UNUK MAP AREA (104B/7E, 8W, 9W, 10E)

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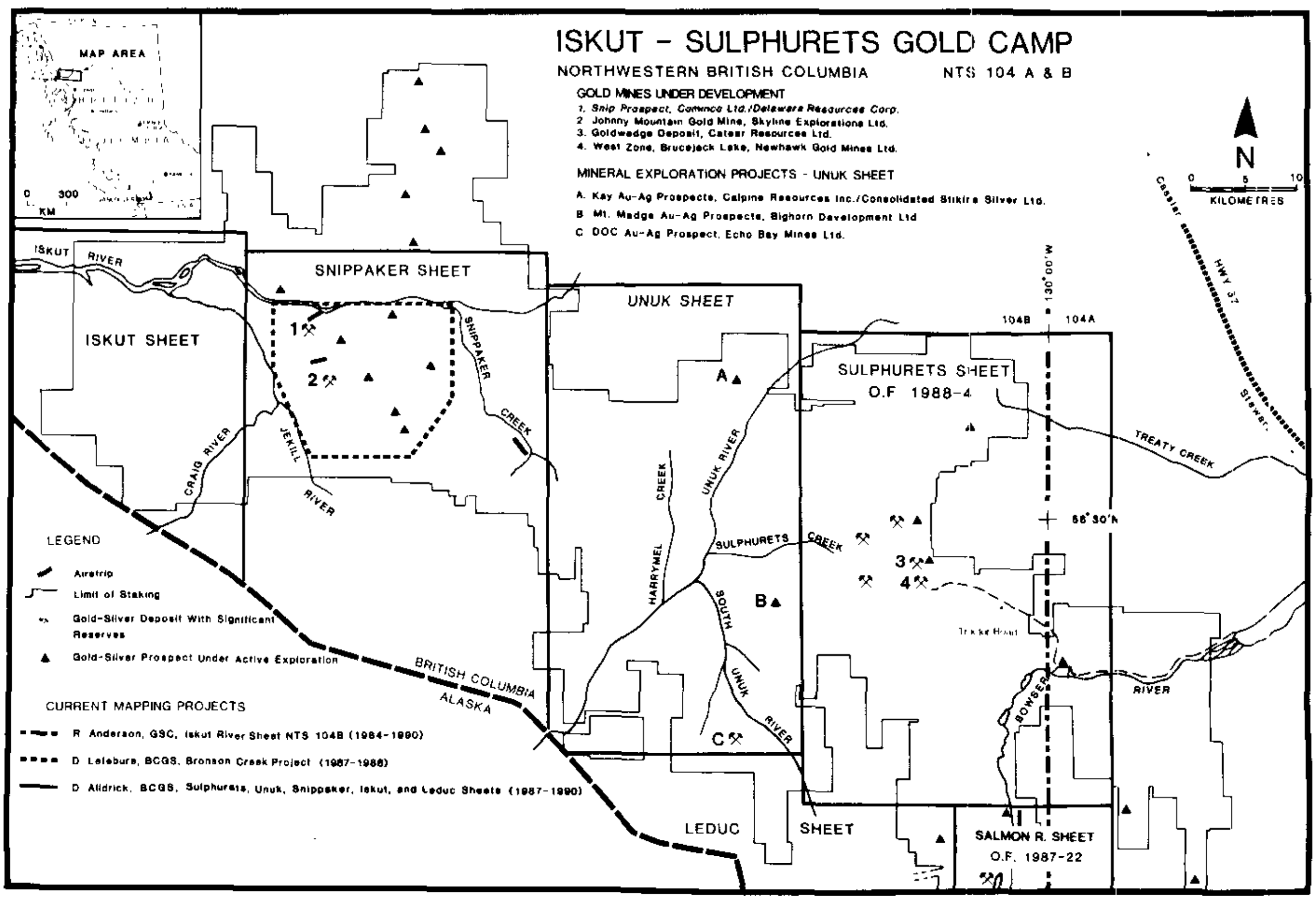
KEYWORDS: Regional geology, Stuhini Group, Hazelton Group, Iskut, Unuk, Sulphurets, polymetallic sulphides, nickel, platinum group, copper-iron skarn, gold-silver veins, porphyry copper-molybdenum, Regional Geochemical Survey.

INTRODUCTION

This report describes preliminary results of regional geological mapping in the Unuk River valley as part of the Iskut-Sulphurets project, a multi-year study of the mineral deposits in this newly emerging gold belt (Figure 1-28-1). The project commenced in 1987 in the Sulphurets map area (Britton and Alldrick, 1988). Its goals are:

- to define regional stratigraphy and structure,
- to produce 1:50 000 and 1:20 000-scale geological maps,
- to document mineral occurrences, and
- *to develop genetic models of mineralization.*

The Unuk map area is roughly centred on the confluence of the north and south forks of the Unuk River and comprises 1250 square kilometres of northern rain forest, sub-alpine plateaus and glacier-clad peaks. Access is by helicopter from Stewart, 70 kilometres to the southeast. One airstrip for fixed-wing aircraft was built in the 1960s on upper Snippaker Creek and float planes have been landing at Tom MacKay Lake since the 1930s. Elevations range from 100 metres to 2500 metres above sea level. About 25 per cent of the area is covered with permanent ice and snow. Valleys are steep-sided and U-shaped. Vegetation below treeline is a dense mixture of alpine fir, spruce and hemlock with slide alder, *stinging nettles and devil's club in local profusion.* Winter arrives early and stays late; temperatures are not severe but



Map courtesy of Teuton Resources Corporation, used & modified with permission.

Figure 1-28-1. Iskut-Sulphurets gold camp: precious metal deposits and current mapping projects.

British Columbia Ministry of Energy, Mines and Petroleum Resources, Geological Fieldwork, 1988, Paper 1989-1.

Figure 1-28-2. Geology and mineral deposits, Unuk map area.

LEGEND

INTRUSIVE ROCKS

Eocene	King Creek Dyke Swarm
	Coast Plutonic Complex
	Lee Brant Stock
Jurassic	Lehto Porphyry
L Jurassic to U Triassic	Diorite and Gabbro: Nickel Mountain (nm), John Peaks (jp), Melville (mv), Max (mx)
U Triassic	Meta-quartz-diorite

STRATIFIED ROCKS

Recent to Pleistocene		Basalt Flows and Tephra
M Jurassic	4	Marine-basin Turbidites
	3	Felsic Pyroclastics
L Jurassic	2 D V S	D = Dacite Marker V = Andesitic Volcanics (with <40% sediments)
U Triassic	1 V S	S = Sediments (with <40% volcanics)

SYMBOLS

Compositional layering (bedding; foliation)

Contact

Anticline; syncline

Harrymel-South Unuk shear

Pillow lavas

Recent volcanic vent

Gossan

Adit

Stream sediment gold values >90th percentile

Mineral occurrence .... ×R

Placer occurrence

MINERAL OCCURENCES

	NAME	COMMODITY
A	Emma	Au,Ag,Pb,Zn,Cu
B	MacKay	Au,Ag,Pb,Zn,Cu
C	Copper King	Cu,Fe
D	Colagh	Cu
E	E&L Nickel	Ni,Cu
F	Cole	Cu,Au,Ag
G	Cumberland/Daly	Au,Ag
H	Mt. Madge (C-10)	Au,Ag,Zn
I	Mt. Madge (GFJ)	Au,Ag,Cu,Zn
J	VV	Cu,Mo,Au,Ag
K	Chris & Anne	Cu,Fe
L	Max	Fe,Cu
M	Unuk Jumbo	Fe,Cu
N	Black Bear	Au,Pb,Zn
O	Boulder Creek	Pb,Zn,Au,Cu
P	Doc	Au,Ag,Pb,Cu
Q	Globe	Au,Ag,Pb,Cu
R	Alf	Au,Ag

snowfall is heavy, beginning soon after Labour Day at higher elevations. Summers are cool and wet.

PREVIOUS AND CURRENT WORK

The pioneering work of Forrest Kerr in the 1920s (Kerr, 1948) approaches the western boundary of the map area but earliest geological coverage was published in 1957 by the Geological Survey of Canada as part of Operation Stikine. E.W. Grove (1971, 1986) mapped the entire area between 1964 and 1970 incorporating geological mapping done by Newmont Mines Limited between 1959 and 1962. Thesis studies include work by R.H. Seraphim (1948) on the Halport (now Doc) vein, D.A. Donnelly (1976) on the Kay claims, and M.H. Gunning (1986) on the stratigraphy and structure of the Prout Plateau area. J.A. Fillipone of The University of British Columbia is presently conducting a structural study of deformed areas adjacent to the Coast plutonic complex, including an area along the South Unuk River. Other sources of information include annual reports of the Minister of Mines, assessment reports and the Ministry's property file.

The whole of NTS 104B is currently being mapped by R.G. Anderson of the Geological Survey of Canada (Anderson, 1989). The results of a regional stream sediment sampling program conducted over this area in 1987 were released in July, 1988 (National Geochemical Reconnaissance, 1988). A synthetic aperture radar (SAR) survey proposed by the province has been completed by the Canada Centre for Remote Sensing, Energy, Mines and Resources Canada, to outline major structures in the Iskut-Sulphurets gold belt.

Fieldwork was conducted from July 4 to September 14, 1988. Traverse data were recorded on 1:15 000 airphoto enlargements and compiled on 1:20 000 and 1:50 000 base maps.

EXPLORATION HISTORY

Placer gold has been prospected on the Unuk River and its tributaries since the 1880s (Wright, 1907) and was worked on Sulphurets Creek near its confluence with the Unuk River as early as 1895. No production was recorded. Earliest hard-rock mining ventures include small adits driven into gold-silver-lead veins at the Globe and Cumberland/Daly prospects around the turn of the century. In 1932, silver and gold-bearing lead-zinc-copper deposits were found east of Tom MacKay Lake and have been explored intermittently ever since. In 1946 the late Tom McQuillan discovered the Halport (now Doc) gold-silver quartz vein along the south fork of the Unuk River. Increased exploration in the wake of the Granduc discovery in 1953 located the E & L nickel-copper deposit in 1958 and the Max copper-iron skarn deposit in 1960. The push for porphyry-style mineralization resulted in the discovery of copper-molybdenum deposits (Cole and VV) north and south of King Creek in the 1970s.

Unlike the Sulphurets and Iskut gold camps to the east and west, there is relatively little current exploration in the Unuk map area. The Tom MacKay Lake prospects are under investigation by Calpine Resources Incorporated. The discovery of coarse visible gold in float near Mount Madge is being followed up by Bighorn Development Corporation. Echo Bay Mines Limited optioned the Doc property in October, 1988 and began an aggressive drilling and underground exploration program (George Cross News Letter No. 196/1988).

GEOLOGIC SETTING

The map area is situated in the southern Boundary Ranges of the Coast Mountain physiographic belt. The contact between the Coast plutonic complex and the Intermontane tectonic belt traverses the southwest corner of the map area. Most of the area is in the Stikine terrane with a small area of "undivided metamorphics" in the southwest, adjacent to the Coast complex (Wheeler and McFeely, 1987).

The area is underlain by a thick (more than 5 kilometres) succession of Upper Triassic to Lower Jurassic volcano-sedimentary arc-complex lithologies capped by Middle Jurassic marine-basin sediments. Strata have been cut by a variety of plutons representing at least four intrusive episodes spanning late Triassic to Tertiary time. These include synvolcanic plugs, small stocks, dyke swarms, isolated dykes and sills, as well as the batholithic Coast plutonic complex. The stratigraphic sequence has been folded, faulted and metamorphosed mainly during Cretaceous time but some Triassic strata are polydeformed and may record an earlier deformational event. Remnants of Pleistocene to Recent basaltic flows and tephra are preserved west of the Unuk-Harrymel drainage.

STRATIGRAPHY

Reconstruction of the stratigraphy has proved an intractable task. Much of the area is underlain by thick, monotonous sequences of fine-grained andesitic tuffs, tuffaceous wackes and siltstones. The rocks have been divided into several lithostratigraphic units that form a discontinuous succession spanning Carnian to Bajocian time.

Sufficient fossil, radiometric and lithostratigraphic data exist to permit broad correlation with the main Mesozoic groups of northwestern British Columbia: Stuhini, Hazelton (including Spatsizi) and Bowser Lake. More specific correlation with formations, members or facies within these groups is not yet possible. There is no field evidence for a major hiatus or unconformity between Triassic and Jurassic strata, although local unconformities no doubt abound, given the depositional (island arc) setting of these rocks.

TRIASSIC

Triassic strata (Unit 1 and the lower part of Unit 2, Figure 1-28-2) equivalent in age to the Stuhini Group of Souther (1971) crop out northeast of John Peaks, west of Harrymel Creek and on McQuillan Ridge.

Fossil evidence suggests the oldest rocks are those on McQuillan Ridge where crushed fragments of *Halobia* (a Carnian index fossil) were found by Newmont Mines Limited (Grove, 1986). These rocks can be divided into three lithostratigraphic sequences of undetermined lateral extent. The lowest consists of thin-bedded siltstones, immature fine-grained wackes, impure limestones and andesitic tuffs that locally attain a considerable thickness. Andesitic tuffs may be laminated to massive, aphyric or hornblende-feldspar-phyric. Limestones that distinguish this unit occur as thin beds or discontinuous lenses that show extensive recrystallization and highly disrupted internal structure. Thickest lenses (up to 30 metres) are located near the confluence of Gracey Creek and South Unuk River.

The second sequence is a poorly exposed package of crudely layered and massive andesitic tuffs and flows with minor limestone lenses.

Overlying this, only on McQuillan Ridge, are green-grey and purple andesitic to dacitic pyroclastic rocks, locally distinguished by coarse (up to 1 centimetre) hornblende phenocrysts. Plagioclase and minor augite are also present as phenocrysts. These pyroclastic rocks have lithologic similarities to Hazelton volcanics of the Sulphurets map area (Alldrick and Britton, 1988) and may in fact be Lower Jurassic.

Northeast of John Peaks, Triassic rocks consist of a thick sequence, perhaps repeated by folds, of immature clastic sediments with tuffaceous interbeds and rare augite porphyry breccias. *Monotis* (a Norian index fossil) has been found near the top of this succession (Gunning, 1986). *Monotis* has also been found west of Harrymel Creek (Grove, 1986) in an area not mapped this year.

JURASSIC

Most of the Unuk map area is underlain by rocks of the Hazelton Group (Units 2 and 3, Figure 1-28-2). Strata in the east and west halves of the map area cannot be directly correlated. This is due to a structural discontinuity that traverses the map area parallel to (and east of) South Unuk River and Harrymel Creek. The structure is interpreted as a major east-dipping shear zone with normal offset, exposing different structural levels and stratigraphic sections.

On the east half of map sheet, a single, westward-facing, but locally overturned, sequence of interbedded volcanics and lesser sediments extends from Storie Creek in the north to Divelbliss Creek in the south. It attains a thickness of 1 to 2 kilometres. Local stratigraphic markers permit correlation along the section for distances of 1 to 5 kilometres.

The best stratigraphic sections are immediately north and south of John Peaks. Further south the section is obscured by the Lee Brant stock. The basal contact with Triassic strata appears to lie near the top of the thick sequence of clastic sedimentary rocks within which *Monotis* is found. Neither an angular unconformity nor a widespread conglomerate marks this lower contact. Jurassic volcanic rocks range in composition from basaltic andesite to rhyodacite; andesite and dacite, locally with columnar jointing, are the most common. On the whole, volcanic and volcaniclastic rocks are more abundant than sedimentary rocks. Limestones are rare or absent in the Lower Jurassic sections. Pillow lavas, breccias, and felsic pyroclastics, including spherulitic rhyolite, serve as markers in the John Peaks area. Another local marker is a polymictic conglomerate distinguished by very well-rounded granitic boulders, cobbles and pebbles, some of which may be derived from the Mitchell suite of monzonitic intrusions exposed to the east (Britton and Alldrick, 1988). This conglomerate occurs at several horizons over a 100 to 200-metre stratigraphic interval, possibly repeated by folding or faulting.

In the west half of the map area Lower Jurassic strata are mostly andesitic volcanics and volcaniclastics, but locally include felsic lapilli and welded tuffs, and basaltic pillow lavas. Lateral continuity of units is poor. One local marker north of Nickel Mountain is a medium to dark green fine-grained andesite with sharply angular, pink, siliceous (or silicified) clasts up to several centimetres across. South of Nickel Mountain maroon, bedded airfall tuffs with fine-grained hematitic chips indicate subaerial volcanism. These rocks are similar to the bedded maroon pyroclastics seen on McQuillan Ridge.

Lower Jurassic volcanism terminated with a thin, but regionally extensive blanket of felsic pyroclastics that include welded tuffs and rare flows (Mount Dilworth formation; Unit 3, Figure 1-28-2). These rocks are white weathering or rusty where pyritiferous. Best exposures are north of John Peaks where the unit forms a dip-slope leading down toward Storie Creek and Unuk River. Rocks include waxy, grey to white, dacitic lapilli tuffs, bedded ash tuffs and welded tuffs; layering on centimetre to metre scale is common. Based on fossil evidence elsewhere (Alldrick, 1987; Brown, 1987) these rocks are Toarcian.

On Prout Plateau, east of Tom MacKay Lake, a package of rhyolitic volcanics and volcaniclastics is host to the MacKay silver-lead-zinc prospects (Donnelly, 1976). The sequence appears to form a tight anticline-syncline pair between Unuk River and Harrymel Creek. These rocks are tentatively correlated with the Mount Dilworth formation on the basis of structural position and age. The unit sits below a thick sequence of Middle Jurassic sedimentary rocks. The age of this extensive felsic unit is bracketed by a Pliensbachian fossil below and a Bajocian fossil above (Donnelly, 1976). Evidence against correlation with Mount Dilworth is the occurrence of pillow lavas immediately above the felsic volcanics (a phenomenon not observed elsewhere in the Stewart complex at the base of Middle Jurassic sediments) and dissimilarity of rock textures east and west of the Unuk River. Prout Plateau felsic volcanics, especially those east of the MacKay prospect, are carbonaceous, black and white mottled, locally flow-banded and autobrecciated rocks, with less evidence of airfall deposition. This may simply reflect a facies variation. Alternatively these rocks may be better correlated with felsic sequences associated with pillow lavas found lower in the Jurassic succession (for example, at John Peaks).

Middle Jurassic sedimentary rocks (Unit 4; Figure 1-28-2) crop out mainly in the northeast corner of the map area, extending southwestwards along Unuk River and onto Prout Plateau. They consist of a thick sequence of thinly bedded turbiditic siltstones and fine sandstones (Salmon River formation of Grove, 1986) perhaps correlative with the Spatsizi Group (Thomson *et al.*, 1986; Brown, 1987). On Prout Plateau a distinctive arenite-conglomerate unit with black chert clasts may be correlated with the Bajocian and younger Ashman Formation of Tipper and Richards (1976).

The rock sequences seen in the field are the products of a long-lived, mostly submarine, volcanic island arc. Individual volcanic centres, marked by coarse ejecta and flows, were short-lived (1 to 2 Ma), recurring at any given location at perhaps 5 to 6 million-year intervals. Volcanic and sedimentary processes operated concurrently. Volcanic edifices were built and eroded rapidly: periods of volcanic quiescence are marked by sedimentary interbeds. Finer grained sedimentary and volcaniclastic facies accumulated at a distance from the volcanic axis in back-arc or inter-arc basins.

PLEISTOCENE AND RECENT

Pleistocene and Recent basaltic flows and tephra are preserved in Copper King, Snippaker and King creeks west of the Harrymel-Unuk drainage. One volcanic centre within the map area consists of a severely eroded mound at the toe of Cone Glacier, on which unconsolidated tephra, flows and minor pillows can be seen. Most flows occupy valley bottoms and commonly show columnar jointing. Their poor preservation suggests eruption onto or under ice. The original distribution of these rocks has been much modified by glacial retreat.

INTRUSIVE ROCKS

Stratified rocks have been intruded by a series of plutons, sills, dykes, and dyke swarms of distinctly different compositions and textures. Preliminary radiometric data indicate a range in age from Late Triassic to Eocene.

The oldest intrusion is an inclusion-rich, foliated to gneissic hornblende-biotite quartz diorite centred on Bucke Glacier. A Late Triassic zircon date (R.G. Anderson, personal communication, 1988) establishes a minimum age for the meta-andesitic tuffs that host the pluton. Contacts are not well defined due to the gneissic fabric of both plutonic and host rocks

Dioritic stocks up to 20 square kilometres in area outcrop on McQuillan Ridge and near Melville Glacier. The McQuillan Ridge stock, called the Max diorite after the copper-iron skarn deposit with which it is associated, is an irregular body that ranges in composition from quartz diorite to hornblende diorite. Rocks are mesocratic to melanocratic. Contacts are both sharp and gradational with adjacent Triassic sediments and volcanics (Grove, 1986). The pluton is mostly unfoliated.

The Melville Glacier stock is a thin sheet-like intrusion along the inferred contact between Triassic and Jurassic strata. It consists of a mesocratic, fine to medium-grained, hornblende-biotite diorite to quartz diorite.

Two small gabbroic stocks occur in the map area. One, underlying John Peaks, is a medium to coarse-grained hornblende gabbro or diorite that forms an isolated plug about 4 square kilometres in area. It has sharp discordant contacts with Upper Triassic and Lower Jurassic strata. Minor gabbroic sills extend to the north and south, up to 1 kilometre from the main body of the pluton. At Nickel Mountain a pyroxene gabbro intrudes thin-bedded tuffs, cherts and siltstones of possible Toarcian age (Grove, 1986). The gabbro is medium to coarse grained, granular to ophitic, locally orbicular, and composed of plagioclase and pyroxene with up to 20 per cent olivine (Jeffrey, 1967). It crops out over an area of less than 2 square kilometres.

Newly discovered this year, the Lehto porphyry is a granodiorite to syenite with potassium feldspar, plagioclase and hornblende phenocrysts. Potassium feldspar phenocrysts are very coarse, up to 4 centimetres long, sharply euhedral, and typically coral or salmon pink. The Lehto porphyry crops out in the northwest corner of the map area as an elongate northeast-trending body roughly 10 kilometres long by 2 kilometres wide. Its southwestern limit in Snippaker Creek valley has not been determined. An associated, subparallel northeast-trending dyke swarm cuts immediately adjacent country rocks and includes locally aphyric aplite, monzonite and microdiorite at the northeastern end. The main porphyritic phase may be equivalent to other potassium feldspar plagioclase porphyries of the Texas Creek granodiorite suite that exhibit a common spatial association with precious metal deposits in the Stewart, Sulphurets and Iskut gold camps.

The Lee Brant stock located east of the South Unuk River is the largest discrete pluton in the map area. It crops out over 40 square kilometres and consists of a homogeneous, coarse-grained, leucocratic, hornblende-biotite quartz monzonite, with large potassium feldspar phenocrysts. Contacts with country rocks are discordant, sharp but unchilled. Country rocks are contact metamorphosed mostly to biotite hornfels facies, locally to garnet hornfels facies. Narrow dykes of quartz monzonite occur up to 200 metres from the main body of the pluton. On the basis of textural and mineralogical similarities with the Summit Lake and Texas Creek plutons to the southeast, a Jurassic age was proposed (Britton and Alldrick, 1988). Preliminary potassium-argon data on both biotite and hornblende separates indicate an Early Eocene age.

The Coast plutonic complex underlies the southwestern corner of the map area. It displays a variable composition ranging from biotite granite east of Gracey Creek to biotite-hornblende quartz diorite north of Boulder Creek and probably contains many discrete stocks. Country-rock contacts are sharp, discordant and thermally metamorphosed. The age of these intrusions is Eocene, based on dating in the Stewart area (Alldrick *et al.*, 1987) but the complex may include remnants of Jurassic granitoids.

On the west side of the map area is a north-trending belt of dykes, called the King Creek swarm, that extends from Canyon Creek to Nickel Mountain. The limits in Figure 1-28-2 show where dykes exceed 50 per cent of the exposed bedrock. In places bedrock consists entirely of dykes. Individual dykes are up to 10 metres wide and appear to anastomose, crosscutting one another at oblique angles. Compositions range from rhyodacite to andesite; textures from aphanitic to holocrystalline. Most dykes are white-weathering, medium-grey andesite to dacite with fine to coarse feldspar phenocrysts in an aphanitic groundmass. More felsic dykes may display flow banding; more mafic dykes tend to be coarser grained (for example diabase and hornblende diorite). The dykes form resistant ridges; in sections underlain by siltstones the only prominent outcrops are dykes. Total width of the swarm suggests there has been country-rock extension in the order of 500 to 1000 metres. They are thought to be the same age as the Portland Canal dyke swarm which yields Early Eocene potassium-argon dates (Alldrick *et al.*, 1987).

STRUCTURE

FAULTS

Normal faults in the map area are mesoscopic structures with relatively small offsets. Minor reverse faults have been observed that repeat better defined stratigraphic sections, for example at the toe of Bruce Glacier. Mapping these faults is not easy and depends on the recognition of local stratigraphic markers or repeated sequences of rock types. Actual fault surfaces or zones are rarely seen. Failure to recognize these structures leads to false conclusions about stratigraphic order, at least on a local scale. They are possibly quite common and may have developed concurrently with regional folding.

A northwest-trending belt of shearing, marked by mainly schistose rock fabrics, can be traced along the eastern valley slopes of South Unuk River. It dips to the northeast and represents a major normal fault that has moved the northeast side down. This structure passes along strike into the subvertical Harrymel Creek fault. Harrymel Creek valley is a 20-kilometre-long, north-trending topographic feature that may extend, with offsets, into Forrest Kerr Creek to the north. It is a zone of recent faulting that may represent a long-lived crustal break.

FOLDS

Soft-sediment, primary folds can be seen in well-preserved sequences such as exposures south of John Peaks. Regional folds, interpreted on the basis of lithologic correlation, are seen in the felsic marker (Mount Dilworth formation) which forms a tight anticline-syncline pair between Unuk River and Harrymel Creek. Limestone units southwest and northeast of South Unuk River form dip slopes into the valley bottom and thus define a northwest-trending syncline. Strata on McQuillan Ridge define a broad south-plunging anticline with steep-dipping limbs. This anticline extends the length of the exposed Upper Triassic west of Harrymel Creek although the axis seems to flatten or plunge to the north near Melville Glacier. More work is needed to resolve the structure west of this Triassic sequence.

METAMORPHISM

Regional metamorphic grade is lower greenschist facies, characterized by saussuritized plagioclase, chloritized mafic minerals, and conversion of clay constituents to white mica. Within 1 kilometre of the Coast plutonic complex, especially east of Gracey Creek, metamorphic grade rises to lower amphibolite facies. Rocks have a markedly gneissic appearance including agmatitic migmatites. These grade through a series of mylonitic zones into rocks of more easily determined protolith.

Dynamic metamorphic effects are on the whole more conspicuous, imparting foliation to finer grained rocks which locally display phyllitic textures. Foliation intensity varies over distances of a few metres, with stretching of lapilli clasts in coarse pyroclastics and minor transposition of compositional layering in finer grained rocks. Deformational effects are most noticable in marble-bearing sequences which show boudinage, convolute fold forms and highly contorted remnants of tuffaceous interbeds. In South Unuk River valley, thicker limestone units consist of lenses of marble with strike lengths in the order of only tens of metres, despite an appearance of regional stratigraphic continuity. What probably was a continuous bed has now been tectonically dismembered.

The age of metamorphism is Cretaceous (Alldrick *et al.*, 1987). However, near the contact of the Coast plutonic complex, granitic dykes thought to be offshoots of the complex have been mylonitized, indicating that deformation has also occurred after this Eocene intrusive event.

The Max and Lee Brant stocks and Coast plutonic complex have contact metamorphic aureoles, mostly biotite-hornblende hornfels. At one location adjacent to the Lee Brant stock (north of Lee Brant Creek) patchy almandine garnet may be found. The size of the pluton seems to govern the size of the aureole. Most hornfels occurs within a few hundred metres of the contact.

MINERAL DEPOSITS AND EXPLORATION POTENTIAL

The map area is midway between the Iskut and Sulphurets gold camps but has attracted little of the intense exploration activity that characterizes them. Although completely staked, the Unuk Valley saw only three major exploration projects in 1988: at Prout Plateau, Mount Madge and Doc Ridge. Field observations coupled with the recently released Regional Geochemical Survey results (B.C. RGS 18), MINFILE compilations, and recently announced exploration results, suggest that the mineral potential of the valley has been under-rated. This section describes selected mineral deposits and emphasizes the potential for new precious metal discoveries.

There are 55 mineral occurrences listed in MINFILE, ranging from showings to developed prospects, including one past producer. Most can be classified into one of four nongenetic categories: stratabound, intrusive contacts, veins, and disseminations.

STRATABOUND

Stratabound mineralization consists almost exclusively of pyritic zones and lenses contained within a particular stratum or restricted set of strata. The best examples are the MacKay prospects (MINFILE 104B 008), located beside Eskay Creek, which consist of at least eight distinct mineralized zones occurring over a strike length of 1800 metres within a sequence of felsic volcanics. They are now being explored by Calpine Resources Incorporated. Preliminary drilling on the 21 zone intersected almost 30 metres assaying 25 grams gold and 38 grams silver per tonne, including 16 metres of 45.6 grams gold and 68.2 grams silver per tonne (George Cross News Letter No. 213/1988). Another of these prospects, the 22 zone produced 10 tonnes of hand-picked gold-silver ore. Best assays were 150 grams gold and 4900 grams silver per tonne (Harris, 1985; 1987). Both stockwork and massive sulphide mineralization are exposed in the Emma adit. Stockwork mineralization is primarily galena and/or sphalerite with varying amounts of tetrahedrite, jamesonite and polybasite in quartz veinlets and silicified breccias in dacitic to rhyolitic pyroclastics. Massive mineralization consists of small pods and lenses of sphalerite, galena and pyrite.

The deposits have been variously interpreted as silicified shear zones (Harris, 1985) or volcanogenic massive sulphide deposits (Donnelly, 1976). In either model there is room for considerable extension down dip and along strike. Mapping this year identified pyritic siliceous zones up to 7 kilometres along strike to the south within the same sequence of felsic volcanics. Other gossanous zones were seen from the air where this unit crosses the Unuk River. More work needs to be done to define local controls on mineralization but the entire strike length of this unit is a target for detailed exploration.

INTRUSIVE CONTACTS

Deposits in this category show a close spatial and temporal relationship with igneous intrusions. A genetic link is highly probable. Three deposits in this category are the E & L nickel-copper prospect (MINFILE 104B 006), and the Max (MINFILE 104B 013) and Chris-Anne (MINFILE 104B 125) copper-iron skarns.

The E & L deposit is located in the headwaters of Snippaker Creek, about 1 kilometre south of the summit of Nickel Mountain. The prospect was explored for its nickel and copper potential in the 1960s and 1970s by diamond drilling and a 450-metre exploration adit. Drill-indicated reserves are 2.8 million tonnes of 0.7 per cent nickel and 0.6 per cent copper (Sharp, 1965).

Mineralization at the E & L occurs within two medium to coarse-grained, olivine-pyroxene gabbro bodies. These roughly triangular plugs are each approximately 1300 square metres in area and are probably connected. They intrude a sequence of argillites, tuffaceous siltstones and grey dacitic ash tuffs that strike northwesterly with moderate to steep southwesterly dips. Mineralization consists of pyrrhotite, pentlandite and chalcopyrite with lesser amounts of pyrite and magnetite. In the northwestern gabbro mineralization extends up to the contact with the sediments whereas in the southeastern gabbro mineralization is confined to the pluton. Diamond drilling has delineated pipe-like pods and disseminations of sulphides to a depth of 120 metres. There has been no reported evaluation of the potential for platinum-group elements in these gabbros. A grab sample of massive sulphide collected in 1987 assayed 225 ppb platinum, 299 ppb palladium, 1.4 per cent copper, 2.14 per cent nickel, 710 ppm cobalt, 58 ppb gold and 2 ppm silver.

The Max prospect lies on the northwest side of McQuillan Ridge, between the Unuk and South Unuk rivers, at elevations between 455 and 1500 metres. Massive magnetite with lesser pyrrhotite and chalcopyrite occur in skarn-altered sedimentary rocks adjacent to a diorite stock. Garnet, epidote, actinolite and diopside characterize the skarn assemblage. Drilling has indicated a reserve of 11 million tonnes at 45 per cent iron (Canadian Mines Handbook 1973-1974, page 432).

The Chris-Anne prospect lies approximately 3 kilometres east of the Max. Skarn mineralization is reported in limestone beds which are up to 10 metres thick and that are interbedded with volcaniclastics. Magnetite and pyrrhotite-rich layers, from 0.5 to 7 metres thick, with minor chalcopyrite, extend over a distance of 1 kilometre. There are minor intrusive bodies reported on the property. Grades range from 0.1 to 0.4 per cent copper (Allen and MacQuarrie, 1981). Some recent stream sediment geochemistry results on this hillside were high in gold (T. Heinricks, personal communication, 1988).

The gold potential of these skarn deposits does not appear to have been tested. Based on recent skarn studies (Ettlinger and Ray, 1988) McQuillan Ridge has many features that are associated with gold-enriched skarns elsewhere in the province: sequences of calcareous and tuffaceous host rocks; structural deformation; intrusion by dioritic I-type granitoids; and contact metamorphism and recrystallization. Some auriferous skarns are enriched in cobalt, an element that may be a useful pathfinder. Regional Geochemical Survey data show high cobalt values in three streams draining the ridge.

VEINS

High-grade precious metal quartz veins are the target of exploration programs at Mount Madge by Bighorn Development Corporation, and at the Doc prospect by Echo Bay Mines Limited. Veins on these prospects illustrate the variety found in the map area.

The Mount Madge prospects are located south of Sulphurets Creek near its confluence with Unuk River, on the east and west sides of Mandy Glacier. Two different targets are being evaluated (Kruchkowski and Sinden, 1988). On the west the C-10 prospect (MINFILE 104B 240) is a stockwork of thin quartz veinlets, locally with thicker quartz lenses, in intensely altered, fine-grained tuffaceous andesite or dacite. Quartz veinlets locally form up to 30 per cent of the rock. The alteration assemblage consists of quartz and sericite with up to 10 per cent pyrite. Chalcopyrite and traces of sphalerite are also present. The rocks are strongly foliated to schistose and are very similar to the broad alteration zones seen at Brucejack Plateau 12 kilometres to the northeast (Britton and Alldrick, 1988). Soil samples locally return analyses in excess of 1 ppm gold.

Two kilometres to the east, Ken Konkin discovered a massive pyrite-siderite float boulder with visible gold. Prospecting uphill led to the discovery of the GFJ veins (MINFILE 104B 233), apparently flat-lying, zoned, siderite-quartz-sulphide veins that returned assays up to 121 grams per tonne gold (Kruchkowski and Sinden, 1988). The veins are poorly exposed. Float blocks seen this year display symmetrical zoning from margin to core across vein widths of 10 to 15 centimetres. Vein margins are 1 to 2 centimetres of thin white quartz layers separated by hairline accumulations of very fine-grained tin-white sulphide, probably arsenopyrite. The core is a very coarse-grained intergrowth of siderite, milky quartz and cubes and clusters of pyrite, with lesser amounts of sphalerite and chalcopyrite as crystals and irregular masses. Rare tetrahedrite and visible gold have been observed (K. Konkin, personal communication, 1988). The veins cut variably foliated andesitic ash tuffs with thin interbeds of foliated to schistose siltstones.

The Doc prospect (MINFILE 104B 014) is located at treeline on a ridge overlooking the South Unuk River, opposite the mouth of Divelbliss Creek. The prospect consists of several west-northwest-trending quartz veins up to 2 metres wide that have surface strike lengths of up to 275 metres (Gewargis, 1986). The main veins (Q17, Q22) are massive white quartz with sparse sulphide mineralization (5 to 10 per cent) consisting of galena, pyrite, chalcopyrite and sphalerite with associated specular hematite and magnetite. Precious metal values are mostly confined to the sheared edges of veins and immediately adjacent wall rock. Shear zones with very little quartz may also return good values. Seraphim (1948) observed that gold was associated with either specular hematite or with galena and pyrite, but not with chalcopyrite and pyrite assemblages. The veins are a true fissure type, crosscutting folded and metamorphosed andesitic tuffs and thin-bedded sediments, including marble, that have been intruded by irregular dioritic dykes or sills and small monzodioritic plugs. The veins are different from any others seen in the Sulphurets or Unuk map areas. They have very restricted wallrock alteration aureoles, no apparent zoning, and appear to be limited to a few large fluid pathways. In this they display characteristics of mesothermal veins. Structural control of the vein sets has not been determined but may be due to fractures related to folds in the host rocks. Total mineral inventory of the Q17 and other veins is given as 426 000 tonnes with 9.26 grams per tonne gold and 44.91 grams per tonne silver (Northern Miner, November 7, 1988).

DISSEMINATED DEPOSITS

Porphyry-type disseminated pyrite, chalcopyrite and molybdenite mineralization occurs immediately north and south of King Creek, west of Harrymel Creek. Two properties have been worked: the VV to the south and the Cole to the north.

The VV property (MINFILE 104B 079) is the site of a heavily weathered monzonitic intrusive body in fault contact, on the east and west, with layered andesitic lapilli tuffs and tuff breccias with minor siltstone and calcareous sandstone interbeds. The stock is 250 metres wide, at least 6 kilometres long, strikes northerly and dips steeply to the west, parallel to the country rocks. Chalcopyrite occurs in quartz stockworks and as fine disseminations within the monzonite. Molybdenite, sphalerite, malachite and azurite have also been reported (Winter and McInnis, 1975; Mawer, *et al.*, 1977). Representative assays give 0.34 per cent copper, 0.003 per cent molybdenum, 2.1 grams per tonne silver, and 0.8 gram per tonne gold. Maximum gold and silver values obtained were 8.64 grams per tonne gold and 19.54 grams per tonne silver (Mawer, *et al.*, 1977).

The Cole prospect (MINFILE 104B 209) is situated approximately 4 kilometres north of the VV claims; it appears to be on strike with the same fault system and has similar intrusive and country rocks. Mineralization consists of up to 10 per cent pyrite, as disseminations and fracture fillings. Minor chalcopyrite and malachite have been reported but the bedrock source of the gold-silver soil anomalies has not been located (Korenic, 1982; Gareau, 1983). Reported assays range up to 0.43 per cent copper; 7.12 grams per tonne gold and 13.03 grams per tonne silver. Gold and copper values show a positive correlation on both properties.

RECONNAISSANCE GEOCHEMISTRY

Geochemical survey results for stream sediment samples collected over the whole of NTS 104B in 1987 were published in July, 1988 (B.C. RGS-18). In the Unuk map area almost every known precious metal prospect is associated with high gold values. Known gold deposits are also associated with high but variable values for such pathfinder elements as silver, arsenic, antimony or barium. For a reconnaissance survey this is a remarkable success rate. High gold values (greater than 90th percentile) not associated with known gold prospects occur along Gracey Creek, King Creek, Snippaker Creek, Boulder Creek, on the south end of Prout Plateau and on the east side of Unuk River near John Peaks (Figure 1-28-2).

Drainages from the Sulphurets gold camp and Prout Plateau (site of the MacKay prospects) have very similar geochemical signatures with elevated gold, silver, arsenic mercury, antimony and barium. Base metal values are also high.

Drainages from the northwest corner of the map area and the adjacent Snippaker map sheet, in particular the area between Snippaker and Palmiere creeks, show high values in a wide suite of elements including gold, silver, barium, lead, zinc, cadmium and manganese with scattered highs in copper, tin, tungsten and molybdenum. Mercury, arsenic and antimony analyses are low. The area contains some small but well-developed gossans. Interestingly, this high gold-silver, low mercury-arsenic-antimony pattern is similar to that of the Iskut gold camp 15 kilometres to the west. The close spatial association of these anomalies, gossans and the Lehto potassium-feldspar porphyry may be significant. There are no records of precious metal exploration in this area.

A cluster of samples from the headwaters of Harrymel Creek are high in mercury, silver, arsenic, antimony and fluorine. One mercury value (3 ppm) is the highest for the whole of NTS 104B. This element association may indicate high-level epithermal mineralization or possible ongoing geothermal activity along this structure.

In Divelbliss Creek, coincident high tungsten, molybdenum and fluorine and above-average molybdenum analyses include the highest tungsten and fluorine results recorded for NTS 104B, F and G. There are no known tungsten deposits in this area. Near Stewart, the Eocene Hyder pluton is spatially and probably genetically associated with molybdenite and tungsten mineralization. Recent potassium-argon dates for the Lee Brant stock at the headwaters of Divelbliss Creek indicate an Eocene age. The stock has a contact metamorphic aureole that may be the source of these anomalies.

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