MINERALOGY AND PETROLOGY OF THE COMMERCE MOUNTAIN COPPER/GOLD DEPOSIT

COMMERCE CLAIMS

FORT STEELE MINING DIVISION - BRITISH COLUMBIA

49°11'N, 114°22'W

N.T.S. 82G/1

KINTLA EXPLORATIONS LIMITED

P.O BOX 1328, Cardston, Alberta TOK OKO

RONALD J. GOBLE, Ph.D., Prof. Geol.

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INTRODUCTION

This report is a summary of mineralogical, petrological and geochemical studies carried out on fifteen specimens of copper-bearing quartzite, copper-bearing dolomite and possibly gold-bearing intrusive igneous rocks from the Commerce Claims of southeast British Columbia. The samples were collected between July 21 and August 18, 1983. Preparation of thin and polished sections and of X-ray fluorescent analysis pressed powder pellets was carried out using facilities at the Department of Geology, University of Nebraska-Lincoln. Detailed mineralogical, petrological and geochemical studies were made using optical, computer-automated X-ray diffractometer and X-ray fluorescent techniques.

The Commerce Claims comprise seventeen full claims centred upon Latitude 49°11′ N and Longitude 114°22′W, approximately 2 miles northeast of Commerce Peak in the Fort Steele Mining Division (see Figure 1 for location map). Access to the eastern portion of the claim blocks is via logging roads up the Sage and Roche Creek valleys and via an extension of the Roche Creek logging road to 'Camp Lake' at the head of Roche Creek (see Figure 2). From Camp Lake the west-central portion of the claims (the 'Gossan Mountain' are) is accessable via a bulldozer trail established in 1973. During the summer of 1983 the Roche Creek - Camp Lake - Gossan Mountain roads were impassable to motor vehicles. Access to the west and northwest portions of the claims is via a logging and seismic road extending up the Commerce Creek valley. During the summer of 1983 the last

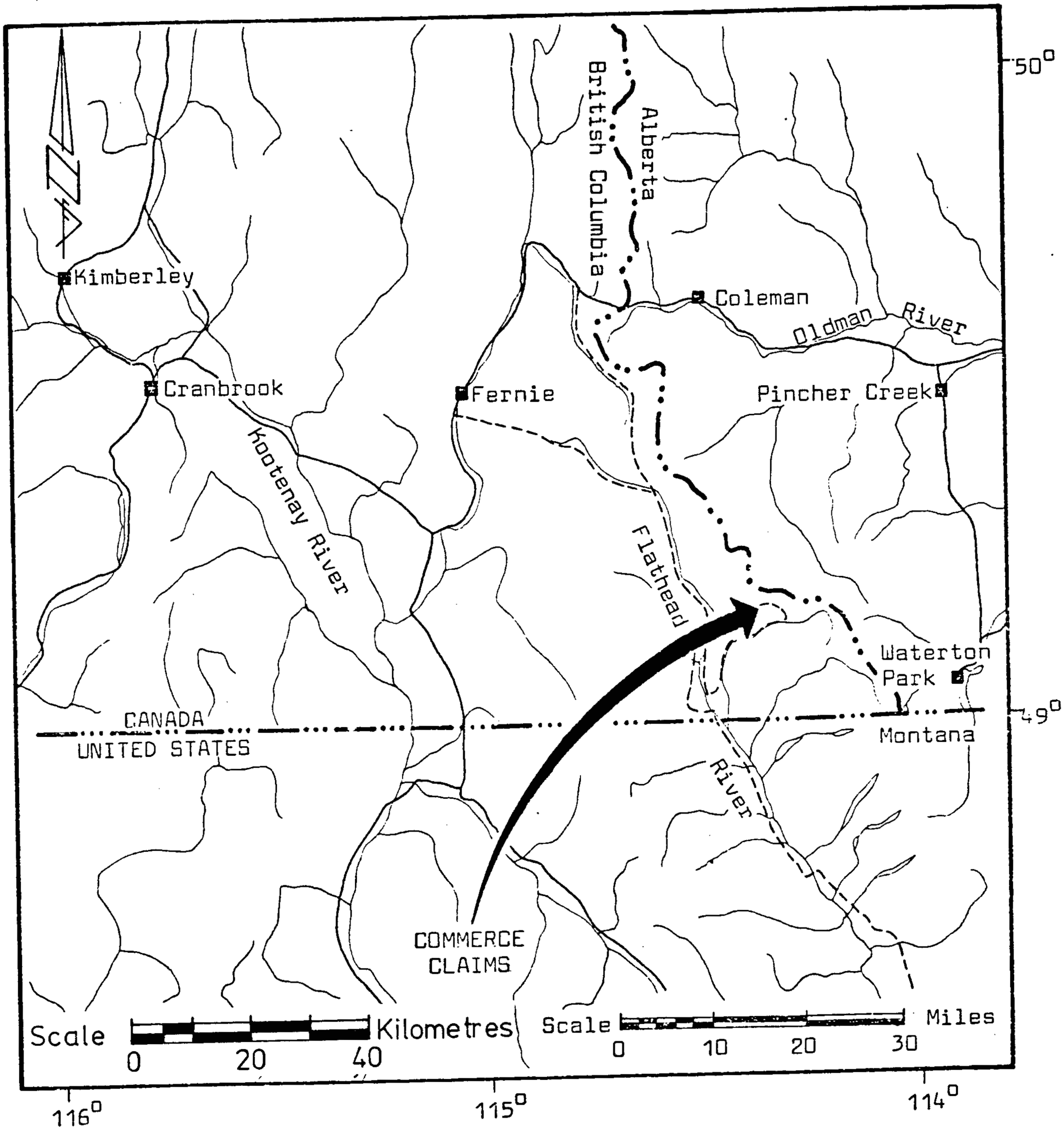
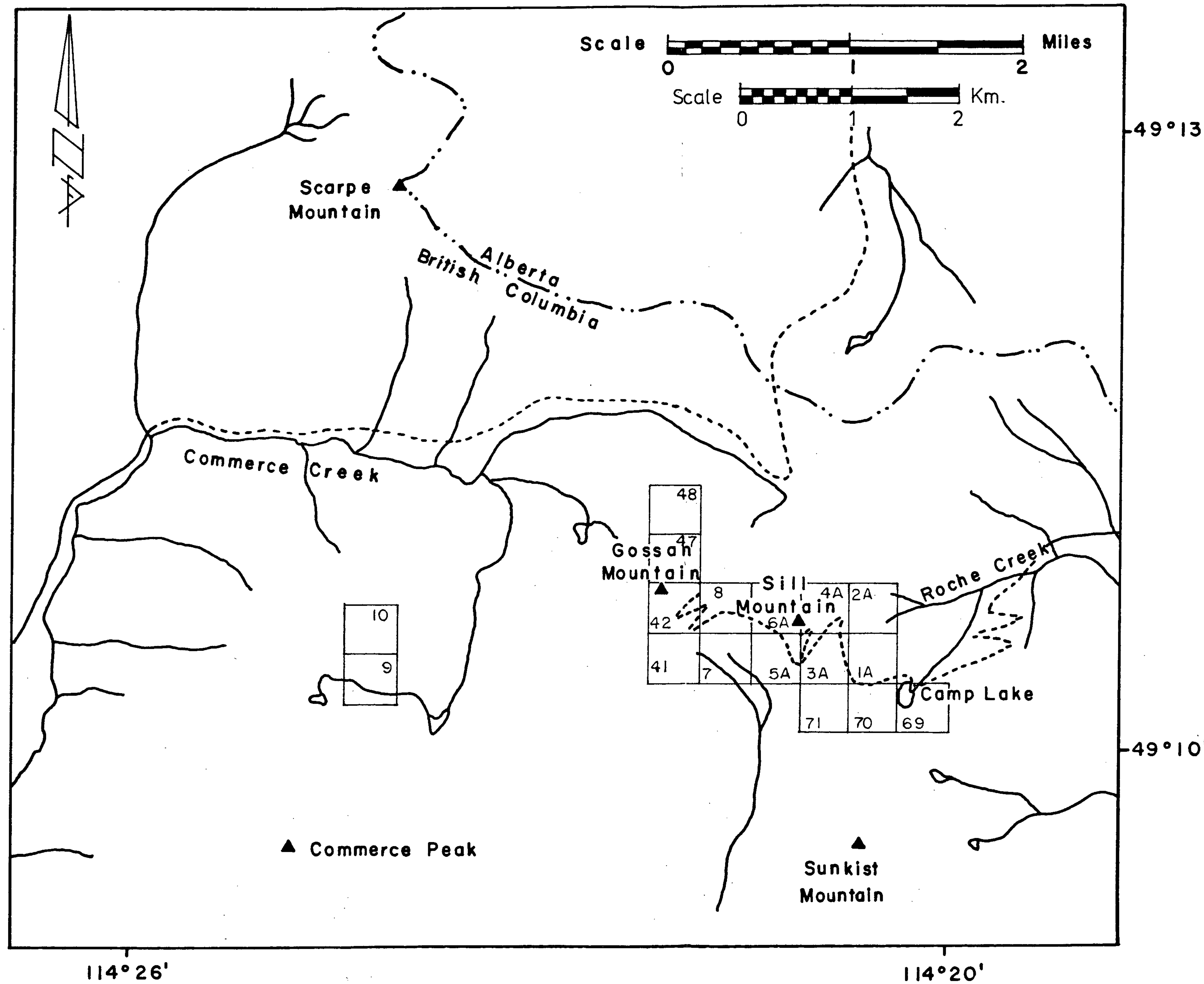


FIGURE 1

LOCATION MAP - COMMERCE CLAIMS



BOUNDARY MAP - COMMERCE CLAIMS
-N.T.S. 82G/1 - control by pace & compass

FIGURE 2

several miles of this road was impassable to motor vehicles.

History and Previous Work

Prior to the location of the first of the present Commerce Claims in 1967, the area had been staked several times in the 20th Century for gold by C. Wise, L. Ashman and F.M. Goble. Claim posts from this period are still present near some of the current posts, as are the remains of several other, much older claim posts. Two old trenches have also been located. One of these has since been obliterated by bulldozer trenching on 'Sill Mountain'. The other, on Gossan Mountain, is still visible, near the location of a high Au-assay (3.84 oz/ton) taken in 1972.

The original forty-five Commerce Claims (Commerce 1-16, 19-39, 41-48) were staked in 1967 by F.M. Goble and R.J. Goble, employees of Kennco Explorations (Western) Limited. These claims were sold on July 9, 1968 to the Goble Family (F.M., L.E., D.F., E.O., R.J. and F.J. Goble). The Goble Family assigned the claims to Goble Explorations Syndicate on September 25, 1969. They were optioned to Falconbridge Nickel Mines Ltd. on January 2, 1970. This option lapsed and the claims were assigned to Franklin Motel Co. Ltd. on December 29, 1971. On January 29, 1972 they were in turn sold to Kintla Explorations Ltd., the current owner.

In March 1973 nine claims (Commerce 50-57, 68) were staked adjoining the original forty-five claims. At this time a separate block of ten claims (Commerce 58-67) was staked to the northwest of the original claim block. An additional three full (Commerce 69-71) and three fractional (Commerce 72-74) claims were staked adjoining the original forty-five in July 1973.

Finally, seventeen claims (Commerce 75-91) were staked southeast of the original block in August 1973 to bring the Claim Block to its maximum size. Since 1973 seventy-six of the maximum eighty-seven claims have been allowed to lapse. Six have been relocated to bring the current holding to the seventeen full claims shown outlined in Figure 2. The original Commerce 1-6 have been replaced by Commerce 1A-6A, staked by D.F. Goble July 21, 1983.

Exploration was carried out on the original forty-five Commerce Claims by Kennco Exploration (Western) Limited in 1967/68; by the Goble Family in 1968/69, 1970/71, 1971/72; by Falconbridge Nickel Mines Ltd. in 1969/70; and by Kintla Explorations Ltd. in 1972/73, 1973/74, and sporadically from 1974 to 1983. Several diamond drill holes have been put down by the Goble Family and Kintla Explorations Ltd. but no cores or logs are available for these holes. Results of exploration carried out by Falconbridge Nickel Mines Ltd. are summarized in a report entitled "Record of Work on the Commerce Claims, Goble Family Option - Commerce Nos. 1-16, 19-39, 41-48. N.T.S. 82 G/1W, Lat. 49°09′ - 49°12′, Long. 114°20′ - 114°25′, June - July 1970" dated February, 1971. Results of exploration carred out by Kintla Explorations Ltd. in 1972/73 and 1973/74 are summarized in reports entitled "Geological Report on the Beth and Commerce Claims Located 45 miles Southeast of Fernie, 49° 114° S.E." dated July 19, 1973 and "Final Geological Report - 1973, Commerce Claims - British Columbia, 49°11′N, 114°22′W" dated February 5, 1974. To the end of 1974 exploration work totalling approximately $77,000.00 had been performed on the Commerce Claims.

Geology of the Commerce Claims

The copper/silver and gold/silver deposits of the Commerce Mountain area occur within rocks of the Precambrian Belt-Purcell Supergroup and within associated intrusive igneous rocks. These rocks occur in the Lewis thrust plate, a sheet of gently folded, almost horizontal strata which has been thrust from the southwest over Paleozoic and Mesozoic formations. Subsequent to movement along the Lewis thrust, the plate has been folded into a series of en-echelon structures trending south to southeast (Bostock et al. 1957). The thrust sheet is cut to the west by the Flathead fault, one of a set of listric normal faults (Bally et al. 1966). The stratigraphic column for the Commerce Mountain area is given in Table 1. Formations present include the Altyn, Appekunny, Grinnell, Siyeh, Purcell Lava, Sheppard, Gateway and Phillips. A series of sills and dikes of diabasic to dioritic composition intrude rocks from the Siyeh to the Sheppard Formation. The intrusions are concentrated in the eastern half of the claim area, particularly in the Gossan Mountain - Sill Mountain area. A later generation of more potassic intrusives is also present. Price (1962) describes the intrusives as aegirine-augite and aegirine trachytes and syenites, latites, felsites, and intrusion breccias. Badham (1972) describes them as syenites and plagioclase-hornblende porphyritic diorites.

Economically significant mineralization within the Commerce Mountain area is of three types: (1) Cu/Ag within the sedimentary rocks, (2) Cu/Ag within quartz-carbonate veins, and (3) Au/Ag within the dioritic intrusive rocks and surrounding

FORMATION		LITHOLOGY	THICKNESS (feet)	
PHILLIPS		Buff shales with calcareous and arenaceous horizons.		>50
GATEWAY		Red silts and shales with sandstone lenses. Salt casts, ripple marks, sun cracks and mud-flake conglomerates.		~300
SHEPPARD	Upper	Buff limestones and calcareous shales with good stromatolitic horizons (hemispheroid-continuous linkage), ripple marks and sun cracks.	250	350
	Middle	Massive chloritized andesite flow with up to 50% chlorite-quartz filled vesicles in top 5'.	30	
	Lower	Interbedded green shales and buff, calcareous shales with three distinctive 2' thick quartz grit beds, containing fragments of green shale and chloritized andesite.	70	
PURCELL LAVA	Upper	Thin, highly vesicular flows.	50	200-400
	Middle	Massive flows with vesicular flow tops. Thins to north.	100-250	
	Lower	Pillowed flows with vesicular and variolitic horizons. Thins to north.	50-100	
SIYEH	Upper	Interbedded flaggy green and grey fissile shales, silts and sandstones.	200-250	2100-2150
	Middle	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.	~400	
	Lower	Buff weathering, black-grey dolomites, shales and calcareous shales. Well-bedded, with sparse sandstone units near the base, containing pyrite micronodules.	~1500	
GRINNELL	Upper	Interbedded red silts and sandstones with silt clasts. 50% sandstones in 6" to 3' beds.	500	1500-2000
	Middle	Interbedded red and green silts and marls and sandstones, with silt clasts. 30% sandstones in 1" to 12" beds.	500-750	
	Lower	Red marls and silts with sparse green silts and 1" to 6" sandstone beds.	500-750	
APPEKUNNY	Upper	Green shales and interbedded sandstones, with the proportion of sandstone increasing toward the top.		~2000
	Lower	Interbedded fissile black and green shales, silts and occasional flags. The base is taken at the lower of two 50' distinctive white sandstone beds, ~100' apart.		
ALTYN		Buff and green shales and dolomites.		>1000

TABLE 1: STRATIGRAPHIC COLUMN - COMMERCE CLAIM BLOCKS

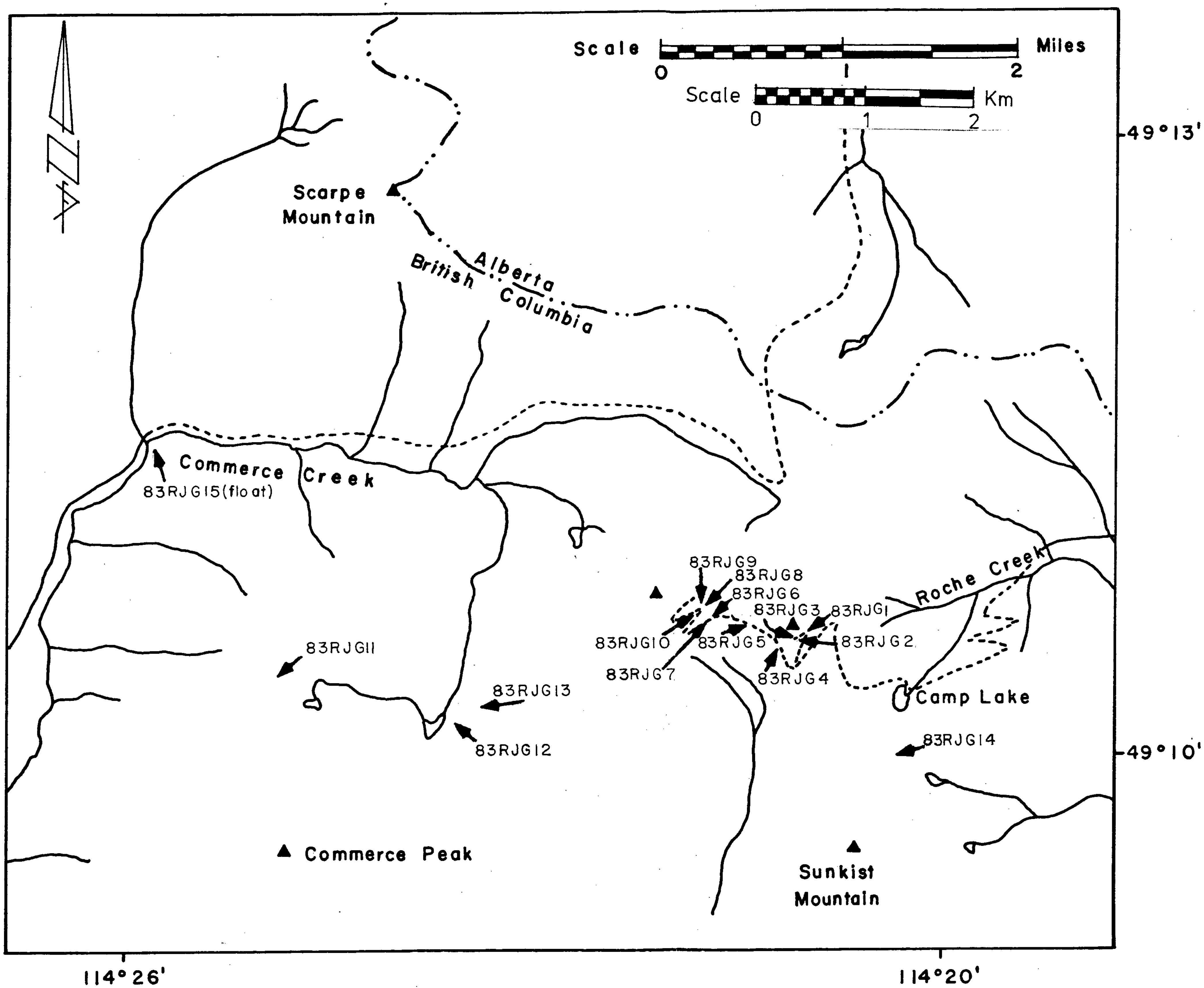
(after BADHAM, 1972).

sedimentary rocks. The Cu/Ag mineralization within the sedimentary rocks is concentrated in thin (4-6") but locally rich (1.5-4.0 % Cu) sandstone/quartzite horizons within the Grinnell Formation of the western part of the claim block and in thicker (7-8') but lower grade (0.97-2.95 % Cu) dolomite horizons within the Phillips formation of the eastern part of the claim block. Cu/Ag mineralization also occurs within thin (< 3'), irregular, low-grade (1.25-1.75 % Cu) quartz-carbonate veins cutting the Siyeh Formation in the western part of the claim block. Sporadic Au/Ag mineralization (0-3.84 oz/ton Au) has been encountered in sulfide-rich segments of some of the diorite and syenite intrusives and also within one area of the Purcell Lava.

The possible economic value of the Commerce Mountain claims would seem to lie in two areas, the low-grade Cu/Ag-bearing dolomites of the Phillips Formation in the eastern part of the claim area and the sporadic Au/Ag mineralization of the igneous rocks intruding the central part of the claim area.

Mineralogical, Petrological, Geochemical Sampling - 1983

Fifteen samples were collected in July and August, 1983. Locations are as shown in Figure 3. Figure 4 (back pocket) is a larger scale map showing the geology of the Commerce Claims, with sample locations indicated. Tables 2 and 3 are keys to the igneous sills and dykes and to the copper occurrences indicated by letter in Figure 4. Sample locations relative to the claims are: Commerce 3A - samples 83RJG1,2; Commerce 4A - sample 83RJG3; Commerce 5A - sample 83RJG4; Commerce 6A - sample 83RJG5; Commerce 8 - samples 83RJG6,7,8,9,10; samples 83RJG11,12,13,14,15 were taken outside of the boundaries of the



SAMPLE LOCATION MAP - COMMERCE CLAIMS
N.T.S. 82 G/1

FIGURE 3

SILLS

SILL NO.	THICKNESS (ft)	DESCRIPTION
1	15	Unmineralized medium-grained diorite.
2	>100	'Sill Mountain Sill'. Mostly grey, unmineralized diorite, but contains pegmatitic, quartz-rich and K-feldspar-rich patches and late dykelets. The base steps near the Purcell Lava-Sheppard contact, and contains many large blocks of Sheppard sediment. The southern contact with the Purcell Lava is well exposed with the lava impregnated with 15-20% sulphide (Py>Po>Cp). Fed by dyke (a).
3	10	Unmineralized diorite. Fed by dyke (a).
4	10	Uniform diorite sill. Unmineralized in its eastern outcrop, but on Gossan Mountain contains up to 5% Py>Po. Surrounding sediments impregnated with Py.
5	10	Similar to (4).
6	10	Diorite. The sill and surrounding sediments are well mineralized. 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	Very irregular diorite. 5-10% Py>Po throughout its outcrop. Intrudes the middle to upper Siyeh contact and has sparse blocks of stromatolitic dolomite caught up in its base. The shales above are well mineralized with pyrite. No sulphides were observed below.
8	5-10	Diorite. Very small patches of up to 1% sulphide in southern outcrop.
9	5-10	Similar to (8).
10	5-10	Similar to (8). Mineralized with 1% pyrite on Andradite Mountain. Surrounding rocks not mineralized. (10a) and (10b) appear to be barren continuations of (10).
11	>100	Mostly grey diorite but with varying texture and grain size. Heavily sheared in places with the shear planes heavily epidotized. Beneath North Ridge the sill is ■ polyphase mixture of diorite and syenite at least 300' thick. It is full of epidotized shears here and has many dykes and veins extending upward from it. All the rocks above it are bleached but they are unaffected 5' below it. Unmineralized.
12	10	Well-mineralized diorite sill. Fed by and cut by vertical, mineralized dykes.
13	10	'Purcell Sill'. Unmineralized diorite sill. Appears to bifurcate in Sheppard limestones.
14	10	Diabase. 100' below (11). Sediments bleached for 20' on each side. Sediments and sill unmineralized.

DYKES

DYKE NO.	THICKNESS (ft)	DESCRIPTION
a	20	Unmineralized diorite feeder dyke to sills (2) and (3).
b	3	Pinkish, trachytic, syenite dyke. Unmineralized.
c	2-5	Quartz-feldspar dyke with blebs of golden mica and sparse pyrite.
d	2-5	Similar to (c).
e	4	Diorite with 1% pyrite.
f	5-10	Diorite with 1-3% pyrite and pyrrhotite. Most of its outcrop is inaccessible.
g	5-10	Similar to (f).
h	5-10	Similar to (f).
j	3	Unmineralized diorite.
k	2-5	(k), (m), (n), (p), (q), (r), (s), (t), form a complex network of vertical dykes of well mineralized diorite. Mineralization from ½-3%. Pyrite and pyrrhotite varies laterally and is generally lower in the central portions.
m	2-5	See (k).
n	2-5	See (k).
p	2-5	See (k).
q	2-5	See (k).
r	2-5	See (k).
s	2-5	See (k).
t	2-5	See (k).
u	2	Quartz-feldspar dyke with blebs of golden mica and sparse pyrite.
v	1	Barren fine-grained diorite.
w	5	Discontinuous semitrachytic syenite. Unmineralized.

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

TABLE 2: SILLS AND DYKES OUTCROPPING ON COMMERCE CLAIM BLOCKS (after BADHAM, 1972).

ZONE	DESCRIPTION
A	Thinly bedded (<12") sandstones carry bornite, malachite, and hematite, both replacing green shale clasts in the sandstone units and as disseminated blebs in the sandstones. The bornite is clearly not a primary mineral. Copper mineralization is confined to the sandstone beds, but is not continuous along the bed, occurring only over some five yards along strike.
B	Similar to (A).
C	5% bornite with minor hematite is found replacing green shale clasts in a 2" sandstone bed about 150 stratigraphic feet above the base of the Grinnell. 400 stratigraphic feet above the base thin sandstones (2-20") occur approximately every 5' in red shales, and small patches (not exceeding 2%) of chalcopyrite, bornite, covellite, chalcocite, tetrahedrite (?), and pyrite are present in nine of these beds. About 1500 stratigraphic feet up into the Grinnell, five beds (12-18") contain up to 5% chalcopyrite, pyrite, and bornite on the edges of green shale clasts and as disseminated blebs. In all mineralized sandstones the sulphides are present in the 'dirtier' (i.e. greater silt content) sandstone beds, and where these become 'cleaner' laterally the proportion of sulphide decreases. Sulphides are confined to the sandstones and do not persist laterally for more than 300'.
D	Malachite and sparse chalcopyrite occur in an 11" sandstone 60' from the top of the Grinnell. Two other minor beds (<6") with minor malachite and chalcopyrite are present in the top 400' of the formation. Approximately 400-500' from the top a 20' thick series of sandstone beds contains malachite, bornite, chalcopyrite, chalcocite, and pyrite. The thickest bed (3-5') contains 2-3% copper sulphides concentrated in shale clasts and shaley lenses. Below this bed 5 thin sandstone beds contain blebs of chalcopyrite and bornite in lenses and pods.
E	A small lens of copper minerals (mainly chalcopyrite) occurs over 3' in two adjoining 6" thick beds.
F	In the middle Grinnell two sandstone beds carry chalcopyrite and malachite. The first is 6" thick and <1% Cp is present over 3'. The second is approximately 3' thick and is exposed for 150-200' 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 (?) occur in the bed. The jointing has stepped the bed giving an illusion of greater thickness. The bed is mineralized over its whole outcrop here, in the core of an F_1 syncline.
G	The fourth sandstone (12") from the top of the ridge contains green and red shale clasts and has blebs and smears of chalcocite at between 3 and 5% present over its whole outcrop. The thirteenth sandstone from the top is 6" thick and contains 1% chalcocite over 3'.
H	Quartz-siderite veins up to 3' in width, carrying concentrations of tetrahedrite, chalcopyrite, pyrite, malachite, and azurite, occur in minor faults in the cores of two tight anticlines. Small amounts of galena have also been noted. The Grinnell rocks are bleached for up to 150' from the veins. Sandstone beds within the bleached zone commonly contain copper, iron, and lead sulphides but the mineralization does not persist laterally beyond the altered zone. On the south side of the southmost vein three copper-bearing sandstone-argillite units occur and persist for up to 50' from the vein. These contain 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 (3"-5') contain chalcopyrite, bornite and malachite. The lower nine have between ½% and 5% of chalcocite blebs, a black soft mineral smeared around 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 mineralized beds do not persist laterally, but fade out by the end of the bleached zone.
I	The top 600' of Grinnell contains three sandstones (2-3') with minor pyrite, malachite, chalcopyrite (up to ½%).
J	1500' south of (H). Four copper-bearing sandstones occur in the top 500' of Grinnell: two 2-4" with chalcopyrite, malachite; one 6" with chalcocite, bornite, malachite; one 8' with sparse chalcopyrite. Nineteen copper-bearing sandstones are present in the interval 500-600' from the top of the Grinnell, totalling ~38' (2"-8' each bed). These beds carry pyrite, chalcopyrite, chalcocite, covellite, bornite, malachite.
K	One buff weathering bed outcrops with an 8-12" sandstone bed in the center carrying abundant bornite, chalcocite, covellite, malachite. The bed has been traced (with mineralization) for 200' north and intermittently for 2000' south.
L	Two 20' thick dark fine-grained diabase sills occur at the top of the Grinnell and 215' below the top. There is a sudden change in bedding attitude below the lower sill. Several very thin sandstones present in the Siyeh above the top sill carry pyrite and malachite. One 6" sandstone with minor malachite is present approximately 100' below the top of the Grinnell. Small amounts of disseminated chalcopyrite occur in sandstone beds 180-200' below the top, including a 12" bed carrying bornite, chalcopyrite, pyrite, and malachite.

TABLE 3: COPPER SHOWINGS WITHIN GRINNELL FORMATION

ON COMMERCE CLAIM BLOCKS

(after BADHAM, 1972, GOBLE, 1967).

actual claims in order to check the economic significance of copper mineralization associated with sedimentary units in the claim area.

Thin sections were prepared of all samples except 83RJG13, a quartz-carbonate vein. For sample 83RJG8 two thin sections were prepared, one of the unweathered intrusive and a second of a heavily weathered sample of the intrusive. Polished sections were prepared for all samples except 83RJG1,3,4. For samples 83RJG7,8 two polished sections were prepared.

Portions of samples 83RJG1,2,3,4,5,6,8 were crushed and pressed into X-ray flueorescent pellets. The samples were analyzed for weight percent SiO_2, Al_2O_3, CaO, K_2O, Na_2O, FeO, MgO, TiO_2, P_2O_5, and S. Standards used were United States Geological Survey Standards G2, GSP1, AGV1, BCR1, W1, PCC1, and DTS1.

TECHNICAL DATA AND INTERPRETATION

Samples were collected with the purpose of identifying the rock types present as hosts for the gold and copper mineralization, identifying the types of sulfide mineralization present, determining the relationship between sulfide mineralization in the intrusives and the sedimentary rocks, and determining the mode of occurrence of the gold mineralization. General field and laboratory descriptions are provided in Table 4.

The intrusives rocks sampled were identified in thin section as varying in composition from diorite to monzodiorite to monzonite, with one sample of granite, 83RJG2, (Table 4). In the diorite/monzodiorite/monzonite suite the dominant minerals were plagioclase (An_{24-47}), hornblende and orthoclase. Other minerals identified include quartz, hypersthene, augite, aegirine-augite, sphene, apatite, and biotite. Many of these samples had abundant fine grained sericite and one (83RJG15) showed evidence of extensive recrystallization. The single granite sample identified, 83RJG2, occurs in an east-west fracture zone cutting a diorite/monzodiorite sill. Several of the samples showed the presence of abundant secondary carbonate.

Samples of the sediments in contact with the intrusives were identified as hornfels and contained fine-grained quartz, carbonate, biotite, and hornblende, with abundant phenocrysts of plagioclase near the immediate igneous-sedimentary contact. The two samples of copper-bearing sedimentary rocks from the Grinnell Formation in the western part of the area (83RJG11,12) were identified as quartzites. The quartz grains were well rounded and well sorted, heavily overgrown with secondary quartz. Grain size averaged approximately 0.5 mm. Minor chert fragments and plagioclase were observed. No carbonate was present. Abundant interstitial sulfide was present. The copper-bearing sedimentary rock sample from the eastern part of the area (83RJG15) was identified as a siliceous dolomite, with fine grained quartz (approximately 0.05 mm) and sulfide (approximately 0.001 mm).

Minor pyrite (up to 5 %) was present in all polished sections of intrusive rocks examined. In many samples alteration rims of goethite were observed on the pyrite grains. These rims were extensively developed in sample 83RJG8b. Very minor quantities of pyrrhotite and chalcopyrite were also observed in several of the samples. Major quantities of pyrrhotite (approximately 6 %) were only observed in the recrystallized specimen (83RJG15). Native gold was not observed in any specimens.

Both of the quartzite specimens from the western part of the claim area had essentially the same mineralogy. The primary minerals were bornite and djurleite, with minor chalcopyrite and anthraxolite. The djurleite had been extensively replaced by anilite, spionkopite, yarrowite, and malachite. Approximately 5 % sulfide was present in each specimen. The sample of quartz-carbonate vein (83RJG13) had a different mineralogy, containing badly shattered pyrite together with chalcopyrite and tennantite. Secondary minerals included malachite and azurite. The siliceous dolomite from the eastern part of the claim area had approximately 2 % very fine-grained disseminated bornite and djurleite. The djurleite was partially replace by anilite.

Seven samples of intrusive igneous rock were analyzed using X-ray fluorescent spectrometry. The results are summarized in Table 5. Ferric/ferrous ratios were not determined; iron present in pyrite was determined from the sulfur analyses and the remainder assigned to Fe_2O_3 and FeO in the proportion 0.15 to 1. Several samples have obviously low totals; these are most likely due to observed carbonate (CO_2 was not determined) and to hydrous phases (H_2O was not determined). The names assigned to these samples based upon chemistry are listed in Table 4.

TABLE 4. SAMPLE DESCRIPTIONS, COMMERCE CLAIMS, 1983.

sample #	field name	thin section name	chemical name
83RJG1	diorite	porphyritic monzodiorite	monzodiorite
83RJG2	granite	granite	alkali granite
83RJG3	diorite	porphyritic monzonite	monzonite
83RJG4	diorite	porphyritic monzodiorite	monzodiorite
83RJG5	diorite	porphyritic monzodiorite	monzodiorite
83RJG6	diorite	porphyritic aegirine-augite monzodiorite	monzodiorite
83RJG7a	diorite	monzodiorite	-----
b	hornfels	hornfels	-----
83RJG8a	diorite	porphyritic monzonite	monzodiorite
b	(heavily weathered sample)		-----
83RJG9	hornfels	quartz-biotite hornfels	-----
83RJG10	hornfels	quartz-biotite hornfels	-----
83RJG11	quartzite	quartzite	-----
83RJG12	quartzite	quartzite	-----
83RJG13	quartz-carbonate vein		-----
83RJG14	silty dolomite	siliceous dolomite	-----
83RJG15	diorite	monzonite	-----

Samples 83RJG1,3,5 are taken from a single diorite sill; sample 83RJG2 is from a granite occupying a shear zone in this sill.
Sample 83RJG7 consists of a sample of a 4" diorite dike and the altered sedimentary rock cut by this dike.
Sample 83RJG8 is from the location of a 1972 high-grade gold assay (Sill 7, Goble 1973); samples 83RJG9,10 are from the altered sedimentary rocks approximately 20 vertical feet above 83RJG8.
Samples 83RJG11,12 are from the lower Grinnell Formation.
Sample 83RJG13 is from a quartz-carbonate vein cutting the lower Siyeh Formation.
Sample 83RJG14 is from the lower Phillips Formation.
Sample 83RJG15 is float from the Commerce Creek valley.

TABLE 5. CHEMICAL (X-RAY FLUORESCENT) ANALYSES OF THE COMMERCE MOUNTAIN IGNEOUS ROCKS

oxide	83RJG1	83RJG2	83RJG3	83RJG4	83RJG5	83RJG6	83RJG8
SiO_2	54.03	68.61	62.63	59.23	62.21	49.70	59.21
Al_2O_3	14.60	13.53	17.76	17.32	16.36	11.72	17.09
CaO	5.38	1.89	3.61	6.82	5.21	16.37	4.71
K_2O	3.25	8.94	5.37	4.20	3.85	1.87	4.41
Na_2O	4.36	0.34	5.61	5.43	4.56	3.63	5.27
Fe_2O_3	0.93	0.03	0.57	1.00	0.76	0.46	0.33
FeO	5.00	0.15	3.07	5.40	4.08	2.43	1.81
FeS_2	0.06	5.24	0.17	0.06	0.19	5.91	4.32
MgO	2.22	1.65	0.99	2.40	1.17	4.62	1.15
TiO_2	0.57	0.33	0.46	0.66	0.48	0.91	0.48
P_2O_5	0.32	0.18	0.18	0.27	0.17	1.11	0.22
TOTAL	90.72	100.89	100.42	102.79	99.04	98.73	99.00
plag.*	71.2%	6.3%	63.4%	69.5%	64.8%	78.7%	67.7%
qtz.**	5.1%	35.7%	1.5%	0.0%	18.8%	5.7%	3.2%
An***	22	19	14	19	8	25	18

The ratio Fe_2O_3/FeO was standardized to 0.15 in molecular proportions.
Greater than 1 % carbonate was noted in thin sections of 83RJG2, 83RJG5 and 83RJG6.
* plagioclase calculated as a percent of total feldspar using norms.
** quartz calculated as a percent of quartz plus feldspar using norms.
*** anorthite calculated as a percent of plagioclase using norms.
Calculations involving samples with greater than 1% carbonate will be somewhat inaccurate because of the percent CaO in the carbonate; this was partially allowed for by estimating the amount of carbonate present.

Interpretation and Conclusions

With the exception of the granite intrusive into the fracture zone within one of the monzodiorite sills it appears that all of the sills examined are from a single generation of alkali magma of the approximate composition of monzodiorite. Within the sills there is some variation in chemistry but, with the exception of 83RJG6, they are remarkably similar in composition. The variation in CaO and MgO shown by 83RJG6 is probably due to the observed high carbonate content in this specimen. Sample 83RJG2, the granite, would seem to represent a later stage, more K_2O rich phase of igneous activity, during which magma was emplaced in fractures cutting the earlier sills and dikes. Other intrusives of apparently similar composition have been observed cutting the west face of Gossan Mountain and should be sampled for comparison.

Most of the intrusives show the presence of abundant pyrite. Samples taken at the contact between intrusives and sedimentary rocks show that the sulfide is frequently concentrated in sedimentary zenoliths, particularly amphiboliitized sedimentary xenoliths, and suggest that the sulfides were intruduced from the sedimentary units. Float samples such as 83RJG15 have clearly been altered, suggesting that the intrusives are multiple stage and that the presence of pyrrhotite rather than pyrite as the dominant sulfide is a result of metamorphism of primary pyrite.

There is no textural evidence present in the sulfides within the quartzites of the Grinnell Formation to indicate that they are primary. However, the widespread nature of the mineralization (Goble 1973) would seem to indicate that it is unrelated to the intrusives. The presence of tennantite in the vein sample from the Siyeh Formation would tend to confirm that the vein is the result of movement of quartz and carbonate from the surrounding formations. Goble (1980) noted that tennantite in the Grinnell Formation in this area was associated with copper mineralization within sedimentary rather than igneous units. The copper mineralization within the siliceous dolomites of the Phillips Formation would appear to be primary. It is very fine grained and disseminated throughout the dolomite, although there is some evidence of partial remobilization along fractures.

Native gold was not noted in samples taken from either the igneous or sedimentary rocks. Study of the mode of occurrence of the gold will have to wait until further trace element X-ray fluorescent and electron microprobe studies have been conducted.

REFERENCES

BADHAM, J.P.N. (1972): Geology and economic potential of the Commerce Claims, British Columbia. Unpublished Kintla Explorations report. 30 p.

BALLY, A.W., GORDY, P.L. & STEWART, G.A. (1966): Structure, seismic data, and and orogenic evolution of the southern Canadian Rocky Mountains. Bull. Can. Petrol. Geol. 14, 337-381.

BOSTOCK, H.S., MULLIGAN, R. & DOUGLAS, R.J.W. (1957): Geology and economic minerals of Canada. Geol. Surv. Can. Econ. Geol. Series No. 1, 4th Ed., 283-392.

GOBLE, R.J. (1973): Geological report on the Beth and Commerce Claims located 45 miles southeast of Fernie, 49° 114°S.E. Unpublished Kintla Explorations Limited report. 58 p.

GOBLE, R.J. (1980): Copper sulfides from Alberta: yarrowite Cu_9S_8 and spionkopite $Cu_{39}S_{28}$. Can. Mineral. 18, 511-518.

PRICE, R.A. (1962): Fernie map-area, East half, Alberta and British Columbia. Geol. Surv. Can. Paper 61-24.

ITEMIZED COST STATEMENT

Wages and Salaries

July 20 to 24, 1983

R.J. Goble	5 days @ $250.00/day	$1250.00
F.M. Goble	5 days @ $200.00/day	1000.00
D.F. Goble	5 days @ $200.00/day	1000.00
S.B. Goble	5 days @ $150.00/day	750.00
L.E. Goble	5 days @ $150.00/day	750.00
H. Goble	5 days @ $150.00/day	750.00
	subtotal	$5500.00

August 16 to 17, 1983

R.J. Goble	2 days @ $250.00/day	$ 500.00
F.M. Goble	2 days @ $200.00/day	400.00
S.B. Goble	2 days @ $150.00/day	300.00
	subtotal	$1200.00

Travel and Food

300 miles @ $0.50/mile	$ 150.00
31 man-days food @ $10.00/day	310.00
subtotal	$ 460.00

Sample Preparation

15 thin sections @ $15.00/section	$ 225.00
15 polished sections @ $25.00/section	275.00
7 X-ray fluorescent pellets @ $5.00/pellet	35.00
subtotal	$ 535.00

Laboratory Studies and Report Preparation

R.J. Goble, 15 days @ $250.00/day	$2750.00
subtotal	$2750.00
TOTAL COST	$10445.00

STATEMENT OF QUALIFICATIONS

I, RONALD J. GOBLE, of the City of Lincoln, in the State of Nebraska, 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 1971.

(3) That I am a graduate of Queen's University, with the degree of Doctor of Philosophy 1977.

(4) That I hold the position of Assistant Professor of Geology at the University of Nebraska-Lincoln.

(5) That I did conduct the Mineralogical/Petrological/Geochemical study outlined in this report.

(6) That the Itemized Cost Statement accompanying this report is true statement of the costs incurred during the study and the preparation of this report.

(7) That this report is a summary of the work carried out on the Commerce Claims.

Submitted by,

Ronald J. Goble, Ph.D., Prof. Geol.

July 15, 1984
1220 N 44 St.
Lincoln, Nebraska 68503

GEOLOGICAL BRANCH
ASSESSMENT REPORT

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