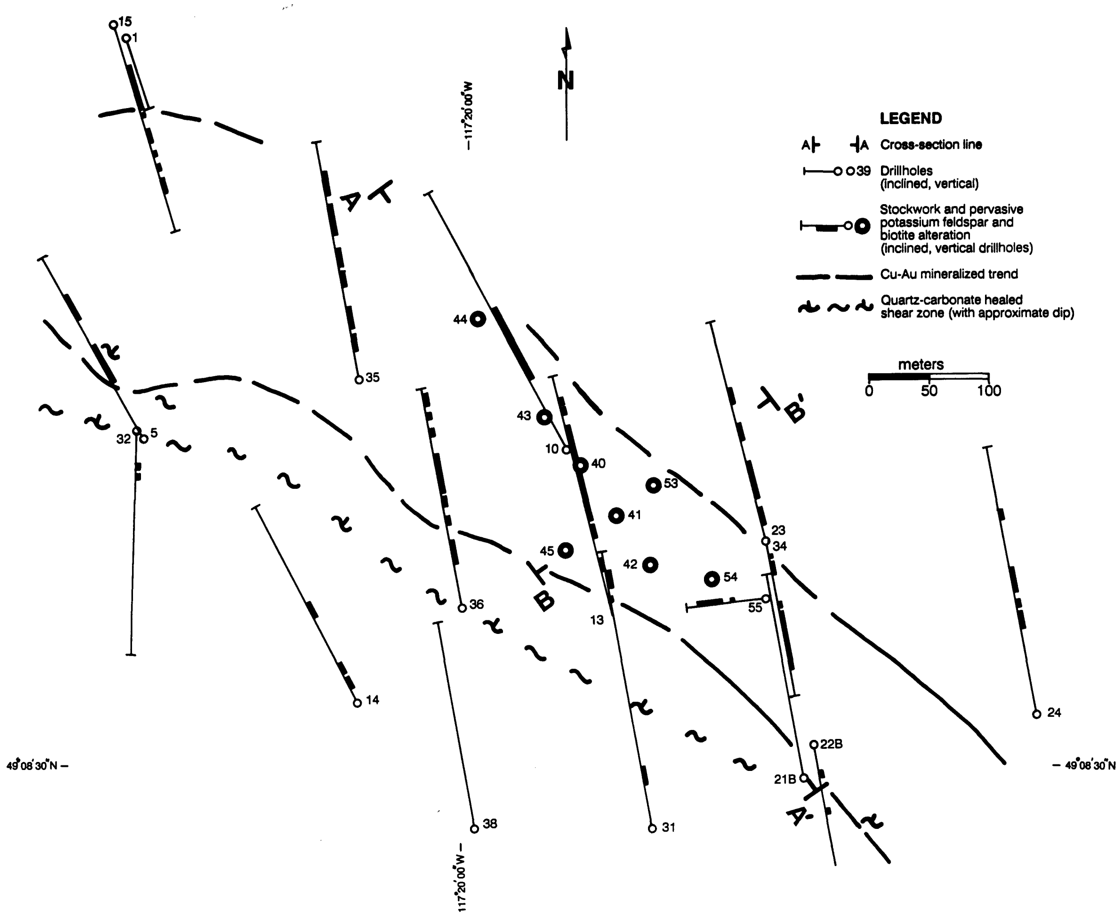

FIGURE 4. Katie main zone surface projection (after Cathro et al., 1993).

als associated with magnetite and ferromagnesian minerals (Getsinger, 1992; McDonald, 1992).

Evidence of retrograde alteration includes sericite replacement of plagioclase and secondary K-feldspar, and chlorite replacement of secondary biotite and amphibole (Getsinger, 1992). An abundance of late calcite and epidote stringers cross-cutting all lithologies may also be indicative of retrograde alteration.

Mylonitic Shear-hosted Stage

Quartz-carbonate-sericite altered mylonitic shear structures cut the Main zone and contain strongly folded quartz-carbonate-sulphide veins. The veins contain up to 30% sulphides consisting of pyrite, chalcopyrite, tetrahedrite, molybdenite and arsenopyrite. These shears are younger than the porphyry stage mineralization and maybe fault structures. Copper-gold grades within the mylonite stage tend to be higher in gold (up to 0.5 g/t Au) and lower in copper (0.1% to 0.2% Cu) than in the surrounding porphyry stage.

Applied Exploration Techniques and Results

Regional exploration strategies have included stream geochemical and airborne geophysical surveys.

The National Geochemical Reconnaissance Program conducted in 1977 involved stream sediment sampling of the major drainages of the southern Kootenays, including the Katie area. Results indicated that sediments in all drainages flowing from the Katie property and surrounding area (Hellroaring, Archibald, Swift and Tillicum creeks) contain levels greater than 100 ppm of copper and zinc. Gold and silver analyses were not conducted.

Airborne magnetometer, VLF-EM and resistivity surveys were flown by Corona Corporation over an area which includes the Katie claims. Airborne magnetometer results (Fig. 8) show anomalies over the Bonnington pluton in the north, the Wallack Creek pluton in the south, and an arcuate magnetic anomaly between the two. The Katie deposit lies under the north end of the arcuate anomaly. Continuations of this anomaly to the south and west represent, in part, disseminated and breccia-filling magnetite as described above. All of the area covered by the arcuate magnetic anomaly is underlain by Elise Formation volcanic rocks.

Airborne resistivity results (Fig. 9) outline a prominent northeast-trending structure correlative with the Hellroaring Creek Fault. The Waneta Fault, which is cut by the Wallack Creek pluton, occurs in the south end of the map area and parallels the Hellroaring Creek Fault. Several low-resistivity "donut" features lie west of the Hellroaring Creek Fault. One of these features is known to correlate on the ground with a rhyolite dike swarm and the other coincides with a syenitic intrusion. Two similar features occur on the Katie claims and are thought to be possible areas of magnetite depletion in areas of strong alteration.

Deposit specific exploration strategies include geochemical and ground geophysical surveys and diamond drilling. Geological mapping is hindered by a lack of outcrop. Soil and stream geochemical surveys have outlined numerous anomalies on the Katie claims. A total of 41 line-kilometres of soil sampling has been completed on the Katie property at a 100 m by 100 m density. When combined with available sampling results from the south, a discontinuous but discernible copper anomaly approximately 8 km by 2.5 km consisting of values greater than 100 ppm Cu is indicated. Single station gold anomalies of up to 200 ppb occur irregularly throughout this zone. This discontinuous anomalous trend correlates with the airborne magnetic anomaly. Pan concentrate stream sediment samples, collected by Noranda from streams draining the 8 km by 2.5 km copper anomaly, have returned values of 225 ppm Cu, 7274 ppb Au; 286 ppm Cu, 6084 ppb Au; and 293 ppm Cu, 5357 ppb Au (McIntyre and Bradish, 1990).

Ground geophysical surveys completed on the Katie claims in-

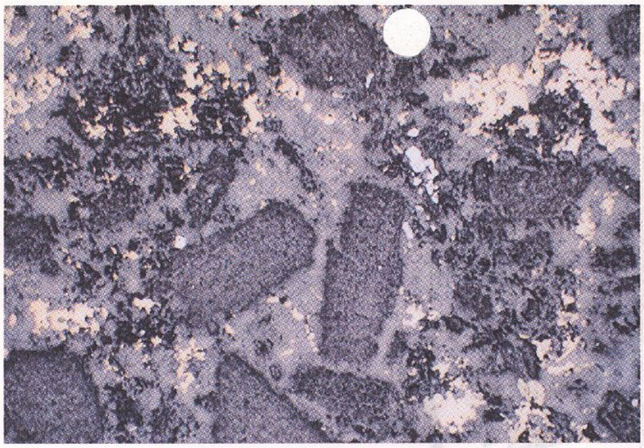

FIGURE 5. Matrix chalcopyrite and rare pyrite in quartz-albite alteration replacing sericitized plagioclase. YKT-92-41, 124.2 m depth. (T./I.L, x 6.25).

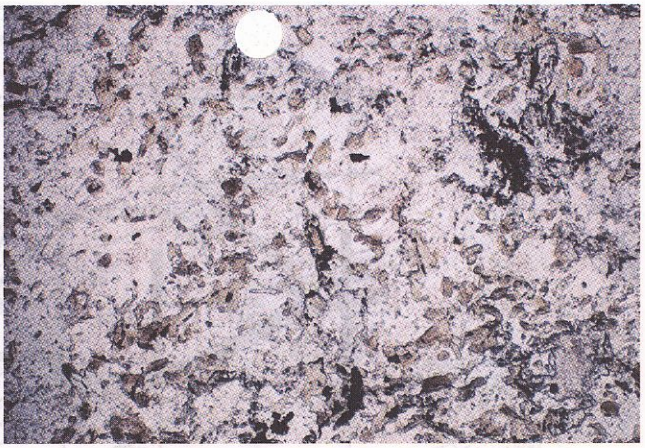

FIGURE 6. Secondary biotite in potassium feldspar altered matrix. DDH YKT-92-39, 118.0 m depth. (T.L, x 2.5).

FIGURE 7. Chalcopyrite interstitial to carbonate-quartz alteration vein that cuts plagioclase-dominated andesite. Plagioclase is partly sericitized. DDH YKT-9239, 96.1 m depth. (I.L., x 2.5).

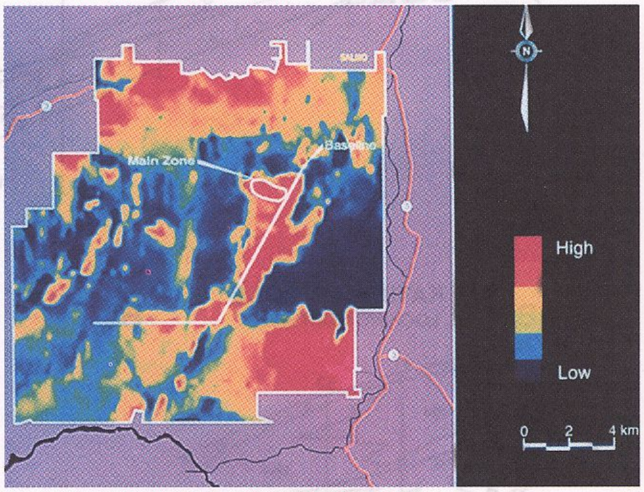

FIGURE 8. Airborne magnetic plan map. Joint venture ground is outlined in white. Red magnetic highs indicate (from north-central to southeast) the Bonnington Pluton, the Katie anomaly and deposit, and the Wallack Creek Pluton. The grid's baseline mirrors the assumed axis of the Katie anomaly.

clude a 41 line-kilometre magnetometer survey at 100 m line-spacing and a 28 line km pole-dipole induced polarization survey at 200 m line-spacing. Although the survey grid is oriented subparallel to the apparent strike of the Main zone, some generalizations can be made. The geophysical signature of the Main zone consists of coincident high chargeability, (1.5 times background), high resistivity (2 times background), and moderate to strong magnetic responses (2 to 3 times background). The 17 zone is outside the area of induced polarization coverage but has a strong magnetic response (2 times background).

Drill Results

A total of 14 008 m of diamond drilling has been completed to date on the Katie claims. Two mineralized zones have been outlined: the Main and 17 zones.

Main zone geology consists of northwest-striking, northeast-dipping Elise Formation andesitic volcanic rocks with intervening synvolcanic gabbro to monzonite dikes and sills. Copper-gold enrichment occurs with pyrite-chalcopyrite mineralization, mainly within potassically-altered andesites. Gold values are also found in later cross-cutting quartz-carbonate-sericite healed mylonitic shear structures. Coincident induced polarization, magnetic, and copper ± gold soil anomalies occur over this zone. Drilling has shown that the Main zone has an apparent true thickness of 70 m to 135 m, dips steeply to the northeast, and is at least 500 m in length. It has been intersected in drillholes at a depth of 350 m. Average

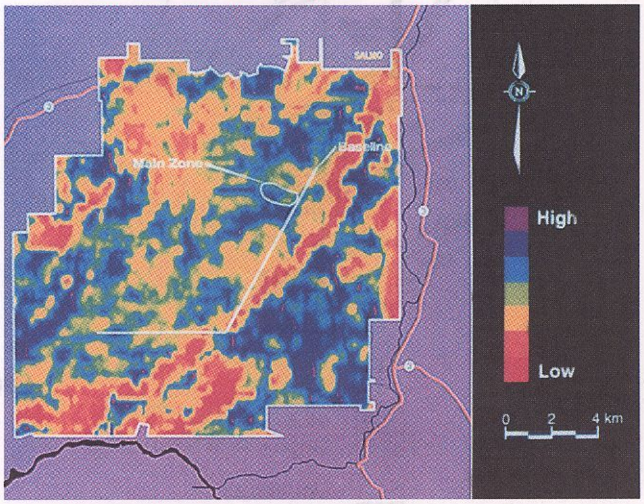

FIGURE 9. Airborne resistivity plan map. The arcuate structure parallel to the baseline is the Hellroaring Creek thrust. The Waneta thrust is south of it (bottom centre), but is cut off by Wallack Creek Pluton. Notice the apparent easterly offset of the Hellroaring Creek thrust east of the Main Zone.

grades within this area are 0.25% to 0.30% Cu and 0.15 g/t to 0.45 g/t Au across 65 m to 130 m (Fig. 10).

The 17 zone is located 670 m south of the Main zone. It is geologically similar to the Main zone and is underlain by Elise Forma-

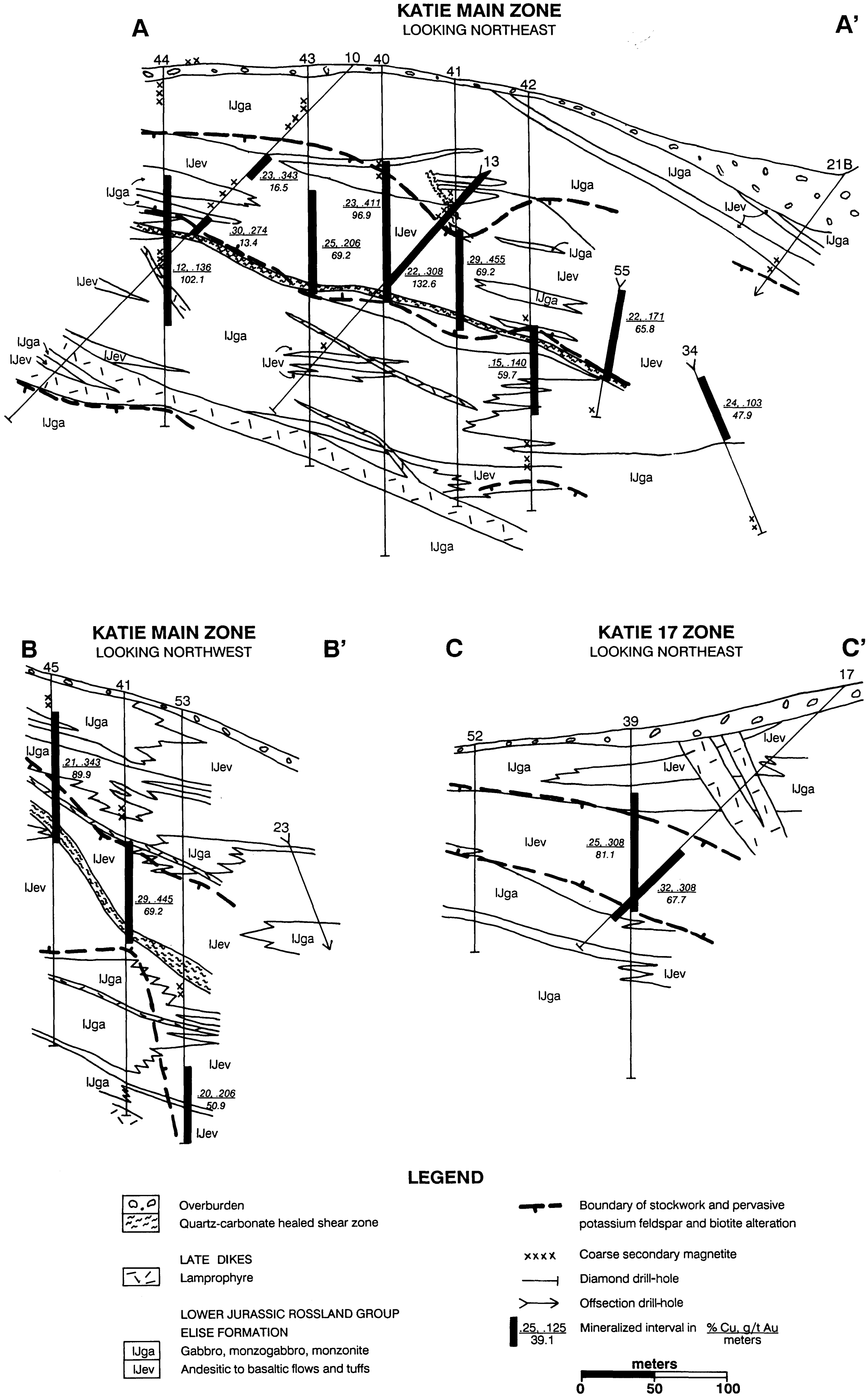

FIGURE 10. Sections through the Main and 17 zones, Katie property (after Cathro et al., 1993).

tion andesitic volcanic rocks and syn-volca ıtrusions. It is within the property-scale copper anomaly and has a strong magnetic signature, but is outside the area of induced polarization coverage. Limited drilling has outlined alteration and mineralization over an area of 300 m by 100 m. The zone appears to strike northwest and dip shallowly to the northeast. It may be a faulted continuation of the Main zone. Average grades within this area are 0.28% Cu and 0.30 g/t Au across 75 m (Fig. 10).

Highlight drillhole results include the following:

Hole	From (m)	To (m)	Length (m)	Cu (%)	Au (g/t)
Main zone					
NKT-91-13	43.9	176.5	132.6	.22	.308
incl.	96.6	128.6	32.0	.37	.617
NKT-91-21B	48.8	265.3	216.5	.13	.171
incl.	202.1	234.1	32.0	.19	.617
NKT-92-40	68.0	164.9	96.9	.23	.411
incl.	118.9	150.0	31.1	.34	.343
17 zone					
NKT-91-17	159.5	227.2	67.7	.32	.308
incl.	185.1	209.5	24.4	.42	.411
NKT-92-39	45.1	126.2	81.1	.25	.308
incl.	81.1	114.0	32.9	.36	.343

Conclusions

The Katie deposit is the easternmost alkaline Cu-Au porphyry system in Quesnellia. It is similar to other well-known alkaline porphyry Cu-Au deposits in British Columbia (e.g., Afton, Copper Mountain and Galore Creek). Similarities include the Jurassic, calc-alkaline to alkaline host rocks, zoned propylitic to potassic alteration, magnetite content and relatively high gold values.

Mineralization in the Katie deposit is typically hosted by potassically-altered mafic to andesitic rocks of the Lower Jurassic Elise Formation and intervening sub-volcanic gabbro and monzonite dikes and sills. The deposit is located near at least three large structural features; the Waneta Fault to the south, the Hellroaring Creek Fault to the southeast and the Archibald-Tillicum Fault to the west.

Alteration is zoned. Regional greenschist facies gives way to propylitic assemblages on the Katie claims. Brittle deformation within the potassically-altered core has created micro-fracture conduits for pyrite-chalcopyrite mineralization. Rare supergene enrichment may, in part, be a result of intense near-surface fracturing, oxidation, and local groundwater flow regimes.

Regional stream sediment geochemistry, airborne geophysical surveys and soil surveys suggest that the copper-gold porphyry environment continues to the south for a minimum of 8 km. Exploration for similar deposits along this trend, or elsewhere in the Rossland Group, should focus on coincident magnetic, chargeability, resistivity, and copper ± gold stream sediment and soil geochemistry anomalies. In areas of outcrop, the identification of alteration assemblages and syn-volcanic intrusions is critical.

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