5938

RADIO_METRIC REPORT
ON
COMMERCE CLAIMS
Fort Steele Mining Division
49*11'N, 114*22'W

Owned & Operated By
KINTLA EXPLORATIONS LIMITED

P.O. Box 763, Cardston, Alberta.

COMMERCE

82G/1W

SUMMARY OF CONTENTS

Location, Access, and description of land

The Commerce Group of claims is located in the southeastern corner of British Columbia, on the east side of the Flathead Valley, at 49*11'N, 114*22' W, on Commerce Mountain, between Sage Creek on the south, the Alberta boundary on the east, Commerce Creek on the north and west, in the Fort Steele Mining Division.

A reasonably good gravelled road provides access to the Sage Creek and Commerce Creek Valleys on the east side of the Flathead River. This road is open for travel from approximately May 15 to December 15 each year. A logging road runs up Sage Creek, with one branch of the logging road continuing up Roche Creek. Kintla in 1973 built an access road from the end of the logging road on Roche Creek to a location near the centre of the claim group, however, this road was washed out at Roche Creek in 1974 and 1975, and there is no access by vehicle to the claims now.

On Commerce Creek, access is provided by a logging road to a point some 3 miles from the north side of the claim group, from there access is only by foot, or helicopter.

The large hanging valley near the west side of the claim group is very difficult of access unless a helicopter is used. The entrance to the valley lies some 2500 feet above the valley floor, with the entrance slopes densely covered with second growth pine and alder bush. In 1976 Kintla personnel were forced to back-pack their equipment and supplies over tis route.

Description of Land:

A detailed description of the access, geology, etc. has been appended to this report, and was taken from the report filed by Kintla in 1974.

INTRODUCTION

Following the undertaking of several scintillometer surveys in the Precambrian rocks of northern Saskatchewan, Kintla Explorations personnel noted the similarities between the rocks of southeastern British Columbia and certain sedimentary rocks of northern Saskatchewan. Ashort prospecting program with scintillometers was undertaken on Kintla's Commerce Mountain group of claims, and following the location of several interesting showings, the program was extended to cover in more detail these locations. The areas of primary interest were in the Grinnell Formation on the western half of the claim group, and an area of secondary interest was located in the Sheppard Formation southwest of Camp Lake at the head of Roche Creek.

Some radioactivity was noted in the granitic and syenitic intrusives of the Siyeh Formation, but this was due to the presence of considerable potassium in these intrusives. The Purcell lava Formation and Appekunny Formation are apparently barren of uraniferous minerals.

A detailed Scintillometer Survey, using the Scintrex Scintillometer, Models 801013 and BGS - 1S, manufactured by Scintrex Limited of Concord, Ontario, was partially completed during the spring of 1976, with surveyed control lines (1 to 9) being used for a base of a grid of measured locations every 100 feet. The survey is approximately one-fourth completed, and will be finished during 1976 and the spring of 1977. Backgrounds of 35, 40, an 30 were subtracted from the field results on the red argillited, green argillites, and quartzites, respectively.

RESULTS

Highly anomalous readings were ootained in the area southwest of the lower

lake in the hanging valley and north and northwest of the upper lakes in the western half of the claim group. Readings of 200 to 300 cps (Scintrex Scintillometer) and 250 to 400 cps above background southeast of the lower were encountered. In some areas as many as 16 anomalous beds, with the intervening argillites somewhat lower in count, were located. The results of samples taken in these locations are presented in the assay sheets at the end of the report.

The readings taken (less background) are plotted on the enclosed map. All readings were taken using the Scintrex Scintillometer, and were taken at 12 inches approximately from the ground.

CONCLUSIONS

The results of the scintillometer survey show that the uranium mineralization is definitely related to the presence of copper in the lower Grinnell Formation quartzites. Where the copper mineralization decreases in percentage the uranium does likewise. Some mineralization is also related to hematite bands at the tops and bottoms of the quartzite beds. The red and green argillites of the hanging valley Grinnell Formation are also anomalous in several places, with results as high as 1.5 pounds U_3O_8 per ton, however, the quartzites assayed as high as 4.8 pounds per ton, and are definitely the most attractive targets for further exploration

INTRODUCTION

This report outlines the geological exploration carried out on the Commerce Claims during the period 1967 through 1972. It also presents data gathered during the 1973 field season by personnel of Kintla Explorations Limited. Finally, it summarizes all the data obtained to date and concludes as to the economic significance of the Commerce Claim blocks.

The Commerce Claim blocks comprise 84 full and 3 fractional claims covering approximately 4422 acres. The claims are centred upon Latitude $49^{\circ}11'$ N and Longitude $114^{\circ}22'$ W, approximately 2 miles northeast of Commerce Peak in the Fort Steele Mining Division (see Figure 1 for location map of the Commerce Claims).

Access to the eastern portion of the claim blocks is good 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). This road is generally passable to summer traffic although wet weather may render it impassable to all but 4-wheel drive vehicles. From Camp Lake the west-central portion of the claims (the 'Gossan Mountain' area) is accessable by 4-wheel drive vehicle via a bulldozer trail established in 1973. Access to the west and northwest portions of the claim blocks is via a logging road up the Commerce Creek valley. This road does not, however, extend onto the main claim block. A seismic trail extending up the Commerce Creek valley from the end of this logging road is impassable at the present time.

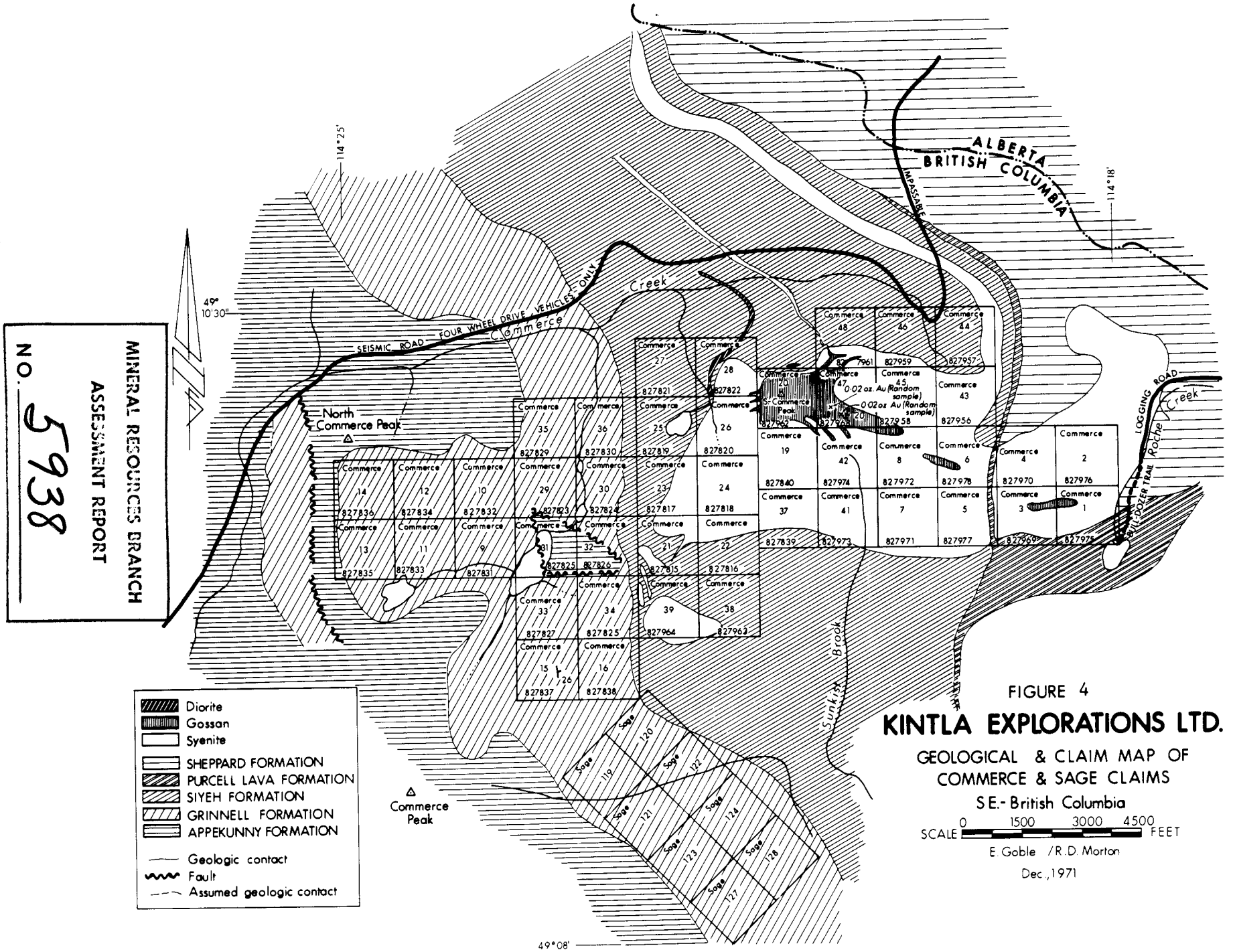

FIGURE 4

KINTLA EXPLORATIONS LTD.

GEOLOGICAL & CLAIM MAP OF COMMERCE & SAGE CLAIMS

S.E.- British Columbia

SCALE 0 1500 3000 4500 FEET

E. Goble / R.D. Morton

Dec., 1971

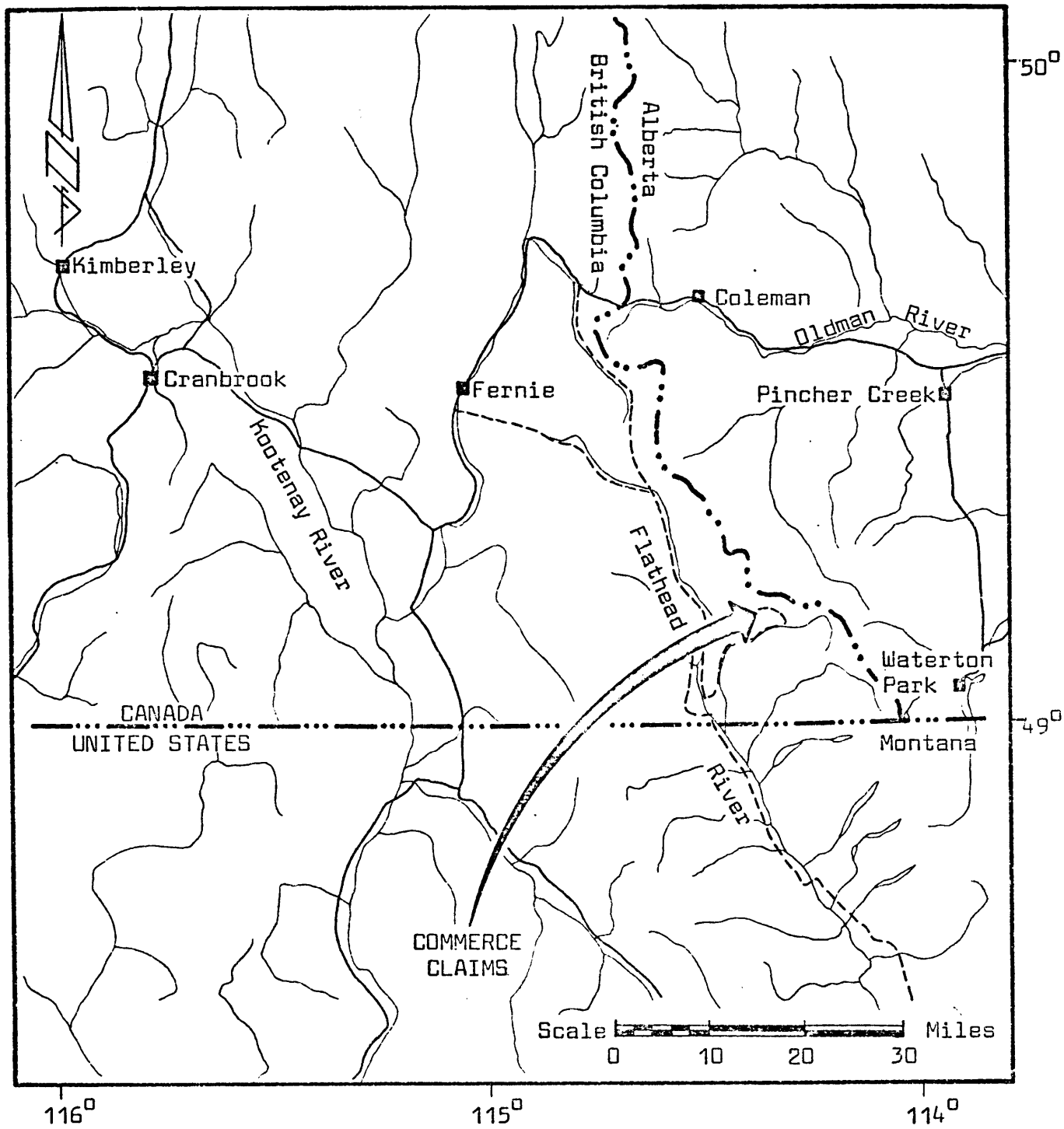

FIGURE 1: LOCATION MAP OF COMMERCE CLAIM ~~BLOCKS~~.

EXPENDITURES

Wages:		
Preliminary Scintillometer Survey: 2 men, 14 days, @ $ 175.00	-	$ 4,900.00
Surveying: 2 men, 11 days, 1 at $ 175.00		1,925.00
1 at $ 75.00		825.00
Scintillometer Survey: 4 men, 12 days, 2 at $ 175.00		4,200.00
2 at 75.00		1,800.00
Travelling: 2 men, 4 days, @ $ 50.00		400.00
4 men, 2 days, @ $ 50.00		400.00
Total, 114 man-days		$14,450.00
Assays, 38 U_3O_8, 18 Thorium. 20 Cu, 21 Ag, 1Au		513.00
Food: 114 man-days, @ $10.00 per day		1,140.00
Supplies, estimated		75.00
Scintillometer rentals, 2 @ $200.00 per month, 1¼ months		500.00
Power saws, 2 @ $ 1.50 per day, 13 days		39.00
camping equipment		175.00
Mileage:		
trucks, 4,380 miles @ $0.15 per mile		657.00
jeep, 120 miles @ $0.25 per mile		30.00
Total:		$17,579.00
Administrative overhead		1,757.90
TOTAL:		$19,336.00

CERTIFICATE

I hereby certify that:

1- I am a graduate of the University of Alberta (1969) with the degree of Bachelor of Science, in Geology.

2- I am a member in good standing in the Association of Professional Engineers, Geologists, and Geophysicists of Alberta.

3- The appended schedule of costs is a true and accurate statement of expenditures undertaken in the described program.

4- I personnally carried out and supervised the program.

5- I have an interest in the property.

Certified at the hamlet of Waterton Park in the Province of Alberta this 19th day of July, 1976.

E.O.Goble,

Geologist.

ASSAY RESULTS

	Au	Ag	Cu	vol. ppm U_3O_8	ThO_2	lb./ton U_3O_8	Map location
10451	tr	.44	.25	4.7	nr	.037	1
10452	nr	0	nr	4.3	nr	.034	2
10453	nr	1.04	1.81	8.4	nr	.069	3
10454	nr	.88	.23	14.6	nr	.117	4
10455	nr	nr	nr	40.3	nr	.322	5
10456	nr	nr	nr	3.7	nr	.030	6
10457	nr	nr	nr	5.5	nr	.044	7
10458	nr	nr	nr	5.0	nr	.040	8
10459	nr	nr	nr	602.0	nr	4.816	9
10460	nr	nr	nr	79.9	nr	.639	10
10461	nr	.24	3.20	41.0	nr	.328	11
10462	nr	.08	1.73	58.9	nr	.471	12
10463	nr	.10	.80	67.8	nr	.542	13
10464	nr	.06	.69	34.6	nr	.277	14
10465	nr	.04	.34	444.0	nr	3.552	15
10466	nr	.30	2.27	115.0	nr	.920	16
10467	nr	nr	nr	4.0	nr	.032	17
10468	nr	nr	nr	3.6	nr	.029	18
10469	nr	nr	nr	2.8	nr	.021	19
10470	nr	nr	nr	0.9	nr	.007	20
10471	nr	nr	nr	4.0	nr	.032	21
10234	nr	nr	nr	6.3	tr	.050	22
10235	nr	nr	nr	6.0	tr	.048	23
10236	nr	nr	nr	4.4	tr	.035	24
10237	nr	.08	.13	13.9	tr	.111	25
10238	nr	nr	nr	6.3	tr	.050	26
10239	nr	.26	.19	3.6	tr	.029	27
10240	nr	nr	nr	3.9	tr	.031	28
10241	nr	nr	nr	4.4	tr	.035	29
10242	nr	.08	.36	5.5	tr	.044	30
10243	nr	.06	.02	10.3	tr	.082	31
10244	nr	.52	2.13	73.2	tr	.586	32
10245	nr	nr	nr	8.3	tr	.066	33
10246	nr	.30	.09	163.0	tr	1.304	34
10247	nr	.12	.01	nd	tr	nd	35
10248	nr	.34	.78	58.3	tr	.466	36
10249	nr	.18	.27	35.3	tr	.282	37
10250	nr	.38	2.50	nd	tr	nd	38
No Tag	nr	.56	1.88	77.2	tr	.618	39

nr - not requested
nd - not detected
tr - trace.

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 for gold in the 20th Century 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 45 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. Under an agreement between F.M. Goble, R.J. Goble and Kennco Explorations (Western) Limited, these claims were sold on July 9, 1968 to the Goble Family (F.M. Goble, L.E. Goble, D.F. Goble, E.O. Goble, R.J. Goble, F.J. Goble). The Goble Family assigned the claims to Goble Explorations Syndicate on September 25, 1969, which in turn optioned the claims to Falconbridge Nickel Mines Limited on January 2, 1970. This option lapsed and on December 29, 1971 the claims were assigned by Goble Explorations Syndicate to Franklin Motel Co. Ltd. On January 29, 1972 Franklin Motel Co. Ltd. in turn sold the claims to Kintla Explorations Limited. At the date of this report the claims are registered to the Goble Family.

In March 1973 9 claims (Commerce 50-57, 68) were staked adjoining the original 45 claims. At this time a separate block of 10 claims (Commerce 58-67) was staked to the northwest of the original claim block. An additional 3 full (Commerce 69-71) and 3 fractional (Commerce 72-74) claims were staked adjoining the original 45 in July 1973. Finally, 17 claims (Commerce

75-91) were staked southeast of the original block in August 1973. Current claim boundaries are indicated on Figure 2.

Exploration was carried out on the original 45 Commerce Claims by Kennco Explorations (Western) Limited in 1967/68; by the Goble Family in 1968/69, 1970/71, 1971/72; by Falconbridge Nickel Mines Limited in 1969/70; and by Kintla Explorations Limited in 1972/73. Several diamond drill holes were put down by the Goble Family but core recovery was poor (F.M. Goble, pers. comm.) and no cores or logs are available for these holes. Results of explorations carried out by Falconbridge Nickel Mines Limited in 1969/70 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. $49^{o}09'$ - $49^{o}12'$, Long. $114^{o}20'$ - $114^{o}25'$, June - July 1970" dated February, 1971. Results of exploration carried out by Kintla Explorations Limited in 1972/73 are summarized in a report entitled "Geological Report on the Beth and Commerce Claims located 45 miles Southeast of Fernie, 49^{o} 114^{o} S.E." dated July 19, 1973. To the end of 1972 exploration work totalling approximately $34,000.00 had been performed on the 45 original Commerce Claims.

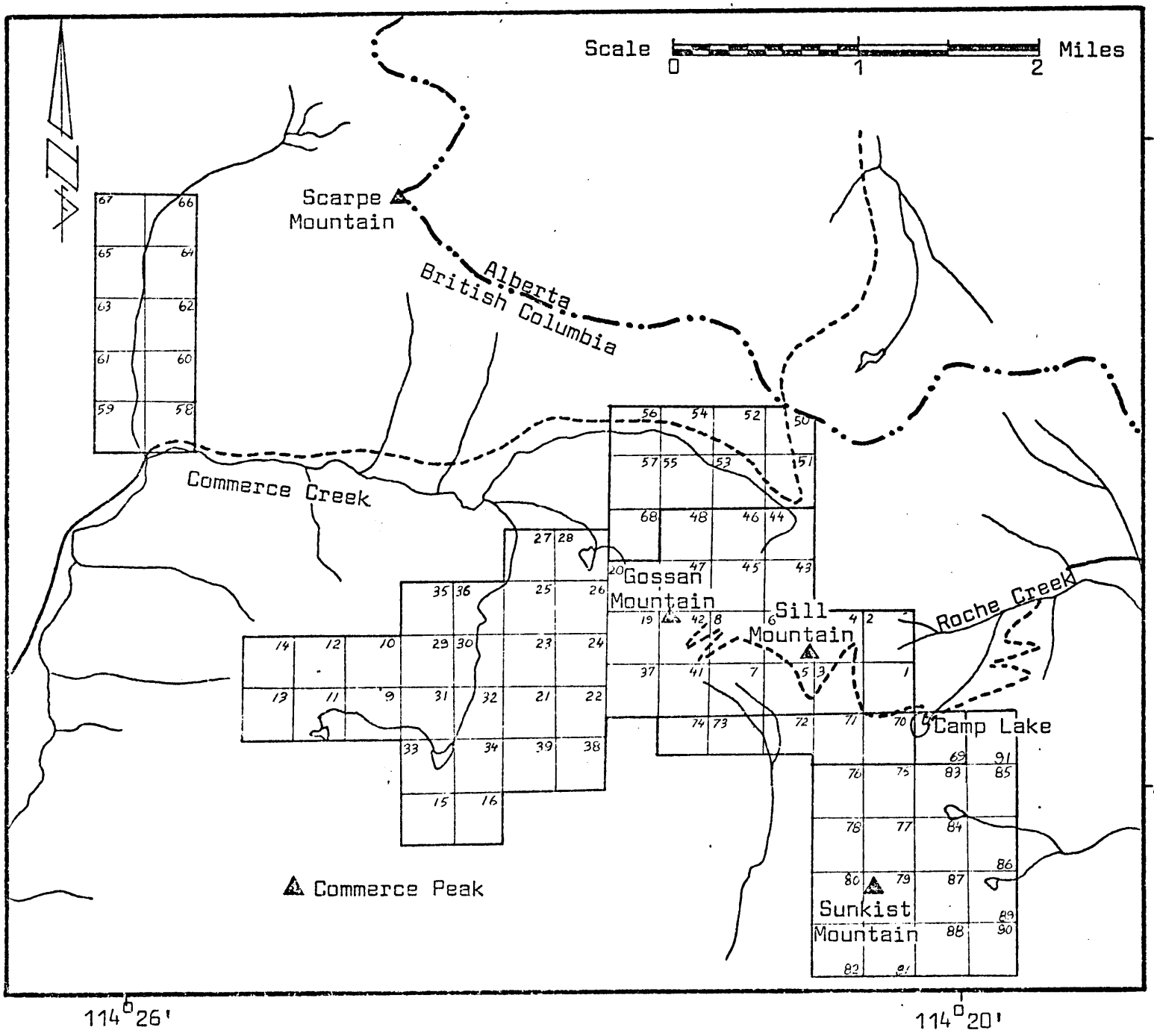

FIGURE 2: CLAIM BOUNDARIES - COMMERCE CLAIM BLOCKS.

REGIONAL GEOLOGICAL SETTING

The Au/Ag, Cu/Ag deposits of the Commerce Mountain area occur within rocks of the Precambrian Lewis Series and within associated intrusive rocks. The Lewis Series, the local equivalent of the Purcell (Belt) Supergroup, outcrops within the Lewis thrust plate, a sheet of gently folded, almost horizontal Precambrian strata which has been thrust over Paleozoic and Mesozoic formations (see Figure 3). Subsequent to movement along the Lewis thrust, the thrust plate has been folded into a series of en-echelon structures trending south to southeast (BOSTOCK et al., 1957). The dominant structure, the Akamina syncline, parallels the Purcell anticlinorium, formed west of the Rocky Mountain Trench (HUME, 1932).

The Lewis thrust sheet is cut to the west by the Flathead fault, one of a set of listric normal faults formed after emplacement of the Lewis overthrust by "back-slippage" along pre-existing thrusts during a phase of post-orogenic uplifting (BALLY et al., 1966). The thrusting and subsequent normal faulting occurred as part of the Laramide orogeny of the Middle Paleocene and Eocene, with movement on the Flathead fault continuing well into the Oligocene (JONES, 1969).

The rocks of the Lewis thrust sheet are for the most part shallow-water, subaerial and marine quartzites, argillites, and carbonates with minor submarine lava flows and deeper water sediments. The stratigraphic succession as given by PRICE (1962) is shown in Figure 4. Deposition of the Lewis Series occurred in a slowly subsiding basin or trough of relatively high stability. The rate of subsidence kept close pace with the quantity of supply, with some localities exposed to subaerial conditions while others were submerged below wave-base (REESOR, 1957). Conditions such as this

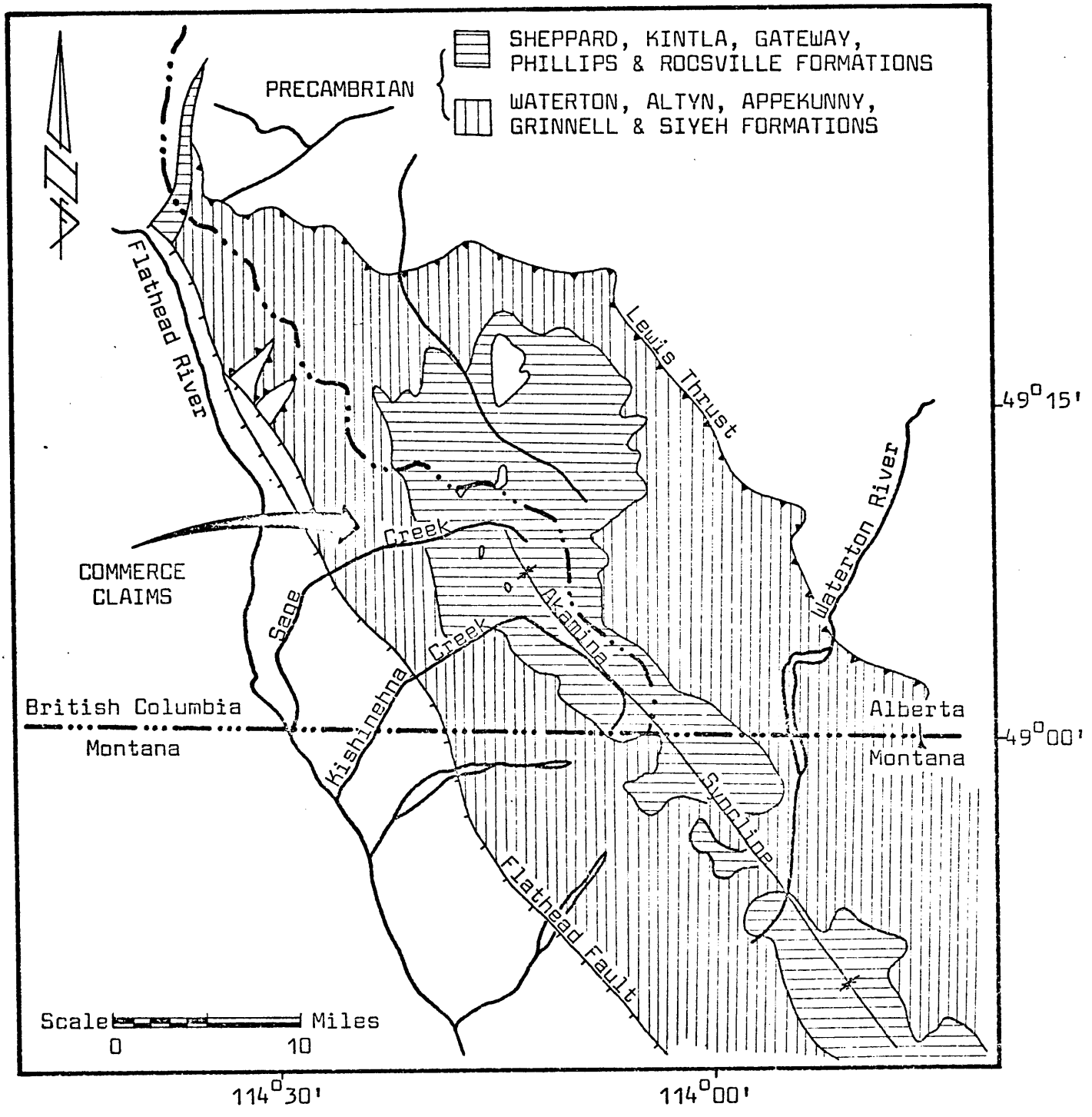

FIGURE 3: GEOLOGY OF LEWIS THRUST SHEET

(after PRICE, 1965).

PERIOD OR EPOCH	GROUP FORMATION	LITHOLOGY	THICKNESS (feet)
	EROSIONAL UNCONFORMITY		
PURCELL	MOYIE INTRUSIONS	Diorite sills and dykes.	
PURCELL (LEWIS)	ROOSVILLE FORMATION	Green argillite, siltstone, sandstone, stromatolitic dolomite.	3500 ±
	PHILLIPS FORMATION	Red sandstone, siltstone, argillite.	500 - 700
	GATEWAY FORMATION	Argillite, argillaceous siltstone, dolomite, dolomitic sandstone, and argillite.	1150 - 3000
	SHEPPARD FORMATION	Quartzitic & dolomitic sandstone, dolomite, oolitic dolomite, argillite, siltstone, pillowed andesite.	150 - 900
	EROSIONAL UNCONFORMITY IN PART		
	PURCELL LAVA	Chloritized andesite, & amygdaloidal andesite, pillowed andesite.	00 - 600
	SIYEH FORMATION	Limestone, dolomite, argillite & sandy limestone & dolomite, argillite, stromatolitic limestone.	1130 - 3000
	GRINNELL FORMATION	Red argillite, sandstone & siltstone; white, green & red quartzite.	350 - 1700
	APPEKUNNY FORMATION	Green argillite, white, grey & green quartzite; sandy argillaceous dolomite & dolomitic argillite; siltstone.	1500 - 2000
	ALTYN FORMATION	Argillaceous limestone & dolomite; sandy dolomite, argillite, & stromatolitic dolomite.	500 - 4000
	WATERTON FORMATION	Limestone & dolomite, argillite, & argillaceous dolomite.	1500 +

FIGURE 4: STRATIGRAPHIC SUCCESSION - LEWIS SERIES

(after PRICE, 1962).

would occur on or adjacent to the flood plain of a large subsiding delta (PRICE, 1964).

There are two distinct groups of structures within the Clarke Range (PRICE, 1962). The first of these, a series of thrust faults (e.g. Lewis thrust) and related folds (e.g. Akamina syncline) is generally cut by the second, a group of younger normal faults dipping towards the southwest or west (e.g. Flathead fault). This may represent late Mesozoic and early Tertiary thrusting followed by late Tertiary normal faulting (BALLY et al., 1966). The normal faults, which are steep at the surface, also flatten at depth (listric normal faults) and may merge with older thrust faults. A third set of northeasterly-trending transverse faults occurring in the Clarke Range may have originated as gravity faults, whose orientations were controlled by the anisotropy of the basement rocks underlying the region (PRICE, 1967).

Two periods of Purcell plutonism within the Lewis thrust sheet took place at 1580 - 1400 million years and 1110 - 1073 million years (HUNT, 1962). These gave rise to Moyie-type chloritized diorite and diabase sills and dykes concentrated within the Altyn, Appekunny, Grinnell, and Siyeh Formations, some occurring as high in the stratigraphic sequence as the Phillips Formation. The second of the two phases of igneous activity also resulted in the extrusion of andesitic lavas belonging to the trachybasalt family (HUNT, 1964). A third period of igneous activity resulted in the intrusion of leucocratic alkalic intrusives of Cretaceous and/or Tertiary age (PRICE, 1962). These occur as narrow dykes and irregular anastamosing stock-like masses, trachyte being the most common rock type, with aegirine-augite and aegirine trachytes and syenites, latites, felsites, and intrusion

breccias also being present (PRICE, 1962). It is these younger alkalic intrusives which are concentrated within the Commerce Mountain area.

GEOLOGY OF COMMERCE CLAIM BLOCKS

Stratigraphy

The Commerce Mountain area contains outcrop of rocks of all formations from the Altyn to the Phillips (see Figure 5). Apart from the immediate contacts with sills and dykes, these rocks are unmetamorphosed. Details of the local stratigraphy as mapped by BADHAM (1972) are given below. For a summary of the local stratigraphic column see Table 1.

Altyn Formation:

Approximately 1000' of dark fissile shales with dolomitic horizons outcropping to the south and west of the claims are assigned to the Altyn Formation.

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. These sandstones are overlain by about 2000' of grey and green fissile shales with occasional dolomitic horizons. There are an increasing number of intercalated thin white sandstone beds towards the top of the formation.

Grinnell Formation:

The base of this approximately 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 sandstone beds increase in number and thickness up the Grinnell, making up some 30% of the outcrop in the middle Grinnell and 50% of the outcrop in the upper 500' of Grinnell.

The buff and green horizons in the lower Grinnell are not true beds,

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	
Aappekunny	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).

but have developed around thin beds and lenses of coarser silt and sandstone, presumably during post-depositional ground water percolation. 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 (actual boundaries are not defineable) the shale clasts are usually green, but green and red ones become mixed in the upper Grinnell.

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 were deposited in part in very shallow water and in part subaerially. They are interpreted as being the deposits of a deltaic floodplain, with the sandstones representing periodic channel spills (BADHAM, 1972).

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 basal shales and dolomites are overlain by approximately 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 dolomite, 30' thick. The depositional environment is interpreted as having been shallow lagoonal (BADHAM, 1972).

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

Purcell Lava:

Between 200' and 400' of pillowed, massive and vesicular green to purple andesitic flows (basaltic andesites and trachybasalts) overlie the Siyeh with complete conformity. The flows thin to the north. The vesicles, which may be round, ellipsoid, amoeboid or tubular and branching, are filled with chlorite, quartz, and carbonate and contain rare specks of pyrite and chalcopyrite. Larger vug cavities are lined with quartz and, occasionally, pyrite. The lavas are interpreted as being extruded both into shallow water and subaerially (BADHAM, 1972).

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 (BADHAM, 1972). The top of the lava flow is ropy and scoriaceous.

Gateway Formation:

300' of red siltstone with shale and sandstone horizons overlie the Sheppard conformably and represent the return of deltaic conditions (BADHAM, 1972). The unit is typified by ripple marks, suncracks, mud-flake conglom-

erates and salt casts.

Phillips Formation:

50' of buff shales overlying the Gateway Formation to the southeast of the claims are ascribed to the Phillips Formation.

Structure

The rocks underlying the Commerce area are folded on an easterly-trending axis into large tight anticlines and open synclines (F_1) (see Figure 5), which are severely discontinuous, and occur mainly in the outcrops of the Grinnell Formation. Associated meso-drag-folds are present in all formations. Large open, northerly-trending folds (F_2), related to the Akamina syncline, have refolded the F_1 structures so that they have a double plunge. F_2 drag folds are only common near the crests of the F_2 anticlines.

Good non-penetrative F_1 and F_2 cleavages are developed in the axial regions of both F_1 and F_2 folds where two easterly-plunging F_1 folds bring the outcrop of the Appekunny Formation onto the western Commerce Claims. The axial planes of F_1 drag folds have broken occasionally, allowing small 'faults' to develop. Overall, however, faulting is very minor, most of the recognized faults being joint planes along which minor adjustments have occurred.

Intrusive Rocks

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. The zone of major intrusion stretches from North Ridge, through Gossan Mountain, to Andradite Mountain, with the majority

of sills and dykes occurring in the top 400' of the Siyeh Formation. The sills and dykes as mapped by BADHAM (1972) are described individually in Table 2 and are numbered, or lettered, on Figure 5.

Most of the sills are plagioclase-hornblende porphyritic diorites. The texture is generally diabasic, but patches of pegmatitic plagioclase are common. The sills are characterized by abundant amphibolitized xenoliths, chilled margins, baked host rocks at the contacts, and late magmatic segregation pods, veins and dykes. Nodules containing olivine, plagioclase, and pyroxene have been noted. 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. Local segragation pods of biotite were observed in the thicker sills, and late dykes of fine quartz-feldspar with large blebs of golden mica (phlogopite ?) have been noted.

The sills are not strictly stratabound but jump on joint planes, have apophyses and offshoot dykes and sills, and may bifurcate and rejoin. They are frequently both fed by and cut by dykes of identical texture and composition. No intrusives have been noted below a more diabasic sill (sill # 14 - see Table 2) outcropping in the middle Siyeh.

Only one sill (sill # 11) is ascribed to the Precambrian periods of intrusive activity, the remainder represent a period of late Cretaceous and/or Tertiary intrusive activity. The texture and mineralogy of the diorites suggest that they were intruded at fairly low temperatures, at shallow depths and under hydrous conditions (BADHAM, 1972).

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 a 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 limestone.
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).

Mineralization

Economically significant mineralization within the Commerce Mountain area is of three types: (1) Cu/Ag within the sediments, (2) Cu/Ag within quartz-carbonate veins, (3) Au/Ag within the dioritic intrusive rocks. Sulphides within the contact zones surrounding the intrusives may carry gold values but are treated in the third group. Many of the intrusives carry minor chalcopyrite and/or galena but this mineralization is not economically significant.

Sediments

Altyn Formation:

Many of the bedding planes in the shales are covered in a thin plating of pyrite, but no other minerals have been noted.

Appekunny Formation:

Pyrite occurs as thin smears on joint planes in the shales and pyrite and hematite blebs are present in some of the upper sandstones. No copper minerals have been noted.

Grinnell Formation:

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

The copper minerals bornite, covellite, chalcocite, and chalcopyrite, with secondary malachite and, rarely, azurite are found in some of the sandstone beds. The copper mineralization is confined to the 'dirty' and clast-bearing portions of the sandstone beds and has occasionally been

noted in the surrounding shales. The sulphides occur as disseminated blebs, or as partial or complete replacements of green shale clasts. No copper mineral has been seen replacing a red shale clast, and only very rarely are copper minerals seen in sandstone beds containing red clasts.

Each showing of copper mineralization in the Grinnell Formation is detailed in Table 3 and located on Figure 5.

Siyeh Formation:

Sandstone beds near the base of the Siyeh Formation contain grains of pyrite and, within 30' of the base, one bed has about 5% micronodules of pyrite. Dolomites within the basal 500' of the formation have been observed carrying minor galena and sphalerite.

Purcell Lava:

Specks of pyrite and chalcopyrite occur within vesicles within the lavas. Larger vug cavities are occasionally lined with pyrite. No primary mineralization has been seen in the matrix of the rocks.

Sheppard Formation:

Mineralization within the Sheppard lava flow is similar to that within the Purcell lavas. No mineralization has been observed within the Sheppard sediments.

Gateway Formation:

No copper mineralization has been observed within the Gateway sediments.

Phillips Formation:

Two 6-8' dolomites carrying very fine-grained bornite, covellite, hematite, and malachite occur approximately 100 stratigraphic feet apart in the southeast Commerce area (see Figure 5).

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 ~36' (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 BADHAN, 1972, GOBLE, 1967).

Veins

On the west face of Fault Mountain the Grinnell Formation has been folded into two tight anticlines (see Figure 5). The crests of these anticlines have cracked and allowed dilation and minor faulting. Quartz has been remobilized from the sandstone beds and deposited with carbonate as veins in parts of these cracks. Where bedding is parallel to the veins, the sandstone beds are recrystallized to quartzite, and the vein, as such, is a bed. Such 'beds' can sometimes be traced laterally to a point where they crosscut the bedding and form a 'vein'. The veins are podiform, being wider at slight kinks. Often there are small offshoots and nearby tension fracture pods.

The south vein is generally barren where it transects the Grinnell, although blebs of chalcopyrite are seen, in places up to 5%. Minor galena has also been reported. This vein does not transect the Siyeh and the sills higher up on Fault Mountain.

The north vein is more regular than the south vein, although in places it does pinch out, to reappear higher in the stratigraphic section. Tetrahedrite, chalcopyrite, pyrite, malachite, and azurite are present, commonly concentrated near irregularities in the vein wall. Numerous offshoot veins and tension fracture pods are present near the main vein. The north vein cuts the Siyeh and parts of the upper Grinnell sediments but fails to transect the sills within the Siyeh higher up on Fault Mountain.

The Grinnell rocks are severely bleached to the north of the south vein, for 100-150', and the beds for 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 except in the lower part of the

section where a segment of Appekunny has apparently been faulted into the core of the anticline. There is a small amount of bleaching around the north vein.

Intrusives

All of the dioritic rocks contain some primary sulphides, mainly pyrite and pyrrhotite, with rarer chalcopyrite and galena. However, in both igneous and sedimentary rocks, major amounts of mineralization are almost entirely confined to the upper Siyeh shales.

Sulphide mineralization is nearly absent where the sills intrude middle Siyeh rocks. The sandstones and limestones are bleached and recrystallized and the growth of epidote, andradite, idiocrase (?), grossularite, tremolite, and diopside has been observed in the siliceous algal bands in the dolomites. For isolated sills, bleaching and metamorphism is 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-mineralized. The Purcell lavas are commonly extensively replaced by sulphides along contacts with sills. Mineralization is not evident in Sheppard rocks intruded by sills.

The dykes are more commonly mineralized throughout their lengths, but some are, nevertheless, barren.

The sulphides are present in the sediments as metablasts and as platings on bedding and joint planes. There is no sign of skarn on contacts between intrusives and limestones, and only a few small patches of malachite have been seen on such contacts. The sulphides in the igneous rocks occur as disseminated primary blebs, and as coatings on joint planes. It is apparent that the sulphides are of magmatic origin, and that the physical (and

chemical ?) nature of the Siyeh shales permitted intrusion of the sills and mineralization at this horizon.

No.	Au.	Ag.	Cu.	U_3O_8 (ppm)	Th_{O_2}	U_3O_8 (lbs./Ton)
1	Tr	.34	nr	4.7	nr	.55
2	nr	0	nr	4.3	nr	.037
3	nr	1.04	1.81	8.4	nr	.096
4	nr	.86	.25	14.4	nr	.069
5	nr	nr	nr	40.3	nr	.113
6	nr	nr	nr	3.7	nr	.323
7	nr	nr	nr	5.5	nr	.030
8	nr	nr	nr	5.0	nr	.044
9	nr	nr	nr	482.0	nr	1.846
10	nr	nr	nr	73.9	nr	.853
11	nr	.24	3.20	41.0	nr	.328
12	nr	.08	1.75	58.3	nr	.491
13	nr	.10	.80	67.8	nr	.592
14	nr	.06	.69	34.6	nr	.277
15	nr	.09	.34	944.0	nr	5.652
16	nr	.30	2.27	116.0	nr	.920
17	nr	nr	nr	4.0	nr	.032
18	nr	nr	nr	5.6	nr	.029
19	nr	nr	nr	2.8	nr	.021
20	nr	nr	nr	0.9	nr	.007
21	nr	nr	nr	4.0	nr	.032
22	nr	nr	nr	6.8	tr	.050
23	nr	nr	nr	6.0	tr	.048
24	nr	nr	nr	4.6	tr	.033
25	nr	.08	.15	15.9	tr	.111
26	nr	nr	nr	6.3	tr	.050
27	nr	.24	.13	3.6	tr	.029
28	nr	nr	nr	3.3	tr	.021
29	nr	nr	nr	4.4	tr	.035
30	nr	.08	.34	5.5	tr	.044
31	nr	.06	.02	10.3	tr	.082
32	nr	.52	2.13	75.2	tr	.586
33	nr	nr	nr	8.5	tr	.066
34	nr	.76	.09	163.0	tr	1.304
35	nr	.12	.01	nd	nr	nd
36	nr	.92	.18	58.3	tr	.466
37	nr	.18	.27	35.8	tr	.282
38	nr	.58	2.50	nd	tr	nd
39	nr	.56	1.80	75.2	tr	.610

Control Line 7

Control Line 6

Control Line 5

Control Line 4

Control Line 3

Upper Lake

Lower Lake

Hanna Valley

Sunrise Ridge

Rocky Creek

Comp. Lake

Commerce 2

Commerce 1

Commerce 27

Commerce 70

Commerce 75

Commerce 63

Commerce 77

KINTLA EXPLORATIONS LIMITED

RADIO-METRIC SURVEY MAP
COMMERCE CLAIMS - FLATHEAD VALLEY
SOUTHEAST BRITISH COLUMBIA

SCALE 0 500 1000 1500 2000 FEET

MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
NO. 5938
MAP NO. #1

5938 M-1

CANADA

82 G/1 W | 1:50,000 | EDITION 1 | 82 G/1 W

Refer to this map as: 82G/1W EDITION 1 ASE SERIES A 721

Commerce Claims (Approx.)

FLATHEAD PROVINCIAL FOREST

BRITISH COLUMBIA — ALBERTA

CANADA — UNITED STATES OF AMERICA — MONTANA

Produced and printed by the SURVEYS AND MAPPING BRANCH, DEPARTMENT OF MINES AND TECHNICAL SURVEYS, 1960, from air photographs taken in 1949.

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SAGE CREEK

BRITISH COLUMBIA - ALBERTA

WEST OF FIFTH MERIDIAN - OUEST DU CINQUIÈME MÉRIDIEN

SCALE 1:50,000 ÉCHELLE

Miles 1 0 1 2 3 Miles

Metres 1000 500 0 1000 2000 3000 4000 Mètres

Yards 1000 500 0 1000 2000 3000 4000 Verges

CONTOUR INTERVAL 100 FEET
Elevations in Feet above Mean Sea Level
North American Datum 1927
Transverse Mercator Projection

MAGNETIC DECLINATION 20°46' EAST
AT CENTRE OF MAP 1960
Annual change (decreasing) 3.5'

ÉQUIDISTANCE DES COURBES: 100 PIEDS
Élévations en pieds au-dessus du niveau moyen de la mer
Réseau géodésique nord-américain unifié (1927)
Projection transverse de Mercator

DÉCLINAISON MAGNÉTIQUE AU CENTRE
DE LA FEUILLE EN 1960 : 20°46' EST
Variation annuelle (décroissante) 3.5'

Routes:

... weather	pavée, toute saison	more than 2 lanes, plus de 2 voies; 2 lanes, 2 voies
ha... surface, all weather	pavée, toute saison	2 lanes or more, 2 voies ou plus; less than 2 lanes, moins de 2 voies
loose surface, all weather	de gravier, toute saison	2 lanes or more; less than 2 lanes
loose surface, dry weather	de gravier, période sèche	2 voies ou plus; moins de 2 voies
cart track	de terre	
trail or portage	sentier ou portage	
Railway, normal gauge, single track	Chemin de fer, voie unique (écartement normal)	siding, voie d'évitement; station, gare
Horizontal control point, with elevation	Point géodésique avec cote	454 △
Bench mark, with elevation	Repère de nivellement avec cote	BM 157 →

Building	Bâtiment	Barn	Grange
School	École	Post Office	Bureau de poste
Church	Église	Cemetery	Cimetière
Mine or Open cut	Mine ou fosse à ciel ouvert		
Lighthouse	Phare		
Power transmission line	Ligne de transport d'énergie		
River with bridge	Rivière avec pont		
Stream, intermittent or dry	Cours d'eau intermittent, ou à sec		
Lake intermittent; indefinite	Lac intermittent; rive imprécise		
Marsh or Swamp	Marais ou marécage		
Depression contours	Courbes de cuvette		

CONVERSION SCALE FOR ELEVATIONS
Feet / Metres

T.N.
1°59' or 35 Mils — Grid North
18°47' or 334 Mils — Magnetic North

Use diagram only to obtain numerical values.
APPROXIMATE MEAN DECLINATION 1960
FOR CENTRE OF MAP
Annual change decreasing 3.5'

GRID ZONE DESIGNATION 11U
100,000 M. SQUARE IDENTIFICATION: PE QE

TO GIVE A REFERENCE TO NEAREST 100 METRES
EXAMPLE: BUILDING
EASTING: Read number on grid line immediately to left of point. Estimate tenths of a square from this line eastward to point. 917
NORTHING: Read number on grid line immediately below point. Estimate tenths of a square from this line northward to point. 455
MILITARY GRID REFERENCE 917455
Nearest similar grid reference 100,000 metres (about 63 miles)

ONE THOUSAND METRE
UNIVERSAL TRANSVERSE MERCATOR GRID
ZONE 11

BROWN NUMBERED TICKS INDICATE THE 1000 METRE U.T.M. GRID ZONE 12

TABLEAU D'ASSEMBLAGE DU SYSTÈME DE RÉFÉRENCE CARTOGRAPHIQUE NATIONAL

82 G/7 UPPER FLATHEAD	82 G/8 BEAVER MINES	82 H/5 PINCHER CREEK	82 H/6 BLAIRMORE
82 G/2 LOWER FLATHEAD	82 G/1 SAGE CREEK	82 H/4 WATERTON LAKES	
U.S.A.	U.S.A.	U.S.A.	

INDEX TO ADJOINING SHEETS OF THE NATIONAL TOPOGRAPHIC SYSTEM

SAGE CREEK
82 G/1 W
EDITION 1

DISTRIBUTED BY THE TECHNICAL DIVISION
DEPARTMENT OF LANDS & FORESTS
NATURAL RESOURCES BUILDING EDMONTON ALBERTA

MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
NO. 5938
MAP NO. #2

5938 M-2