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GEOLOGICAL REPORT
ON
THE BETH AND COMMERCE CLAIMS
LOCATED 45 MILES SOUTHEAST OF FERNIE, 49° 114° S.E.

BASED ON REPORTS PREPARED BY
J.P.N. BADHAM,
P.A. NIELSEN,
G. HOFFMAN,
UNDER THE SUPERVISION OF
R.J. GOBLE, B.Sc., M.Sc., P. Geol.

PROPERTIES HELD BY
F.M. GOBLE,
L.E. GOBLE,
D.F. GOBLE,
E.D. GOBLE,
F.J. GOBLE,
R.J. GOBLE.

REPORT PREPARED FOR
KINTLA EXPLORATIONS LIMITED,
#7 - 8540 - 109 Street,
EDMONTON, ALBERTA.

EXPLORATION CARRIED OUT
JULY 25 - SEPTEMBER 15, 1972
ASSAYS TO FEBRUARY 28, 1973

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FIGURES ACCOMPANYING REPORT

INTRODUCTION

This report constitutes a summary of geological mapping and sampling carried out on the Beth and Commerce Claims (Beth, Commerce, and Sunkist Claim Groups) during the 1972 field season. The report contains three separate reports prepared by J.P.N. Badham, P.A. Nielsen, and G. Hoffman under the supervision of the author. These have been augmented by data obtained from assay results and from other sources.

The Beth Claims are a group of 8 full claims, covering a total of 414 acres, centred upon Latitude 49°9'N and Longitude 114°7'W on LaCoulotte Ridge, west of Roche Creek in the Fort Steele Mining Division.

The Commerce Claims are 45 full claims, covering 2327 acres, centred upon Latitude 49°9'N and Longitude 114°23'W, approximately 2 miles northeast of Commerce Peak in the Fort Steele Mining Division. The Commerce Claims are grouped into the Commerce Group (Commerce Nos. 26-32, 35-37, 41-42, 43-48) and the Sunkist Group (Commerce Nos. 1-16, 19-25, 33-34, 38-39).

GEOLOGY AND ECONOMIC POTENTIAL OF THE COMMERCE CLAIMS, BRITISH COLUMBIA

by

J.P.N. BADHAM (B.A. Hons.)

August, 1972

Location

The Commerce claims are staked on a number of lines, none of which are recognisable at present owing to the depradations of second growth, bears and the weather. The claim outline on the map (to which the reader is referred) is approximated from details of the claims locations taken from R.D. Morton (1971) and from details given by F. Goble, Esq. The claims were staked to cover two zones of immediate economic importance: firstly, the Grinnell Formation between Commerce and Sage Creeks, for its potential of stratabound copper mineralisation, and secondly, a zone of intrusion of sills and dykes in the eastern claims, for its potential of copper-gold mineralization.

Introduction

The Sage and Commerce claims were examined and mapped by the author during the period 15th July - 9th August. A separate report on the Sage Claims is included. The author was assisted at all times by K. Goble Esq., hwo proved an able and amiable geologist, and who is almost ready to conduct a small mapping and evaluation project on rocks he knows well. ?

The area was mapped onto an enlarged portion of the topographic sheet (SAGE Creek, B.C.), at 417' to 1". Since the topographic maps are drawn at 1:50,000 from air photographs, they sacrifice much detail. Consequently, the enlargement of the topographic map is singularly lacking in the details required when mapping at this scale. The problems of accurate location on this map were great, and errors of ± 100' are to be expected. While it is recommended that a topographic sheet always be provided in areas of such pronounced relief, to allow an accurate understanding of outcrop pattern, it is nevertheless vital that mapping on this scale in future be done from an enlarged air photograph or from an accurate picket line.

Air photograph enlargments have an excellent resolution and are extremely important in allowing identification and interpretation of linear features. They allow excellent identification of location and can be used to plan proper traverses. None of these conditions holds true for enlarged topographic maps. Air photograph enlargements can be obtained from Riley's Datashare International at ~ \$3.50/sq.ft., plus a small charge for making the negative.

The area was mapped with the philosophy of understanding the geology, understanding the nature and controls of known areas of mineralisation, evaluating such areas, and determining their limits. The area was not prospected in detail, but mineral occurrences were noted and evaluated where found during traverses. In an area that has been so extensively prospected it was expected that most of the mineral showings would be known. It is surprising to me that the company had prepared no 'prospector's map' of showings for use by the geologist in evaluation. It came as something of a shock to discover that most zones discovered during mapping were already known, if not understood, and had been sampled. In future it is recommended that the company make available all information concerning a claim group in order to avoid duplication, frustration, and a waste of the company's time and money.

The map consequently locates those mineral showings that were intersected during traverses, but no attempt was made to traverse every foot of the property. The map may usefully be used as a base on which to locate all prospector-discovered showings. It is the opinion of the author, however, that all the 'Gossan Zone' mineralisation and a large proportion of the strata-bound copper mineralixation were located, evaluated and understood.

General Geology of the Claim Group Area

The area is underlain by rocks of the Purcell Period, and sections of all formations from the Altyn to the Phillips were traversed. For details of the regional stratigraphy the reader is referred to Price (1961), and to the enclosed Table of Formations, adapted by the author from Price's for use in the Sage Creek-Commerce Creek area only.

The rocks are Proterozoic in age and are cut by diabasic to dioritic dykes and sills. The rocks were folded on an easterly-trending axis into large tight anticlines and open synclines (F_1) which are severely discontinuous, and occur mainly in the Grinnell Formation, although the associated meso-drag-folds are present in all formations. Those folds were refolded by large open, northerly trending folds (F_2), so that they have a double plunge. These F_2 folds are related to the Akamina syncline. F_2 drag folds were found only to be common near the crests of the F_2 anticline.

Apart from the immediate contacts with the sills and dykes, the rocks are unmetamorphosed. Faulting, in contradiction to Morton (1971, p. 10) is not intense, but is extremely minor: most of the recognised faults are joint planes along which minor adjustments have occurred.

Altyn Formation:

About 1000' of dark fissile shales with dolomitic horizons outcrop to the south and west of the claims and are assigned to the Altyn Formation. Many of the bedding planes in the shales are covered in a thin plating of pyrite, but no other minerals were observed.

Appekunny Formation:

The base of this formation is taken at the lower of two 50'-thick distinct white sandstone bands which outcrop, 100' apart, to the south and west of the claims. They are overlain by about 2000' of grey and green fissile shales with occassional dolomitic horizons and towards the top there are an increasing number of intercalated thin white sandstone beds. Pyrite was observed as thin smears on joint and bedding planes in the shales and pyrite and hematite blebs were seen in some of the upper sandstones. No copper minerals were seen.

Two easterly plunging F_1 folds bring the outcrop of this formation onto the western Commerce claims, and in the axial regions of both F_1 and F_2 folds good non-penetrative F_1 and F_2 cleavages are developed. The axial planes of F_1 drag folds have broken occassionally, allowing small 'faults' to develop.

The Grinnell Formation:

The base of this ~2000' thick formation is marked by the incoming of the first red bed, which conformably overlies the Appekunny. The lower part of the Grinnell consists of red silts and marls with buff and green horizons and very rare sandstone beds. The buff and green horizons are not true beds, but are developed round thin beds and lenses of coarser silt and sandstone, presumably during post-depositional ground water percolation.

The sandstone beds increase in number and in thickness up the Grinnell until they make up some 50% of the outcrop in the upper 500'.

The silts contain ripple marks, suncracks and mud-flake conglomerate horizons. The sandstones are often cross-bedded, have rippled and scoured bases, and contain shale clasts. The rocks are interpreted as being the deposits of a deltaic floodplain, with the sandstones representing periodic channel spills. The rocks were deposited in part in very shallow water and in part subaerially.

The sandstones are not homogenous along strike but vary from pure to 'dirty', from massive, to laminated to cross-bedded, and from empty to shale clast bearing. In the lower and middle Grinnell (no actual boundaries are defined or defineable) the shale clasts are usually green, but green and red ones become mixed in the upper Grinnell. This greenness indicates that the beds were permeable to ground water solutions of low EH, and that Fe^{3+} was reduced to Fe^{2+} in them. That the beds were not completely permeable along strike is indicated by the change from green to red clasts along some beds, the corresponding decrease in green alteration of the surrounding red silts, and by the heterogeneity of the beds.

Secondary hematite is common in many of the sandstone beds, and can usually be seen to be crystallised from primary detrital iron oxides, the lag concentrates on cross-bed foresets. Pyrite was seen less frequently in the sandstone beds, usually as small blebs disseminated amongst the quartz-grains, and as partial replacements of green shale clasts.

Copper minerals - bornite, chalcocite, chalcopyrite, and occasionally covellite, with secondary malachite and, rarely, azurite - are found in some of the sandstone beds, over parts of their length. These minerals occur as disseminated blebs, or as partial or complete replacements of green shale clasts. No copper mineral was seen replacing a red shale clast, and only very rarely were copper minerals seen in sandstone beds containing red clasts.

In no case was the copper mineralisation extant over the complete outcrop of a bed, but was found only in the 'dirty' and clast-bearing portions. No copper was found in the surrounding shales.

Each showing of copper mineralisation is detailed below, but it can be generalised that:

1. The copper is of local origin.

2. The copper was leached into or deposited in the sandstone beds, and was precipitated or reprecipitated as sulphides where the EH was such that Fe^{2+} was stable.

3. An epigenetic source is impossible because of the restriction of mineralisation to certain parts of certain beds.

4. Copper is an inherent part of the Grinnell sandstones, and was crystallised to its present form in most beds prior to folding, etc.

However, it is apparent that this primary, and probably uneconomic, copper mineralisation may be concentrated later - see the description of copper zones H and F.

Description of the Individual Copper Zones in the Grinnell Formation

Zones A, B, and C are described separately in the SAGE claims report. → probably Ass. Rpt. 3160 gaw. 11/73

Zone D:

Owing to the nature of the topography here, the lateral continuity of some beds could not be ascertained. On this razorback ridge the upper Grinnell rocks dip steeply to the SE and contain frequent sandstones up to 5' thick. Five thin sandstone beds were seen to contain blebs of chalcopyrite and bornite in lenses and pods and a thick sandstone (3'-5') with shaley lenses contains 2-3% copper sulphides over its 200' of accessible outcrop. The SW end is hidden beneath snow and scree, and the NE end runs down a vertical cliff. This bed may be continuous with the uppermost one at Zone C, but if so the copper mineralisation is not continuous for the horizon was traversed between Zones C and D. Above this bed occasional specks of copper minerals were seen in three beds up to the Siyeh contact.

Zone E:

A complete section of all the Grinnell rocks exposed between 8108 Mountain and Commerce Peak, revealed only this small lens of copper minerals (chalcopyrite, mainly) over 3' in two adjoining 6" thick beds.

The copper in Zones C, D, and E may be slightly concentrated in the core of the F_1 syncline, but is probably at its original concentration. Only the one bed in Zone D shows any promise of lateral continuity - the rest are proven discontinuous.

Zone F:

No copper was observed in the lower Grinnell on Commerce Ridge here, but in the middle Grinnell two sandstone beds were observed to carry chalcopyrite and malachite. The first is 6" thick and < 1% Cp was seen over 3'. The second is 3' ± thick and is exposed for 150^{x}-200^{x} on a dip-slope. Small vertical, quartz-filled joints, parallel to F_1 cut the rock, and both these and the bedding planes are covered in chalcopyrite and malachite. Disseminated blebs of chalcopyrite and ?chalcocite were seen in the bed. The jointing has stepped the bed giving an illusion of greater thickness. The bed is mineralised over its whole outcrop here, in the core of an F_1 syncline. No other copper mineralisation was observed on the ridge between here and 7900 Mountain, although there is only 10-20' of Grinnell exposed here above the cupriferous bed.

Zone G:

A detailed traverse from the ridge top down 600' of middle Grinnell rocks revealed two mineralised sandstone beds. The fourth sandstone from the top is exposed for 70^{x} between a snow-filled gully in the south and a scree in the north. It is 1' thick with green and red shale clasts and contains blebs and smears of chalcocite at between 3 and 5% over its whole outcrop. The thirteenth sandstone from the top is 6" thick and contains ~ 1% chalcocite over 3'. One end is not exposed, the other is barren.

Traverses about 1000' to the north failed to locate mineralisation in a stratigraphically similar position.

Zones F and G appear to be slightly concentrated zones of copper mineralisation associated with the trough of a major F_1 syncline.

Zone H and Associated Veins:

The Grinnell Formation is folded here into two tight anticlines (see sketch below), and the crests of these anticlines have cracked and allowed dilation and very minor faulting. Quartz has been remobilised from the sandstone beds and deposited as veins in parts of these cracks. Where bedding is parallel to the veins, the sandstone beds are recrystallised to quartzite, and the vein, as such, is a bed. The veins are podiform, being wider at slight kinks. Often there are small offshoots and nearby tension fracture pods.

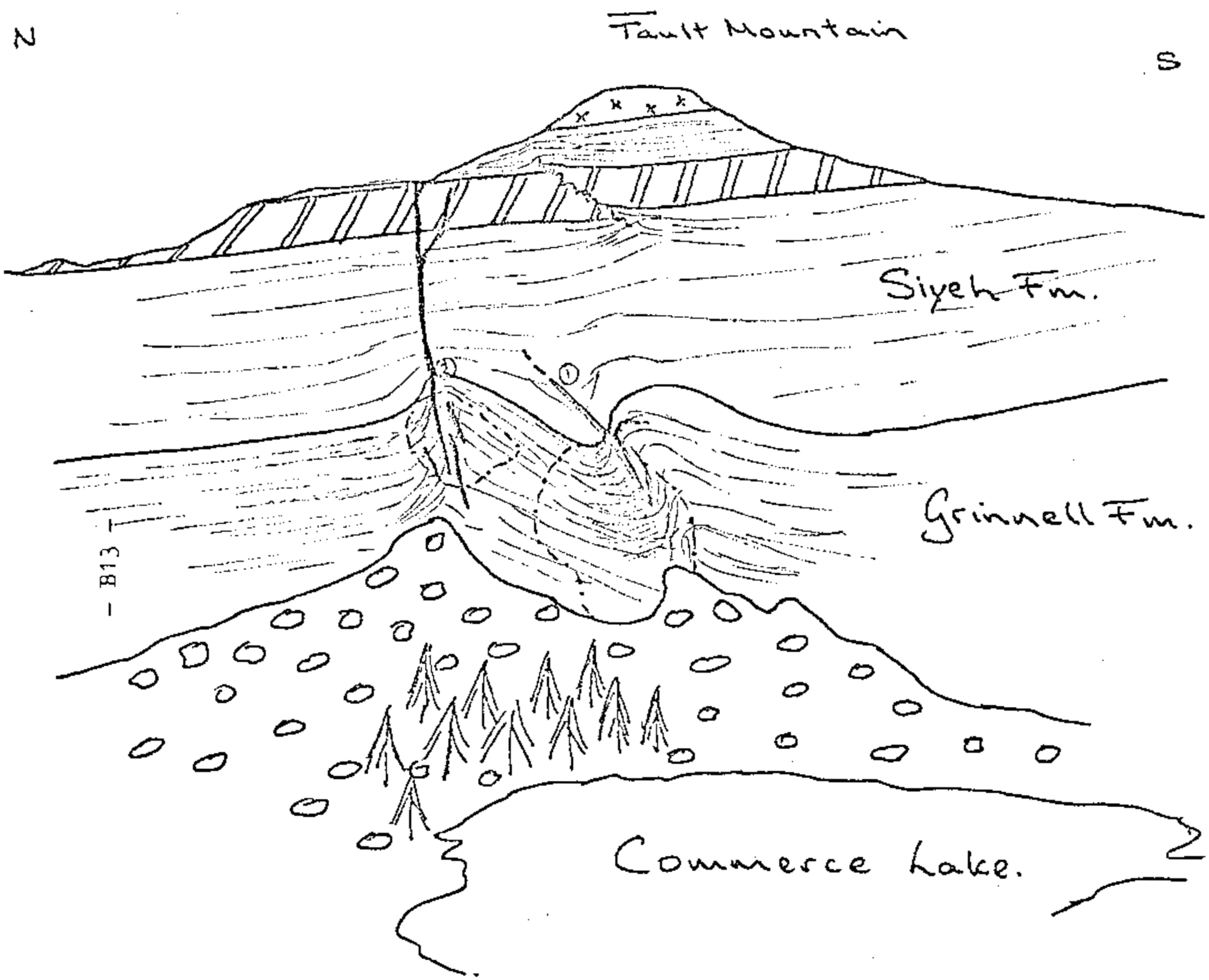
Vein 1 is generally barren where it transects the Grinnell, although blebs of chalcopyrite were seen, in places up to 5%. The vein was covered in snow and inaccessible where it presumably transects the Siyeh Formation. This vein does not transect the Siyeh and the sills higher up on Fault Mountain.

Vein 2 is very poorly exposed at its lower end, and was not seen to be mineralised. The top is likewise barren. Owing to the time and the snow, the middle portion was not examined, but concentrations of tetrahedrite and chalcopyrite are reported from it (Morton, 1971).

The Grinnell rocks are severely bleached to the north of Vein 1, for 100-150', and the first 50' north of the vein are weathered rusty. These bleached beds (pale green and brown) can be traced laterally into the normal red succession. There is a small amount of bleaching around Vein 2.

Traverses were made up both sides of Vein 1 and down the north side of Vein 2. On the south side of Vein 1 three copper-bearing sandstones were found and were persistent up to 50' from the vein. These contained disseminated blebs of chalcocite and chalcopyrite up to 3% in concentration. 50' to the north, in the rusty zone, 18 beds or sets of beds contain copper minerals. The lower nine have between ½% and 5% of chalcocite blebs, a black soft mineral, smeared round quartz grains (? tetrahedrite) and some chalcopyrite specks. In the upper nine beds the proportion of chalcopyrite increases sharply at the expense of the other minerals, keeping a concentration of 1-5% sulphides. Malachite and azurite are well developed. These mineralised beds do not persist laterally, but fade out by the end of the bleached zone - mineralisation is restricted to the Grinnell Formation and does not continue into the Siyeh above. On the north side of Vein 2 500' of Upper Grinnell were traversed and one sandstone bed containing ½% chalcopyrite was noted.

It seems clear that the primary concentrations of copper in the Grinnell have been selectively emplaced in fold cores here,



- — · — = margin of bleached + rusty weathered Grinnell Fm.
- bedding.
- Copper minerals in sandstone.
- × × 100' sill (Diorite).
- // // 40' sill (Diabase).
- Talus.

~100'

presumably as the deposits of a syn-tectonic fluid migration. The mineralisation is not of an 'epigenetic hydrothermal' variety - both copper sulphides and the vein material are of local derivation.

The veins were not located on the east side of Fault Mountain, nor is the Grinnell exposed there. However, the folds, while being vertically discontinuous, may persist laterally and allow a substantial amount of mineralisation beneath Fault Mountain. It is recommended that the immediate area of the veins be mapped on 100':1" on a baseline and grid and that mineralised blocks be sampled statistically to obtain rough tonnage and grade figures.

Rough calculations taking a block of 500' x 100' with a depth beneath the mountain of 100', and containing 1-5% copper sulphides in 10% of the rock by volume, indicate ~ 50,000 tons of good mineralisation.

In Conclusion:

1. The Grinnell Formation contains small patches of primary copper sulphide mineralisation in some sandstone beds.

2. Such mineralisation has been concentrated by fluid migration into fold cones during or after F_1 folding.

3. No other concentrators, such as the faults and dykes observed on other of the Company's properties, were observed in the Grinnell on the Commerce or Sage claims.

The Siyeh Formation

The basal 1000-1500' of this formation consist of well-bedded, buff weathering grey and black shales and dolomites with sparse sandstone beds. The latter contain grains of pyrite, and, near the base, one bed has about 5% micronodules of marcasite. These are overlain by ~ 400' of interbedded dolomites and sandstones. The dolomites are often algal (hemispheroid to parallel, continuous linkage, indicating just sub-tidal) and often contain inclusions of grey limestone with 'molar tooth' (Daly, 1912) and heiroglyph structures. These are interpreted partly as brecciated fragments of algal mat and partly as soft sediment brecciation during compaction and cementation (Adshead, 1963). Towards the centre of the middle Siyeh a 50' thick algal dolomite is a distinctive marker and towards the top there is another such, 30' thick. The depositional environment is interpreted as having been shallow lagoonal.

The upper Siyeh consists of 200-250' of well-bedded fissile argillites and arenites, with green and grey shale being the dominant lithology.

The Purcell Lavas

Between 200' and 400' of pillowed, massive and vesicular green to purple flows overlie the Siyeh with complete conformity. These flows were identified in the field as 'andesite', but the work of Hunt (1961) and the lack of tuffaceous activity would indicate them to be basaltic andesites and trachybasalts. The vesicles may be round, ellipsoid, amoeboid or tubular and branching. They are filled with chlorite, quartz and carbonate, containing rare specks of pyrite and chalcopyrite. Larger vug cavities are lined with quartz and, occasionally, pyrite. No primary mineralisation was seen in the matrix of the rocks, which are interpreted as being extruded both into shallow water and subaerially.

The Sheppard Formation

The apparent thinning of the Purcell lavas, and the presence of volcanic fragments in quartz grit beds in the base of this formation testify to unconformity here, shown as a disconformity in this area, and representing small tectonic adjustments to the volcanic event.

The basal Sheppard contains three distinct quartz grit beds, in 70' of shales and calcargillites. A 30' thick flow and set of flows, indistinguishable from Purcell Lava in the field, overlies these, and is in turn overlain by 250' of stromatolitic dolomites (just subtidal) and calcargillites, representing a return to lagoonal conditions. The top of the lava flow is ropy and scoriaceous.

The Gateway Formation

300' of red siltstones with shale and sandstone horizons overlie the Sheppard conformably and represent the return of deltaic conditions. The unit is typified by ripple marks, sun-cracks, mud-flake conglomerates and salt casts.

The sandstones in this unit should be prospected for indications of primary copper mineralisation. 50' of buff shales overlie the Gateway Formation on Hopper Mountain and are tentatively ascribed to the Phillips Formation.

The Gossan Mountain Mineralisation

The top of the middle Siyeh, the upper Siyeh, the Purcell lavas, and the lower Sheppard are intruded by numerous dykes and sills of diabasic to dioritic composition. For complete chemical descriptions of these rocks the reader is referred to Hunt (1961).

Most of the sills are plagioclase-hornblende porphyritic diorites. They contain abundant amphibolitised xenoliths, chilled margins, baked host rocks at the contacts, and late magmatic segregation pods, veins and dykes. The texture is generally diabasic, but patches of pegmatitic plagioclase are common. K-feldspar and quartz-bearing pods occur frequently and the late magmatic dykes and veins are occasionally K-feldspar--hornblende-biotite porphyritic, but are more generally pink and aplitic. Nodules containing olivine, plagioclase, and pyroxene have been reported (Hoffman, pers. comm.) from one of these sills outside the area reported on herein. Local segregation pods of biotite were observed in the thicker sills, and late dykes of fine quartz-feldspar with large blebs of golden mica (phlogopite ?) were seen.

The sills are frequently both fed by and cut by dykes of identical texture and composition. The sills are not strictly stratabound but jump on joint planes, have apophyses and offshoot dykes and sills, and may bifurcate and rejoin. All the dioritic rocks contain primary sulphides, mainly pyrite and pyrrhotite, with rarer chalcopyrite.

One sill of more diabasic nature was found in the middle Siyeh, and no intrusions were observed below this. The basal nature of this last sill, the postulated relationship of the Purcell lava and these sills (Daly, 1912) (Hunt, 1961), the presence of basic nodules, and the presence of more basic intrusions at similar horizons elsewhere, leads to the conclusion that the diorites are the differentiates of a more basic liquid and their texture and mineralogy suggests that they were intruded at fairly low temperatures, at shallow depths and under hydrous conditions.

Where the sills intrude the middle Siyeh rocks sulphide mineralisation is absent. The sandstones and limestones are bleached and recrystallised and the growth of epidote, andradite, idiocrase (?), grossularite, tremolite, and diopside was observed in the siliceous algal bands in the dolomites. Where the sills are isolated, bleaching and metamorphism was not apparent beyond 20' from the contacts, but in zones of multiple intrusion the metamorphism is more widespread. Where the sills intrude upper

Siyeh rocks both they and the shales are often well-mineralised. The Purcell lavas are commonly extensively replaced by sulphides along contacts with sills. Mineralisation was not evident in Sheppard rocks.

The dykes are more commonly mineralised throughout their length, but some are, nevertheless, barren.

The zone of major intrusion stretches from North Ridge, through Gossan Mountain, to Andradite Mountain. The majority of sills and dykes are in the top 400' of the Siyeh Formation, and the mineralisation in both igneous and sedimentary rocks is almost entirely confined to the Upper Siyeh shales.

A number of possibilities present themselves:

1. The Siyeh shales represented a permissive zone at the depth of intrusion of mineralised sills.

2. The Siyeh shales were sulphide rich and the permissive intrusion mobilised the concentrated the sulphides.

3. The chemical nature of the Siyeh shales allowed replacement by sulphide from the dykes and sills.

The sulphides are present in the sediments as metablasts and as platings on bedding and joint planes. Those in the igneous rocks occur as disseminated primary blebs, and as coating on joint planes. It must be concluded that the sulphides are of magmatic origin, and that the physical (and chemical ?) nature of the Siyeh shales permitted intrusion of the sills and mineralisation at this horizon.

There is no sign of skarn (s.s.) on contacts between intrusives and limestones, and only two very small patches of malachite were seen on such contacts. The sills and dykes are described individually, and are numbered, or lettered, on the map. Sketch sections of their outcrop are attached.

SILLS

1. 15' thick unmineralised medium-grained diorite.

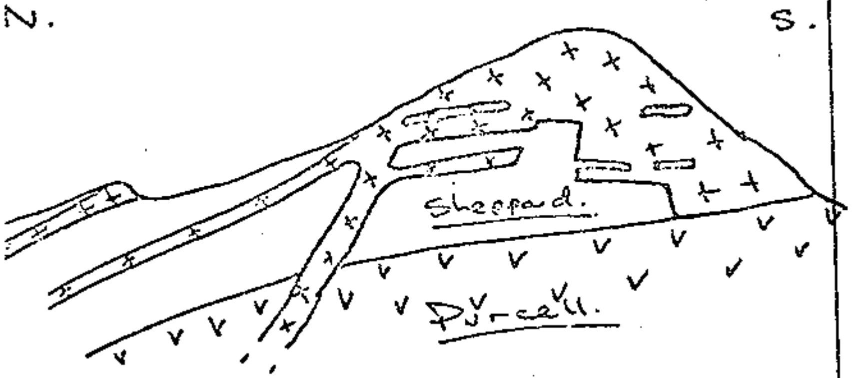
2. 'Sill Mountain sill'. At least 100' thick. The base steps near the Purcell lava - Sheppard contact, and contains many large blocks of Sheppard sediment. It is fed by a vertical, 20' thick dyke (α) of medium-grained diorite. The sill is mostly grey, unmineralised diorite, but contains pegmatitic, quartz-rich and k-feldspar-rich patches and late dykelets.

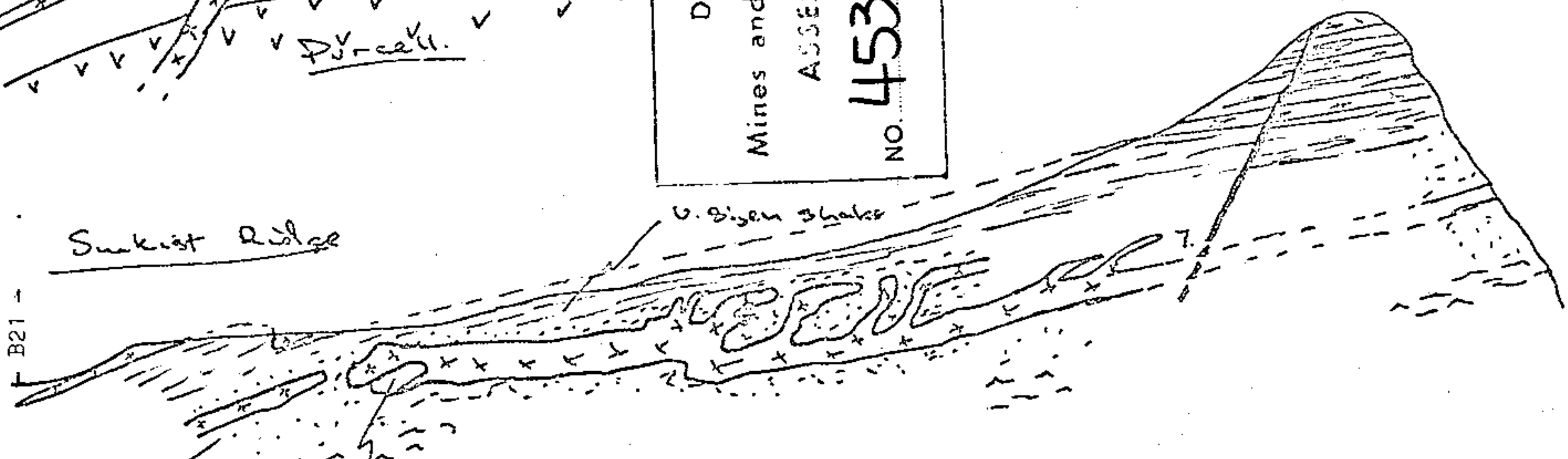
One patch, with late vuggy quartz, contains good sulphide mineralisation, from which gold assays have been attained. The zone was badly weathered and half covered by snow, so a further understanding of this zone was impossible. The southern contact with the Purcell lava is well exposed and the lava is impregnated with 15-20% of pyrite > pyrrhotite > chalcopyrite. This zone must be trenched and investigated immediately.

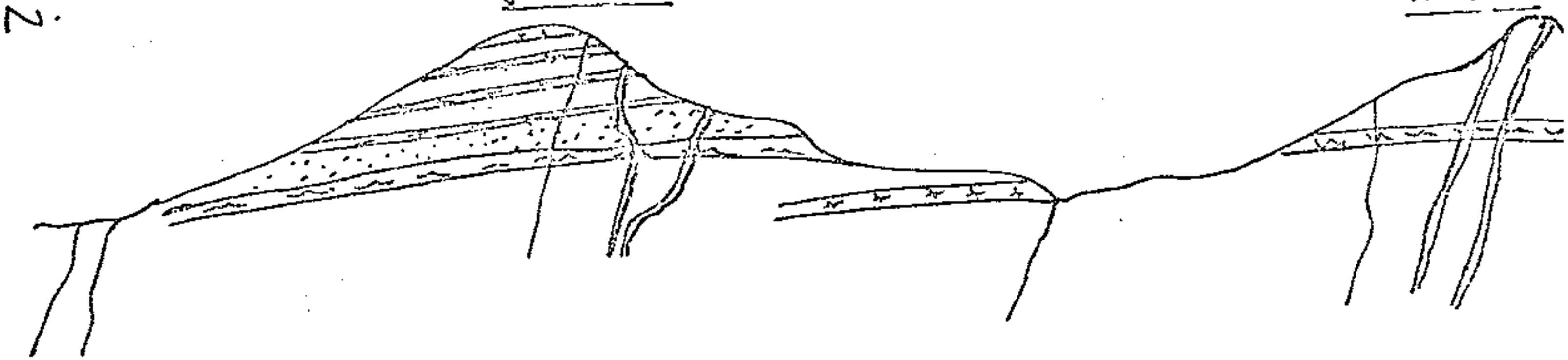
Small patches of rusty weathering occur in the Purcell lava and the sill near the western contact, but little fresh sulphide was seen.

3. 10' thick, exposed for 50^{x} at base of Sill Mountain. Fed

Sketch Sections from notebook.

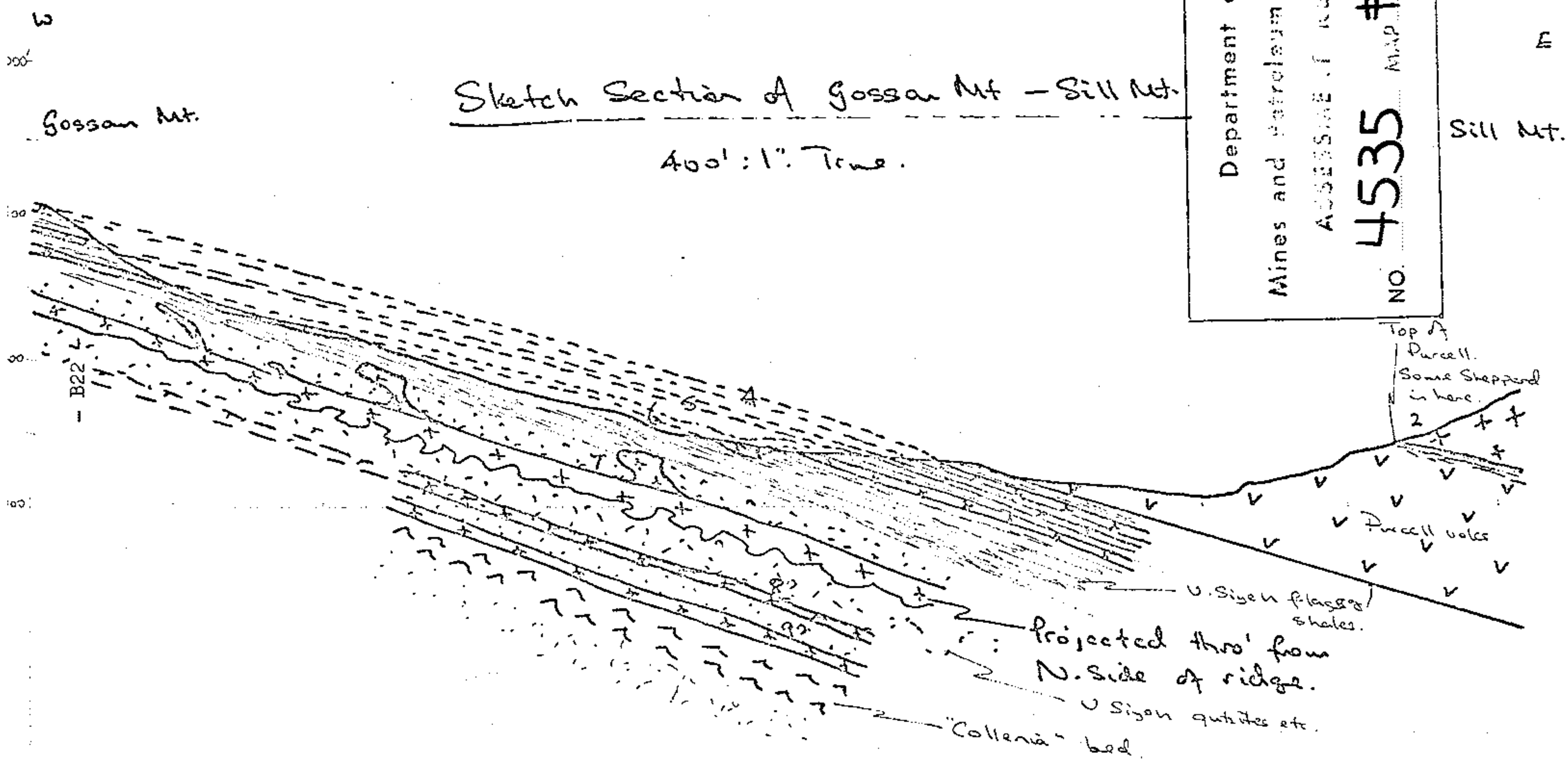






Sketch Section of Gossan Mt – Sill Mt.

400' : 1". True.



by dyke α. Unmineralised diorite.

4. 10' thick uniform diorite sill. Unmineralised in its eastern outcrop, but in its outcrop on Gossan Mountain it contains up to 5% Py > Po, and the sediments around it are impregnated with pyrite.

5. Similar to (4).

6. 10' thick diorite. Outcrops all the way up the eastern slope of Gossan Mountain and both it and the surrounding shales are well mineralised. On Gossan Mountain the sulphides concentrate up to 5% in the margins of the sill, and drop to ½% in the central portions. Py > Po.

7. 15-20' thick, very irregular diorite. Mineralised with 5-10% Py > Po throughout its outcrop. It intrudes the Middle to Upper Siyeh contact and has sparse blocks of stromatolitic dolomite caught up in its base. The shales above it are well mineralised with pyrite. Below it, no sulphides were observed.

8. 5-10' diorite. Very small patches of sulphide concentration up to 1% in its southern outcrop.

9 and 10. Similar to (8). 10 is mineralised with 1% pyrite on Andradite Mountain. The surrounding rocks are not mineralised. 10a and 10b appear to be barren continuations of 10.

11. The 100' sill. Mostly grey diorite but with varying texture and grain size. It is severely sheared in places and the shear planes are heavily epidotised. Beneath North Ridge, this sill is at least 300' thick and is polyphase consisting of mixed diorite

and syenite. It is full of epidotised shears here. Many dykes and veins extend upward from this sill, and all the rocks above it are bleached. Below it the rocks are unaffected 5' from the contact. Apart from a few grains of pyrite, the sill is unmineralised.

12. Small, well-mineralised diorite sill on top of Andradite Mountain, both fed by and cut by vertical, mineralised dykes.

13. Unmineralised diorite sill that appears to bifurcate in Sheppard limestones.

14. 100' below (11), this is a 40' thick diabase. The Siyeh sediments are bleached for 20' on each side, but neither they, nor the sill, are mineralised.

DYKES

α) Unmineralised diorite feeder dyke to sills 2 and 3.

β) Pinkish, trachytic, syenite dyke. 3' wide; unmineralised.

γ) Δ) Two 2-5' wide quartz-feldspar dykes with blebs of golden mica and sparse pyrite.

ε) 4' wide diorite with 1% pyrite.

η) π) κ) Three 5-10' wide diorite dykes with 1-3% pyrite and pyrrhotite. Most of their outcrop is inaccessible.

σ) Unmineralised 3' diorite.

τ) ω) φ) ζ) ρ) ο) λ) ψ) Complex of 2-5' vertical dykes of well mineralised diorite. Mineralisation from ½-3%. Pyrite and pyrrhotite varies laterally and is generally lower in the central portions.

s) 2' wide dyke as α) and Δ).

x) 1' wide barren fine-grained diorite.

g) 5' wide discontinuous semitrachytic syenite as β).

Unmineralised.

In addition the section from Gossan Mountain to North Ridge, above the 100' sill, is laced by a complex network of thin, unmineralised dykes, sills and veins in the dolomites and sandstones.

Conclusions

1. The sills 11 and 14 are the base of a horizon of extensive intrusion.

2. Many of the feeder dykes appear to originate in sill 11.

3. The dykes and sills are coeval.

4. Mineralisation is common in the feeder dykes, and is consequently of magmatic origin.

5. Mineralisation in the sills is restricted to those that intrude Upper Siyeh shales and Purcell lavas, and is concentrated in the margins of these sills.

6. The shales and lavas marginal to mineralised sills are also mineralised. No other horizons are mineralised.

7. The thickening of sill 11 beneath North Ridge, and the concommittant increase in the number of smaller intrusions and the degree of metamorphism above sill 11 here indicate that the 'root zone' would seem to be beneath North Ridge. The root zone is unlikely to be a stock because of the lack of alteration beneath sills 11 and 14, but is probably a vertical pipe.

8. The sills and dykes attain their maximum development beneath Gossan Mountain and decrease in size and intensity to the east.

Recommendations

Because of the extensive pyrite and pyrrhotite mineralisation in the sills and dykes in the Gossan Mountain area, and because of the good possibility of associated gold mineralisation, the 'Gossan Zone' from Andradite Mountain and North Ridge, to Camp Lake, should be mapped and sampled in detail.

This investigation should follow the course of outlining blocks of rock with constant visual percentages of sulphides, followed by the statistical sampling of these blocks, in order to be able to make a tonnage-grade estimate.

Since there is good three-dimensional exposure of most of the mineralised zones, the above procedure will prove both cheaper and more accurate (not to mention more practical) than diamond drilling.

It is imperative that, to assist the above programme, areas where gossan outcrops, but exposure is poor, be trenched immediately. The depth of weathering is not great, but it is necessary for the geologist carrying out this programme to see fresh rock. Random grab samples of mineralised zones indicate mineralisation but do not prove or even indicate either a grade or a tonnage.

Summary of Conclusions and Recommendations

1. The Grinnell Formation contains primary copper mineralisation in sandstones. This is not economically important.

2. The above copper mineralisation may be slightly concentrated into fold cores. Again this is not economically important.

3. Where such fold cores have broken owing to their tightness the copper mineralisation may concentrate to levels to be of economic interest.

4. Such a zone (Zone H) on the Commerce claims should be mapped and sampled in order to make tonnage and grade estimates.

5. Diorite sills are mineralised where they intrude Upper Siyeh shales and Purcell lava. The host rocks may also be mineralised.

6. The above mineralisation consists of pyrite, pyrrhotite, and some chalcopyrite, from which assemblage gold assays have been returned.

7. The outcrop of the above mineralisation is restricted to the 'Gossan Zone', which must be mapped and sampled to estimate reliable tonnages and grades.

8. To help this programme some fairly large mineralised areas must be stripped of overburden and weathered surface rocks.

Nick Badham

REFERENCES

Adshead, J.D., 1963. Petrology of the Carbonate Rocks of the Siyeh Formation, SW Alberta. M.Sc. Thesis, U. of A.

Daly, R.A., 1912. Geology of the North American Cordillera at the 49th Parallel. Geol. Surv. Can., Memoir 38.

Hunt, G.H., 1961. The Purcell Eruptive Rocks. M.Sc. Thesis, U. of A.

Morton, R.D., 1971. Report on the Geology and Economic Potential of the Properties of Kintla Exploration Limited within SE British Columbia and SW Alberta.

Price, R.A., 1961. Fernie Map area, east half. Geol. Surv. Can., Paper 61-24.

Stratigraphic Column of Formations in the SAGE Creek Area, for use with the Geologic Map and Report of J.P.N. Badham (1972)

Formation	Type Section and Thickness		Lithology
Phillips ?	> 50' (Hopper Mt.)		Buff shales with calcareous and arenaceous horizons.
Gateway	~300' (Hopper Mt.)		Red silts and shales with sandstone lenses. Salt clasts, ripple marks, sun cracks and mud-flake conglomerates
Sheppard	250' (Hopper Mt.)		Buff limestones and calcareous shales with good stromatolitic horizons (hemispheroid - continuous linkage), ripple marks and sun cracks.
	30' (Camp Lake Corrie)		Massive chloritised andesite flow with up to 50% chlorite-quartz filled vesicles in the top 5'.
	70' (Camp Lake Corrie)		Interbedded green shales and buff, calcareous shales with three distinctive 2' thick quartz grit beds, containing fragments of green shale and chloritised andesite.
Purcell lavas	200' in N -400' in S (Sill Mt. and Sunkist Mt.)		50' of thin, highly vesicular flows. 100'-250' massive flows with vesicular flow tops. 50'-100' pillowed flows with vesicular and variolitic horizons.
Siyeh	200-250' (Gossan Mt.)		Interbedded flaggy green and grey fissile shales, silts and sandstones.
	~400' (Andradite Mt.)		Interbedded pale sandstones and dolomites. A 30' stromatolitic dolomite (parallel to hemispheroid - continuous linkage) near the top. Dolomites contain 'heiroglyph' and 'molar tooth' patches of limestone.
	~1500' (Weasel Creek Ridge)		Buff weathering, black-grey dolomites, shales and calcareous shales. Well-bedded, with sparse sandstone units near the base, containing marcasite micronodules.
Grinnell	1500-2000' (Weasel Creek, Commerce Ridge)	U.	Interbedded red silts and sandstones with silt clasts. 50% sandstones in 6" to 3' beds.
		M.	Interbedded red and green silts and marls and sandstones, with silt clasts. 30% sandstones in 1-12" beds.
		L.	Red marls and silts with sparse green silts and 1-6" sandstone beds.
Appekunny	~2000' (8108 Mt.)	U.	Green shales and interbedded sandstones, with the proportion of sandstone increasing toward the top

Formation	Type Section and Thickness	Lithology
Appekunny (continued)		Interbedded fissile black and green shales, silts and occasional flags. The base is taken at the lower of two 50' thick distinctive white sandstone beds, ~ 100' apart.
Altyn	> 1000' (8108 Mt.)	Buff and green shales and dolomites.

This column is applicable only to the Commerce Creek-Sage Creek area, and, although it follows Price (1961) closely, certain free adaptations are made, making the division of units simpler and more easily applied to this area.

DETAILED GEOLOGY AND ECONOMIC POTENTIAL OF THE SILL MT.-GOSSAN MT. AREA, COMMERCE CLAIM GROUP, BRITISH COLUMBIA

by

PETER A. NIELSEN (B.A. Hons., M.A.)

August, 1972

Location

The area under investigation lies on the northeastern portion of the Commerce Claim Group, and was studied for its potential of copper-gold mineralisation. Detailed mapping covers the ridge between Sill Mt. and Gossan Mt., and the northern part of Sunkist Ridge.

Introduction

The area was mapped and sampled by the author during the period 2 August - 22 August. Assistance was provided by S. Demkiw. All mapping was done at the scale of 1" 100'. Where possible,all localities shown on the map were located by observing two or more pickets, thus all localities south of the base line should be within 5' of their true grid location. Locations north of the baseline are probably within 50' of their true grid location, as there are no pickets north of the baseline.

The mineralization observed was confined to sills and dykes and the locally intruded host rocks. Consequently, with the exception of the Purcell mineralized zone, all volume-tonnage figures are given for sills only. The author has distinguished three mineralised zones which will be discussed separately. These zones are summarized in Table 1.

Zone 1 includes a 10' thick sill of feldspar-hornblende porphyritic diorite (the Sheppard Sill, Badham,1972) and the mineralised Purcell Lava sequence below it. Zone 2 occurs between 9+00w and 22+00W on the Base line. The best mineralisation observed in Zone2 occurred in Sill 7 (Badham, 1972), which the author has devided into 4 sections for volume-tonnage calculations. Zone 3 includes the trenched area on the SE slope of Sill Mt.

Geology of Zone 1

Zone 1, on the northern part of Sunkist Ridge lies approximately 400' South of the cat road where it crosses the low pass. A sill of feldspar-hornblende porphyritic diorite intrudes the lower Sheppard Fm. and is characterized by 2% disseminated pyrite. Its outcrop is confined to a zone 240' long along the ridge crest. It then passes into an area of heavy tree cover and areas of talus on both slopes of the ridge. 100' further North, the uppermost Purcell Lava outcrops. Here, the Purcell is highly vesicular, with the vesicles most often filled by sulfides (pyrite > pyrrhotite > chalcopyrite). Minor carbonate (pink calcite) is also present in some of the vesicles. In addition to vesicle fillings, the sulfides also occur along joint planes, as fracture fillings, and at the contact of successive lava flows.

Along the crest of Sunkist Ridge, the Purcell contains up to 20% sulfides. The Purcell can be traced sporadically for approximately 1000', with a gradual decrease in the percent of mineralisation from 20% at the ridge crest to 2% at the lowest point sampled. The average sulfide content over the 1000' of sporadic outcrop is about 15%. The average exposed thickness is 12', and it ranges from 5' to 20'. The mineralised zone may well be thicker than the maximum exposure of 20', but cannot be observed because of heavy tree cover and extensive soil development. A thickness of about 50' is suggested by sample NA20.9, which is almost 40' downslope from NA20.5. NA20.5 averages 20% sulfides, and NA20.9 averages 3%, with some horizons in the 6' section up to 10%. Due to extensive vegetation and soil development, it was not possible to sample the Purcell between NA20.5 and NA20.9.

It is recommended that this area be drilled, stripped or trenched in order to determine the full extent of the mineralised zone. For the volume-tonnage calculations in Table 1, a width=1/2 strike length was used.

Geology of Zone 2

Zone 2 extends from 9+00W to 22+00W on the base line along the ridge between Sill Mt. and Gossan Mt. The best mineralisation is associated with Sill 7 (Badham, 1972). This sill ranges from 2% to 12% mineralisation and averages 7.35% alomg its 1000' of outcrop. The sulfides observed (in decreasing abundance) were pyrite, pyrrhotite, and chalcopyrite. Chalcopyrite was only observed when the total sulfide content was greater than 7%. The width of Sill 7 was assumed to be equal to 1/2 the width of the ridge at the elevation of the sill outcrop. This assumption was made because there is no observable outcrop of Sill 7 on the South side of the ridge, probably because of extensive vegetation and talus development. The sill is primarily a feldspar-hornblende porphyritic diorite with the sulfides disseminated throughout the sill. Locally, minor joint plane mineralisation is developed. The surrounding sediments exhibit local joint plane mineralisation and frequent development of pyrite replacing the more arenaceous interbeds in the Siyeh argillite sequence. Such mineralisation is generally confined to a zone within 10' of the sill at the upper contact.

Sill 7 was devided into 4 sections for volume-tonnage calculations (Table 1).These sections were not drawn arbitrarily, but represent dislocations within the sill and abrupt changes in the degree of mineralization. The boundaries between the various sections of the sill correspond to offsets in the level of intrusion, as can be seen on the accompanying map.

In addition to the bodies defined in Table 1, several smaller sills in this zone were sampled. These are not tabulated on Table 1 because their outcrop is sporadic and they cannot be traced laterally due to extensive areas of talus development. It is unfortunate that these sills are not better exposed as some of them show excellent disseminated sulfides. Other sills showing a moderate degree of mineralisation (7%) are so irregular that they do not lend themselves at all to volume-tonnage calculations. One such area occurs between 10+50W and 12+00W along the Base line. Here, the sill varies in thickness between 3" and 10' over a distance of less than 50'. The sill is also intruded by a late stage hornblende porphyritic fluid in which the hornblende has been altered to chlorite. There is no obvious mineralisation associated with this late stage intrusion. The area is further complicated by minor faulting and folding such that the sill varies in thickness and attitude throughout the cliff-face. Such variation in the 2 observable dimensions cautions against assuming anything to be constant in the 3rd dimension.

It is recommended that work on this specific zone, and similiar zones be undertaken only if encouraging values are obtained from assays of the samples collected this season. The only reasonable program for this area would be a series of test holes, and there are many more important areas that require test drilling. Two such areas in Zone 2 are the southern extensions of sections B and C of Sill 7, where drilling will be necessary to determine the true width and extent of mineralisation of the sill beneath the ridge crest.

It is further recommended that if assays returned from the samples of Sill 7 indicate gold values of economic concentration, the sulfides present in the samples be analyzed with the ARL Scanning Electron Microprobe to determine if the gold occurs in solid solution in the sulfides, or as a separate phase. A similiar analysis for silver, if present, is also advised. Sill 7 contains more than 43,500 tons of mineralisation, and if these sulfide minerals are auriferous, then economic exploitation of the Commerce Claim Group may indeed be a reality.

Geology of Zone 3

Zone 3 lies on the SE slope of Sill Mt. at approximately 17+00E and 4+00N. The mineralisation occurs near the lower contact of the Sill Mt. Sill (Badham, 1972) and the lower Sheppard Fm. The trench put down in this area shows extensive disseminated sulfides occuring in both the syenite and the host rock. The per cent mineralisation cannot be accurately gived due to extensive oxidation and production of a large gossan zone. Visible gold has been taken from the trench from a quartz rich band (F. Goble, pers. comm.). The trench was statistically sampled by Mr. F. Goble, and the author suggests that the sample line parallel to the trench walls be assayed first, as it cuts across all of the rock units exposed in the trench. The sample lines perpendicular to the trench walls should then be assayed with regard to the results of the assays returned from the first line. Subsequent sampling and diamond drilling sites should be chosen to intersect the rock types suggested by the assays as most favorable gold bearing units.

Conclusions

1) Three areas of extensive mineralisation are developed. They are- 1-Zone 1, the upper Purcell lavas exposed on Sunkist Ridge, 2-, the sills and host Siyeh argillites between 9+00W and 22+00W, and, 3-,

the trenched zone on the SE slope of Sill Mt.

2) Mineralisation in Zone 1 is of a replacement type, with sulfides (pyrite > pyrrhotite ≫ chalcopyrite) replacing quartz and calcite as vesicle fillings, and coating fractures and joint planes, where fluid migration was easiest.

3) The mineralisation in Zone 2 is confined to the sills and the host argillites within 10' of the sills. The predominant sulfide is pyrite followed by pyrrhotite and minor chalcopyrite. The sulfides are disseminated throughout the sills, but are confined to joint planes and arenaceous horizons in the overlying Siyeh argillites.

4) The mineralisation in the trenched zone appears to be produced by the Sill Mt. syenite sill, with sulfide minerals disseminated in the sill and the intruded Sheppard Fm. Silica bearing fluids permeated much of the contact zones, giving rise to the quartz veins and crystal filled cavities found throughout the trench. Subsequent oxidation has leached the mineralised zone to a depth greater than 15'.

Recommendations

1) The mineralised area in Zone 1 should be examined in order to determine the full extent of the mineralisation. This will require stripping off large areas of tree cover which currently obscures more than 80% of the Purcell. Diamond drilling further south would establish whether the mineralisation extends under Sunkist Ridge alon the Purcell-Sheppard Sill contact.

2) If encouraging assays are returned on the sills in Zone 2, drilling should be used to establish the lateral extent of the sills and their mineralised zones

3) The trenched area of Zone 3 should be drilled off in order to 1- determine the grade and mineralogy of the unaltered rock, and 2- make tonnage and grade calculations.

4) Where assays indicate economic concentrations of gold and silver, the sulfides be analyzed fpr Au and Ag on the ARL Scanning Electron Microprobe to determine if the Au or Ag is in solid solution in the sulfide, or occurring as a separate phase.

Peter A. Nielsen

TABLE 1

SECTION	LENGTH (feet)	WIDTH (feet)	THICKNESS (Average) (feet)	VOLUME (cu. ft.)	TONNAGE 10 ft³/Ton	% SULFIDES (Average)	TONS SULFIDES	LOCATION	
Sheppard Sill	240	120	10	288000	28800	2	576	18E	7SE
Purcell	1000	500	12	6000000	600000	15	90000	18E	6SE
Sill 7A	450	500	10	1850000	185000	3	5400	18W	2S
Sill 7B	225	500	25	2812500	281250	10	28125	16W	2S
Sill 7C	250	500	10	1250000	125000	8	10000	14W	BL
Sill 7D	50	20	10	10000	1000	3	30	13W	BL
Sill 9	100	1000	10	1000000	100000	2	20000	12W	7N
sill 7 (total)					592250	7.35	43555		
Total Zone 1 + Zone 2					1322050	11.65	154131		

REPORT TO KINTLA EXPLORATIONS, LTD. ON THE BETH CLAIMS AND PARTS OF THE COMMERCE CLAIMS

Georgia Hoffman

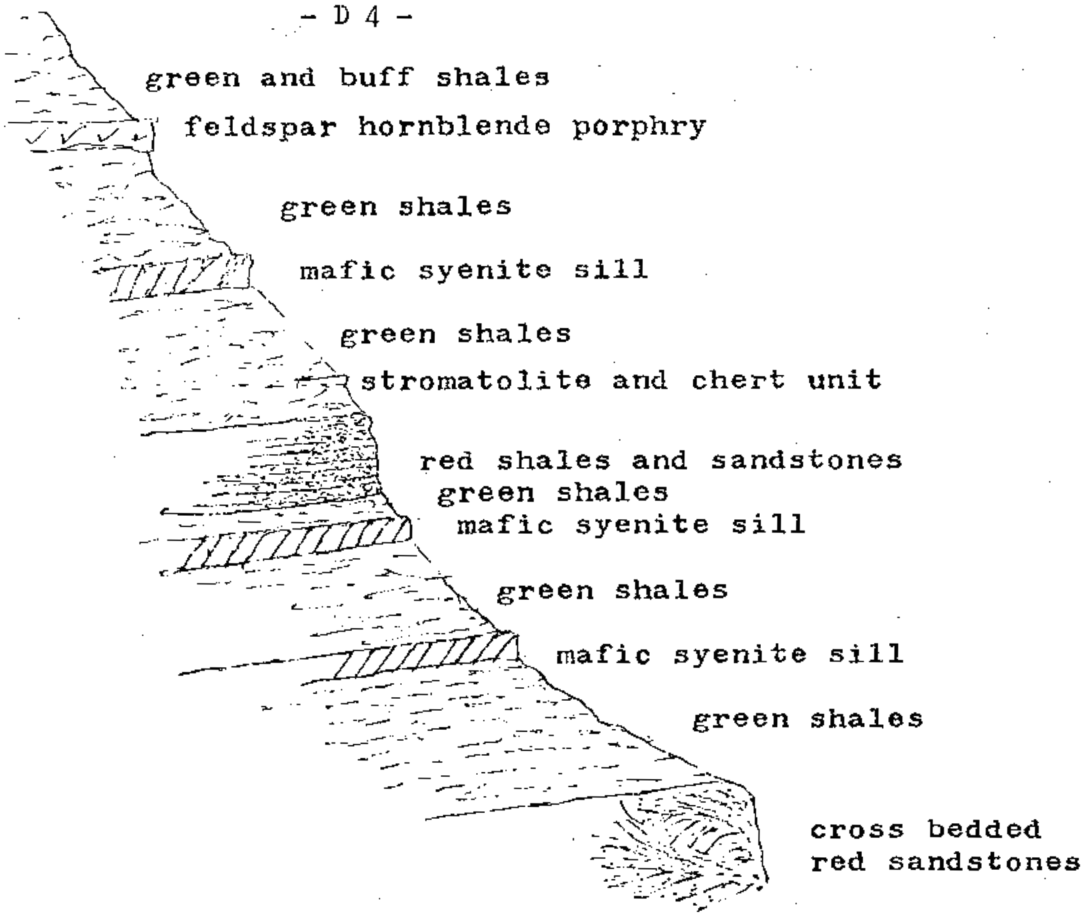
September, 1972

THE BETH CLAIMS:

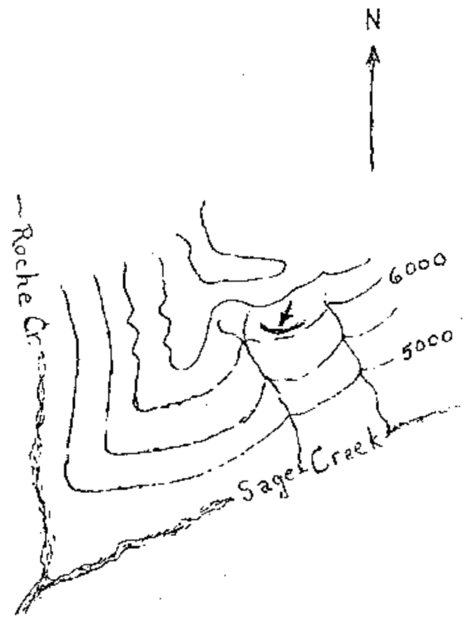
This area was claimed because of good copper assays obtained by Eric Goble from a mineralised zone associated with a red "chert" (the material was actually too soft to be chert) bed. A similar zone was located by Frank and Dave Goble on the east side of the cliffs above Sage Creek; however, the chert bed was much thinner (six inches as opposed to several feet) than that described by Eric. This worker sought and found the chert bed in the area where it had been located by Frank and Dave. It was about six inches thick, and was underlain by a resistant limestone stromatolite bed usually about one foot thick. The mineralised zone was about five feet above these beds in green shales. Its thickness varied, the maximum being about two feet, with up to five percent chalcopyrite, and some malachite forming as a weathering product. Unfortunately this zone died out quickly to the north, although the chert and stromatolite units could be traced at least half way to the back of the valley. The mineralisation could be followed about half way to the next drainage to the east, although outcrop was rather sparse. The mineralisation was definately absent in the next drainage itself. The west side of the valley was covered by grass, so no attempt was made to find the zone there. Traverses were also made east from Roche creek, where no mineralisation of any kind was found either in the float or in place, and down the southwest ridge, where a minor zone of chalcopyrite was found which died out in a few feet or yards in any direction. The stromatolite and chert unit could not be found in these areas, and since its approximate stratigraphic position is easily recognised, I would assume that it is absent from these areas.

The sills in the area are mafic syenites, except for one of feldspar hornblende porphry, and there are no sulfides associated with them, except for an occasional speck of pyrite.

Chalcopyrite was found in float in porous stromatolite material. No outcrop of this material was ever found, although it must come from stratigraphically above the stromatolite and chert units. Some galena was also found in float, but no occurrence of any note was found in place.



A stratigraphic column, not drawn to scale, showing the stratigraphy of the Beth claims and the position of the stromatolite and chert units somethimes associated with chalcopyrite mineralisation.



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The area of the Beth claims, taken from the topographic map, showing the approximate location of the stromatolite and chert units and chalcopyrite mineralisation. The elevation is only an estimate.

Ronald James Goble
July 19, 1973

SILL MOUNTAIN:

The Sill Mountain sill, on the Commerce claims, lies just above the Purcell, separated from it by a few feet of sedimentary rock. It is best exposed along the west ridge of the mountain, most of the east face and south ridge being covered by grass and float. The sill varies from syenite to diorite, often with large crystals of plagioclase and potassic feldspar, and probably consists of more than one intrusive, although shortage of outcrop would make it difficult to subdivide it into more than one mappable unit. Xeonliths of diorite, argillite, and amphibolite(?) are common.

With the exception of the trench, the only mineralised zone found was on the north ridge, where a few percent of pyrite were present in the sill. There was insufficient outcrop to allow a meaningful chip sample to be taken; however, grab samples (HA201 and HA202) of the rock were taken to determine wether the zone merits further investigation. Chip samples (KGA201 and KGA202) were taken of the typical sulfide-free rock of the west ridge, but these will probably show nothing of interest.

In the trench it appears that diorite has been intruded and altered by pegmatites and then by late-stage fluids, along a north-south direction. The visible mineralisation is confined to the pegmatites. It will be difficult to determine the extent of these pegmatites, as they are deeply weathered and disappear in both directions under a cover of grass and talus, through which only ledges of the tough, unaltered sill outcrop.

GOSSAN MOUNTAIN:

Gossan Mountain, on the Commerce claims, is made of limestone overlain by argillite, intruded by feldspar- and hornblende-bearing dikes and sills. The upper intrusives show some sulfide mineralisation. They consist of blue plagioclase with minor hornblende and occasional traces of biotite, and contain variable amounts of pyrite or pyrrhotite, usually only one or two percent. Chalcopyrite was rarely identified.

The main sill is twenty-five to thirty feet thick, with an average attitude of 340°, 15° east. Its approximate shape could be assumed to be that of a triangle 500' x 400' x 300' x 25'. Chip samples HA162, HA171, HA182, KA162, KGA181, KGA182, and HA181 are from this sill.

Other smaller (five feet to six inches) sills and dikes of the same material form a complex network in the argillite. The argillite itself is unmineralised, although sulfides can sometimes be found on joint surfaces.

The lower sills and dikes in the limestones proved to be unmineralised or extremely poorly mineralised. They contain more hornblende than the higher intrusives and could be described as feldspar hornblende porphries. Chip sample HA191 is from one of the larger (twenty-five feet thick) ones. Due to their lack of visible mineralisation, lack of base line where they are exposed (the west face), and physical difficulties involved in reaching some of them, some of these sills have been mapped only approximately at a scale of one hundred feet to the inch, and some not at all at that scale.

A late-stage equigranular plagioclase-hornblende diorite can be found along the north ridge in units varying from three foot sills to tiny veins and dikes. It is undoubtedly unmineralised. Several unmineralised late dikes of fine-grained feldspar and blebs of biotite, which were probably once hornblende phenocrysts, have also been mapped.

LIST OF SAMPLES:

DESCRIPTION: Large sill on Gossan Mtn., 25' thick, blue plagioclase, minor hornblende, rare biotite, pyrite & pyrrhotite 0-2%.

LAB NO.	FIELD NO.	LOCATION
4854	HA162	28+00W 2+00S
4856	HA171	27+00W 2+00S
4855	KA162	27+50W 2+50S
4864	KGA171	31+00W 2+00S
4860	HA181	30+00W 4+00S
4861	KGA181	31+00W 2+00S
4862	KGA182	30+50W 2+50S
4863	HA182	29+00W 2+00S

DESCRIPTION: Smaller sill on Gossan, 8' thick, feldspar, minor hornblende, 1% sulfide.

4852	KA161	25+00W 2+10S
4853	HA 163	26+00W 2+20S

DESCRIPTION: Feldspar sill on ridge, similar to above, 4% sulfide.

4851	HA161	14+80W 0+25S

DESCRIPTION: Sill Mtn. sill, syenitic feldspar-hornblende porphry, 1% pyrite. Both are grab samples. Taken on north ridge.

4866	HA201	8+00N 0+50W
4867	HA202	9+00N 0+50W

DESCRIPTION: Sill Mtn. sill, west ridge, typical rock, sulfides trace to absent. Taken on cliff above trail, to summit.

4868	KGA201	lower half
4869	KGA202	upper half

DESCRIPTION: Feldspar-hornblende porphry, no visible sulfide, taken on south ridge of Gossan, east side, just above saddle.

4865	HA191

All of the above are chip samples except 4866 and4867, which are grab samples.

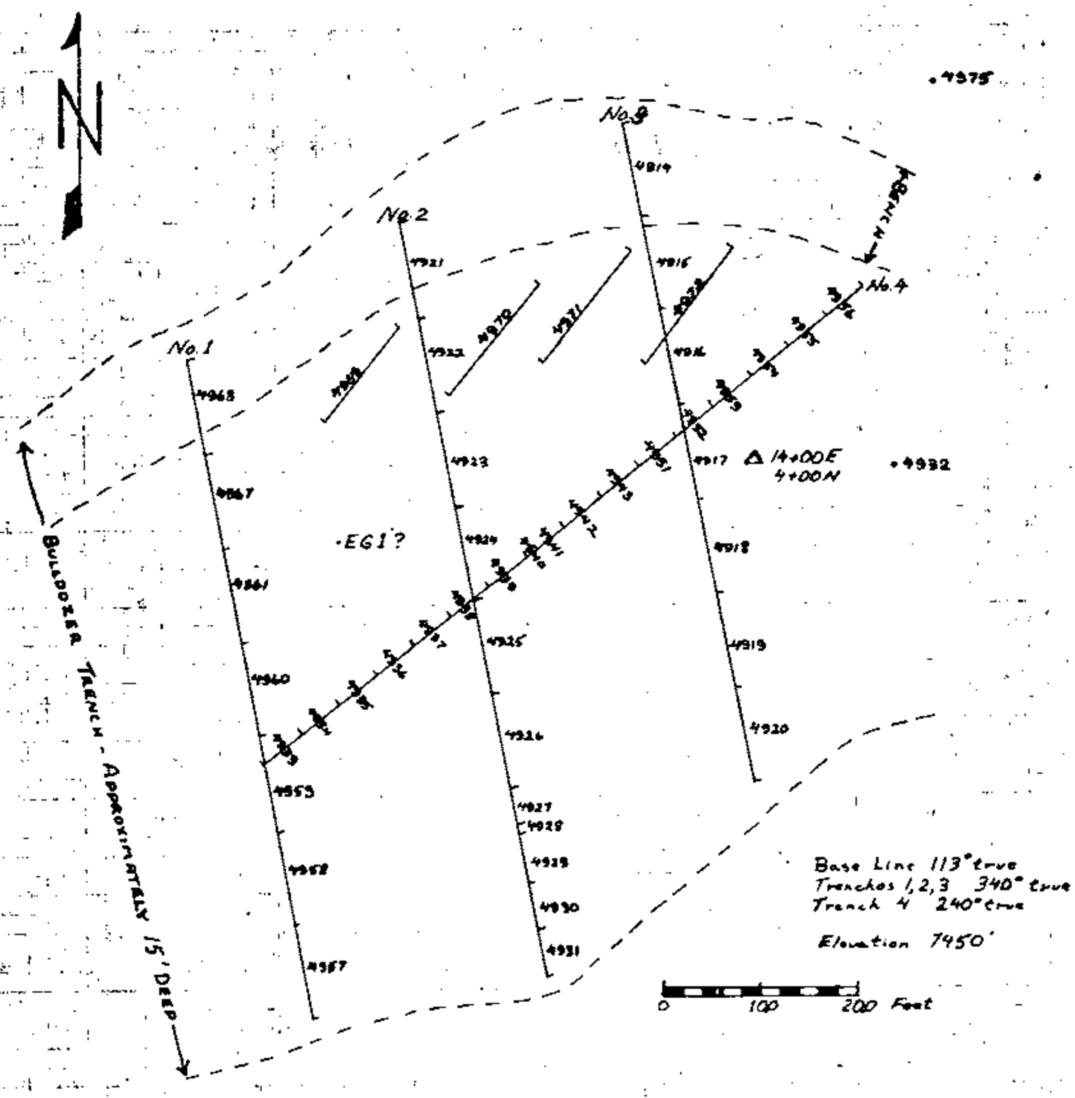
ASSAYS - TO ACCOMPANY MAPS 2 AND 3

Sample No.	Au (oz/Ton)	Ag (oz/Ton)	Thickness (feet)
HA16.1	3.84	N.D.	8
HA16.2	N.D.	N.D.	25
HA16.3	N.D.	N.D.	8
HA17.1	N.D.	0.17	25
HA18.1	TR.	N.D.	25
HA18.2	N.D.	0.14	25
HA19.1	N.D.	N.D.	25
HA20.1	0.01	N.D.	?
HA20.2	N.D.	0.78	?
NA14.1	N.D.	TR.	15
NA14.2	0.01	TR.	18
NA16.1	TR.	N.D.	8
NA16.2	N.D.	N.D.	6
NA16.3	N.D.	TR.	20
NA16.4	N.D.	N.D.	25
NA16.5	TR.	TR.	6
NA16.6	TR.	N.D.	8
NA17.1	N.D.	TR.	4
NA17.2	N.D.	0.42	10
NA17.3	N.D.	N.D.	15
NA17.4	N.D.	TR.	10
NA17.5	N.D.	N.D.	15
NA17.6	N.D.	4.19	15
NA17.7	N.D.	0.43	15
NA17.8	N.D.	N.D.	8
NA17.9	N.D.	N.D.	4
NA17.10	N.D.	0.93	10
NA17.11	N.D.	0.22	10
NA18.1	TR.	N.D.	7
NA18.2	N.D.	N.D.	3
NA18.3	N.D.	N.D.	10
NA18.4	0.01	0.15	10
NA18.5	N.D.	N.D.	6
NA18.6	TR.	N.D.	3
NA18.7	N.D.	N.D.	10
NA18.8	N.D.	0.42	2½
NA18.9	N.D.	0.15	4
NA18.10	TR.	N.D.	15
NA18.11	TR.	N.D.	8
NA18.12	TR.	N.D.	8
NA19.1	N.D.	N.D.	10
NA19.2	N.D.	TR.	10
NA19.3	N.D.	TR.	15
NA19.4	TR.	TR.	3
NA19.5	N.D.	TR.	4
NA20.1	N.D.	0.20	6
NA20.2	0.01	TR.	10
NA20.3	0.01	0.90	10

ASSAYS - TO ACCOMPANY MAPS 2 AND 3

Sample No.	Au (oz/Ton)	Ag (oz/Ton)	Thickness (feet)
NA20.4	N.D.	0.17	13
NA20.5	TR.	N.D.	12
NA20.6	TR.	1.90	14
NA20.7	N.D.	TR.	8
NA20.8	1.43	N.D.	15
NA20.9	N.D.	0.20	5½
KA16.1	N.D.	TR.	8
KA16.2	N.D.	TR.	25
KGA17.1	N.D.	N.D.	25
KGA18.1	TR.	N.D.	25
KGA18.2	N.D.	TR.	25
KGA20.1	N.D.	TR.	?
KGA20.2	TR.	TR.	?

SAMPLE LOCATION MAP - TRENCH ON COMMERCE NO. 3



Sketch map by F.M. Goble
Sampled for KINTLA EXPLORATIONS LTD.
By F.M. Goble

Ronald James Goble
July 19, 1973

ASSAYS - TRENCH ON COMMERCE NO. 3

Sample No.	Cu (%)	Ag (oz/Ton)	Au (oz/Ton)	Pb (%)	Thickness (feet)
4914			<0.003		10
15		0.02	<0.003		10
16		0.03	0.003		10
17	<0.01	0.01	<0.003		10
18		0.05	<0.003		10
19		0.01	<0.003		10
20		0.05	0.005		10
21		0.03	<0.003		10
22		0.03	<0.003		10
23			0.005		10
24			0.003		10
25			<0.003		10
26			<0.003		10
27			<0.003		5
28		0.03	<0.003		1
29			<0.003		5
30			<0.003		5
31			<0.003		5
32			<0.003		?
33			<0.003		5
34			0.003		5
35			0.005		5
36			0.005		5
37			<0.003		5
38			0.003		5
39			0.003		5
40			0.003		5
41			0.005		5
42			0.003		5
43			0.003		5
4951			0.003		5
52			0.005		5
53			0.005		5
54			0.008		5
55		0.05	0.005	0.02	5
56			0.007		5
57			0.007		10
58		1.24	0.008	0.35	10
59		0.07	0.010	0.01	10
60		0.06	0.007	0.02	10
61			0.006		10
4967		0.05	0.005		10
68		0.05	0.005		10
69		0.05	0.007		15
70		0.03	0.005		15
71		0.05	0.007		15
72		0.36	0.008	0.08	15
73		0.05	0.005		?
74		0.02	0.008		?
75		0.04	0.008		?
EG1			0.258		?

ASSAYS - BETH CLAIMS

Sample No.	Cu (%)	Ag (oz/Ton)	Au (oz/Ton)	Pb (%)	Ni (%)	Zn (%)
4807			0.010			
08	0.01	0.01	0.006		0.01	
10	2.00	1.38				
12		0.02	0.003			
27	0.28					
28	1.00	0.25	0.005	0.01		0.01
29	0.20	0.08				
30		0.06		0.14		0.24
31	0.30	0.13				
32	0.50	0.15				
33	0.24	0.06				
34	1.01	0.26				
35	0.61	0.18				
4965	1.57	0.15	0.003			
66	0.39	0.21		2.75		
21506		0.01	0.003			
07		0.01	0.003			
08		0.03	0.003			

SUMMARY AND CONCLUSIONS

Commerce Claims

The Grinnell Formation contains primary copper mineralization in sandstones. This mineralization may be economic where concentrated in fold cones that have broken due to their tightness. Such zones of mineralization contain on the order of 50,000 tons of material.

A series of dioritic sills are mineralized where they intrude the upper Siyeh shales and the Purcell lavas. The mineralization extends outwards from the sills up to 10 feet into the sediments. The sulfide assemblage is pyrite pyrrhotite chalcopyrite. Sill 7, containing an estimated 592,250 tons of material, returned an 8 foot section grading 3.84 oz/Ton Au. Gold mineralization was also encountered in the Purcell lavas, from which an assay of 1.43 oz/Ton was returned. A shattered area within the Sill Mtn. sill showed 0.258 oz/Ton in a grab sample but showed only minor gold mineralization when sampled on a systematic basis. Silver values up to 4.19 oz/Ton were encountered in the sills and the surrounding sediments.

It is concluded that the copper mineralization within the Grinnell sandstones are not by themselves economic due to their location and limited size. Economic concentrations of Au and Ag may be found in two areas, sill 7 on Gossan Mtn. and the Purcell lavas associated with the dioritic sills south of Sill Mtn. These two areas should be resampled prior to drilling to check the grade and extent of the mineralization. The sediments on Gossan Mtn. should be sampled to check for economic concentrations of Ag. It is of interest to note that in two of the three areas in which Au has been located to date (the trench on Sill Mtn. and sill 7) fluorite has been found in the intrusives. Further occurrences of fluorite-bearing diorite on North Ridge should be sampled on this basis.

Beth Claims

The mineralization on the Beth Claims occurs in, and for up to 7 feet above, a red 'chert' unit approximately 6 inches thick. The mineralization occurs in a rusty series of shales but extends laterally past the rusty horizon. The mineralization grades up to 2.00% Cu across 2 feet with minor Cu value (0.20 - 0.30%) across a further 5 feet.

Minor Pb (up to 2.75%), Ag (up to 1.38 oz/Ton), and Zn are associated with the copper. The mineralization dies out approximately 300 feet to the west and 750 feet to the east of the main zone.

The 'chert' bed appears to be an altered sandstone and changes in character away from the mineralized zone, as do the rusty shales topping the chert bed. It is concluded that the zone is a zone of alteration, possibly formed by solutions moving out from an underlying intrusive. It is recommended that drilling be undertaken to the north (back into the mountain) to determine whether the mineralized zone increases in grade or dies out in this direction.

WORK AFFIDAVIT-COMMERCE CLAIMS

Trenching on Commerce Nos. 1,2,3,4

Bulldozer charges $1184.50

Wages: 1 man July 25 to August 1 - 6½ days @ $1000/mo = $250.00

1 man July 25 to August 1 - 6½ days @ $ 700/mo = $175.00

2 men July 25 to August 1 - 6½ days @ $ 550/mo = $275.00

TOTAL TRENCHING COST = $1884.50

Mapping on Commerce and Sunkist Groups

Wages:	1 man	July 25	to	August 9	- 13 days	@ $1200/mo	=	$ 600.00
	2 men	August 2	to	August 28	- 26 days	@ $1000/mo	=	$2000.00
	1 man	August 2	to	August 12	- 9 days	@ $ 600/mo	=	$ 216.00
	1 man	August 15	to	August 28	- 13 days	@ $1000/mo	=	$ 500.00
	1 man	August 2	to	August 28	- 26 days	@ $ 700/mo	=	$ 700.00
	1 man	August 2	to	August 28	- 26 days	@ $ 306/mo	=	$ 306.00
	2 men	August 2	to	September 10	- 39 days	@ $ 550/mo	=	$1650.00
	1 man	July 25	to	August 1	- 3½ days	@ $ 550/mo	=	$ 77.50

TOTAL WAGES FOR MAPPING AND SAMPLING = $6049.50

Other Related Costs

Assaying = $844.00

Vehicle rental: 2 vehicles for 1½ months @ $350.00/mo = $1050.00

Camp costs: wages for 1 cook for 1½ months @ $750.00/mo = $1125.00

food for 221 man-days @ $2.50/man-day = $552.50

TOTAL RELATED COSTS = $3571.50

NOTE: wages paid on 26 day month

TOTAL COSTS ON COMMERCE GROUP AND SUNKIST GROUP = $11,505.50

PROFESSIONAL GEOLOGIST ALBERTA

RONALD JAMES GOBLE

WORK AFFIDAVIT-BETH CLAIMS

Mapping and Sampling on Beth Group

Wages: 2 men August 31 to September 13 - 13 days @ $1000/mo = $1000.00
       1 man August 31 to September 13 - 13 days @ $ 700/mo = $ 350.00
       1 man August 31 to September 13 - 13 days @ $ 306/mo = $ 153.00

Assaying = $104.20

Vehicle: a vehicle for $\frac{1}{2}$ month @ $350.00/mo = $175.00

Food for 52 man-days @ $2.50/man-day = $130.00

TOTAL COSTS FOR MAPPING AND SAMPLING = $1808.00

NOTE: wages paid on 26 day month

TOTAL COSTS ON BETH GROUP = $1808.00

PROFESSIONAL GEOLOGIST ALBERTA
RONALD JAMES GOBLE

CERTIFICATE

I, RONALD JAMES GOBLE, of the City of EDMONTON, in the Province of Alberta, hereby declare:

(1) That I am a registered Professional Geologist in the Province of Alberta.

(2) That I am a graduate of the University of Alberta, with the degrees of Bachelor of Science 1968 and Master of Science (Geology) 1971.

(3) That I hold the position of Geologist and Secretary-Treasurer with Kintla Explorations Limited of #7 - 8540 - 109 Street, Edmonton, Alberta.

(4) That I did supervise the work done on the Beth and Commerce Claims in the Fort Steele Mining Division between July 25 and September 15, 1972.

(5) That reports entitled 'Geology and Economic Potential of the Commerce Claims, British Columbia', 'Detailed Geology and Economic Potential of the Sill Mt.-Gossan Mt. Area, Commerce Claim Group, British', and 'Report to Kintla Explorations, Ltd. on the Beth Claims and Parts of the Commerce Claims' describe geological investigations carried out on the Beth and Commerce Claims and that this report entitled 'Geological Report on the Beth and Commerce Claims Located 45 Miles Southeast of Fernie, 49° 114° S.E.' is a summary of the work carried out under my supervision.

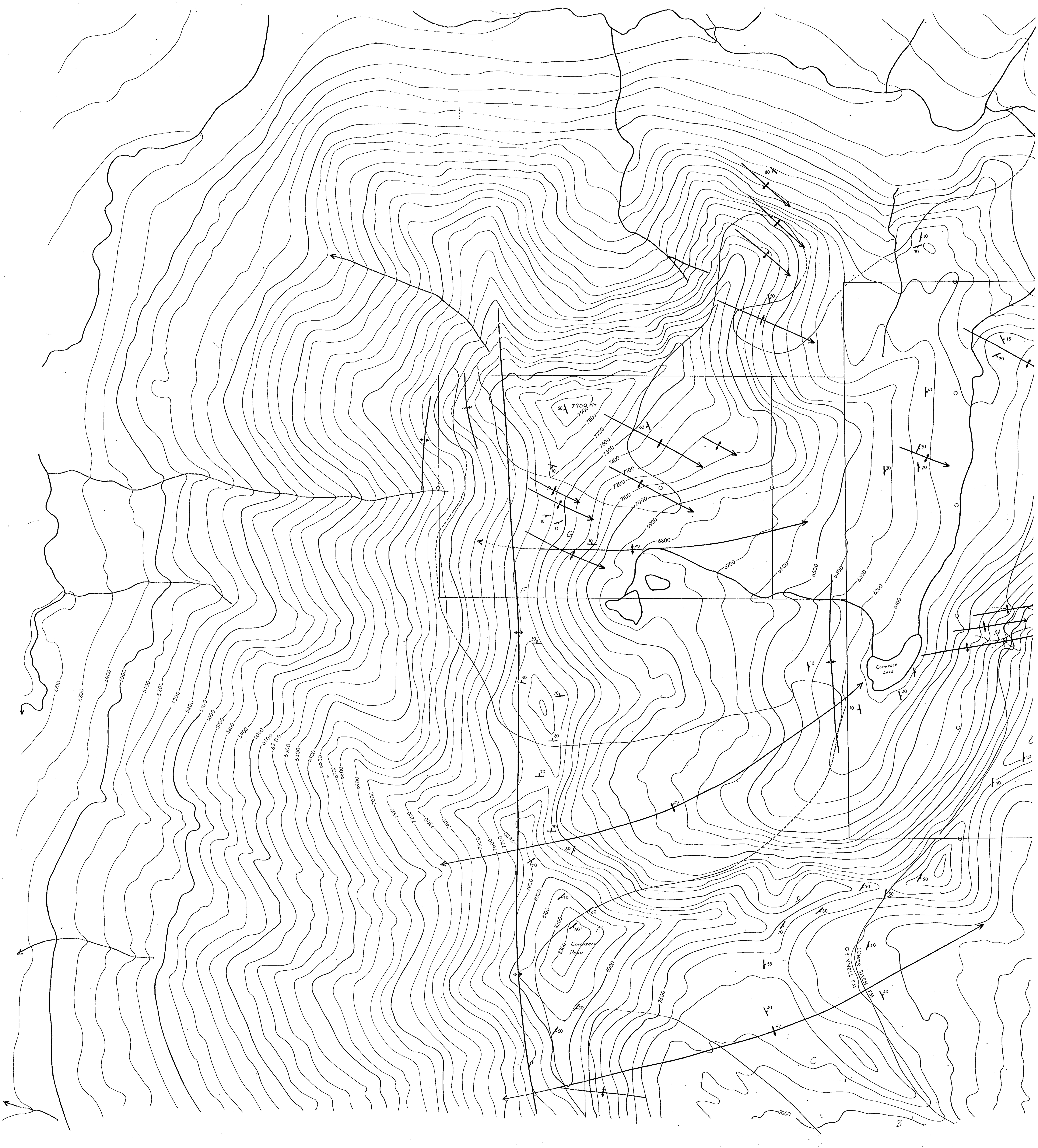
Respectfully submitted,

Ronald James Goble

RONALD JAMES GOBLE, B.Sc.,M.Sc.,P.Geol.

DATED 19 July, 1973

PROFESSIONAL GEOLOGIST ALBERTA
RONALD JAMES GOBLE



7900 Ft.
7800
7700
7600
7500
7400
7300
7200
7100
7000
6900
6800
6700
6600
6500
6400
6300
6200
6100
Commerce Lake
Commerce Peak
8300
8200
8100
8000
7500
Lower Siyeh Fm.
Grinnell Fm.
4700
4800
4900
5000
5100
5200
5300
5400
5500
5600
5700
5800
5900
6000
F
G
D
E
C
B

Department of
Mines and Petroleum Resources
NO. 4535 MAP #10

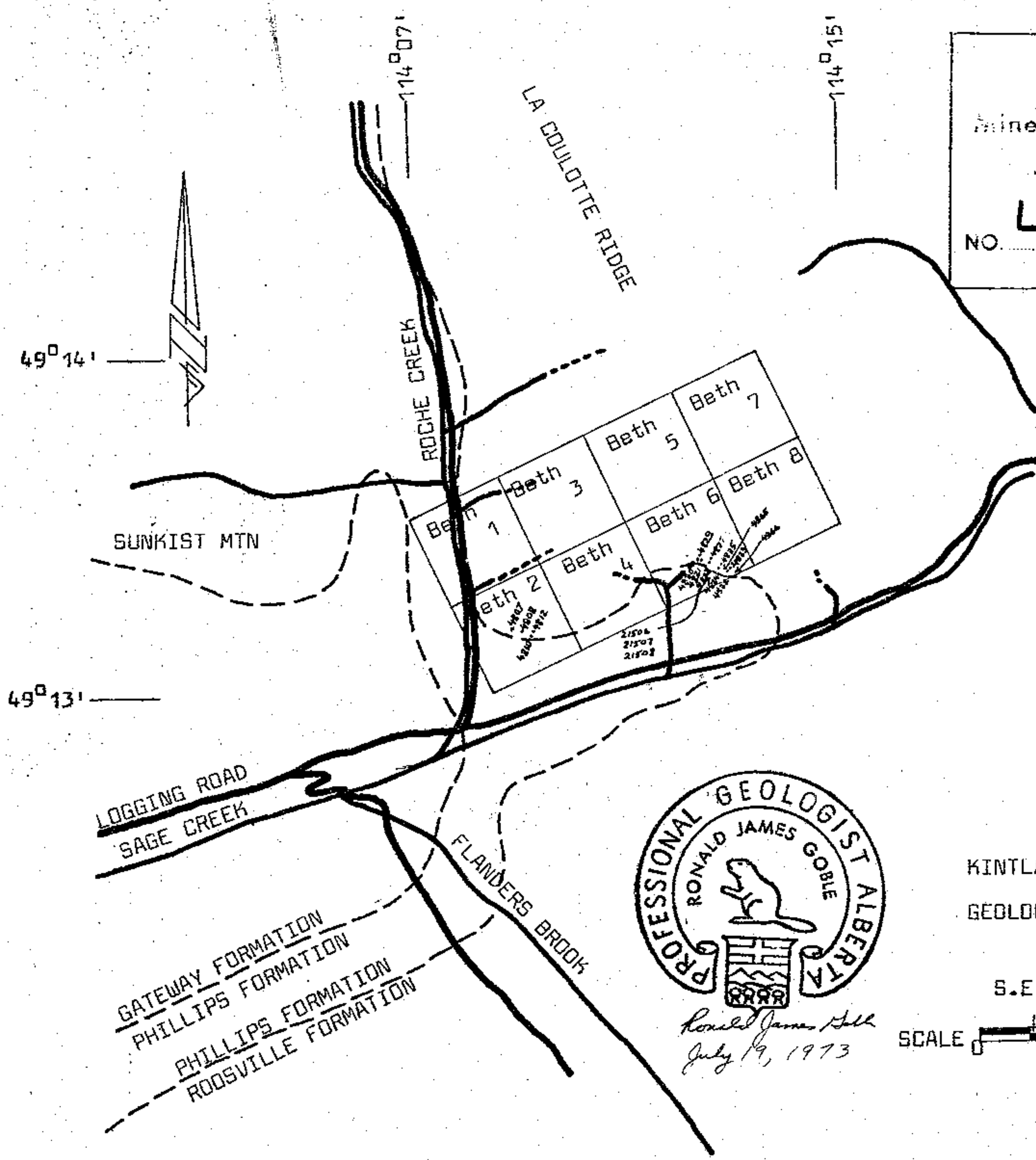


FIGURE 5

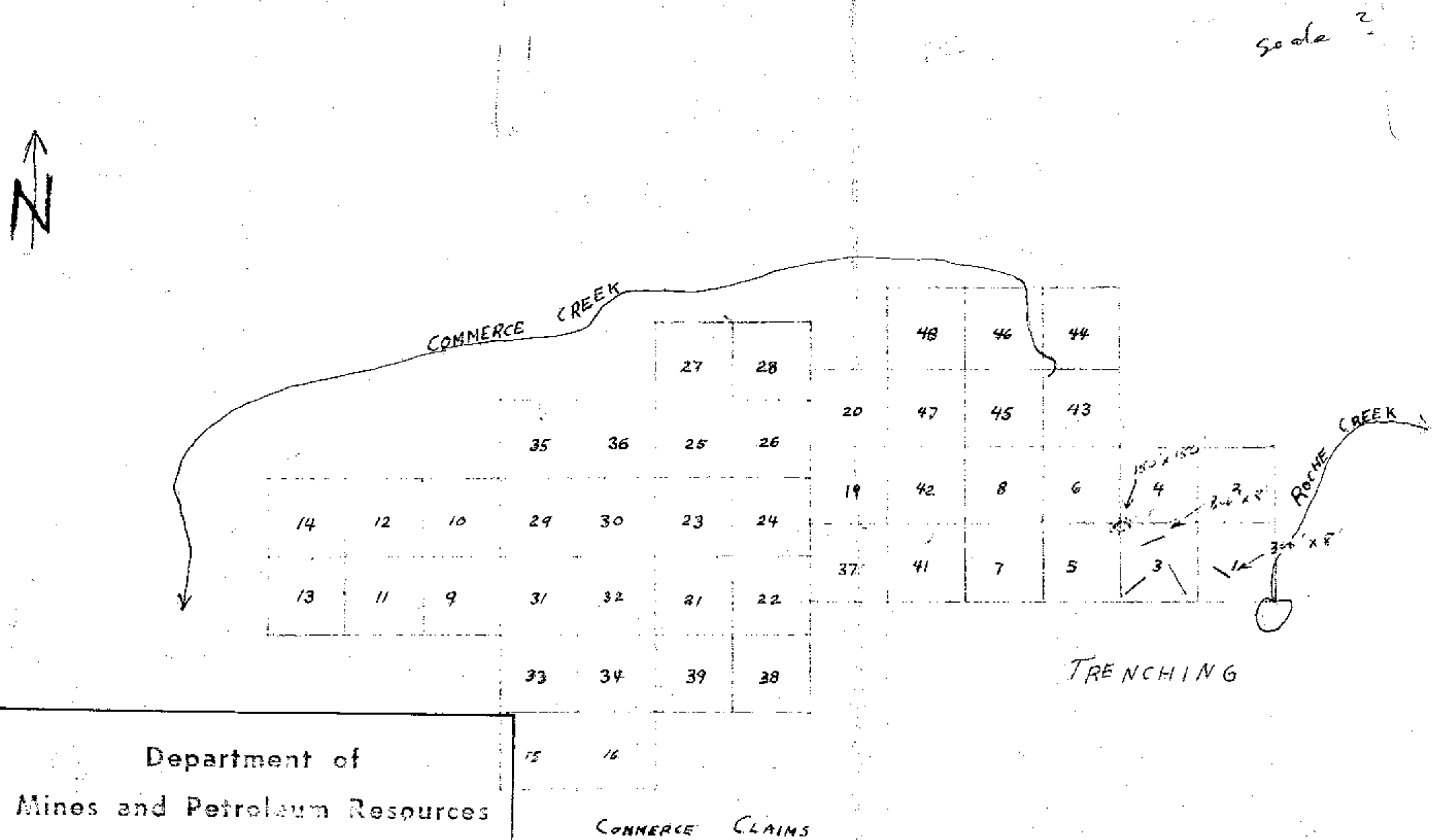
KINTLA EXPLORATIONS LIMITED

GEOLOGICAL & CLAIM MAP OF

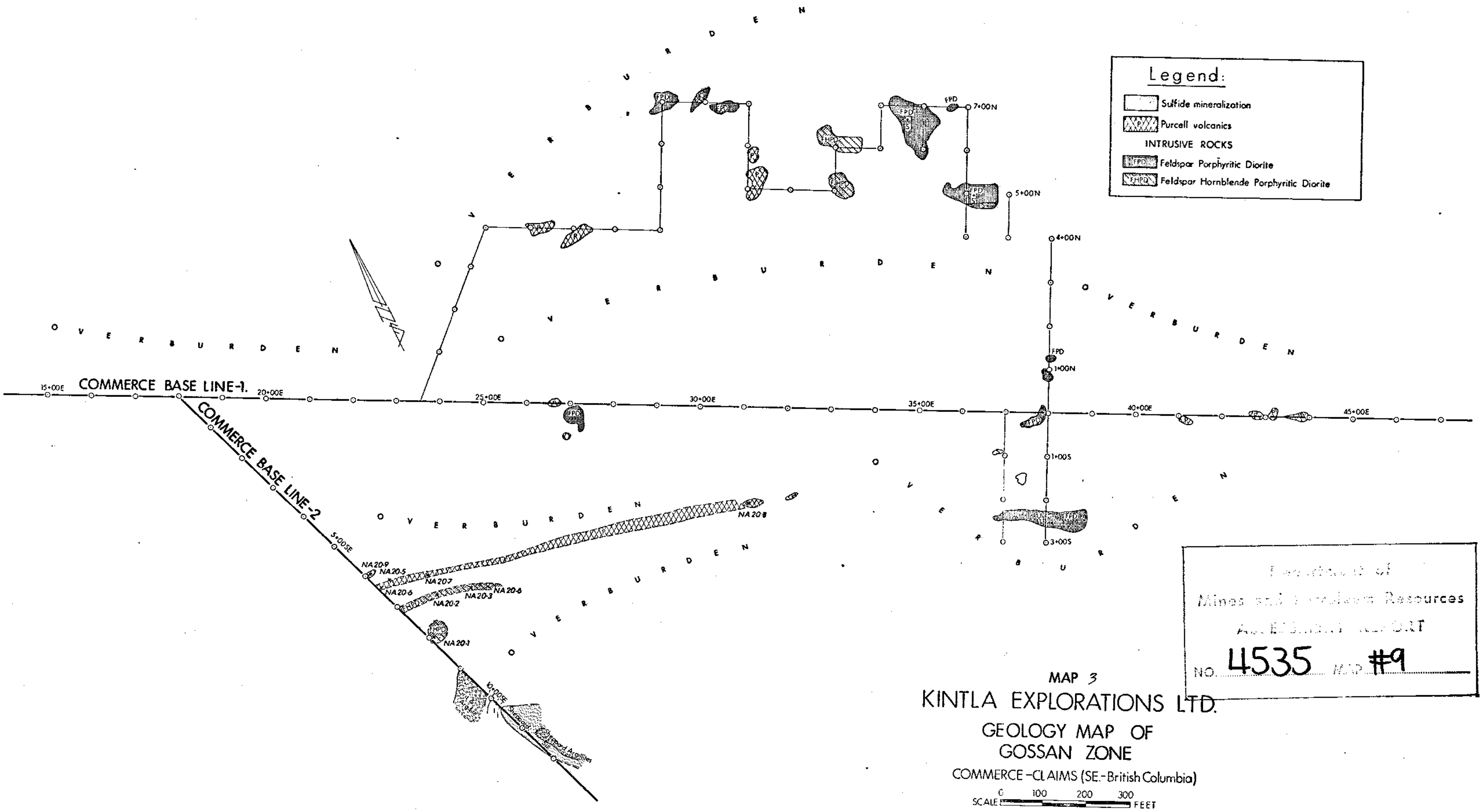
BETH CLAIMS

S.E.-BRITISH COLUMBIA

SCALE 0 4500 FEET



Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 4535 MAP #11



MAP 3

KINTLA EXPLORATIONS LTD.

GEOLOGY MAP OF GOSSAN ZONE

COMMERCE-CLAIMS (SE.-British Columbia)

SCALE 0 100 200 300 FEET

P.A. Nielsen - G.L. Hoffman
August - 1972

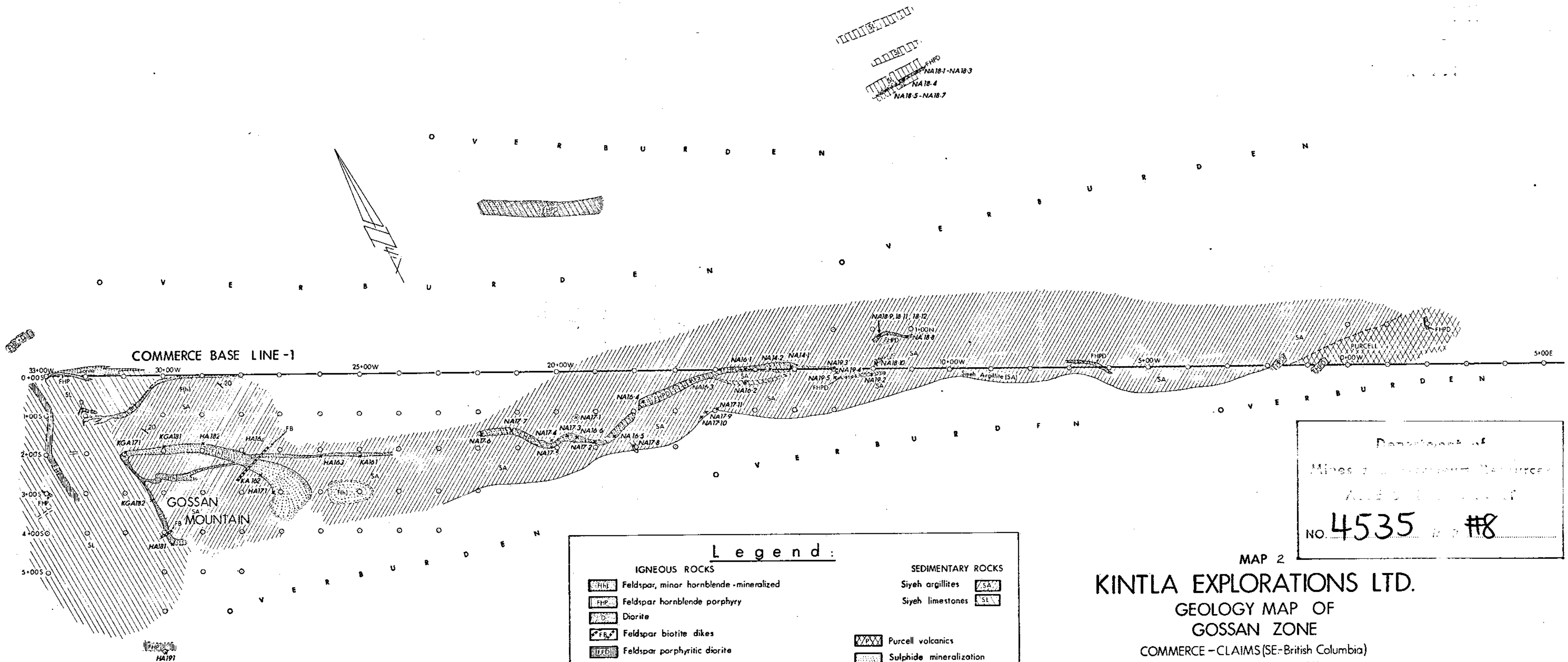
Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 4535 MAP #9

To accompany report by RONALD JAMES GOBLE, P. Geol., on the COMMERCE GROUP, on Commerce Mountain, Fort Steele Mining Division, dated July 19th, 1973.

PROFESSIONAL GEOLOGIST ALBERTA
RONALD JAMES GOBLE

4535
M9

Ronald James Goble
July 19, 1973



Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 4535 MAP #8

MAP 2

KINTLA EXPLORATIONS LTD.

GEOLOGY MAP OF GOSSAN ZONE

COMMERCE – CLAIMS (SE-British Columbia)

SCALE 0 100 200 300 FEET

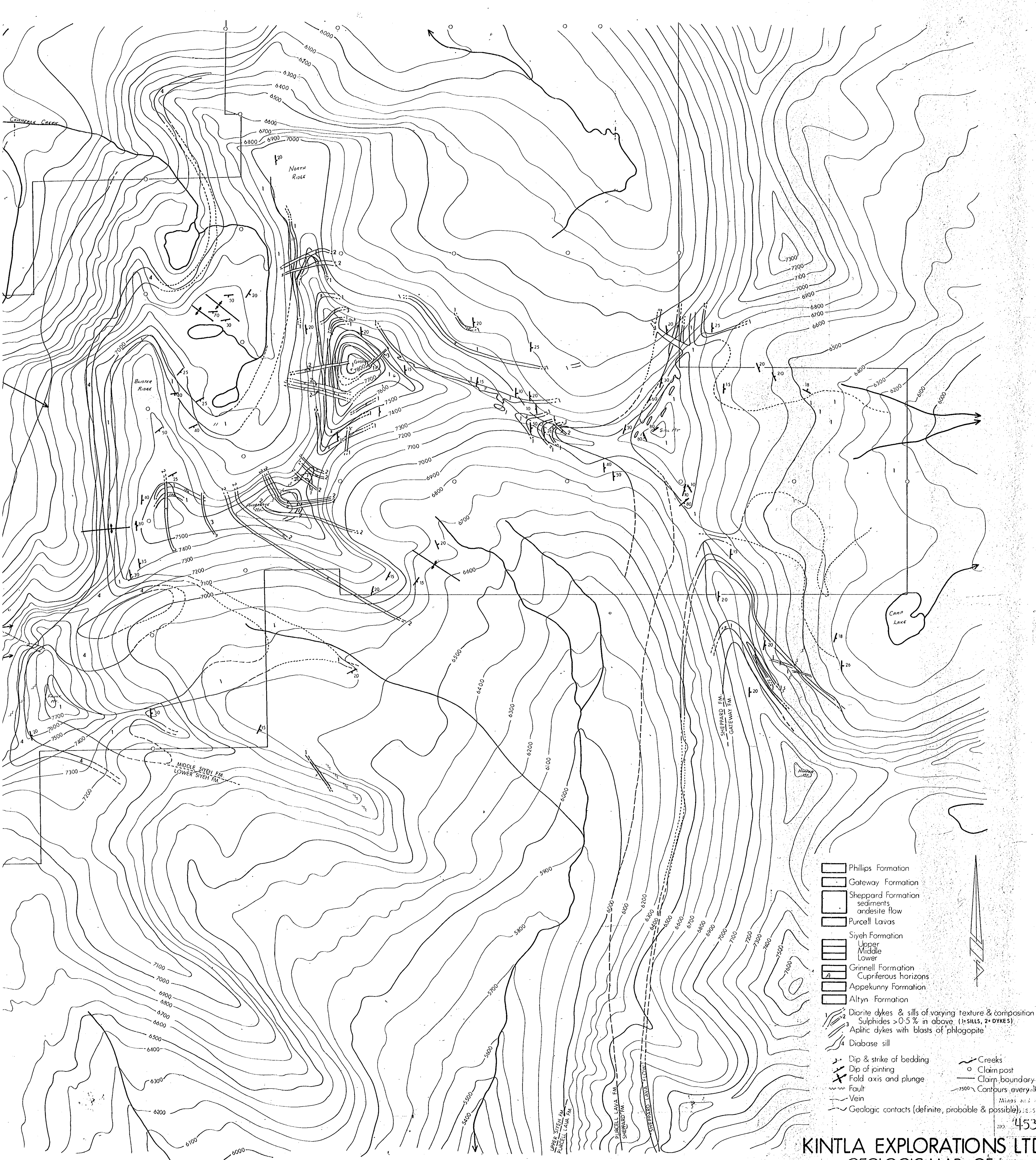
P.A. Nielsen - G.L. Hoffman
August — 1972

To accompany report by Ronald James Goble, P. Geol. on the Commerce Group, on Commerce Mountain, Fort Steele Mining Division, dated July 19th, 1973.

4535
M8

PROFESSIONAL GEOLOGIST ALBERTA
RONALD JAMES GOBLE

Ronald James Goble
July 19, 1973



Mines and Petroleum Resources
Assessment Report
No. 4535 Map #1

KINTLA EXPLORATIONS LTD.

GEOLOGIC MAP OF COMMERCE CLAIMS

Southeast British Columbia

To accompany report by Ronald James Goble, P.Geol., on the Commerce Group, on Commerce Mountain, Fort Steele Mining Division, dated July 19th, 1973

PROFESSIONAL GEOLOGIST ALBERTA — RONALD JAMES GOBLE

SCALE 0 500 1000 1500 2000 FEET

J. P.N. BADHAM Nov. 1972

4535-M

Ronald James Goble
July 19, 1973


GOSSAN MTN.
SILL MTN.
BASELINE
SILL 2
PURCELL LAVA
SHEPPARD FM.
Au
Au
6000
6100
6200
6300
6400
6500
6600
6700
6800
6900
7000
7100
7200
7300
7400
7500
7600
7700
5900
5800
5700
5600
5500
5400
Diorite dykes & sills of varying texture & composition
Trench
Au Mineralization
KINTLA EXPLORATIONS LTD.
COMMERCE CLAIMS
Southeast British Columbia
SCALE 0 500 1000 1500 2000 FEET
after NIELSEN 1972