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Mineral Deposit Research Unit

Metallogenesis of the Iskut River Area, Northwestern B.C.

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6. Geology of The HANK Property

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6.1 INTRODUCTION

The focus of this research project is to document the geology, alteration and timing of precious metal mineralization on the Hank property in northwestern British Columbia. The goal is to develop a model that includes the style of hydrothermal alteration and precious metal mineralization, thereby assisting in the evaluation of the economic potential of the Hank property and serving as a guide to exploration for other similar deposits in B.C. and elsewhere.

The research project is separated into three sections of investigation; (i) fieldwork and compilation of all existing geochemical data, (ii) laboratory analysis and (iii) development of a model for the hydrothermal alteration system and precious metal mineralization that may be applied to exploration.

The fieldwork provides the data for the production of a detailed geological map and cross-sections. The laboratory portion will utilize techniques to quantitatively describe the stratigraphy, alteration and mineralization on the Hank property.

These quantitative studies on the alteration and precious metal mineralization, combined with the compilation of existing geochemical data from the Hank property, will provide the basis of a model that will explain the distribution of precious metal mineralization within this broad alteration system. The model will assist in defining the economic potential of the prospect and other similar systems and will provide general exploration criteria.

Fieldwork conducted as a part of a Homestake Canada Ltd. exploration program between July and September, 1992, consisted of geologic mapping of the property and relogging of selected diamond-drill core. Mapping was conducted at two scales, 1:5000 property-scale mapping and 1:2000 detailed mapping of the informally named Felsite Hill, Bald Bluff and Rojo Grande areas. Subsequent research at the University of British Columbia will comprise part of an M.Sc. thesis supervised by Dr. A.J. Sinclair and Dr. J.F.H. Thompson.

6.2 LOCATION AND ACCESS

The Hank property is situated in northwestern British Columbia (NTS 104G/1,2), approximately 20 kilometres northwest of Bob Quinn Lake (Figure 6.1). The property lies along a broad, northeast-trending ridge southeast of Ball Creek and varies in elevation from 900 metres in the northeast corner of the property to 2050 metres in the southwest. Access to the property is by helicopter from Bob Quinn Lake; the claims are served by a network of cat trails developed by Lac Minerals Ltd. between 1985 and 1989.

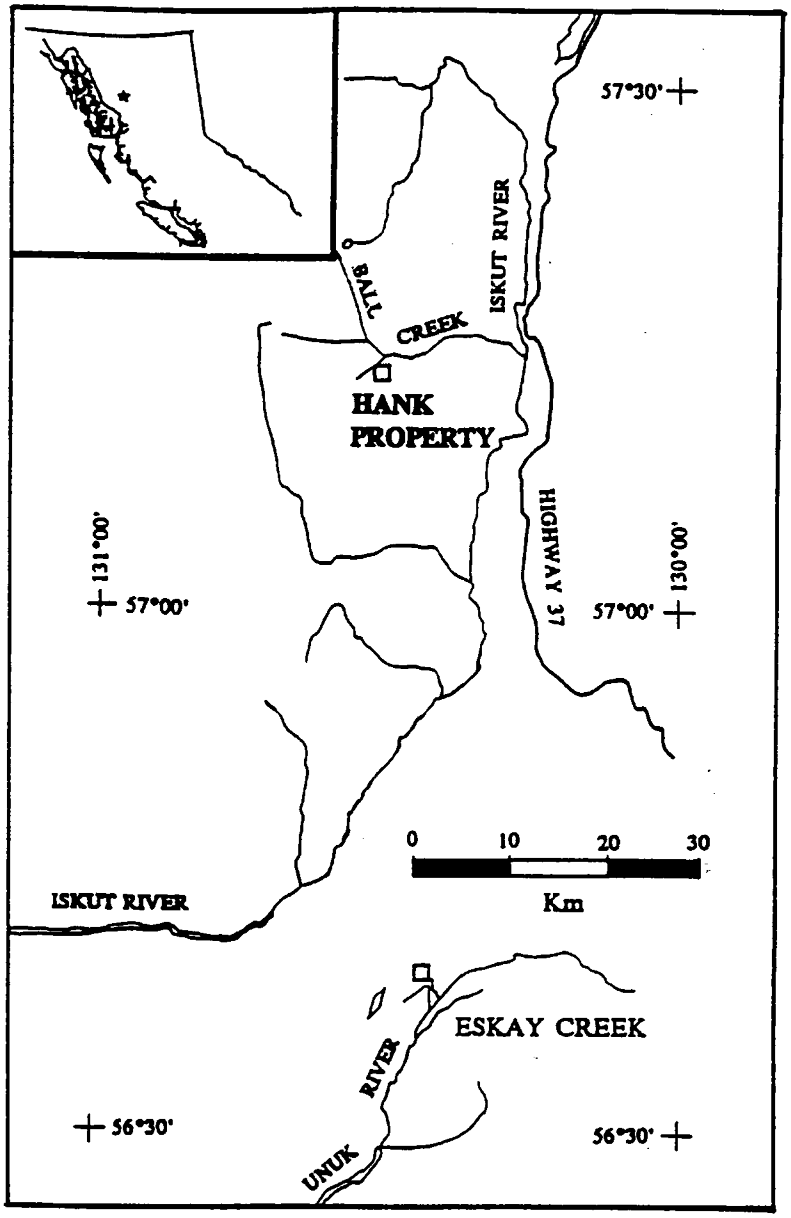

Figure 6.1: Property location map adapted from Anderson and Thorkelson, 1990.

6.3 PREVIOUS WORK

The Hank property comprises two groups of claims totaling 91 units. The Hank claims, owned by Lac Minerals Ltd., cover a large hydrothermal system that extends to the south and east onto the Panky claims, owned by Comlnco Ltd. Homestake Canada Ltd. optioned both groups of claims in 1992.

The Hank prospect was initially identified and staked by Lac Minerals Ltd. in 1983, based on regional stream-sediment geochemical anomalies and the presence of prominent gossans along the ridge. Preliminary geological mapping and sampling that year outlined several broad zones of anomalous gold and arsenic values.

Lac Minerals Ltd. completed more extensive geologic mapping, sampling, trenching and geophysical surveys resulting in the discovery of two subparallel, northeast-trending alteration zones, the upper and lower alteration zones (Figure 6.3). Trenching identified a zone of gold mineralization which averaged 3.3 grams per tonne gold over 13 metres coincident with a broad gold anomaly (> 300 ppb) in soils within the upper zone. Four diamond-drill holes totalling 288.1 metres tested this zone and hole 84-2 cut an intercept assaying 1.98 grams per tonne gold over 18 metres (Turna, 1985).

Lac Minerals Ltd. completed additional mapping, trenching, sampling and geophysical surveying during 1984 to 1985 and 1987 to 1989. Additional diamond drilling totaled 11604.1 metres in 88 holes, in both the upper and lower alteration zones and several other targets. Drilling outlined a geologic reserve of 245 000 tonnes with an average grade of 4.0 grams per tonne gold and 218 000 tonnes with an average grade of 2.0 grams per tonne gold in the 200 and 440 pit areas (Figure 6.3).

Carmac Resources Ltd. (now Camnor Resources Ltd.) optioned the Hank claims in 1990 and drilled five holes totalling 1090.5 metres in the upper and lower zones, then terminated the option. The Panky claims were staked by Cominco Ltd. in 1988, and geological mapping and sampling were completed in 1988 and 1990.

Homestake Canada Ltd. optioned the Hank and Panky claims in 1992, and completed a program of soil and rock sampling, an induced polarization survey and both property-scale and detailed geological mapping. Work concentrated on exploring the extensive alteration zones lying topographically and stratigraphically above the previously explored upper and lower alteration zones, with most of the detailed work in the "Felsite Hill" and "Rojo Grande" areas (Figure 6.3).

6.4 REGIONAL SETTING

The Hank Property lies within the Stikine Terrane along the western margin of the Intermontane Belt and the eastern margin of the Skeena fold belt. Regional mapping in the area (Logan *et al.*, 1992., Evenchick, 1991., Anderson and Thorkelson, 1990, Souther, 1972) has defined the stratigraphy as predominately: Paleozoic volcanic and sedimentary rocks of the Stikine assemblage; Mesozoic volcanic-plutonic arc assemblages, represented by Triassic Stuhini, and Jurassic Hazelton Groups;a Middle and Upper Jurassic overlap assemblage, the Bowser Lake Group, and the Mesozoic to Cenozoic Coast Plutonic Assemblage.

The oldest rocks in the region are complexely folded schists and gneisses of Middle Paleozoic age, which form the basement to the area and are exposed in Moore creek south of the Hank property (Figure 6.2; Souther, 1972). Closer to the property, regional mapping has defined the stratigraphy surrounding the property as Upper Triassic; augite andesite flows, pyroclastic rocks and volcanic-derived sediments overlain by Lower Jurassic grits, conglomerates and greywackes (Units 5, 7, 8 and 13; Souther, 1972). Sedimentary rocks of the Middle Jurassic Ashman Formation of the Bowser Lake Group are exposed along the Iskut River valley to the east (Evenchick, 1991). Augite-phyric flows, andesite tuffs and volcanic derived wackes and sandstones of the Upper Triassic Stuhini Group are exposed along the western margin of the property (Units uTSv, uTSs, and uTSsn, Logan *et al.*, 1992).

To the west of the property a large-scale northwest-striking fault is mapped at the head of Hank Creek (Souther, 1972). A subparallel fault, informally named the West Hank fault, adjacent and to the east of the large-scale fault, is exposed on the ridge to the northwest of the claims and continues along the western margin of the claims (Souther, 1972). The Lower to Middle Jurassic sediments (Units 13 and 14) form a broad northwest trending syncline in the south-central portion of the Hank property (Figure 6.2; Souther, 1972).

6.5 PROPERTY GEOLOGY

The Hank property is underlain by a succession of flows, pyroclastic and minor sedimentary rocks divided into four units (Figure 6.3). On the northeast side of the West Hank fault the stratigraphy consists of Upper Triassic Stuhini Group pyroxene-phyric flows and breccias overlying hornblende±pyroxene flows, pyroclastic rocks, siltstones, sandstones and biotite-phyric flows and breccias. Lower Jurassic carbonaceous siltstones, sandstones, wackes and pebble conglomerates which locally contain fossilized wood fragments are unconformably overlying the volcanic succession (Souther, 1972).

Legend for Figure 6.2

GEOLOGY OF THE TELEGRAPH CREEK
MAP AREA (104G)
(Adapted from Souther, Map 11-1971)

LEGEND

QUATERNARY
PLEISTOCENE AND RECENT

29 — Fluviatile gravel; sand, silt; glacial outwash, till, alpine moraine and colluvium

TERTIARY AND QUATERNARY
UPPER TERTIARY AND PLEISTOCENE

26 — Rhyolite and dacite flows, lava domes, pyroclastic rocks and related sub-volcanic intrusions; minor basalt

25 — Basalt, olivine basalt, dacite, related pyroclastic rocks and sub-volcanic intrusions; minor rhyolite

CRETACEOUS AND TERTIARY
UPPER CRETACEOUS AND LOWER TERTIARY
SLOKO GROUP

24 — Light green, purple and white rhyolite, trachyte and dacite flows pyroclastic rocks and derived sediments

SUSTUT GROUP

20 — Felsite, quartz-feldspar porphyry, pyritiferous felsite, orbicular rhyolite

JURASSIC AND/OR CRETACEOUS

18 — Hornblende diorite

17 — Granodiorite, quartz diorite; minor diorite, leucogranite and migmatite

JURASSIC
MIDDLE AND UPPER JURASSIC
BOWSER LAKE GROUP

16 — Chert-pebble conglomerate, grit, greywacke, siltstone and shale

MIDDLE JURASSIC

15 — Basalt, pillow lava, tuff-breccio, derived volcaniclastic rocks and related sub-volcanic intrusions

LOWER AND MIDDLE JURASSIC

14 — Shale, minor siltstone, siliceous ans calcareous siltstone, greywacke and ironstone

LOWER JURASSIC

13 — Conglomerate, polymictic conglomerate; granite-boulder conglomerate, grit, greywacke, siltstone; basaltic and andesitic volcanic rocks, peperites, pillow-breccia and derived volcanic rocks

TRIASSIC
UPPER TRIASSIC

9 — Undifferentiated volcanic and sedimentary rocks (Units 5 to 8 inclusive)

8 — Augite-andesite flows, pyroclastic rocks, derived volcaniclastic rocks and related subvolcanic intrusions; minor greywacke, siltstone and polymictic conglomerate

7 — Siltstone, thin-bedded siliceous siltstone, ribbon chert, calcareous and dolimictic siltstone, greywacke, volcanic conglomerate and minor limestones

6 — Limestone, fetid argillaceous limestone, calcareous shale and reefoid limestone Greywacke, silstone, shale; minor calcareous shale and siltstone

5 — Greywacke, siltstone, shale; minor conglomerate, tuff and volcanic sandstone

PERMIAN AND OLDER

2 — Phyllite, argillaceous quartzite, quartz-sericite schist, chlorite schist, greenstone, minor chert, schistose tuff and limestone

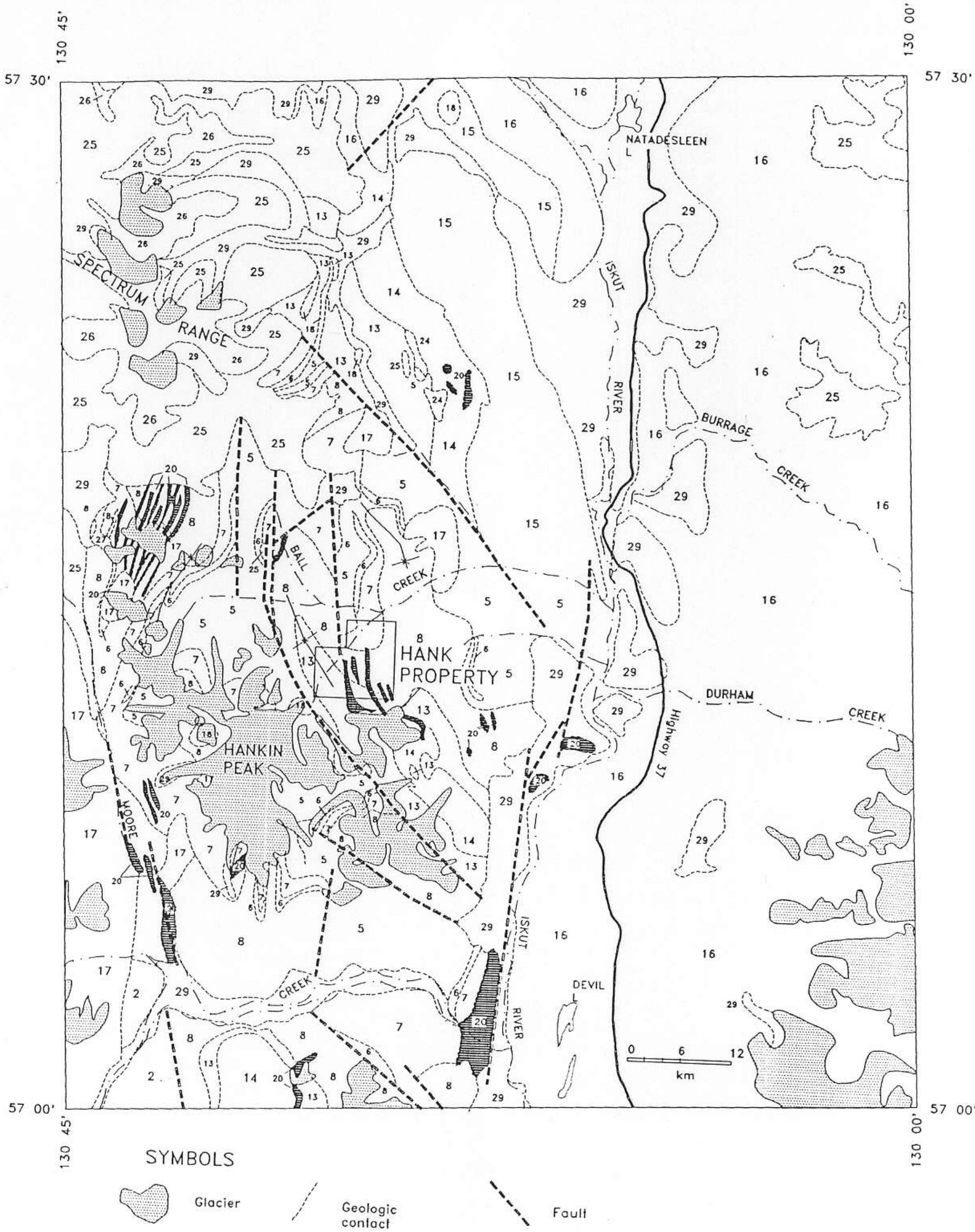

Figure 6.2: Regional Geology Map adapted from Souther, 1972.

Legend for Figures 6.3-6.6

LEGEND

STRATIGRAPHY

	East of the West Hank Fault	West of the West Hank Fault
Middle Jurassic		5a Dark green amygdaloidal aphyric flows and flow breccias
		5b Rusty, pyritic, flow banded rhyolite
Lower Jurassic	4 Undivided siltstone, well bedded sandstone and heterolithic conglomerate	
	Unconformity	
Upper Triassic Stuhini Group	2c Bioclastic and silty limestone	3 Well-bedded, feldspar-rich, volcanic derivrd sandstones, conglomerates, greywacke and siltstones
	2b Andesitic, pyroxene+feldspar phyric volcaniclastic breccia	
	2a Andesitic to basaltic, magnetic, pyroxene+feldspar phyric flows	
	1d Maroon, magnetic, hornblende feldspar+/- pyroxene flows, sills and dikes	
	1c Interbedded siltstone and well bedded sandstone	
	1b Feldspar+/-biotite phyric ash tuffs and biotite phyric flows and breccias	
	1a Undivided green to maroon feldspar+/-hornblende+/- pyroxene volcaniclastic tuffs and breccias	

INTRUSIONS

A Bald Bluff Porphyry: Orthoclase megacrystic hornblende phyric monzonite, bx=breccia, ex=possible extrusive equivalent of the Bald Bluff porphyry	B Medium grained hornblende diorite

ALTERATION

Clay+/-quartz+/-pyrite (For figure 3)	
Clay+/-quartz	Clay+pyrite+carbonate+/-quartz with carbonate stockwork
Quartz+/-pyrite	Sericite+pyrite+/-chlorite+/- clay +/-carbonate
Quartz+clay+/-pyrite	Sericite+pyrite+/-carbonate
Quartz+clay+pyrite	Quartz+sericite+pyrite+/-clay

SYMBOLS

- Geologic contact (defined, assumed, infered)
- Fault
- Alteration contact

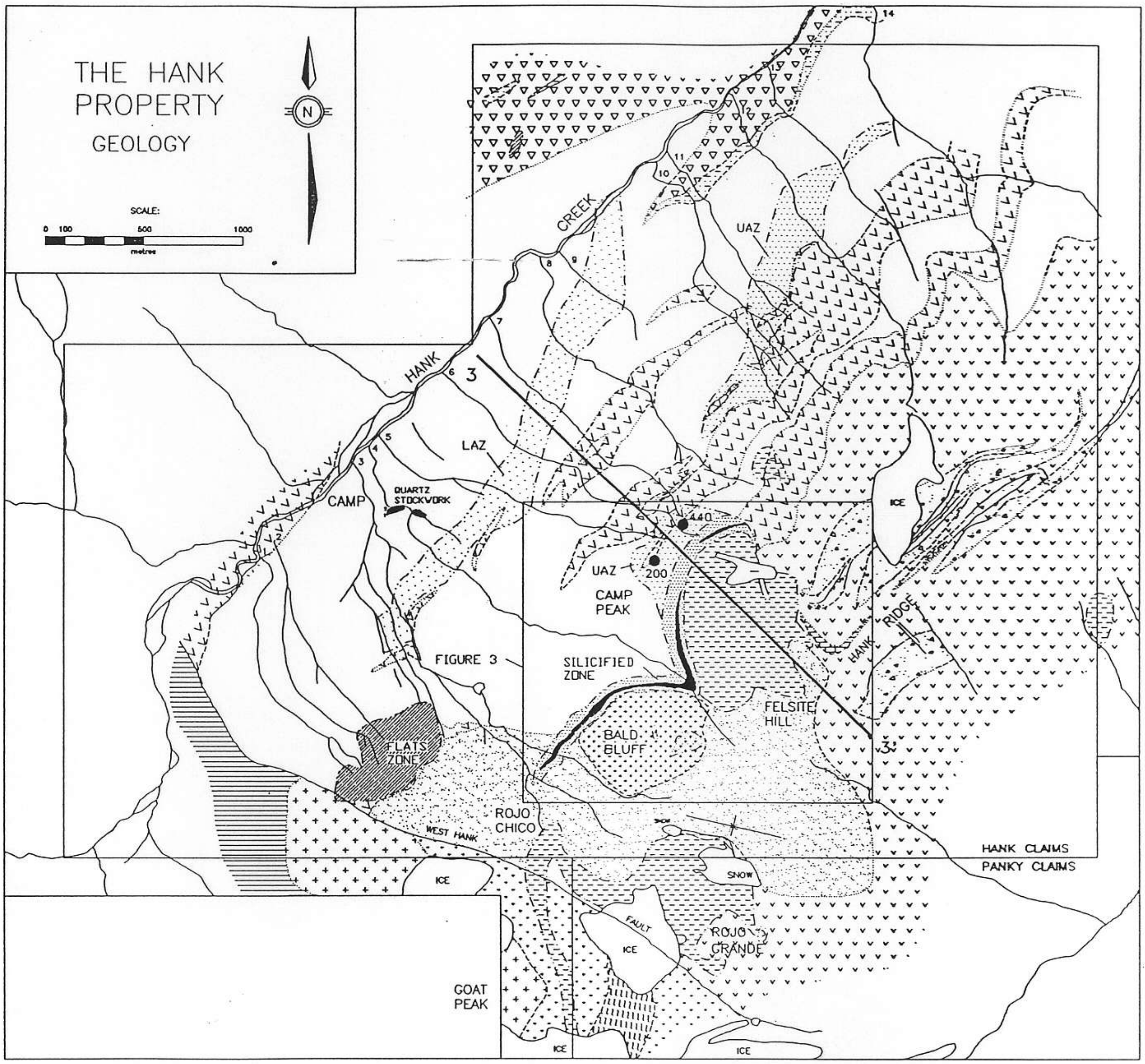

Figure 6.3: Generalized geology of the Hank prperty.

On the west side of the fault Upper Triassic Stuhini Group interlayered aphyric flows and flow-banded rhyolites are overlain by siltstone and fine-grained sandstone. Two intrusive plugs are exposed on the property, an orthoclase-megacrystic, hornblende-phyric monzonite which outlines the prominent knoll, Bald Bluff, and a medium-grained hornblende-diorite which crops out on Goat Peak. Prominent gossans on the property mark the location of argillic (Felsite Hill and Rojo Grande) and sericitic (upper and lower alteration zones) altered rocks (Plate 7.1).

Stuhini Group

Unit 1a: On the northeastern side of the West Hank fault, the most volumetrically abundant unit on the property are green, black and maroon volcaniclatic lapilli and tuff breccias (Plate 7.2). Rocks in this unit are poorly sorted and display weak normal grading from lapilli to breccia-sized fragments. Individual layers are difficult to identify, imparting an overall massive appearance to the rock. The fragments are feldspar±hornblende±pyroxene phyric, typically angular and vary in size from 2 to 50 centimetres. Feldspar laths vary from 1 to 4 millimetres and make up 20 to 35 percent (this and all subsequent mineral percentages are based on field estimates) of the fragments. Hornblende varies from 2 to 5 millimetres and pyroxene from 1 to 2 millimetres; together they comprise 15 percent of the fragments. The matrix of lapilli and tuff breccia is composed of a fine-grained mass of broken feldspar crystals and aphanitic ash.

Within this sequence isolated lenses of well-bedded ash tuff, composed of broken feldspar laths and ash are exposed in Creeks 4 and 7 and on Camp Peak and vary from 0.5 to 1 metre wide. Poorly indurated, well-bedded, maroon and green calcareous siltstones and volcanic sandstones crop out at the top of Creek 13.

Unit 1b: At the base of Creeks 8, 9 and 10 a lens of feldsparbiotite-phyric ash and lapilli tuff interfingers with Unit 1a. On the ridge to the north these tuffs are interbedded with black biotite and feldspar-phyric flows and breccias. Fragments are subrounded to rounded and vary in size from 2 to 20 centimetres. The groundmass is composed of fine-grained ash and isolated shards of volcanic glass. Flows, 20 to 30 metres thick are massive to amygdaloidal and medium-grained with euhedral 2 to 5 millimetre biotite phenocrysts.

Unit 1c: Overlying Unit 1b are black, finely laminated siltstones interbedded with grey and brown fine to medium-grained sandstones. Individual sandstone beds vary in thickness from 2 to 20 centimetres and occasional load structures indicate that beds are upright. The thickness of this unit varies along strike from 20 to greater than 50 metres.

Unit 1d: Interfingering with Unit 1a are maroon to grey, magnetic, hornblende-feldspar±pyroxene-phyric flows, sills and dykes. On the west side of the property these flows are volumetrically minor forming thin lenses which are discontinuous over 100 metres strike length. On the east side of the property, a series of flows and sills up to 70 metres thick dominates the stratigraphy. Flows and sills of unit 1d are distinguished on the basis of field relationships; flows are massive with amygdaloidal bases, best exposed in Creeks 6 and 7 whereas sills display quenched upper and lower contacts. Hornblende phenocrysts vary from 2 to 20 millimetres in size and comprise up to 15 percent of the rock. Feldspars are commonly pale green and form single crystals or radiating masses with magnetite inclusions. Pyroxene occurs as equant crystals 2 to 4 millimetres in size. The groundmass is maroon, aphanitic and contains disseminated magnetite.

Unit 2a: Overlying Unit 1, pyroxene and feldspar-phyric, dark green to grey, magnetic flows and sills are best exposed along Hank Ridge (Figure 6.3). The sills are massive and range in thickness from 20 to greater than 100 metres (Plate 7.3). Recessively weathering pyroxene crystals are equant, vary in size from 2 to 10 millimetres and comprise 10 to 30 percent of these rocks. Feldspars occur as crowded white laths up to 3 millimetres in size and forming 20 to 40 percent of the rock. The groundmass is aphanitic and contains fine-grained disseminated magnetite. Flows range in thickness from 5 to 15 metres and are bounded by volcanic deerived breccias of unit 2b. Isolated limestone clasts are observed in the flows near the top of the section on Hank Ridge.

Unit 2b: Interlayered with the dark green grey pryroxene+plagioclase flows are volcaniclastic breccias which are derived from the flows of unit 2a (Plate 7.4). The breccias are massive and poorly sorted and consist of angular to well rounded fragments up to 1.5 metres in size.

Unit 2c: A lens of partially recrystallized, bioclastic and silty limestone crops out near the top of the exposed section of Unit 2a on Hank Ridge (Figure 6.3). The limestone contains bivalve and gastropod fossil fragments in strongly bioturbated layers interbedded with well-laminated, fine-grained silty limestone (Plate 7.5). This unit is overlies tuff breccia and underlies pyroxene+feldspar-phyric flows.

Unit 3: On the west side of the West Hank fault Upper Triassic Stuhini Group well-bedded, feldspar-rich, volcanic derived sandstones, conglomerates, greywacke and thin bedded siltstones are exposed along the north flank of Goat Peak (Logan et al.., 1992). On the property, this unit is exposed west of Creek 1, and consists of brown to black, well-bedded, calcareous siltstone and fine-grained sandstones with carbonaceous plant fragments along bedding planes.

Unit 5: A Wedge of dark green to black amygdaloidal aphyric flows and flow breccias (Plate 7.6; unit 5a), interlayered with rusty, pyritic, flow-banded rhyolites (Plate 7.7; unit 5b), are exposed on the east flank of Goat Peak along the southwest side of the West Hank fault. These volcanic rocks were previously grouped with Upper Triassic sedimentary rocks of unit 3, but have now been assigned a possible Middle Jurassic age based on field observations.

Lower Jurassic

Unit 4: Unconformably overlying Unit 2 are poorly indurated, maroon and green siltstones, brown and green well-bedded sandstones, and heterolithic pebble to cobble conglomerates. Fossilized wood fragments up to 2 metres are common (Plate 7.8), and rare *Weyla* are reported (Turna, 1985). Siltstones are well laminated and individual beds vary from 0.5 to 5 metres. The sandstones are calcareous and display low-angle, cross trough bedding with pebble lags along foresets. Clasts in the conglomerates are well rounded and vary in size from 0.5 to 10 centimetres. Clasts are dominantly intraformational and derived from the underlying volcanic rocks. Distal equivalents of the coarse clastic rocks were observed on the ridge to the northwest of the Hank property and consist of well bedded siltstones with lenses of cross-bedded medium grained sandstones.

Intrusive Rocks

Unit A: An orthoclase-megacrystic, hornblende-porphyritic intrusive is exposed on Bald Bluff (Plate 7.9). The intrusive is well foliated and locally flow-banded with the strike of the foliation subparallel to the margins of the plug and dipping near vertically. A contact breccia with angular fragments of the foliated intrusive cemented by calcite, iron-bearing carbonate and grey to red silica is exposed on the margins of the intrusive (Plate 7.10). On the top of Bald Bluff the foliation flattens, and well-banded orthoclase-megacrystic intrusive rock underlies silicified breccia derived from it (Plate 7.11).

The Bald Bluff porphyry has intrusive contacts with the surrounding sediments and breccia dikes related to it intrude sedimentary rocks adjacent to the contact. Minor hornfelsing of unit 4 is observed in outcrop adjacent to the intrusion and represented by the occurrence of black, euhedral biotite and fine-grained, disseminated pyrite. A sample of the Bald Bluff intrusion collected during the 1992 field season for zircon dating yielded a preliminary age of 185±3 Ma (J.K. Mortensen, personal communication).

Unit B: A plug of relatively homogeneous, medium-grained equigranular diorite which locally contains more pegmatitic phases, crops out on Goat Peak west of the West Hank fault.

STRUCTURE

The West Hank fault was identified during mapping along the southwestern margin of the Hank property. This fault is recognized as an extension of a fault previously mapped on the ridge to the northwest (Logan *et al.*, 1992). In outcrop the fault is marked by abundant white calcite veining, brecciation and contorted bedding in sedimentary rocks adjacent to it.

Bedding in the volcanic succession on the northeast side of the West Hank fault strikes northeast and dips 20 to 40 to the southeast along Hank Ridge. On the ridge to the north, bedding strikes southwest and dips 20 to the northwest. Within Unit 2b, above Felsite Hill, bedding strikes southeast and dips 50 to the southwest. Local variations in bedding are also recorded within Unit 1b at the base of Creeks 10 and 12.

Within Unit 4 bedding is more variable due to doming, caused by the intrusion of the Bald Bluff porphyry and folding along the east side of Rojo Grande. Along the margins of the intrusion, east to northeast striking bedding steepens from 30 to 60. On the east side of Rojo Grande an asymmetric syncline trending southeast probably corresponds to one mapped by Souther (1972). Bedding on the southwest side of the West Hank fault strikes south and dips steeply to the west. Bedding in the sedimentary rocks adjacent to the fault and along Hank Creek strikes east and dips steeply south. Within the volcanic succession along the northwest side of Hank Ridge local faults have been identified in outcrop and drill core. These faults strike north-northwest and have offsets of less than 100 metres.

6.6 ALTERATION AND MINERALIZATION

Seven alteration zones were identified during mapping and examination of drill core. The use of sericite and clays are field terms only. Preliminary X-ray diffraction work has indicated that most of the sericite is illite and clays are kaolinite ± dickite.

Lower Alteration Zone

The lower alteration zone is a broad northeast-striking zone of sericite+pyrite±carbonate alteration which dips steeply to the southeast and cuts stratigraphy (Plate 7.12; Figure 6.3). Within this zone a sericite+pyrite+carbonate altered orthoclase megacrystic dyke is exposed in Creek 7 (Plate 7.13).

The intensity of alteration increases toward the lower boundary of the alteration zone from weak chlorite+pyrite+carbonate alteration to strong sericite+pyrite+carbonate alteration. The lower boundary of the alteration zone is based on a decrease in the estimated percentage of carbonate and the prominent change in the colour of the gossans in the creeks along the northeast side of Hank ridge. The upper contact of the lower alteration zone is gradational and marked by a gradual decrease in the intensity of alteration to weak chlorite+pyrite+carbonate±sericite with discontinuous pods of stronger alteration.

The northern boundary of the lower alteration zone terminates between creeks 9 and 10 along Hank Creek (Figure 6.3). Reconnaissance mapping on the ridge to the north of the property indicates that it does not extend across Hank Creek. The southwest limit of the lower zone is a fault contact with unaltered hornblende and feldspar-phyric lapilli tuff.

Altered rocks are typically pale grey in colour and very uniform. Pyrite is euhedral, 1 to 10 millimetres in size, comprises 10 to 15 percent of the rock and is commonly disseminated or concentrated within relict lapilli. Sericite is predominantly white and less commonly pale green to brown and comprises up to 80 percent of the alteration assemblage. The predominant carbonate mineral is fine-grained calcite which comprises less than 10 percent of the assemblage.

Within the lower alteration zone gold hosted in quartz-carbonate veins which also carries sphalerite+galena+pyrite±chalcopyrite and vary from 2 to 50 centimetres in width (Plate 7.14). In drill core these veins appear to be localized along dilational zones which pinch and swell, while on surface they appear to be discontinuous over tens of metres. Where zoned the veins consist of fine-grained, grey quartz on their margins and coarse-grained, white to pale pink calcite and sulphides in their cores. Angular fragments of wall rock along the margins of the veins is rare. Wallrock alteration typically increases to soft pyritic clay adjacent to the margins of the veins.

Pyrite stringers, less than 1 centimetre wide cut calcite stringers and in turn are cut by late pink to white carbonate veins up to 30 centimetres wide. Gypsum and anhydrite fill the latest set of fractures with crystal growth typically perpendicular to the fracture walls.

Quartz Stockwork

Below the lower alteration zone in Creek 4, a 10 by 150 metre zone of quartz stockwork is exposed within chlorite+iron-carbonate+pyrite altered lapilli tuff of Unit 1a. The zone appears to terminate to the east of Creek 4 and is covered by talus to the west. Both milky white quartz veins up to 2 centimetres wide and silica flooding of the rock are observed in out crop. Sheeted quartz veins in the core of the stockwork strike 170 and dip vertically.

Upper Alteration Zone

The upper alteration zone is less continuous than the lower zone and forms a series of northeasterlytrending zones from the head of Creek 4 to the west side of Creek 12 (Figure 6.3). Alteration varies from strong sericite+pyrite±carbonate to strong sericite+chlorite+pyrite+carbonate. In Creeks 10, 11 and 12 the footwall of the zone is very sharp; in drill core within the 200 and 440 pit areas this lower boundary coincides with the top of maroon hornblende±pyroxene-phyric flows. In Creek 12 the upper contact of the alteration zone coincides with the base of a thick pile of hornblende-phyric flows. This suggests that the upper alteration zone may be stratigraphically controlled.

The alteration assemblage in the upper zone comprises pale green, sericite+chlorite+pyrite+carbonate alteration with localized pods of intense pale grey, sericite+pyrite±carbonate alteration similar to the lower zone.

Disseminated pyrite varies from 10 to 15 percent, is very fine-grained (< 1 mm) and appears to be concentrate in relict lapilli. Pyrite stringers up to 1 centimetre wide cut calcite stringer veins. Disseminated carbonate varies from 5 to 15 percent of the alteration assemblage with an increase in calcite occurring along the margins of quartz-carbonate veins.

Quartz-carbonate veins carrying sphalerite-galena-pyrite±chalcopyrite, similar to those in the lower alteration zone are present but less abundant. Late, coarse-grained, milky white to pale pink, crustiform calcite±pyrite veins up to 50 centimetres in width cut these veins. Gypsum and anhydrite fill the latest set of fractures. Discontinuous zones of grey silicification are seen in core and correspond to an increase in the percentage and grain size of pyrite. These zones are usually related to an increase in the amount of veining and are up to 10 metres in width.

Between the upper alteration zone and quartz-clay-pyrite alteration on Felsite Hill there is a poorly exposed zone, up to 100 metres wide, of transitional alteration best seen in drill core within and above the 200 pit area (Figure 6.3). In drill core there is a general decrease in the degree of silicification downward from quartz+clay+pyrite alteration to friable clay+pyritequartz. Crumbly clay+pyrite±quartz grades downward into sericite+clay+pyrite+/-carbonate and into typical upper zone alteration. Within this transitional zone is an interval of diffuse silica flooding which may correspond with the position of the silicified zone described below.

Gold mineralization in the upper zone is related to an increase in pyrite veining, quartz-carbonate veining and zones of silicification which are related to northeast-striking structures which dip steeply to the southeast. These zones coincide with an increase in sericitization which imparts a friable nature to the rock.

Silicified Zone

The "silicified zone" consists of intense silicification, sometimes accompanied by disseminated pyrite, exposed at the base of Bald Bluff and extending along the western margin of Felsite Hill (Figure 6.3). Below Bald Bluff the sillcified zone appears stratigraphically controlled within sedimentary rocks of Unit 4; it strikes 100 and dips 30 to the south. It may pinch and swell along strike, as indicated by the absence of this type of alteration in drill core below Felsite Hill (Figure 6.3). The zone is bounded by a poorly exposed zone of strong sericite+clay+pyritequartz alteration of unknown width. Below Bald Bluff this zone contains cavities lined with drusy quartz and quartz veins similar to those observed in the "flats zone" described below.

Alteration in the silicified zone is composed of pale grey to dark blue-grey, very fine-grained quartz. Pyrite is present as very fine-grained disseminations within grey quartz and coarse-grained pyrite within blue-grey quartz. At least three phases of brecciation are recognized in the zone (Plate 7.17). The earliest phase is characterized by white to grey angular fragments in a grey silica matrix. The second phase is characterized by rebrecciation and partial cementation by silica. Drusy cavities occurring at the interstices between angular fragments and chalcedonic veinlets up to 2 millimetres wide are associated with this phase. The lastest phase is characterized by the brittle fracturing of silicified outcrops and the presence of barite in open cavities.

Felsite Hill

Alteration on Felsite Hill forms a broad oval zone with a north-trending long axis cutting across stratigraphic contacts (Plate 7.18; Figure 6.4). Along the margins of the zone are altered sedimentary rocks of Unit 4 and pyroxene and feldspar-phyric flows of Unit 2a. The dominant alteration on Felsite Hill is intense quartz+clay+pyrite followed by quartz+clay±pyrite and clay±quartz. A small zone of quartz+pyrite alteration similar in appearance to the silicified zone is exposed on the top of Felsite Hill.

Quartz+clay+pyrite alteration is texturally destructive with relict feldspar and fragment outlines present only on weathered surfaces. Near the margins of quartz+clay+pyrite alteration, the intensity of silicification decreases and clay-altered feldspars (Plate 7.19), and fragments are visible. Texturally this alteration type is composed of fine-grained blue to grey silica, grey to white clay and up to 15 percent very fine-grained disseminated pyrite. Hydrothermal breccia pipes are rare. Where present the hydrothermal breccias contain fragments of quart+clay and quartz+clay+pyrite altered fragments within a matrix of fine-grained quartz+clay+pyrite (Plate 7.20).

A small pod of clay quartz-altered, fine-grained sediments with carbonaceous partings is exposed within quartz+clay+pyrite alteration on the west side of Felsite Hill. This alteration varies from clay+/-quartz which appears more granular than the typical soft amorphous clay described below.

Quartz+clay±pyrite alteration varies from texturally destructive vuggy, quartz+clay alteration to less intense alteration with relict primary textures and isolated pods of fine-grained pyrite. In the former, intensely altered roek, fine-grained white to buff quartz makes up to 70 percent of the rock with small cavities throughout the rock. These cavities contained clay which has since been leached out. Where textures are more visible there is an increase in clay+pyrite alteration. Pyrite occurs as fine-grained euhedral grains in localized disseminations of up to 15 percent pyrite. Small pods of chalcedonic grey silica and white amorphous clay veinlets have been identified in outcrop.

Clay+/-quartz alteration varies dramatically in intensity along the southern margin of alteration on Felsite Hill (Figure 6.4). In this region clay±quartz alteration preserves primary sedimentary textures in the maroon siltstones and conglomerates. Clay varies from white to maroon in colour and occurs initially as soft amorphous clay alteration of the matrix (Plate 7.21). With an increase in alteration intensity, clasts in the conglomerates are altered to fine-grained clay similar to the matrix.

Patchy zones of moderate quartz+clay+pyrite±sericite alteration with textural similarities to alteration on Felsite Hill and in the upper alteration zone are exposed on the top of Bald Bluff.

Rojo Grande

Alteration on Rojo Grande forms a more irregular zone than on Felsite Hill, extending from Rojo Chico eastward to Rojo Grande and southward onto Goat Peak (Plate 7.22; Figure 6.5). The style of alteration is similar to alteration on Felsite Hill with quartz+clay+pyrite the dominant assemblage, followed by quartz+clay±pyrite and minor clay±quartz. On Rojo Grande zones of intense quartz±pyrite alteration are more abundant and occur as north-striking linear zones.

Where alteration is less intense on Rojo Grande, primary textures are more visible. On the northeast flank of Rojo Grande fine-grained siltstones of Unit 4 are altered quartz+clay+pyrite (Plate 7.23). In contrast, vuggy quartz+clay altered rocks indicated that zones of extreme acid leaching by condensing hypogene vapour were present.

Rojo Chico is situated to the west of Rojo Grande and is altered to quartz+clay±pyrite (Figure 6.5). Altered rocks are typically massive and granular in appearance with fine-grained, blue-grey quartz, disseminated pyrite and white clay.silica and white amorphous clay veinlets have been identified in outcrop.

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Along the east-northeast side of Goat Peak a prominent zone of quartz+clay+pyrite alteration appears to strike towards Rojo Chico. This linear zone cuts across the West Hank fault along the base of Goat Peak with no observable offset. Along the ridge line, a quartz+clay+pyrite assemblage alters aphyric amygdaloidal flows of Unit 5a. This zone includes linear bands of unaltered flows striking 170^{o} and dipping vertically (Figure 6.5).

Quartz+clay altered rocks occur along the base of Goat Peak adjacent to the fault. Within this zone, white amorphous clay pods and veins up to 2 centimetres wide are observed adjacent to a zone of hydrothermal brecciation measuring 1.0 by 4.0 metres (Plate 7.24). The clasts in this breccia are altered to quartz and

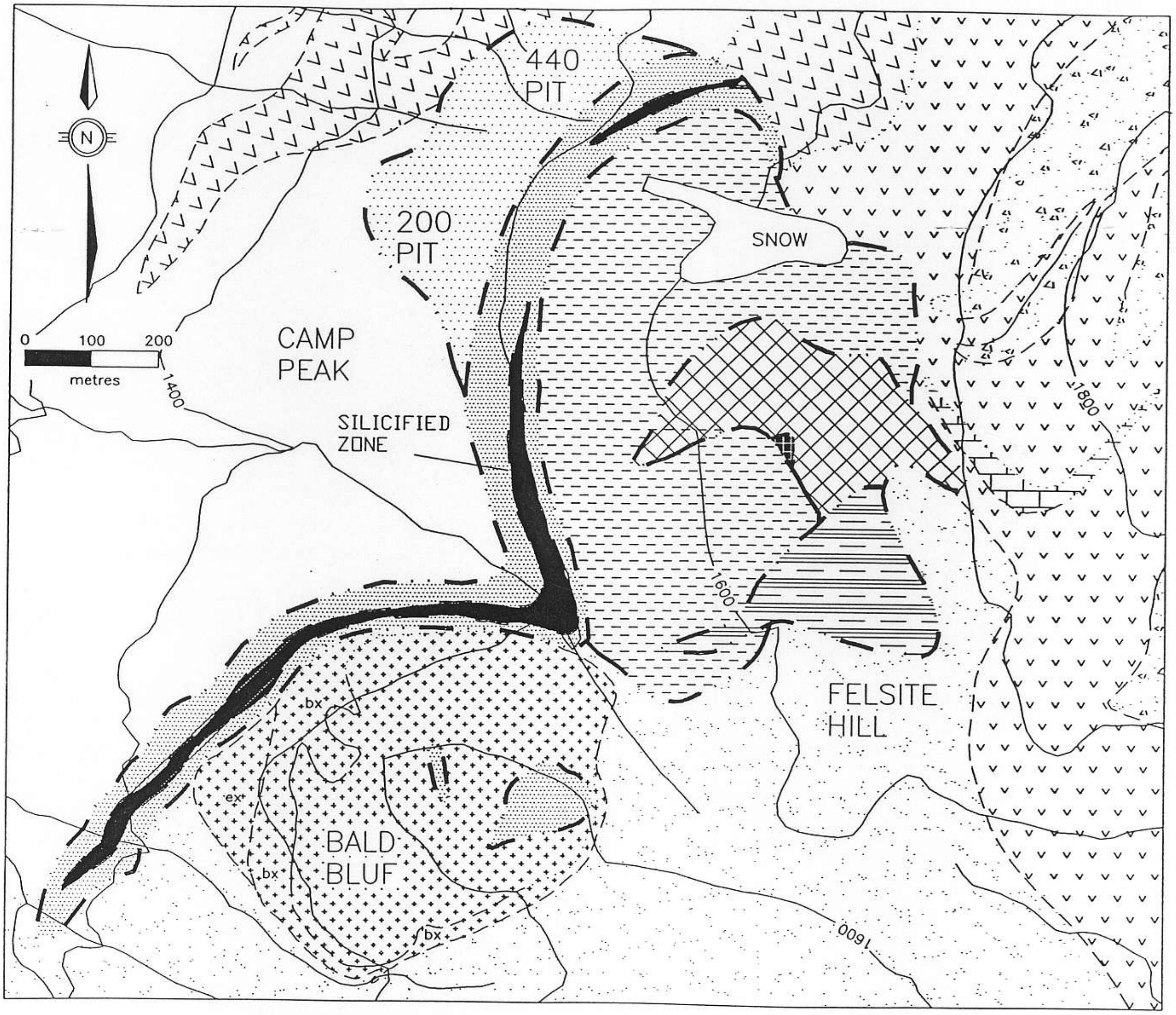

Figure 6.4 **Distribution of alteration assemblages on Felsite Hill.**

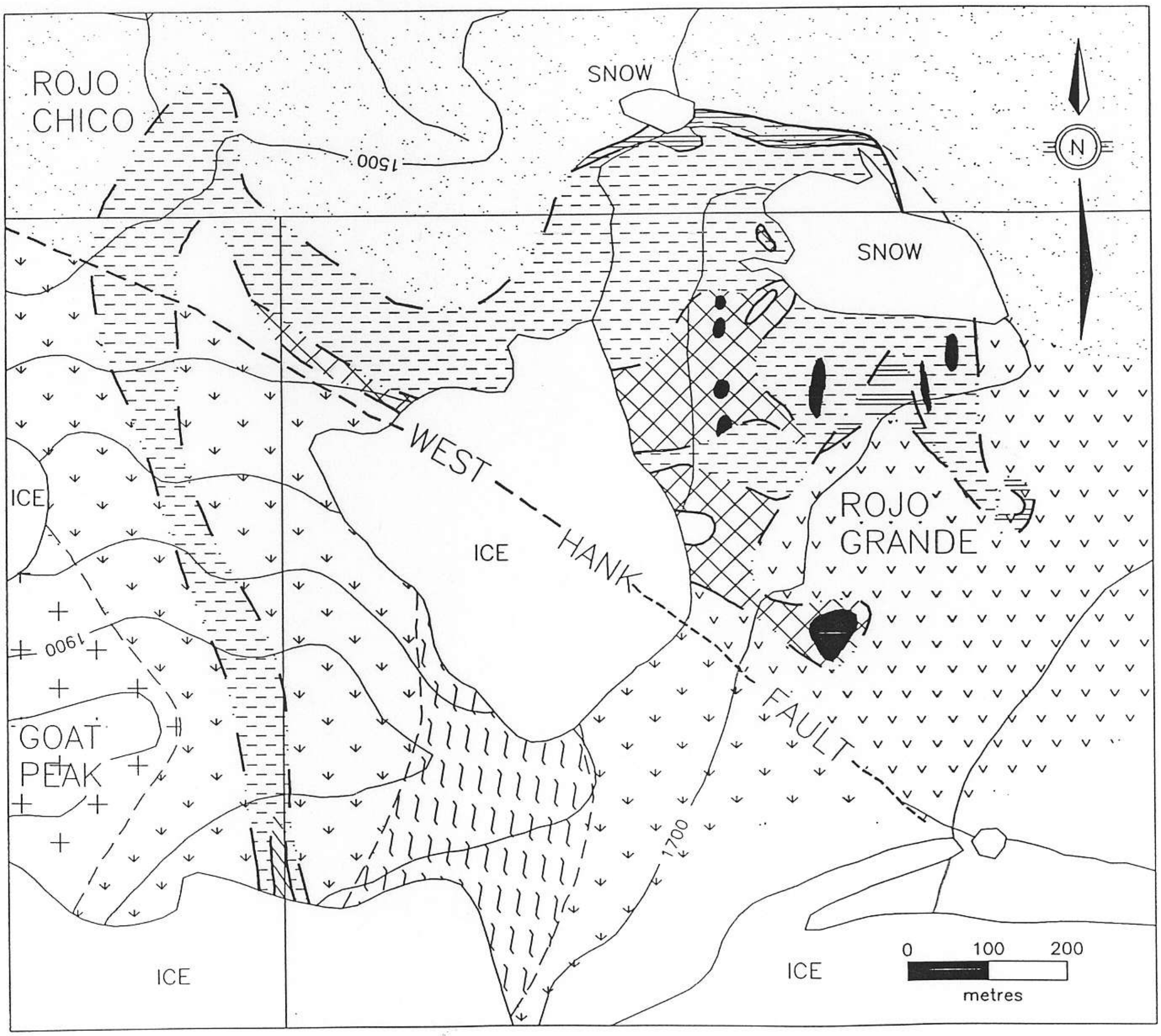

Figure 6.5: Distribution of alteration assemblages on Rojo Grande, Rojo Chico and Goat Peak.

clay and cemented by fine-grained grey quartz. A vein of light brown sugary crystals 1.0 centimetre wide also occurs adjacent to the breccia (Plate 7.25). X-ray diffraction of this material has identified it as a combination of natroalunite and dickite.

Flats Zone

A poorly exposed zone of quartz+sericite+pyrite alteration hosting pods of clay+pyritequartz alteration is exposed at the top of Creeks 1 to 3 (Figure 6.3). Alteration in the flats zone is composed of pale grey, fine-grained, sericite+quartz+pyrite alteration with milky white, druzy quartz cavities and crustiform veining up to 3 centimetres wide (Plate 7.26). Fine-grained disseminated pyrite comprises 5 to 20 percent of the rock. Clay+pyritequartz alteration is seen in small outcrops of friable white to grey rock with very fine-grained disseminated pyrite. Within this zone are discontinuous pods of grey silica which are recognized by an increase in the competence of the rock. These pods of clay+pyritequartz are surrounded by a broad zone of yellow and white, clayey soil.

In drill hole 87-7, collared in this zone, quartz+potassium-feldspar-pyrite alteration has been confirmed at a depth of 46.5 metres by X-ray diffraction. This alteration assemblage occurs as more competent intervals within friable quartz-sericite-pyrite alteration.

6.7 DISCUSSION

The Hank property is underlain by Upper Triassic Stuhini Group andesitic to basaltic flows, pyroclastic rocks, volcanic-derived sediments and minor limestone, overlain unconformably by poorly indurated, well-bedded sediments of Jurassic age. These rocks have been intruded by the Bald Bluff orthoclase-megacrystic porphyry and a diorite intrusion. Three main alteration assemblages have been identified, possibly representative of a low-sulphidation epithermal system. They include; the sericite+pyrite+carbonate assemblage of the upper and lower alteration zones, where gold is concentrated in narrow quartz-carbonate veins in the lower parts of the system, and is related to zones of pyrite veining, quartz+carbonate veining and silicification in the upper parts of the system; pervasive multiphase silicification within a transitional zone of decreasing carbonate+sericite and increasing quartz+clay alteration and; variable quartz±clay±pyrite alteration of the broad Felsite, Rojo Chico and Rojo Grande zone, where gold mineralization is restricted to quartz-clay zones. This alteration may represent the upper levels of an epithermal system where steam heated acid sulfate fluids condensed above the paleo-water table which coincided with the present trace of the silicified zone. Weak quartz+clay+pyrite±sericite alteration within the Bald Bluff porphyry suggests that it intruded during the final phases of the mineralizing event. The genetic relationship between alteration on the Hank property and the orthoclase megacrystic intrusion is supported by the altered orthoclase phyric dyke in Creek 7.

Figure 6.6, located on Figure 6.3 shows the approximate orientation of the lower alteration zone and alteration on and below Felsite Hill. The lower alteration zone is interpreted from drill core data to dip steeply to the southeast whereas the upper alteration zone is interpreted to dip beneath the argillic alteration on Felsite Hill. On Felsite Hill is interpreted to decrease in intensity and thickness to the southeast from quartz+clay+pyrite to clay±quartz alteration. The silicified zone is not exposed in this section, but would lie within transitional alteration between sericitic alteration in the upper zone and argillic alteration cn Fclsite Hill. Future geochronometry, petrology, X-ray diffraction and whole-rock geochemistry work will help to constrain these temporal relations.

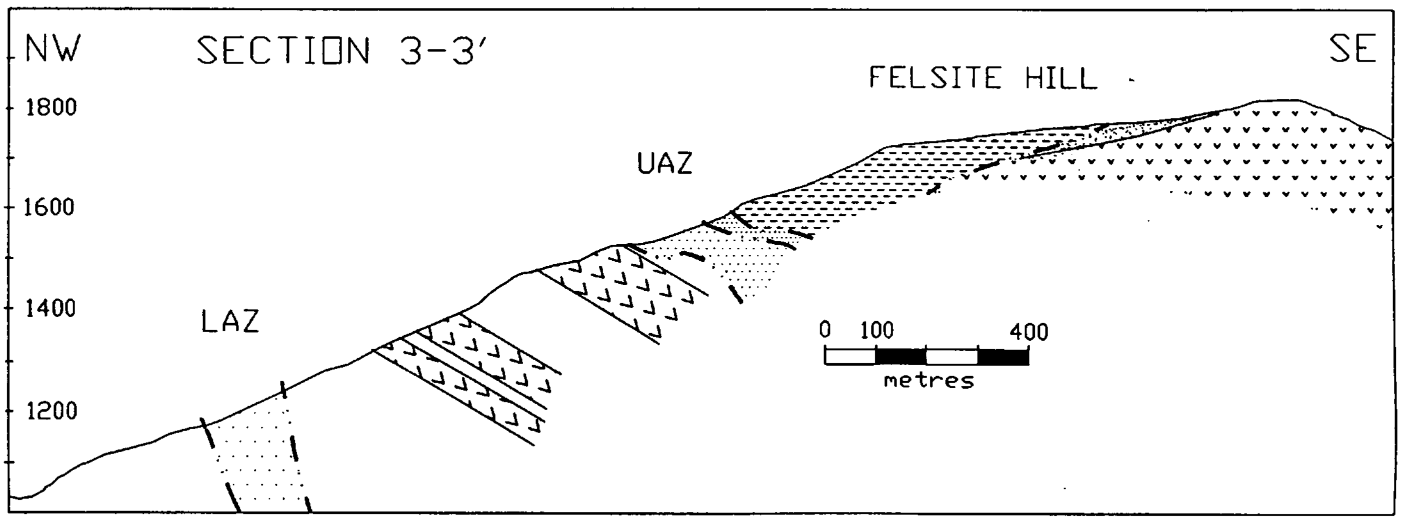

Figure 6.6: Cross Section A-A'; location shown on Figure 6.3

6.8 SUMMARY AND FUTURE WORK

1. At present the stratigraphy underlying the Hank property is believed to be predominately Upper Triassic Stuhini Group (Units 1 to 3) which are unconformably overlain by Lower Jurassic sedimentary rocks (Unit 4). On the west side of the West Hank fault the vesicular basalts and flow-banded rhyolite (Unit 3), have tentatively been grouped along with the sediments into the Upper Triassic.

2. Bald Bluff, the orthoclase megacrystic porphyry is thought to be related to mineralization at the Hank property. This is supported by the presence of a sericite+carbonate+pyrite altered dyke of orthoclase porphyry within the lower alteration zone, zones of sericite+carbonate+pyrite±clay alteraton within the intrusion, and the spatial location of the Bald Bluff, i.e. surrounded by zones of agillic alteration on Felsite Hill and Rojo Grande.

3. A sample of the Bald Bluff intrusion was submitted for U-Pb zircon geochronometry, preliminary results give an age of 185.2 (+ 4.5/- 1.2) Ma (J. Mortensen, Personal Communication, July 1992; N.B. same age - within error limits - as Eskay Porphyry and flow dome at Brucejack Lake - refer to previous Iskut Project Annual reports). In addition, samples of the silty limestone in unit 3 have been submitted in an attempt to define the age of stratigraphy.

4. Alteration on the Hank property is thought to be characteristic of a low-sulphidation epithermal environment characterized by argillic alteration on Felsite Hill and Rojo Grande overlying zones of sericite+pyrite±carbonate alteration within the upper and lower alteration zones. Research during 1993-94 will concentrate on characterizing the alteration and associated base and precious mineralization on the Hank Property in an effort to develop a model for the hydrothermal system on the property.

5. Work during the 1993 field season will involve the collection of samples for a geochemical analysis of the alteration on the Hank property as well as the continued mapping of the property and surrounding area. Critical information will also be obtained from the proposed Homestake drilling program on Felsite Hill. With the information obtained from the drill program the style of alteration at depth willbe better constrained, thereby adding important information in the development of a metallogenetic model for the Hank property.

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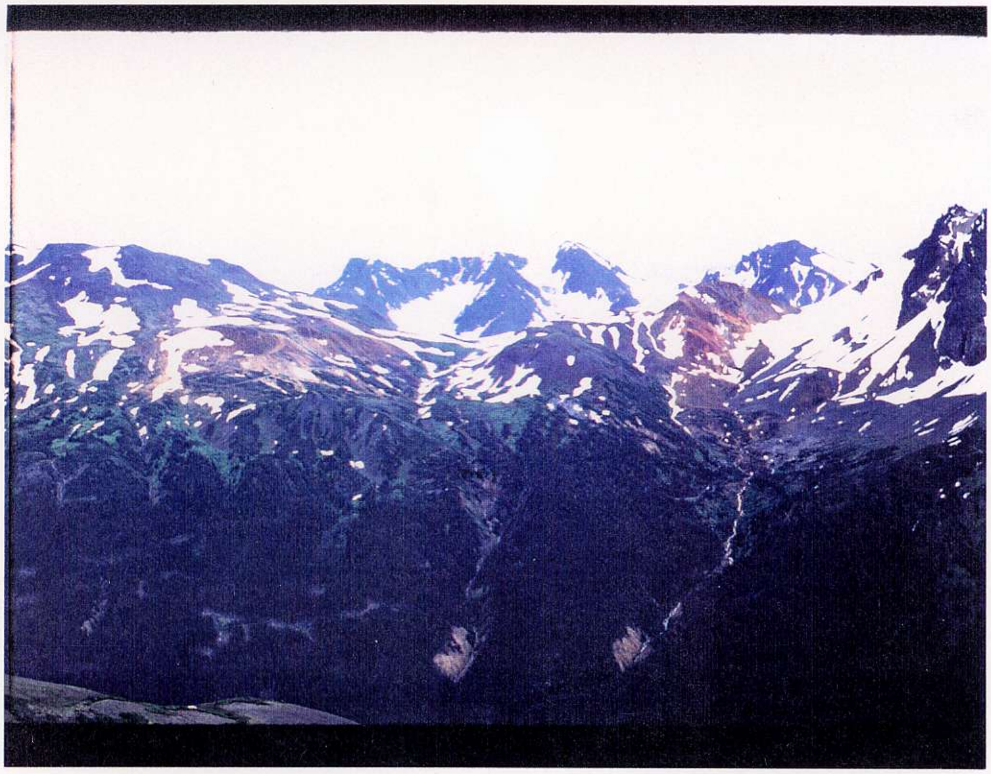

Plate 7.1 View to the southeast of Hank Ridge showing the prominent gossans on the property. Felsite Hill (left) and Rojo Grande (right) are observed on the top of Hank Ridge above the Lower alteration zone (near the base of Hank Ridge).

Plate 7.2 Unaltered green blocky feldspar±hornblende±pyroxene tuff of unit 1a in creek 12.

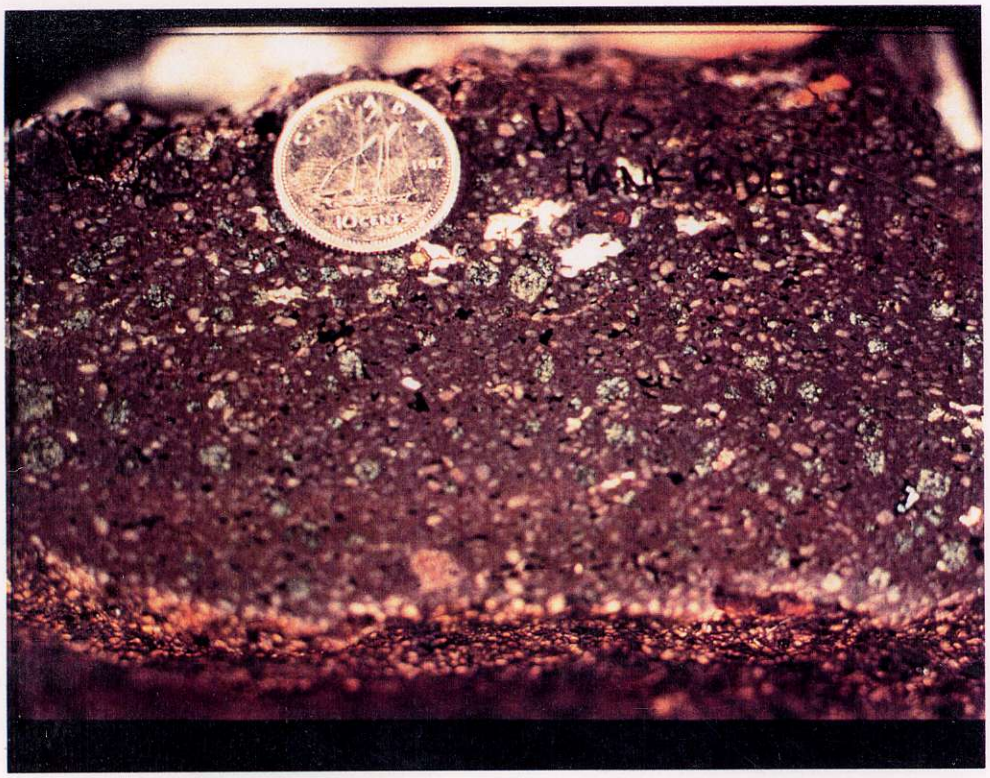

Plate 7.3 Dark green to maroon pyroxene+feldspar phyric flows of unit 2a.

Plate 7.4 Pyroxene+feldspar tuff breccia of unit 2b.

Plate 7.5 Silty limestone of unit 2c exposed at the top of the observed section on the Hank property. The limestone forms discontinuous lenses overlying and as fragments within flows of unit 2a, and within the tuff breccias of unit 2b.

Plate 7.6 Amygdaloidal, pryroxene-phyric flows, unit 5a, which flank the east side of Goat Peak, west of the West Hank Fault. Amygdules have chloritic rims and are filled with pyrite.

Plate 7.7 Flow-banded rhyolite, unit 5b, interlayered with amygdaloidal, pyroxene-phyric flows of unit 5a.

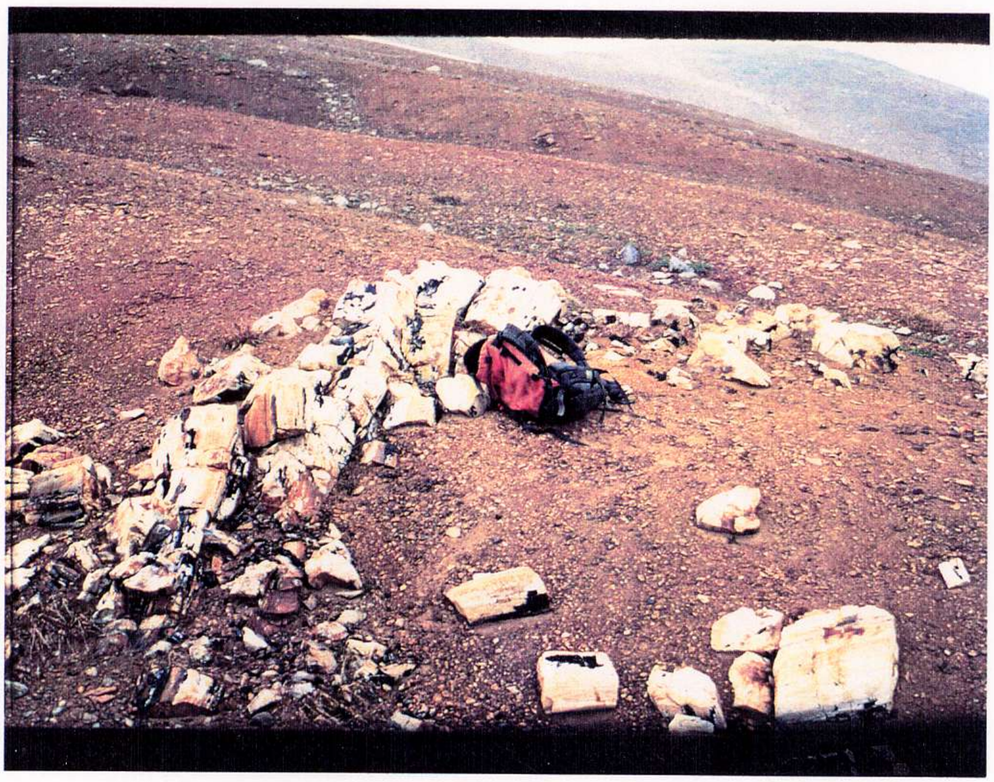

Plate 7.8 Silica replaced wood pieces lying on and within the Lower Jurassic sediments of unit 4.

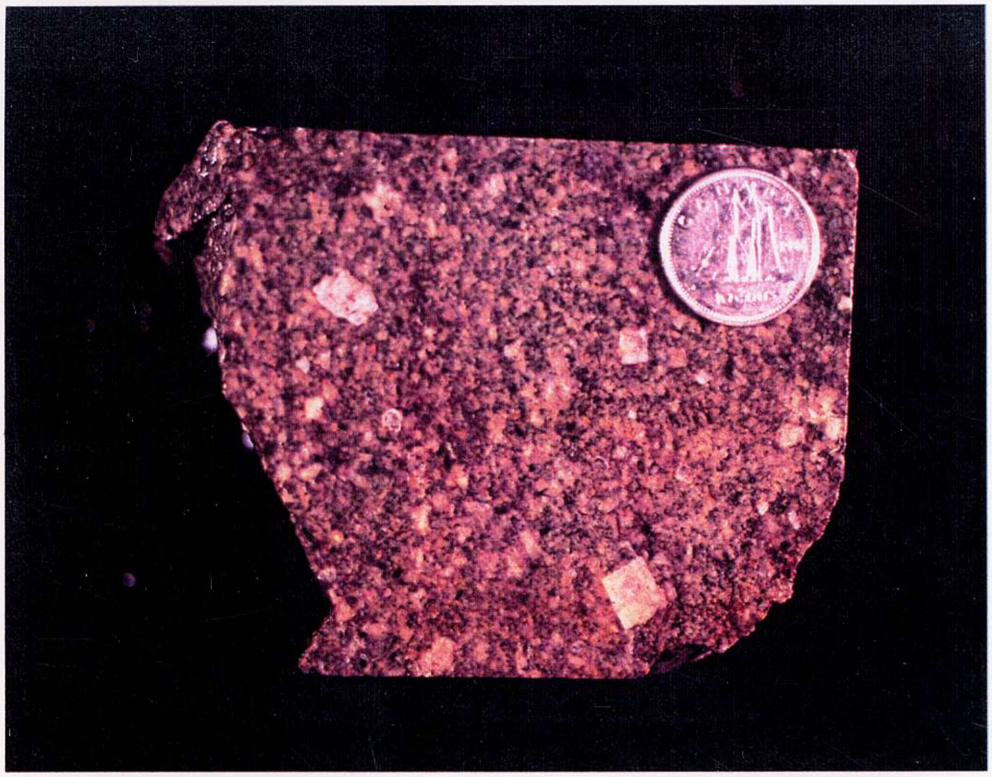

Plate 7.9 Unit A, orthoclase megacrystic porphyry (U-Pb = 185±3 Ma.) which forms the prominent knoll Bald Bluff.

Plate 7.10 Contact-breccia of orthoclase megacrystic porphyry is exposed along the margins of the Bald Bluff intrusion. Hematitic silica, iron-carbonate and white carbonate fill the intersticies of the breccia.

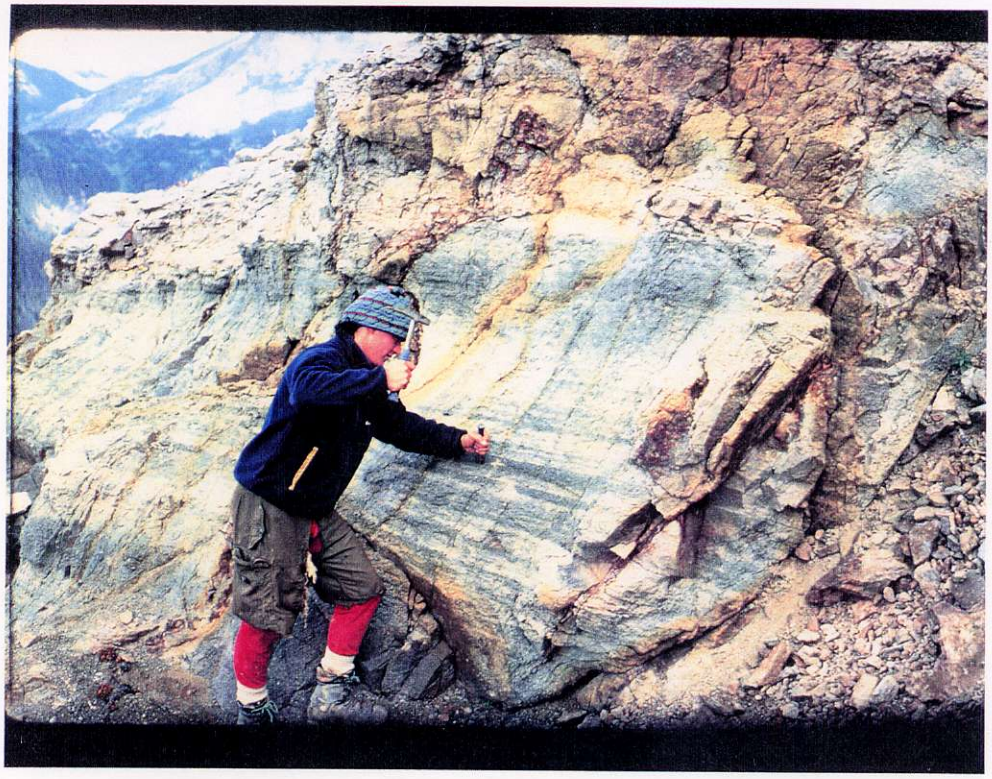

Plate 7.11 Horizontal layering within the orthoclase megacrystic porphyry. Layering is located near the top of Bald Bluff.

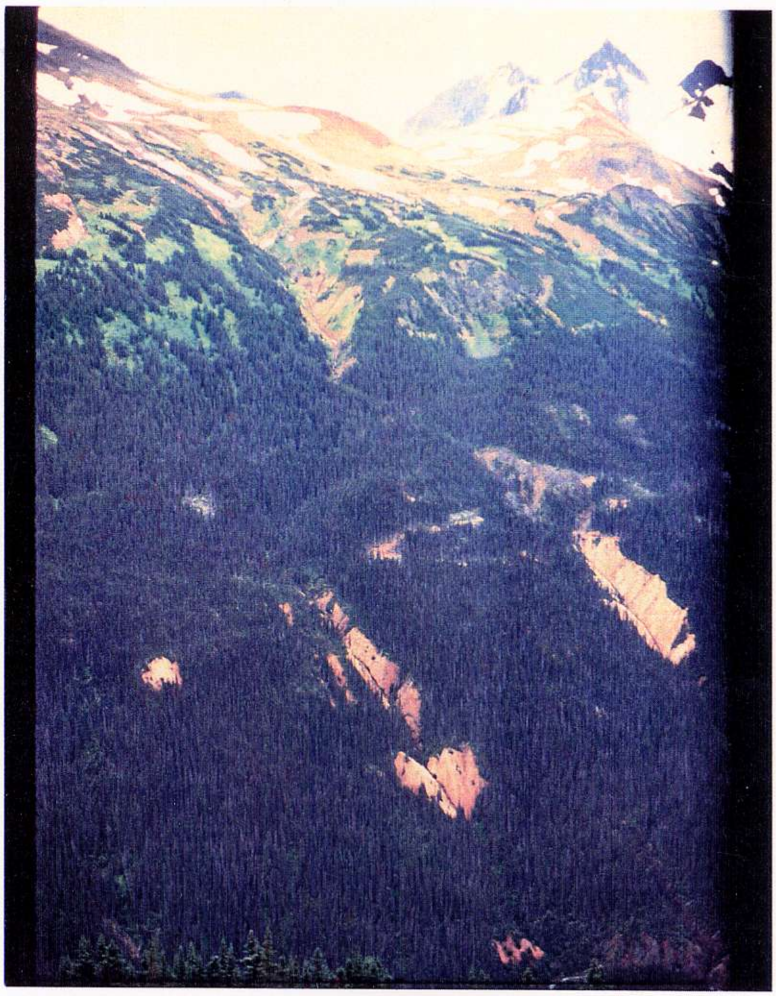

Plate 7.12 View to the south of gossanous creeks which mark the trace of the Lower alteration zone.

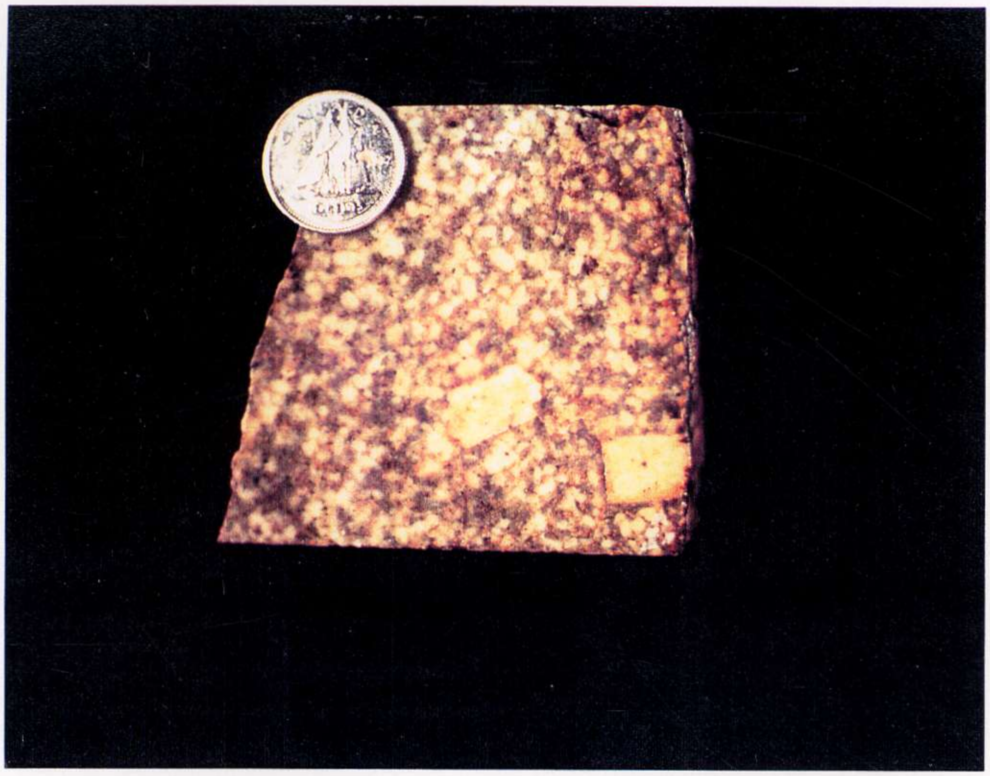

Plate 7.13 Pyrite+sericite±carbonate altered orthoclase megacrystic dyke exposed within the Lower alteration zone in Creek 7.

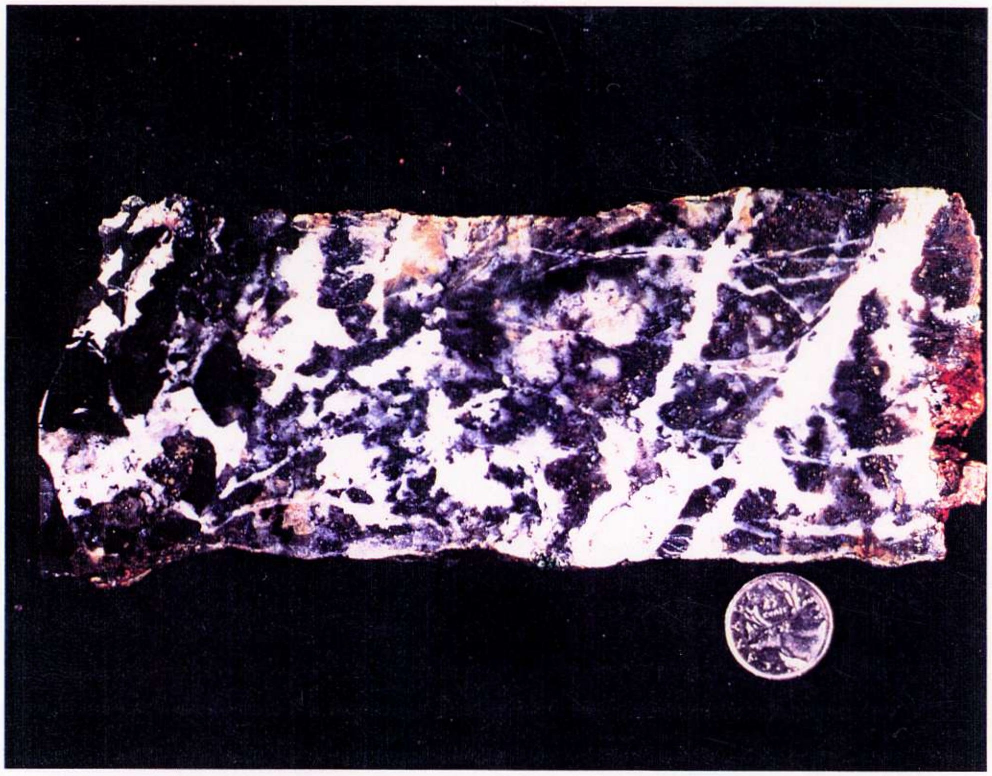

Plate 7.14 Quartz-carbonate vien which hosts sphalerite, galena and minor chalcopyrite within the Lower alteration zone in Creek 3. Angular fragments of black silstone are located along the margin of the vein.

Plate 7.17 Silicified breccia cemented by chalcedonic blue-grey silica. Barite filled drusy cavities are observed between breccia fragments.

Plate 7.18 View to the northeast of Felsite Hill. Rusty coloured outcrops are composed of quartz+clay+pyrite altered volcanic rocks, and overlying sediments of unit 4. The pale coloured alteration is composed of quartz+clay±pyrite altered rocks.

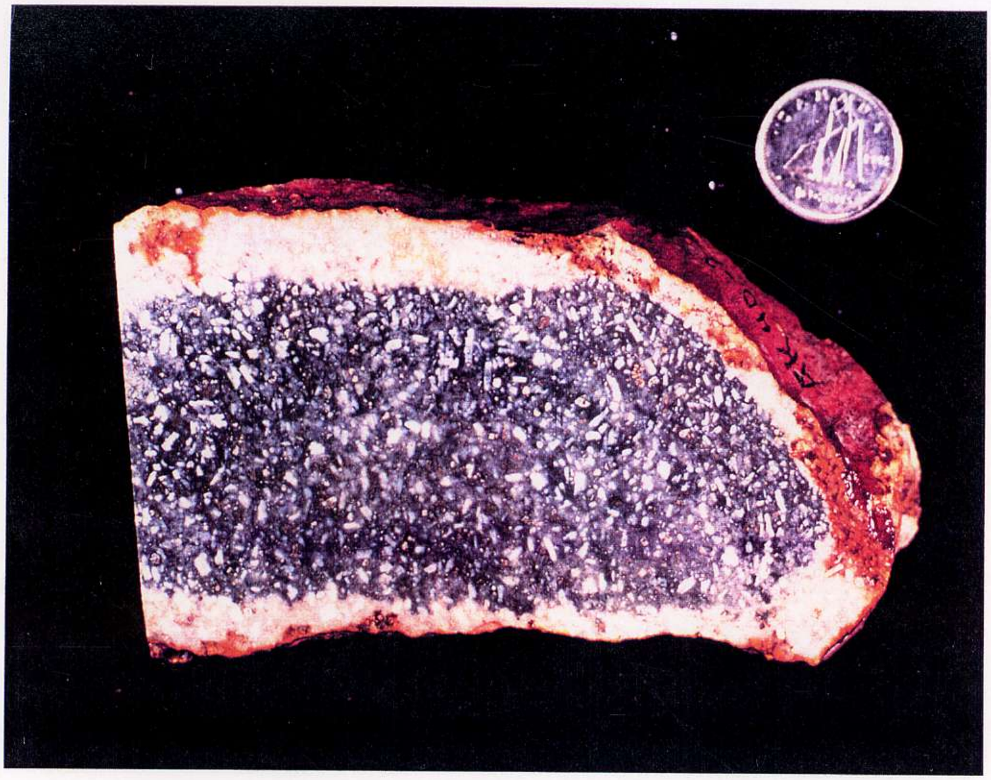

Plate 7.19 Intensely altered felspar+hornblende-phyric volcanic rocks of the of unit 1d. Feldspar laths are altered to white kaolinite within a matrix of quartz+clay+pyrite.

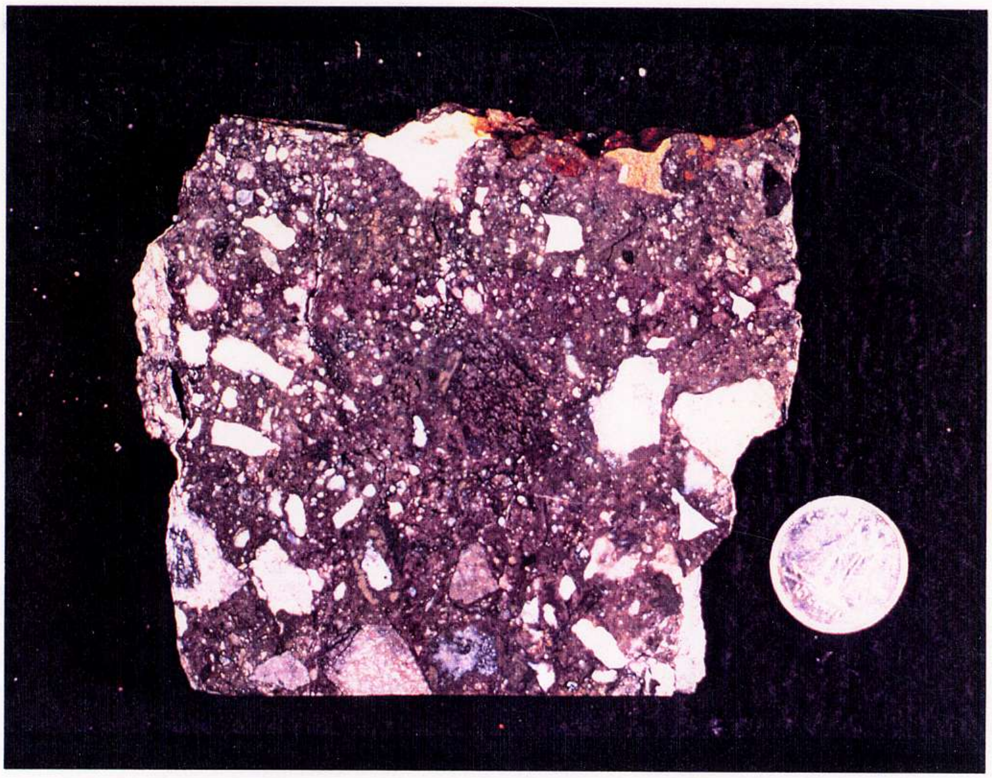

Plate 7.20 Hydrothermal breccia composed of quartz+clay+pyrite and quartz+clay altered fragments within a matrix of quartz+clay+pyrite.

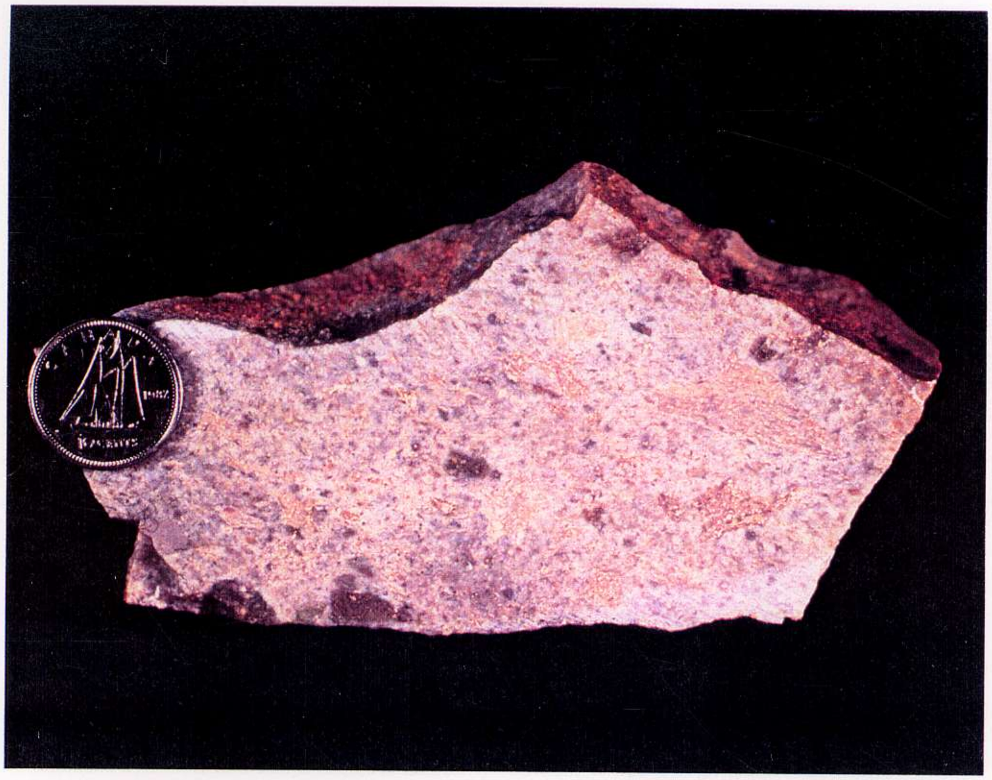

Plate 7.21 Pale green to white clay±quartz altered sedimentary rocks of unit 4.

Plate 7.22 View to the southeast of the Rojo Grande alteration zone.

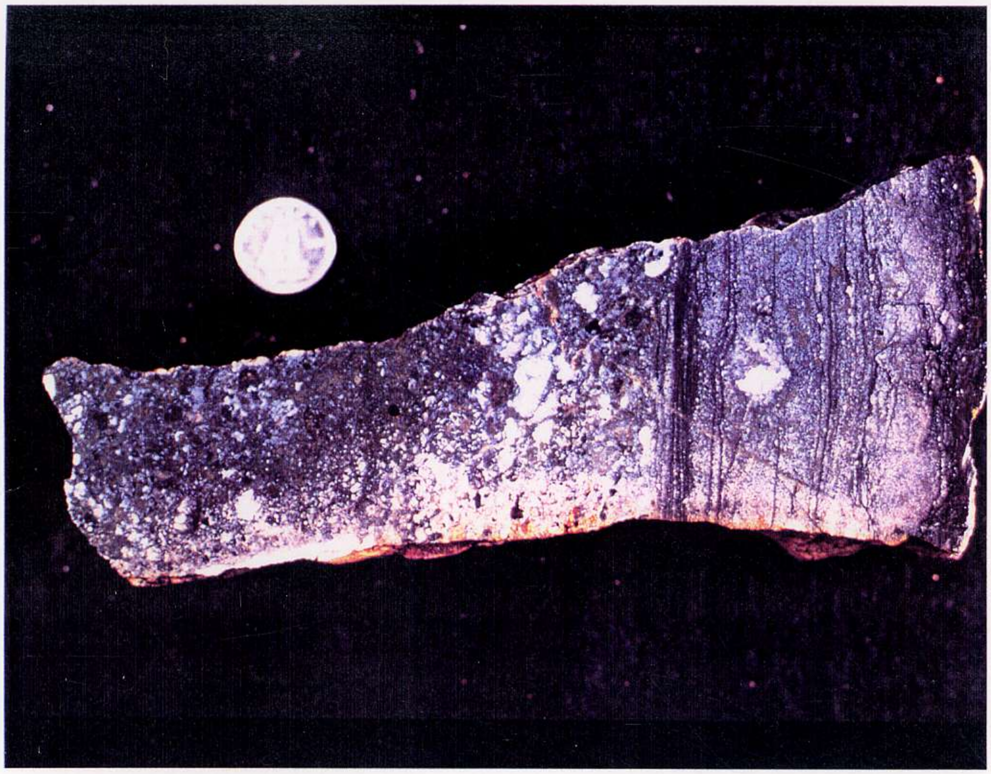

Plate 7.23 Quartz+clay+pyrite altered well-bedded siltstones from Rojo Grande.

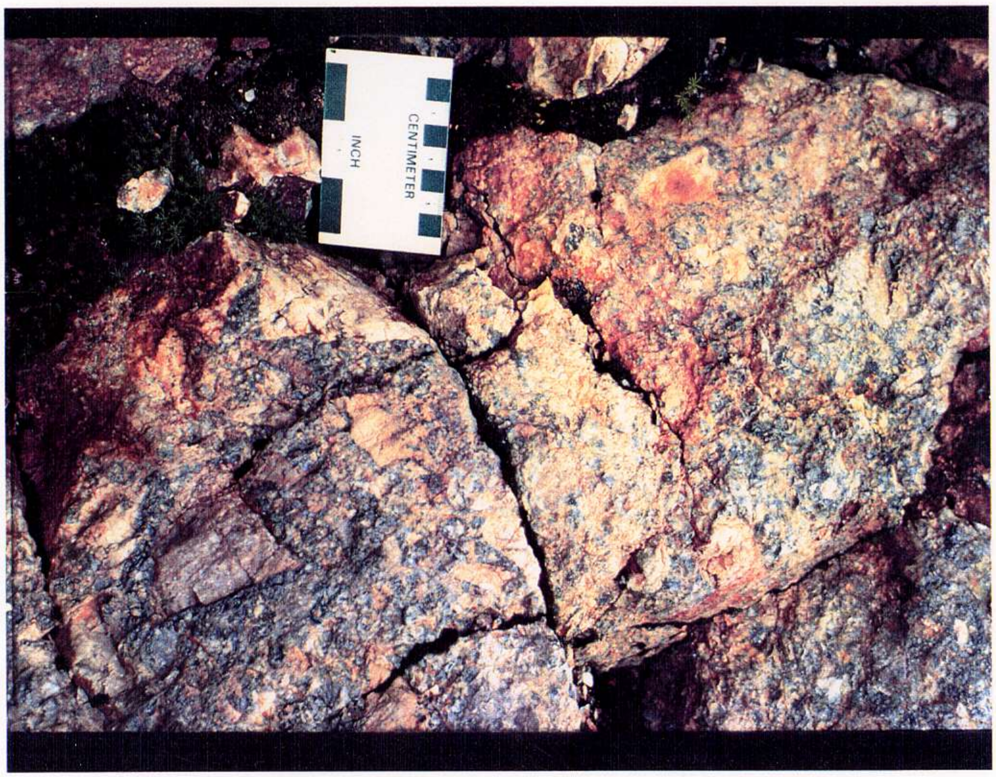

Plate 7.24 Hydrothermal breccia within quartz+clay altered rocks.

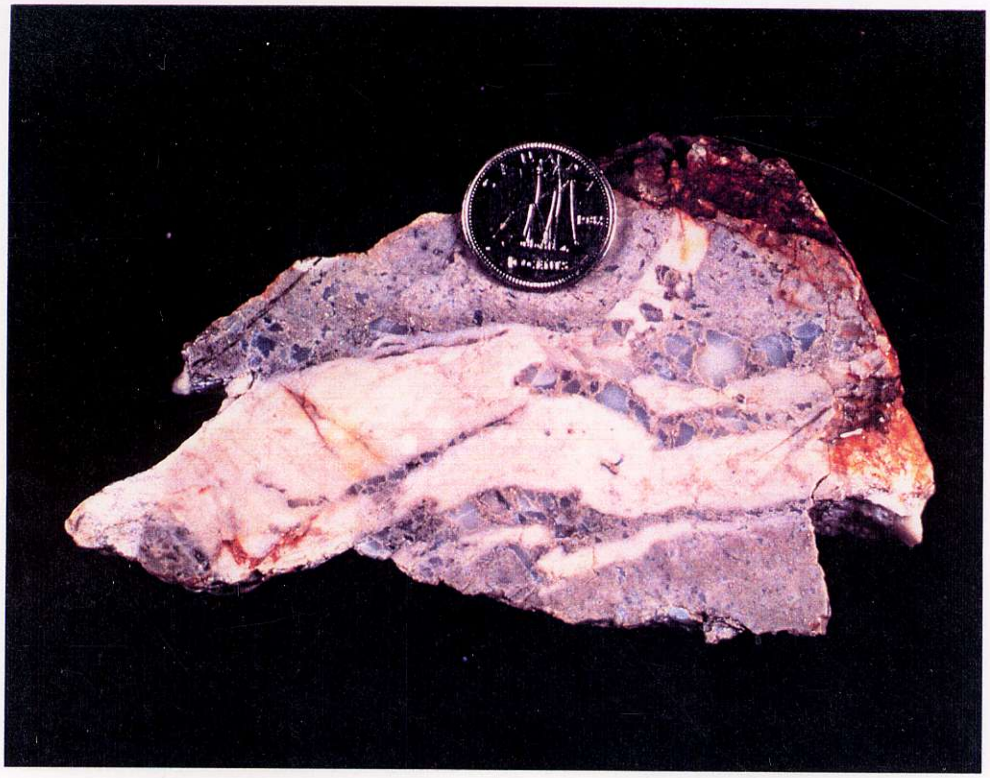

Plate 7.25 Veinlet of kaolinite+alunite within clay±quartz altered rocks.

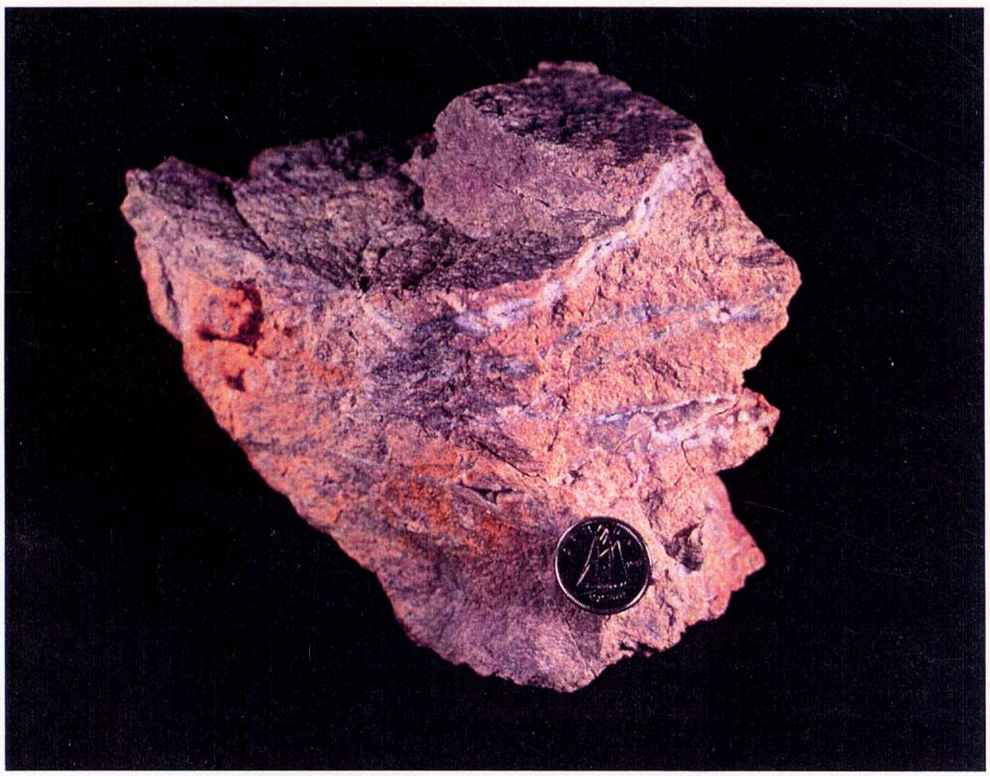

Plate 7.26 Quartz+sericite+pyrite alteration from the Flats zone.

GOLOGY AND ALTERATION ZONATION OF THE HANK PROPERTY, NORTHWESTERN BRITISH COLUMBIA (104G/1,2)

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and
David Gaunt, Homestake Canada Ltd.

DRAFT

Keywords: Economic geology, Stuhini Group, epithermal, alteration, gold, Middle Jurassic megacrystic porphyry.

INTRODUCTION

The Hank property is situated in northwestern British Columbia 20 kilometres northwest of Bob Quinn Lake (Figure 1).

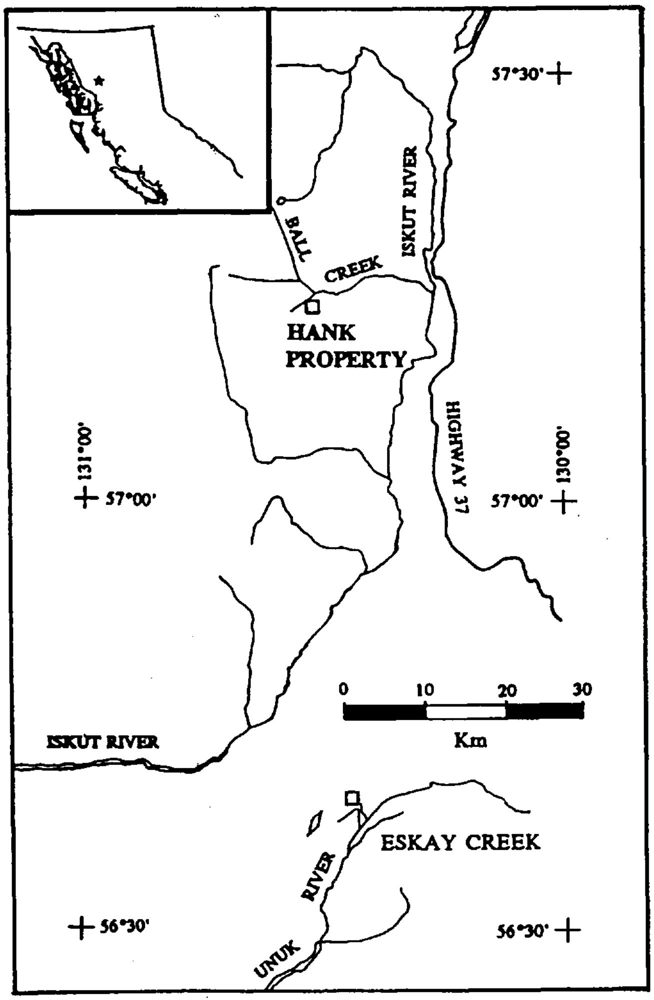


Figure 1. Location of the Hank property adapted form Anderson and Thorkelson (1990).

Access to the property is by helicopter from Bob Quinn Lake; the claims are served by a network of cat trails developed by Lac Minerals Ltd. between 1985 and 1989.

Fieldwork concentrated on relogging of core in the Lower and Upper alteration zones and logging of core from the Homestake Canada Ltd. 1993 diamond drilling program on Felsite Hill. The emphasis of fieldwork was to document the vertical changes in alteration from the Lower alteration zone to Felsite Hill, to identify the lateral extent of the silicified zone beneath Felsite Hill, and to identify those features which characterize hydrothermal alteration on the Hank property as a low sulfidation epithermal environment. Continued research at the University of British Columbia will comprise part of a Msc. Thesis supervised by Dr. A.J. Sinclair and Dr. J.F.H. Thompson.

EXPLORATION HISTORY

The Hank property comprises two groups of claims, the Hank claims, owned by Lac Minerals Ltd., which cover the majority of the hydrothermal alteration on the property, and the Panky claims, owned by Cominco Ltd., which lie to the east and south.

The Hank property was initially staked by Lac Minerals Ltd. in 1983. During 1984 to 1985 and 1987 to 1989 Lac Minerals Ltd. completed geologic mapping, geochemical surveys, trenching, geophysical surveys, and diamond drilling totaling 11604 metres in 88 holes in the Upper, Lower and Flats alteration zones. Drilling outlined geological reserves of 245 000 tonnes with an average grade of 4.0 grams per tonne gold and 218 000 tonnes with an average grade of 2.0 grams per tonne in the 200 and 440 pit areas of the upper alteration zone respectively (Figure 2).

Carmac Resources Ltd. (now Camnor Resources Ltd.). optioned the Hank claims in 1990 and drilled five holes totalling 1090.5 metres in the Upper and Lower zones, then terminated the option.

Homestake Canada Ltd. optioned the Hank and Panky claims in 1992 and completed a program of soil and rock sampling, an induced polarization survey and detailed geological mapping, concentrating on the Felsite Hill and Rojo Grande alteration zones (Figure 2, Kaip

LEGEND (For Figures 2 through 5)

STRATIGRAPHY

	East of the West Hank Fault	West of the West Hank Fault
Middle Jurassic		5a Dark green amygdaloidal aphyric flows and flow breccias 5b Rusty, pyritic, flow banded rhyolite
Lower Jurassic	4 Undivided siltstone, well bedded sandstone and heterolithic conglomerate	
	Unconformity	
Upper Triassic Stuhini Group	2c Bioclastic and silty limestone 2b Andesitic, pyroxene+feldspar phyric volcaniclastic breccia 2a Andesitic to basaltic, magnetic, pyroxene+feldspar phyric flows 1d Maroon, magnetic, hornblende feldspar+/− pyroxene flows, sills and dikes 1c Interbedded siltstone and well bedded sandstone 1b Feldspar+/−biotite phyric ash tuffs and biotite phyric flows and breccias 1a Undivided green to maroon feldspar+/−hornblende+/− pyroxene volcaniclastic tuffs and breccias	3 Well−bedded, feldspar−rich, volcanic derivrd sandstones, conglomerates, greywacke and siltstones

INTRUSIONS

A Bald Bluff Porphyry: Orthoclase megacrystic hornblende phyric monzonite, bx=breccia, ex=possible extrusive equivalent of the Bald Bluff porphyry

B Medium grained hornblende diorite

ALTERATION

- Clay+/−quartz
- Quartz+/−pyrite
- Quartz+clay+/−pyrite
- Quartz+clay+pyrite
- Clay+pyrite+carbonate+/−quartz with carbonate stockwork
- Sericite+pyrite+/−chlorite+/− clay +/−carbonate
- Sericite+pyrite+/−carbonate
- Quartz+sericite+pyrite+/−clay

SYMBOLS

- Geologic contact (defined, assumed, infered)
- Fault
- Alteration contact

and Macpherson, 1993). In 1993 Homestake Ltd. drilled five diamond drill holes for a total of 657 metres targeting geochemical, and geophysical anomalies in the Flats zone and Felsite Hill alteration zones.

REGIONAL GEOLOGY

The Hank property lies within the Stikine Terrane along the western margin of the Intermontane Belt and the eastern margin of the Skeena fold belt. Regional mapping in the area (Logan *et al.*, 1992; Evenchick, 1991; Anderson and Thorkelson, 1990; Souther, 1972) has defined the following major units: Paleozoic volcanic and sedimentary rocks of the Stikine assemblage; Mesozoic volcanic-plutonic arc assemblages, represented by Triassic Stuhini, and Jurassic Hazelton Groups; a Middle and Upper Jurassic overlap assemblage, the Bowser Lake Group; and, the Mesozoic to Cenozoic Coast Plutonic suite.

The oldest rocks in the region are complexely folded schists and gneisses of middle Paleozoic age, which form the basement to the area and are exposed in Moore creek south of the Hank property . Closer to the property, regional mapping has defined the stratigraphy surrounding the property as Upper Triassic augite andesite flows, pyroclastic rocks and volcanic-derived sediments overlain by Lower Jurassic grits, conglomerates and greywackes (Souther, 1972).

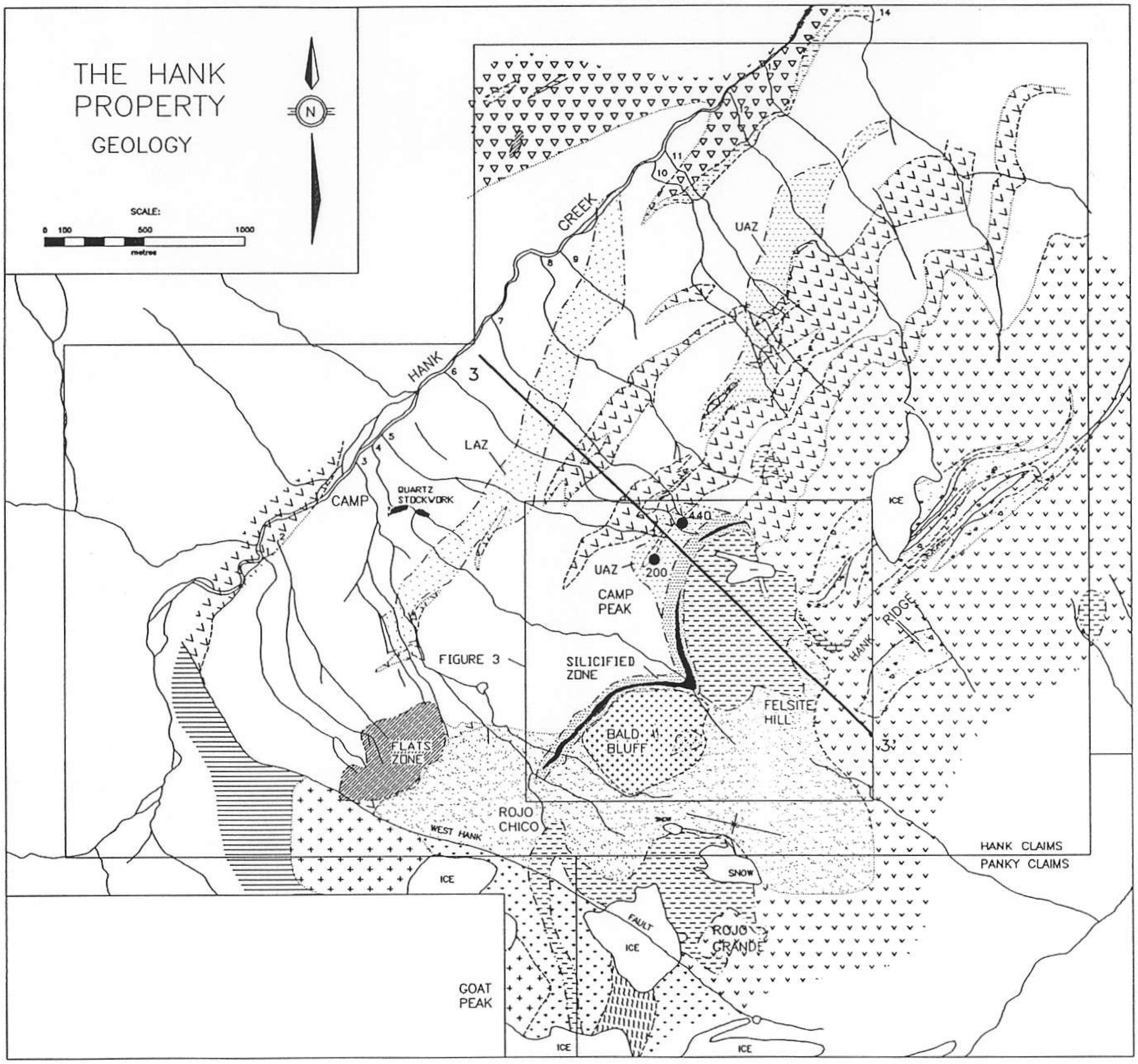


Figure 2. Geology of the Hank property.

Sedimentary rocks of the Middle Jurassic Ashman Formation of the Bowser Lake Group are exposed along the Iskut River valley to the east (Evenchick, 1991).

To the west of the property a northwest-striking fault is mapped at the head of Hank Creek (Souther, 1972). A subparallel fault, informally named the West Hank fault, adjacent and to the east of the regional fault, is exposed on the ridge to the northwest of the claims and traces across the southwest corner of the property (Figure 2).

PROPERTY GEOLOGY

The Hank property is underlain by a succession of flows, sills, volcaniclastic and minor sedimentary rocks divided into five units and described in detail by Kaip and McPherson (1992, Figure 2). On the northeast side of the West Hank fault the stratigraphy consists of Upper Triassic Stuhini Group pyroxene+feldspar-phyric flows, sills, breccias and minor limestone overlying hornblende±pyroxene+feldspar-phyric flows, sills, and volcaniclastic breccias with intercalated siltstones, sandstones, biotite-phyric flows and breccias. On the property the Stuhini volcanic rocks strike northeast along Hank Ridge and dip 30 to 50° to the southeast.

Lower Jurassic calcareous siltstones, sandstones, wackes and pebble conglomerates which locally contain abundant fossilized wood fragments unconformably overlie the volcanic succession. The Lower Jurassic sediments are folded about a southeast-plunging syncline exposed between Felsite Hill and Rojo Grande (Figure 2). Diamond drilling by Homestake Canada Ltd. to the southeast of the Flats zone intersected sedimentary rocks of unit 4 (Figure 2), and extended the known extent of unit 4 to immediately overlying the flats zone.

On the west side of the fault Upper Triassic Stuhini Group well-bedded, feldspar-rich, volcanic derived sandstones, conglomerates, greywacke and thin bedded siltstones are exposed along the north flank of Goat Peak (Logan *et al.*, 1992).

A wedge of possible Middle Jurassic interlayered aphyric vesicular basalt flows and flow-banded rhyolites and minor volcaniclastic sediments are exposed along the eastern flank of Goat Peak and are bounded by the West Hank fault on the northeast side and hornblende diorite to the west (Figure 2).

Two intrusive plugs are exposed on the property, an orthoclase-megacrystic, hornblende-phyric monzonite which underlies the prominent knoll, Bald Bluff, and an elongate medium-grained hornblende-diorite intrusion which crops out on Goat Peak. A sample of the Bald Bluff intrusion collected during the 1992 field season for zircon dating yielded a preliminary age of 185±3 Ma (J. K. Mortensen, personal communication).

ALTERATION

Seven alteration zones are present on the Hank property with characteristic alteration assemblages described by Kaip and McPherson (1992). They include; (i) the quartz stockwork consisting of quartz veining and silica flooding within chlorite+carbonate+pyrite altered volcaniclastic breccias of unit 1a, (ii) the Lower alteration zone, dominated by intense sericite+pyrite± carbonate alteration, (iii) the Upper alteration zone, dominated by sericite+pyrite±chlorite±clay±carbonate alteration, (iv) the Flats zone situated at the head of Creeks 1 to 3 and characterized by quartz+sericite+ pyrite alteration hosting pods of more intense clay+pyrite ±quartz alteration and quartz+ potassium-feldspar+pyrite alteration, (v) the Silicified zone characterized by intense silicification±pyrite and barite which displays multiple phases of brecciation, (vi) Felsite Hill and Rojo Grande dominated by intense quartz+clay+pyrite alteration and lesser quartz+clay±pyrite and clay±quartz alteration (Figure 2). Based on x-ray diffraction studies on type alteration assemblages, sericite refers to fine grained muscovite, and clay refers to a mixture of dickite+kaolinite.

SECTIONS 1 AND 2

Sections 1 and 2 (Figures 4a and 4b), are located on Figure 3 and incorporate data collected from recent drilling on Felsite Hill by Homestake Canada Ltd., and relogging of core from the 200 pit area of the Lower alteration zone. Hydrothermal alteration in this area is continuous from the base of the Lower alteration zone to the top of Felsite Hill and provides the opportunity to characterize the vertical changes in alteration within a low-sulphidation epithermal environment.

UPPER ALTERATION ZONE

The Upper alteration zone is less continuous in the vicinity of the 200 pit area and comprises green sericite+pyrite+carbonate±chlorite alteration near the base and intense, pale grey clay+sericite+pyrite± carbonate alteration near the upper contact with the silicified zone (Figure 3). This change in alteration is characterized by a decrease in competency of core as clay becomes an important alteration mineral. In this region the Upper zone strikes northeast and dips semiconformably to stratigraphy within volcaniclastic breccias of unit 1a. In outcrop and drill core the footwall to the upper alteration zone is defined by a flow and/or sill of unit 1d.

Six types of veining are recognized; (i) quartz-carbonate veins carrying sphalerite, galena, pyrite and minor chalcopyrite, (ii) barite±pyrite veins, (iii) quartz-pyrite veins, (iv) pyrite veinlets, (v) white to pink

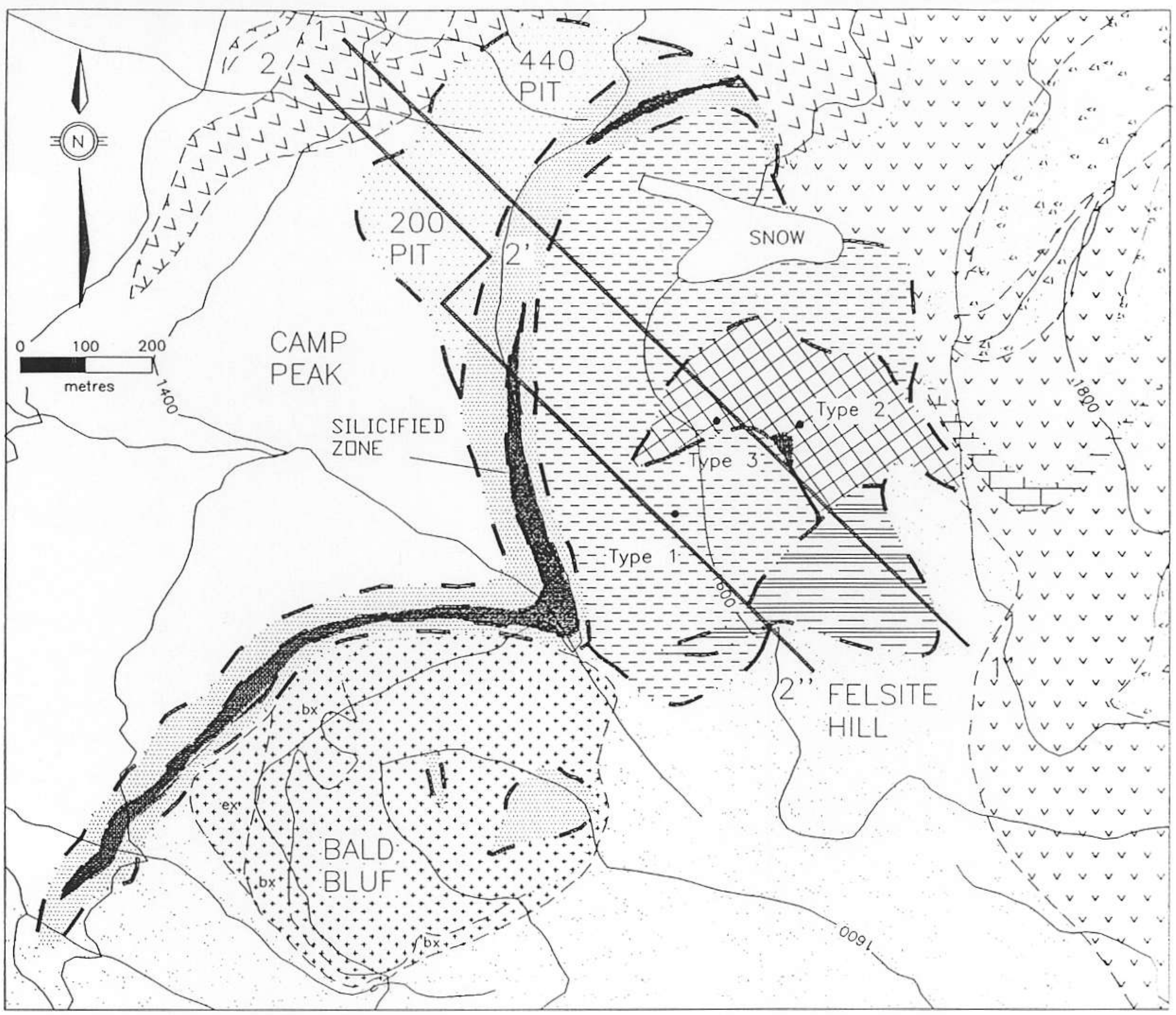


Figure 3. Distribution of alteration assemblages on Felsite Hill, and locations of breccias types.

carbonate veins, and, (vi) crustiform calcite veins. Barite veins are characterized by coarse grained bladed barite with minor disseminated pyrite and frequently contain wallrock fragments. Quartz+pyrite veins, commonly less than 10 centimetres wide contain euhedral coarse grained pyrite concentrated along the margins. Pyrite veinlets, less than 1 centimetre in width are abundant in the upper zone and cut and are cut by white to pink carbonate veinlets. Crustiform calcite veins up to 1 metre in width are exposed in the 200 and 440 pit area of the Upper alteration zone. These crustiform calcite veins contain minor pyrite and bladed quartz after calcite.

Gold mineralization in the upper zone occurs within a subhorizontal zone dipping gently to the southeast, approximately 30 metres above the base of the upper zone (Figure 4b). Mineralization is related to an increase in pyrite veining, quartz-carbonate and quartz-pyrite veining enveloped by intense clay+sericite+pyrite± carbonate alteration. Veining in the zone of gold mineralization strikes to the northeast and dips steeply to the southeast.

SILICIFIED ZONE

The silicified zone is exposed along the base of Bald Bluff and Felsite Hill (Figure 3). Alteration in the silicified zone is hosted by sedimentary rocks of unit 4 and volcanic rocks of unit 1. Above the 200 pit area the trace of the silicified zone was intesected in drill core and consisted of grey, intense silicification hosting very fine grained diseminated pyrite (Figure 4a and 4b). The upper and lower margins of the silicified zone display evidince of brecciation with coarse grained pyrite and barite filling open cavities.

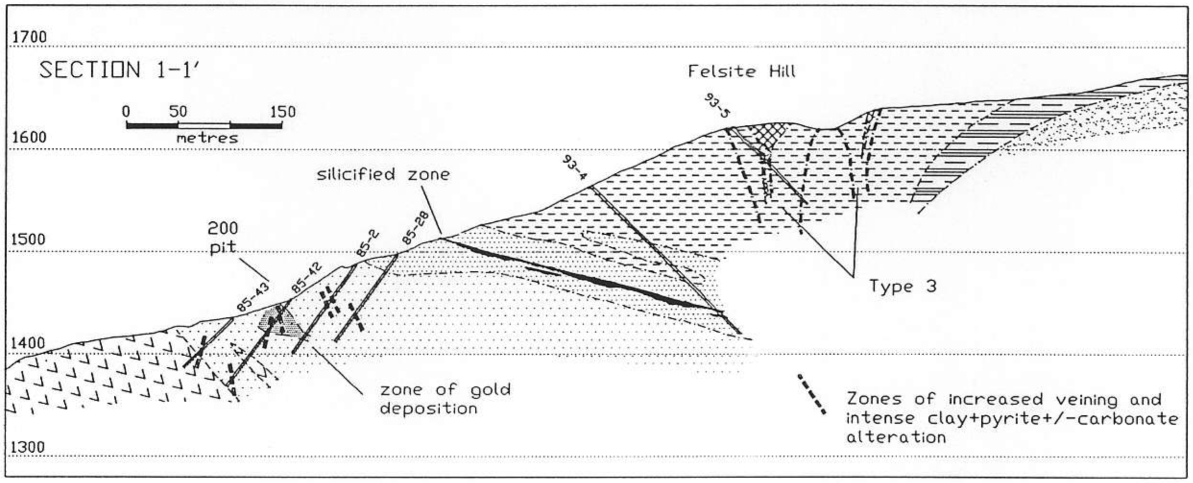
On surface a poorly exposed zone of friable, recessive weathering alteration corresponds to the trace of the silicified zone. In drill core this zone, up to 70 metres wide, is marked by a general decrease in the degree of silicification downward from quartz+clay+pyrite alteration to friable clay+pyrite+carbonate±quartz which grades downward into typical upper zone alteration (Figure 4a and 4b). This zone is also characterized by a carbonate stockwork composed of white to pink calcite veins 1 to 2 centimetres in width and abundant pyrite veinlets above and below the silicified zone. In addition, within this envelope several intervals of silicification occur above the main silicified zone (Figure 4b).

From the intersection of the silicified zone in core it is apparent that it is semiconformable to stratigraphy, striking 117° and dipping 15 to 20° to the south.

FELSITE HILL

Alteration on Felsite Hill is hosted by sedimentary rocks of unit 4 and hornblende+feldspar-phyric flows and/or sills of unit 1d (Figure 3). Four types of alteration are present; (i) quartz+clay+pyrite, (ii) quartz+clay± pyrite, (iii) clay±quartz, and, (iv) quartz±pyrite.

Quartz+clay+pyrite alteration is hosted by hornblende+feldspar phyric flows/sills of unit 1d. Alteration is characterized by clay altered plagioclase phenocrysts within a matrix of grey quartz+clay+pyrite. Quartz+clay±pyrite alteration is hosted by units 4 and 1d and varies from texturally destructive vuggy, quartz+clay alteration to less intense alteration with relict primary textures and isolated pods of fine-grained pyrite. Quartz+clay±pyrite alteration overlies and extends to the southeast of quartz+clay+pyrite alteration; from drill core it is apparent that this type of alteration cuts quartz+clay+pyrite alteration as vertical structures which narrow at depth (Figure 4a). Clay±quartz alteration varies dramatically in intensity along the southern margin of the alteration on Felsite Hill and is hosted by sedimentary rocks of unit 4. Clay varies from green to maroon in colour and occurs initially as pervassive clay alteration of the host rock.



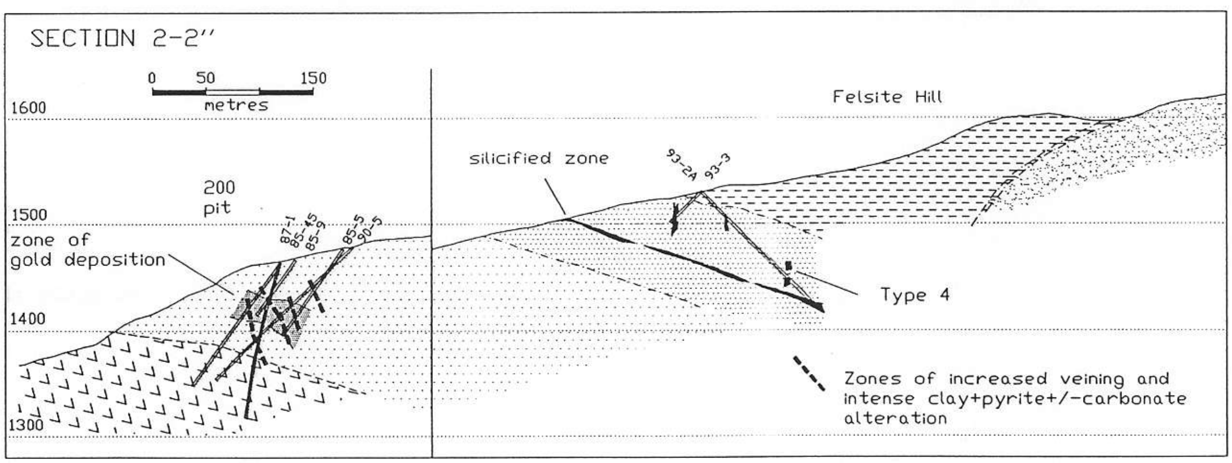


Figure 4: Cross-sections 4a and 4b through the upper alteration zone and Felsite Hill. Sections identify distribution of alteration, hydrothermal breccias, and level at which gold deposition occured.

Four types of hyrothermal brecciation are observed in outcrop and core (Figures 3 and 4). Type 1 breccia is characterized by fragments of white quarz+clay±pyrite and grey quartz+pyrite+pyrite altered fragments within a matrix of quartz+clay+pyrite followed by white porcellanous clay±quartz matrix. Type 2 breccia is characterized by white quartz+clay altered fragments within a matrix of black silica. This type of breccia is located within quartz+clay±pyrite altered siltstones with carbonaceous reed fragments. Type 3 breccia consists of quartz+clay+pyrite altered anngular fragments of feldspar-phyric volcanic rock with serrate margins. The matrix of the hydrothermal breccia is composed of quartz+clay+pyrite followed by white porcellanous clay± quartz. Diamond drilling hole 93-5 intersected Type 3 hydrothermal breccia at depth (Figure 3a). In drill core Type 3 breccia is cored by several 2 to 5 metre zones of vuggy quartz+clay alteration with limonite-covered fracture surfaces; similar to quartz+clay±pyrite alteration observed at surface. Type 4 breccia is observed in diamond drill hole 93-2A, and consists of milled, quartz+clay+pyrite altered milled fragments in a matrix of soft clay+pyrite (Figure 4b).

DISCUSSION

The topography, combined with outcrop and diamond-drill hole data from the Hank property provides an excellent cross-section through an epithermal alteration system, as defined by Lindgren (1933). Alteration is characteristic of a low-sulphidation, near-surface environment with sericitic alteration at depth in the Lower alteration zone (Kaip and McPherson, 1992) and clay alteration at higher elevations on Felsite Hill and Rojo Grande. The Upper alteration zone is transitional between these two styles of alteration with sericite+pyrite+carbonate±chlorite near the base and clay ±sericite+carbonate+pyrite near the upper contact with the silicified zone. The latter is characterized by multiphase silicification within a broad zone of clay+pyrite+carbonate±quartz and carbonate stockwork.

The overall morphology of these alteration zones shown in Figure 5, suggests that the lower alteration zone may be a feeder zone as it cuts stratigraphy at a high angle. The upper alteration zone is semiconformable to stratigraphy, is hosted by rocks of unit 1a, and may indicate lateral movement of hydrothermal fluids along a permeable horizon. The presence of large crustiform banded carbonate veins with silica-replaced bladed calcite crystals suggests; (i) that bicarbonate fluids were present and (ii), that boiling may have taken place in the upper alteration zone (Chistienson and Simmons, 1993). Alteration on Felsite Hill is dominated by clay+pyrite alteration with varying degrees of silicification and displays a vertical and lateral zonation of quartz+clay+pyrite to quartz+clay±pyrite to clay±quartz from core to periphery. Hedenquist (1993), indicates that clay dominant alteration can occur on the margins of low-sulfidation epithermal environments where temperatures are cooler and alteration products are characteristic of vapour condensates. From drill hole 93-5, it is apparent that vuggy quartz+clay alteration forms along vertical structures and overprints quartz+clay+pyrite-altered hydrothermal breccia. This feature may represent the effects of encroaching surface water on the collapsing hydrothermal system. The silicified zone, which lies above the upper alteration zone and below Felsite Hill, may indicate a zone of increased permeability and the former presence of a paleo-water table. Alternatively, the silicified zone may represent the level at which boiling fluids deposited silica, although this has yet to be determined from mineralogical and geochemical investigations.

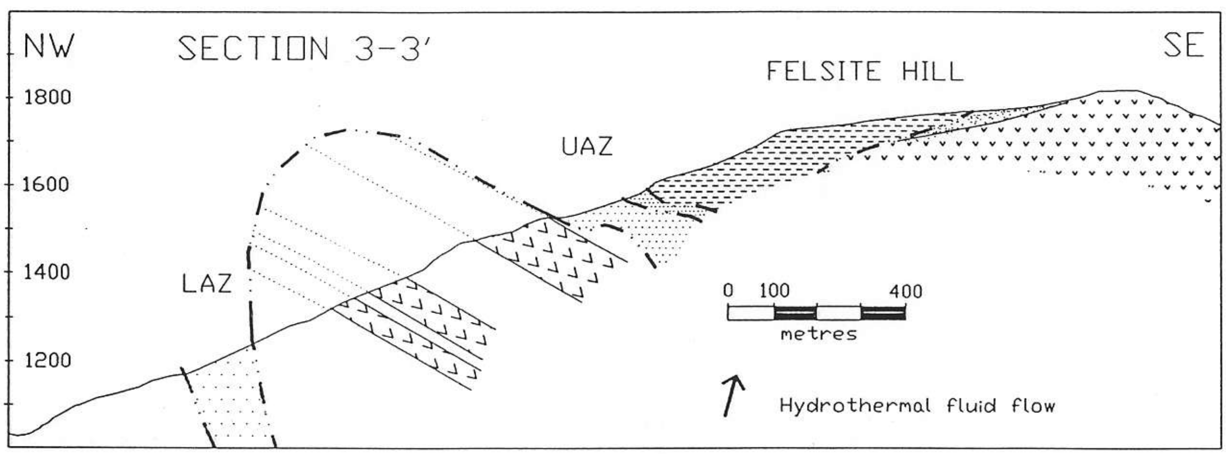


Figure 5. Cross-section 3-3' through the lower, upper alteration zones and Felsite Hill showing zoning in the type of alteration from the Lower alteration zone to Felsite Hill.

At the Hank property there appears to be a genetic link between the intrusion of the Bald Bluff orthoelase megacrystic porphyry and hydrothermal alteration based on field mapping. This hypothesis is supported by the age of intrusion at 185±3 Ma. and a Middle Jurassic signature obtained from galena in precious metal bearing quartz+carbonate+sulfide veins from the Lower alteration zone.

Within the Iskut region the Hank property is the first known occurance of a Middle Jurassic epithermal system, apparently related to the intrusion of orthoclase megacrystic porphyries which have been shown regionally to be temporaly and spatially related to other types of mineralizing environments.

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