

# MAR 19730001: SOUTHWESTERN ALBERTA

Received date: Dec 31, 1973

Public release date: Jan 01, 1975

## **DISCLAIMER**

By accessing and using the Alberta Energy website to download or otherwise obtain a scanned mineral assessment report, you ("User") agree to be bound by the following terms and conditions:

- a) Each scanned mineral assessment report that is downloaded or otherwise obtained from Alberta Energy is provided "AS IS", with no warranties or representations of any kind whatsoever from Her Majesty the Queen in Right of Alberta, as represented by the Minister of Energy ("Minister"), expressed or implied, including, but not limited to, no warranties or other representations from the Minister, regarding the content, accuracy, reliability, use or results from the use of or the integrity, completeness, quality or legibility of each such scanned mineral assessment report;
- b) To the fullest extent permitted by applicable laws, the Minister hereby expressly disclaims, and is released from, liability and responsibility for all warranties and conditions, expressed or implied, in relation to each scanned mineral assessment report shown or displayed on the Alberta Energy website including but not limited to warranties as to the satisfactory quality of or the fitness of the scanned mineral assessment report for a particular purpose and warranties as to the non-infringement or other non-violation of the proprietary rights held by any third party in respect of the scanned mineral assessment report;
- c) To the fullest extent permitted by applicable law, the Minister, and the Minister's employees and agents, exclude and disclaim liability to the User for losses and damages of whatsoever nature and howsoever arising including, without limitation, any direct, indirect, special, consequential, punitive or incidental damages, loss of use, loss of data, loss caused by a virus, loss of income or profit, claims of third parties, even if Alberta Energy have been advised of the possibility of such damages or losses, arising out of or in connection with the use of the Alberta Energy website, including the accessing or downloading of the scanned mineral assessment report and the use for any purpose of the scanned mineral assessment report so downloaded or retrieved.
- d) User agrees to indemnify and hold harmless the Minister, and the Minister's employees and agents against and from any and all third party claims, losses, liabilities, demands, actions or proceedings related to the downloading, distribution, transmissions, storage, redistribution, reproduction or exploitation of each scanned mineral assessment report obtained by the User from Alberta Energy.

*Copper*

ECONOMIC MINERALS

FILE REPORT No.

*CU-AF-035(1)*

*CU-AF-036(1)*

*CU-AF-037(1)*

KINTLA EXPLORATIONS LIMITED

GEOLOGICAL REPORT # V - P 1

JUNE - SEPTEMBER 1972

PERMIT AREAS # 171, 172, 173.

SOUTHWESTERN ALBERTA

E. Goble,

February, 1973.

700254  
700256  
700258  
INDEXING DOCUMENT NOS.

CONTENTS:

	PAGE
INTRODUCTION.....	1
REGIONAL SETTING.....	1
REGIONAL GEOLOGY.....	2
PREVIOUS HISTORY OF EXPLORATION.....	5
OUTLINE OF THE 1972 PROSPECTING PROGRAM.....	7
RESULTS.....	9
DRYWOOD CREEK - PINCHER CREEK AREA.....	9
INTERPRETATION AND CONCLUSIONS.....	11
TABLE MOUNTAIN - GLADSTONE MOUNTAIN -	
NORTH KOOTENAY PASS.....	12
INTERPRETATION AND CONCLUSIONS.....	15
GRIZZLY CREEK - WHISTLER MOUNTAIN - BARNABY RIDGE...	16
INTERPRETATION AND CONCLUSIONS.....	18
CENTRAL PORTION OF THE AKAMINA SYNCLINE.....	19
INTERPRETATION AND CONCLUSIONS.....	20
ADDITIONAL SHOWINGS OF INTEREST.....	21
CONCLUSIONS.....	23
RECOMMENDATIONS.....	24
REFERENCES.....	25

## INTRODUCTION

The Kintla - Vestor prospecting permit areas, numbers 171, 172, and 173, are three contiguous mineral exploration permits of 9,920 acres each, covering a total area of 29,760 acres, centred upon latitude  $49^{\circ} 20' N$  and longitude  $114^{\circ} 15' W$ . The permit areas lie approximately 15 miles southwest of Pincher Creek, Alberta in an arc from South Drywood Creek to West Castle River, covering the northern exposure of Grinnell, Siyeh, Purcell Lava, and Sheppard Formations (of the Precambrian Belt Series) in the Akamina Syncline. The permits were obtained by Kintla Explorations Limited and Vestor Explorations Ltd. in June of 1972 following Kintla's discovery of high-grade lead-silver mineralization in the Siyeh Formation on Kintla's Big horn claims, 4 miles southeast of Permit 171. A prospecting program was undertaken on the permits during the summer of 1972. This is a summary of that program.

## REGIONAL SETTING

The Kintla - Vestor prospecting permits are situated within the Clarke Range of the Rocky Mountains some 20 miles north of the Canada - United States border. The permit areas are bounded by longitudes  $114^{\circ} 3' W$  and  $114^{\circ} 25' W$ , and latitudes  $49^{\circ} 15' N$  and  $49^{\circ} 22' N$ , covering a total area of 46.5 square miles.

The permit areas are situated in mountainous terrain typical of the Lewis Range of the southern Canadian Rockies. Relief in the area is rugged with valley bottoms between 4,000 and 6,000 feet above sea-level, and mountain peaks between 7,500 and 9,000 feet above sea-level. Access is good via forestry roads along all valleys except Mill and Gladstone Valleys, and with a passable 4-wheel drive road up Mill Creek. Gladstone Valley is accessible only on foot. Winter access is restricted by annual snowfalls of 80 to 90 inches, but ridge tops and the southern faces of the mountains

are generally open almost all year.

#### REGIONAL GEOLOGY

The permit areas are situated within a region underlain by Precambrian rocks of the Lewis Series. The stratigraphic succession of the area is given in Table 1 (after Price, 1962). The areas of the permits are for the most part underlain by quartzites, argillites, and carbonate horizons, with minor intercalated submarine lavas. The Appekunny, Grinnell, Siyeh, Purcell Lava, Sheppard, and Gateway Formations outcrop on the permit areas (see Figure 1).

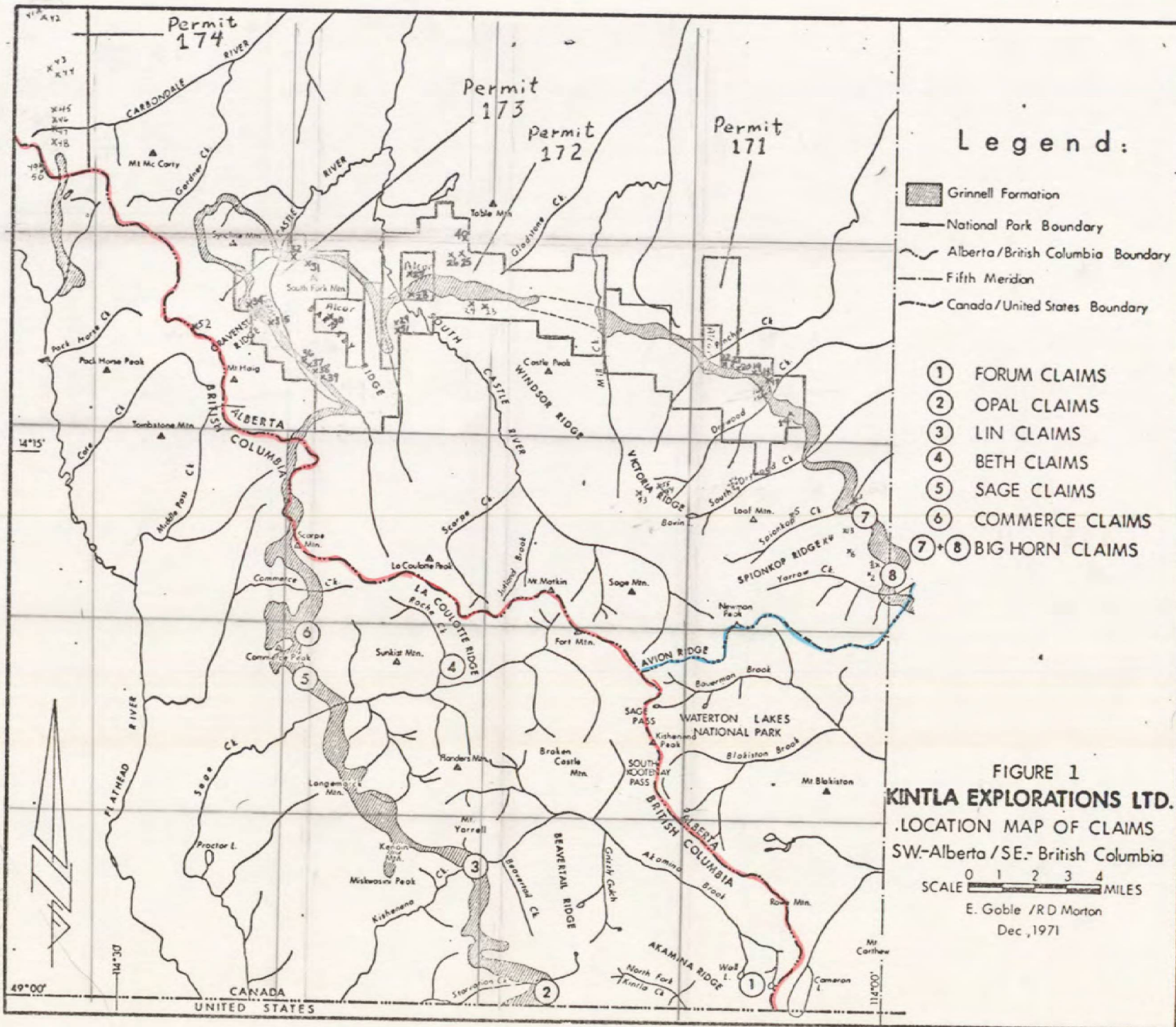
Reesor (1957), Price (1964), and Harrison (1972) postulate that the Lewis Series sediments of which these are a part, were deposited in the shallow waters of a deltaic basin and were in part of subaerial origin. Smith and Barnes (1966) recognize cyclic deep - shallow water depositional phases in the Montana equivalents of the Lewis Series. One such cycle terminates at the base of the Siyeh Formation with the Appekunny and Grinnell Formations representing the shallow water half of the cycle. The next cycle begins at the base of the Siyeh Formation with black marcasitic shales, continues through the carbonate sequence of the central and upper Siyeh, and terminates after the upper red beds of the Sheppard, Gateway, and Phillips Formations.

The Appekunny, Grinnell, Siyeh, and Sheppard Formations have been intruded by a series of amygdaloidal, porphyritic quartz - diabase sills and dykes up to 100 feet thick. These are of Precambrian age and are probably contemporaneous with the extrusion of the Purcell lavas. The Siyeh, Purcell Lava, and Sheppard Formations have been intruded by a series of porphyritic trachytic syenite sills and dykes of which the age is still unknown.

The Precambrian rocks in this area are part of the Lewis thrust sheet in which the Precambrian sediments have been thrust from the southwest over the younger Paleozoic and Mesozoic sediments. According to Price (1962), the Clarke Range is characterized by a series of thrust

ERA	PERIOD OR EPOCH	GROUP FORMATION	LITHOLOGY	THICKNESS (feet)	
		EROSIONAL UNCONFORMITY			
PRECAMBRIAN	PURCELL	MOYIE INTRUSIONS	Diorite sills and dykes		
	PURCELL (LEWIS)	GATEWAY KINTLA	ROOSVILLE FORMATION	Green argillite, siltstone, sandstone, stromatolitic dolomite	3500+ _
			PHILLIPS FORMATION	Red sandstone, siltstone, argillite	500- 700
			GATEWAY FORMATION (upper member)	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+		

Table 1. Stratigraphic succession of SW Canadian Precambrian (after Price, 1962)



**Legend:**

- Grinnell Formation
- National Park Boundary
- Alberta/British Columbia Boundary
- Fifth Meridian
- Canada/United States Boundary

- ① FORUM CLAIMS
- ② OPAL CLAIMS
- ③ LIN CLAIMS
- ④ BETH CLAIMS
- ⑤ SAGE CLAIMS
- ⑥ COMMERCE CLAIMS
- ⑦+⑧ BIG HORN CLAIMS

**FIGURE 1**  
**KINTLA EXPLORATIONS LTD.**  
 .LOCATION MAP OF CLAIMS  
 SW-Alberta / SE- British Columbia  
 SCALE 0 1 2 3 4 MILES  
 E. Gable / RD Morton  
 Dec, 1971

19730001

faults and associated folds, cut by younger SW- or W- dipping normal faults. Bally et al., (1966) suggest that the thrusts are of late Mesozoic to early Tertiary age and that later faults were late Tertiary listric structures, perhaps merging with thrusts at depth. Figure 2 illustrates the general structural setting of the region and the extent of the Lewis thrust sheet which is folded into a broad synclinorium (the Akamina Syncline) and truncated to the west by the Flathead fault.

#### PREVIOUS HISTORY OF EXPLORATION

Copper mineralization in Purcell lavas and diabases of the North Kootenay Pass region in southwestern Alberta was first reported by Dawson in 1886. The region was prospected for gold in the 1870's and 1880's but no mineralization was found until the oil discovery at Oil City, now in Waterton Lakes National Park concentrated activity in that area. At that time (1901 - 1903) gold was discovered on the northwestern slope of Buchanan Ridge in Appekunny Formation quartzites. No development was done and when the oil boom collapsed the claims were dropped. Gold was also discovered in the Appekunny Formation on the east side of Goat Haunt Mountain, now in Glacier National Park, Montana, at approximately this same time and was mined up to the death of the owner.

During the first decade of the 20th century, small scale mining operations were located on copper bearing diabase dykes on Blakiston Brook, Waterton Lakes, and on Chief Mountain in Glacier National Park. Outcrops of cupriferous quartzites and diabase intrusions were found and staked in the Yarrow Creek area at this same time, but these claims were never recorded. In 1963 the first 10 Big Horn claims were staked on these occurrences by Frank and Erik Goble, and by 1966 75 Big Horn group claims and 40 other claims had been staked in that area.



In 1966 Kennco Explorations (Western) Ltd. optioned the 75 Big Horn claims and during the 1967 field season carried out an exploration program on them and on the remainder of the Belt Series of southwestern Alberta and southeastern British Columbia. During the year that Kennco held the Big Horn claims an estimated 1,000,000 tons of up to 3.45% copper and 1.86 oz. per ton silver was outlined on the northern edge of the claim block. During this time Kennco located and staked the Commerce Mountain property and the Lin group of claims on Kishenena Creek. Work was confined to the upper portion of the Appekunny Formation and the Grinnell Formation and the options and claims were dropped in 1968.

In 1968 Alcor Minerals Ltd. took out leases covering almost the entire southwestern Alberta outcrop of Precambrian and after a cursory prospecting program, optioned much of the area now covered by the Kintla - Vestor permits 172 and 173 to Cominco Ltd. Cominco carried out a drill program on the Grizzly Creek copper property but dropped the option in 1971. In 1970 Canadian Superior Explorations Ltd. prospected the upper red-bed sequence of the Akamina Syncline for copper - silver mineralization and found numerous low grade showings, none of which were rich enough to warrant staking.

In 1972 the Big Horn, Commerce Mountain, Beth, Forum, Lin, and Opal claim blocks were obtained from the Goble Exploration Syndicate by Kintla Explorations Limited. A program of mapping and prospecting undertaken during the spring of 1972 on the Big Horn claims outlined a rich lead - silver showing on the southern portion of that claim block. The discovery was made in the previously unprospected Siyeh Formation on the south arm of Spionkop Ridge approximately 3/4 mile northwest of the main copper showing in the Grinnell Formation.

Prospecting and mapping located a mineralized zone in the Siyeh limestones 19 feet wide and 1000 feet long which consists of disseminated and

massive galena in limestone assaying at 16.2 % lead and 0.82 oz. silver per ton. This average includes a massive galena/anglesite vein varying from 3 1/2 to 4 1/2 feet thick assaying from 57.35 to 69.5 % lead and 2.25 to 3.87 oz. silver per ton. Similar mineralization was found in float 2,400 feet southwest along strike.

Additional prospecting subsequently carried out in the Siyeh Formation located numerous showings of 1 - 3 % lead in the Siyeh of the Big Horn and Commerce Mountain claim blocks, and in the Grinnell Formation on the Opal claims in Starvation Valley, British Columbia. The Starvation Valley property is unique in that the lead - silver - copper mineralization is found in a shatter zone in the Grinnell Formation rather than the Siyeh Formation. The mineralization occurs as disseminated galena and chalcopyrite in diabase intrusives and Grinnell Formation quartzites, as veinlets and joint plane coatings in the intrusives, and as a massive replacement of a shatter zone. The most important mineralization is a 4 to 8 foot thick replacement of the shattered base of a diabase sill. This zone has been traced on surface in excess of 800 feet, and in float for 500 feet beyond that. The average assay results from the replacement zone is 9.85 % lead, 14.75 ounces silver per ton, 0.95 % copper, and 0.015 ounces gold per ton, with the silver values ranging as high as 17.80 ounces per ton.

The three prospecting permits were taken out by Kintla and Vestor on a 50 : 50 basis following the above discoveries with the intention of examining the unprospected northeastern outcrop for possible deposits of lead - silver or copper - silver.

#### OUTLINE OF THE 1972 PROSPECTING PROGRAM

In June of 1972 a program of prospecting and sampling the permit areas was undertaken by Kintla. The purpose of the program was to determine by means of a modest field program whether or not there were sufficient

Mineralized showings on the permits to warrant a more detailed investigation. The primary targets were the quartzites of the upper portion of the Grinnell Formation, known to be favourable for deposition of copper - silver sulphides, and the overlying Siyeh Formation. No attempt was made to cover the entire area of the three permits, and only the most accessible portions with the best exposure were examined.

Forty eight good showings were found in 15 traverses with only 3 traverses not locating good mineralization. These three were:

- 1 - From West Castle River up Rainy Ridge to the Middle Kootenay Pass through the Grinnell and Siyeh Formations.
- 2 - From South Drywood Creek (end of oil road) to the top of Pincher Ridge, Siyeh Formation.
- 3 - From the pipeline heater north of Pincher Creek to the top of Prairie Bluff, through the uppermost Siyeh, Purcell Lava, and portions of the Sheppard Formation.

In no case did a traverse fail to locate some copper in the Grinnell Formation or lead - zinc in the Siyeh and Sheppard Formations. In addition, concentrations of 0.10 to 0.20 % copper were common in the flow tops of the Purcell lava, with some portions as high as 1.80 % across narrow widths.

## RESULTS

Upon commencement of prospecting it was found that the quartzitic upper portions of the Appekunny Formation and the calcareous shales of the lower Sheppard Formation carried good mineralization and were subsequently included in the traverses. The program progressed from east to west through the permits with several areas omitted due to lack of time.

Three main areas of interest were located:

- 1 - Copper showings in the Grinnell and upper Appekunny Formations between Drywood Creek and Pincher Creek, with possible extensions to Victoria Peak.
- 2 - Sheppard Formation lead - zinc - silver showings on Table Mountain, Mount Gladstone, and Lys Ridge, and the related Sheppard Formation showings in the North Kootenay Pass area.
- 3 - Grinnell Formation copper showings on Grizzly Creek, Whistler Mountain, west of Barnaby Ridge, and on Gravenstafl Ridge.

### 1 - DRYWOOD CREEK - PINCHER CREEK AREA:

The mineralization in this area consists of chalcocite and bornite with minor chalcopyrite in quartzites of the upper portion of the Appekunny Formation and lower Grinnell Formation. The showings are extensive, with one quartzite bed in the upper Appekunny continuously mineralized for 2 1/4 miles. Only the southernmost showing is associated with intrusive activity as is common in the Yarrow Creek - Spionkop Ridge, Grizzly Creek, and Starvation Valley occurrences.

This group of showings is as follows:

- 14 - Grinnell Formation, Drywood Mountain, massive bornite and chalcocite in argillites and quartzites, 0.75 to 3.0 % copper; associated with diorite intrusions also containing copper (up to

- 1.0 % copper). Quartzites 3 - 4 feet thick, argillites 7 - 8 feet thick, exposed 350 feet along the west side of the valley.
- 15 - Grinnell Formation, Pincher Ridge, 4 foot thick quartzite bed containing disseminated bornite and chalcocite, continuous with # 16; 0.6 % copper, 3/4 mile northwest of # 14.
- 16 - Grinnell Formation, Pincher Ridge, 4 1/2 foot thick quartzite bed containing veins of bornite and chalcocite, 0.9 to 1.25 % copper, 175 feet north of sample # 15.
- 17 - Appekunny Formation, Pincher Ridge, 10 foot thick quartzite and argillite sample; individual beds from 2 inches to 3 feet thick, 0.24 % copper, 0.06 oz. silver; heavily leached. 1/4 mile northeast of # 16.
- 18 - Appekunny Formation, Pincher Ridge, 3 foot channel sample of green argillites and dirty quartzites, with chalcocite replacing argillite pebbles and disseminated in the quartzites. The base of the bed is not exposed; 500 feet north of # 17; 1.01 % copper, 0.26 oz. silver.
- 19 - Appekunny Formation, Pincher Ridge, 10 foot channel sample of the same bed as # 18; mineralization is zoned with chalcopyrite in the lower 2.5 feet, bornite for 1 foot, and chalcocite across the remaining 6.5 feet; 0.61 % copper, 0.18 oz. silver; 275 feet north of # 18.
- 20 - Appekunny Formation, Pincher Ridge, 8 foot exposed width of the same bed as #'s 18, 19; 1.55 % copper, 0.3 oz. silver; 1/2 mile north of # 19.
- 21 - Appekunny Formation, Pincher Ridge, 3 1/2 foot exposed width of same bed as #'s 18, 19, 20; 0.9 % copper, 0.16 oz. silver. This appears to be the lower portion of the bed; 1 mile north of # 20.

22 - Appekunny Formation, Pincher Ridge, 11 foot channel sample 30 to 35 feet lower in the section than the bed sampled in #'s 18, 19 20, 21, that bed not exposed at location 22; dirty quartzites interbedded with green argillites, 0.30 % copper, 0.13 oz. silver; 400 feet north of # 21.

INTERPRETATION AND CONCLUSIONS - DRYWOOD CREEK AND PINCHER CREEK AREA

These samples represent a very continuous 2 1/4 mile long exposure of copper mineralization generally between 0.6 and 1.1 % copper with minor associated silver. The bed apparently continues some 1 1/2 to 2 miles to the north of Pincher Creek as Alcor holds a 480 acre lease there on a high geochemical anomaly in the lower Appekunny Formation (G. Talbot, pers. comm.). There has been copper mineralization reported at the head of the southeast fork of Whitney Creek but this has never been investigated.

This area definitely represents a target for further prospecting as the very rich copper showing in the side valley south of Drywood Creek has never been thoroughly prospected, mapped, or drilled, and the quartzite in the upper Appekunny north of Drywood Creek should be examined in detail.

- TABLE MOUNTAIN - GLADSTONE MOUNTAIN - NORTH KOOTENAY PASS:

This mineralization was first discovered on Table Mountain and subsequent traverses were extended to cover the Sheppard Formation. Stratabound lead - zinc - silver was located where ever the Sheppard Formation was traversed, with the highest silver values in the North Kootenay Pass area and with the lead - zinc percentage consistent over the entire area. Subsequent to the discovery on Table Mountain, NO traverses were made through the Sheppard Formation to the south east, and this area should definitely be prospected in the future.

The mineralization is difficult to recognize, with the lead - zinc - silver being definitely sedimentary and confined to the black shale bands within grey shale sections of the lower 75 feet of the Sheppard Formation. This mineralization can occasionally be seen as fine galena coatings along joint planes, but appears as hydrozincite, a white carbonate of zinc extremely easy to confuse with the common calcareous coating on the rocks in the area. The prospecting teams finally resorted to the use of ultra violet lamps in the field and were able to locate the mineralization in this manner. Individual bands of the black shale contain as much as 10 % combined lead-zinc with up to 5 ounces of silver per ton.

All lead - zinc - silver showings found in the Sheppard are within the same 10 to 20 foot horizon. After the lead - zinc - silver of the Sheppard was located and traced from Mount Gladstone to North Lost Creek, a section was taken through the Siyeh Formation in the North Kootenay Pass area with the express purpose of checking the black shales of the Siyeh. Showing # 48 was found on the only Siyeh traverse made when checking the black shales with an ultra violet light. Most of the Sheppard and Siyeh Formations of southwestern Alberta are covered by the 3 permit areas, and

remains to be examined with more detailed prospecting. The samples from this zone are as follows:

- 23 - Sheppard Formation, Mount Gladstone, 12 foot section of interbedded shales and siltstones containing chalcopyrite and galena in streaks and blebs; 1.26 % lead, 0.4 % zinc, 0.72 % copper; exposed for 150 feet along the ridge.
- 24 - Sheppard Formation, Mount Gladstone, same beds as # 23; 3 foot section of argillaceous dolostone in the center of the mineralized zone 3.25 % lead, 0.8 % zinc, trace copper. The remainder of the mineralized zone not assayed, but was apparently 0.25 to 0.5 % lead, 0.5 to 0.75 % copper. These beds are exposed 1/4 mile northwest of # 23.
- 25 - Sheppard Formation, Table Mountain, same beds as #'s 23, 24; 15 foot section of siltstones and dolomitic siltstones containing:
- 14 inches of dolomitic siltstone with galena in streaks and blebs assaying at 3.5 % combined lead - zinc;
  - 4 feet of chalcopyrite - galena bearing siltstone, approximately 0.75 to 1.0 % lead, 0.4 to 0.5 % copper.
  - 2 feet of chalcopyrite bearing siltstone, 1.2 % copper.
  - several 2 inch to 4 inch beds containing lead and copper between 0.25 and 1.0 % lead, and 0.3 to 1.0 % copper.
- 26 - Sheppard Formation, Table Mountain, the same beds as #'s 23, 24, 25; 10 foot section through the entire set of beds; 2.26 % lead, 0.70 % zinc, 0.23 % copper. Contains a richer central 2 feet than is present in # 25.
- 29 - Sheppard Formation, Lys Ridge, same beds as #'s 23 - 26; 24 foot section containing galena and chalcopyrite in streaks and blebs in siltstones, 2.18 % lead and 0.44 % zinc, traces copper only; exposed for more than 600 feet on top of the ridge.



- 40 - Sheppard Formation, Table Mountain; same beds as #'s 23 - 26, and 29; not assayed, appears to contain 2 - 3 % lead.
- 41 - Sheppard Formation, North Lost Creek, same beds as #'s 23 - 26, 29, 40; 8 foot section of interbedded black shales and grey argillaceous siltstones; 3.4 % lead, 0.2 % zinc, 2.75 oz. silver.
- 42 - Sheppard Formation, North Lost Creek, same beds as # 41; 8 foot thickness of 3.2 % lead, 0.2 % zinc, 3.05 oz. silver; 1/2 mile south of # 41.
- 43 - Sheppard Formation, South Lost Creek, same beds and rock type as # 42; 7 1/2 feet thick; 2.9 % lead, 0.3 % zinc, 3.50 oz. silver, 2 miles south of # 42.
- 44 - Sheppard Formation, South Lost Creek, same bed as # 43; 9 feet thick; 3.02 % lead, 1.0 % zinc, 3.6 oz. silver; 1/2 mile south-east of # 43.
- 45 - Sheppard Formation, Carbondale River, same bed and rock type as # 44; 10 feet thick; 2.06 % lead, 1.24 % zinc, 4.43 oz. silver; 1 1/2 miles south of # 44.
- 46 - Sheppard Formation, Carbondale River, same bed and rock type as # 45; 10 feet thick; 1.80 % lead, 1.22 % zinc, 4.50 oz. silver; 1/4 mile south of # 45.
- 47 - Sheppard Formation, Carbondale River; same bed and rock type as # 46; 11 feet thick, 1.92 % lead, 1.43 % zinc, 4.75 oz. silver; 1/4 mile south of # 46 in river bottom.
- 49 - Sheppard Formation, North Kootenay Pass, NOT same bed as # 47, approximately 50 feet higher in the section; 1.2 % copper, 1.5 % lead, 0.3 % zinc; 6 feet thick.
- 50 - Purcell Lava, North Kootenay Pass, 0.95 % copper, 1.0 foot thick top of lava; same section of lava as contains 1.8 % copper immediately below # 46.

51 - Purcell Lava, North Kootenay Pass, 1.8 % copper across 2.5 feet, top of lava exposed approximately 50 feet below # 46.

48 - SIYEH FORMATION, North Kootenay Pass, 6 foot thick limey siltstone with galena in black shaley bands; 2,56 % lead, 1.40 % zinc, 2.32 oz. silver; 1/2 mile southeast of # 47.

INTERPRETATION AND CONCLUSIONS - TABLE/GLADSTONE MOUNTAINS NORTH KOOTENAY PASS:

The extreme lateral extent of this mineralization suggests very strongly that it is syngenetic in nature. The area to the southeast of Table Mountain and Gladstone Mountain should be examined in detail as this was not rechecked after the prospecting team located lead - zinc on Table Mountain. The entire outcrop of Sheppard Formation should be prospected in detail as only those sections with easy access and good exposure were prospected, and once the mineralization had been found, no sections through the Sheppard failed to show lead - zinc mineralization.

There is an increase in silver and zinc content to the south from North Lost Creek with a comparable decrease in lead content. The average total lead - zinc content remains roughly the same for the entire Sheppard, and the vast areal extent of located mineralization indicates excellent possibilities of local enrichment and thickening. The discovery of apparently syngenetic lead - zinc - silver mineralization in the Siyeh near the end of the field season greatly increases the likelihood of discovering lead - zinc in the Siyeh Formation exposed in the permit areas. However, the nature of the mineralization makes prospecting difficult and unless the prospectors are very familiar with the appearance of hydrozincite, an ultra violet lamp must be used.

- GRIZZLY CREEK - WHISTLER MOUNTAIN - BARNABY RIDGE:

The mineralization in this area was first discovered by Akamina Minerals Ltd. (now Alcor Minerals Ltd.) in 1968, was subsequently optioned to Cominco Ltd., and then converted to two leases of 1 1/2 sections each after Cominco dropped the ground. Cominco drilled the Grizzly Creek showing and hit good chalcocite - bornite mineralization in upper Grinnell Formation quartzites with thicknesses up to 20 feet. Further work was recommended by the geologist in charge, L. Nagy, but Cominco decided to drop the Alcor option (L. Nagy, pers. comm.). Cominco also found and trenched the Whistler Mountain showing, now on the extreme southern portion of Alcor's second lease. This showing consists of several thin (2 inches to 1 foot thick) high grade (2.5 to 7.5 % copper) quartzite beds mineralized with bornite and chalcocite. The beds are within a 20 to 30 foot thick section of upper Grinnell dipping to the southwest at approximately 25°.

The main showings on the Kintla - Vestor permits in the Grinnell Formation, excluding the down-dip extension of the Whistler Mountain showing, are on the west side of Barnaby Ridge, some 1.5 miles southwest of and stratigraphically equivalent to the Grizzly Creek Showing. These showings are:

- 27 - Appekunny Formation, Whistler Mountain; 1 1/2 foot thick quartzite bed exposed for roughly 400 feet north of the fire look-out; varies in grade from 1.5 to 2.5 % copper; traces of silver.
- 28 - Grinnell Formation, Whistler Mountain; one of the two main showings held by Alcor Minerals Ltd.; 6 to 8 thin (2 inches to 12 inches thick) quartzite beds exposed for 800 feet on top of ridge; assays range from 2.5 to 7.5 % copper, with only traces of silver.

- 30 - Grinnell and Siyeh Formations, Grizzly Creek; held under lease by Alcor Minerals Ltd., has been drilled ( Cominco, 1968, 1969) and contains in excess of 1 million tons of 1.5 to 2.0 % copper with traces of silver and lead; there has been no exploration work done by Alcor since 1970. Excellent surface showings on the east side of Barnaby Ridge.
- 34 - Grinnell Formation, Gravenstaf1 Ridge; 14 foot thick exposure of quartzite with veins of chalcocite and bornite, exposed in gulley only, 0.8 % copper.
- 35 - Grinnell Formation, Gravenstaf1 Ridge - Mount Haig; 8 foot exposed thickness of same bed as # 34, 80 foot strike length exposed; 0.91 % copper, trace silver.
- 36 - Grinnell Formation, Barnaby Ridge; in excess of 8 foot thickness containing disseminated chalcopyrite in grey quartzite and replacing green argillite pebbles; 0.6 to 0.8 % copper; exposed in gulley only.
- 37 - Grinnell Formation, Barnaby Ridge; 10 foot thickness, lower 8 feet of which is equivalent to # 36, upper 2 feet contains bornite and chalcocite replacing argillaceous pebbles; 0.9 to 1.2 % copper, exposed in gulley only; 1/2 mile south of # 36. Top of bed not exposed.
- 38 - Grinnell Formation, Barnaby Ridge; 2 1/2 foot thick exposed width of massive white quartzite bed with large inclusions of massive bornite in a narrow band within the quartzite; 1.00 % copper up to 1.68 % copper and 0.25 to 0.37 oz. silver (two assays). Also a more than 3 foot thick green argillite bed immediately below the quartzite contains chalcocite in blebs; 0.20 % copper, 0.08 oz. silver; about 1 mile southeast # 37.

39 - Grinnell Formation, Barnaby Ridge; green argillites only, no exposure of the quartzites, 0.21 % copper, trace silver, #'s 36 to 39 are exposed in the bottoms of gulleys along the west side of the ridge and are apparently stratigraphically equivalent to the lower portion of the Grizzly Creek showing on the east side of the ridge.

31 - Siyeh Formation, Barnaby Ridge; Siyeh Float containing an estimated 1.0 % lead and traces of copper.

INTERPRETATION AND CONCLUSIONS - GRIZZLY CREEK - WHISTLER MOUNTAIN - BARNABY RIDGE

The mineralization located on the western edge of the northwestern nose of the Akamina Syncline is lithologically identical and stratigraphically equivalent with the lower portions of the Grizzly Creek showing held by Alcor Minerals Ltd. That portion of the Grinnell Formation which is equivalent to the upper portions of the Grizzly Creek showing is not exposed on the western side of Barnaby Ridge. There is no outcrop above the sampled sections of samples 36, 37, 38, and 39. This area will have to be checked with a detailed geochemical survey and subsequent drilling if indicated.

CENTRAL PORTION OF THE AKAMINA SYNCLINE:

The central portion of the syncline (not covered by the three permits) is represented by samples 10, 11, 12, 53, 54, and 55. The mineralization in that area is typically a pyrite - chalcopyrite assemblage disseminated in the arenaceous sedimentary rocks and almost entirely absent from the argillaceous sedimentary rocks. Approximately one foot in one hundred and fifty feet of section in the entire syncline will test positive for copper or heavy metals using a Holman kit (excluding the calcareous portions which all test positive). However, economic or near economic concentrations appear to be completely absent from the Gateway, Phillips, and Roosville Formations.

The samples representing this portion of the syncline are:

- 10 - Gateway Formation, Drywood Mountain; 12 inch bed of siltstone containing chalcocite replacing argillite pebbles.
- 11 - Gateway Formation, Drywood Mountain; 7 foot bed of siltstone containing disseminated chalcopyrite and bornite, 125 feet above # 10.
- 12 - Gateway Formation, Drywood Mountain; 2 foot thick bed of dirty quartzite with disseminated chalcopyrite and bornite, 50 feet above # 12. #'s 10, 11, and 12 contain 0.3 to 0.5 % copper.
- 53 - Roosville Formation, Victoria Ridge; (possibly Cambrian basal conglomerate); lower 18 inches contains sporadic veins of bornite; 0.68 % copper.
- 54 - Roosville Formation, Victoria Ridge; siltstone 6 1/2 feet thick exposure exposed on surface for 200 to 300 feet around the shoulder of the mountain; 0.39 % copper, disseminated and veined chalcopyrite.
- 55 - Roosville Formation, Victoria Ridge; siltstone 4 feet thick, exposed for 400 feet along the ridge, 0.20 % copper.

INTERPRETATION AND CONCLUSIONS - CENTRAL PORTION OF AKAMINA SYNCLINE:

The upper red-beds (Gateway, Phillips, and Roosville Formation) contain widespread but very low grade copper mineralization. There has been very little intrusive activity in this area, with subsequently little remobilization of low grade widespread deposits into economic deposits. The mineralization in the Yarrow Creek - Spionkop Ridge, Commerce Mountain, Grizzly Creek, Starvation Mountain, and Starvation Valley areas is associated with intrusions in each case, indicating remobilization and redeposition of initially syngenetic deposits.

ADDITIONAL SHOWINGS OF INTEREST:

- 52 - Waterton Formation, Syncline Mountain; fossil river channel, 50 feet by 650 feet, 0.01 oz. gold<sup>d</sup>, 0.10 % copper.
- 5 - Siyeh Formation, Loaf Mountain; 0.25 % copper in Siyeh limestone float.

Samples 1, 2, 3, 4, and 6 represent mineralization in the north and west portion of Kintla's Big Horn claims:

- 1 - Siyeh Formation, Spionkop Ridge; massive galena vein in a shatter zone, 57.3 to 69.5 % lead and 2.25 to 3.87 oz. silver, across 3 1/2 to 4 1/2 foot widths; traced on surface in excess of 800 feet. Adjacent 5 feet average 6 % lead, and next 14 feet average 4 % lead.
- 2 - Siyeh Formation, Spionkop Ridge; massive and veined galena float in Siyeh limestone found in a talus slope 1,200 feet southwest of # 1; not located in place.
- 3 - Grinnell Formation, Spionkop Creek; 0.25 to 1.1 % copper in the upper 3 to 5 feet of a diabase intrusion at the base of the Grinnell Formation; 3,000 feet west of Kintla's main copper showing north of Spionkop Ridge.
- 4 - Siyeh Formation, Spionkop Ridge; 0.91 % zinc associated with chalcopyrite, wolframite, and galena in a shatter zone in the Siyeh limestone.
- 6 - Siyeh Formation, Spionkop Ridge; massive bornite replacing black shales in the upper portion of the Siyeh Formation, not assayed, visible bornite estimated at 0.5 to 0.75 % copper in a 10 to 15 foot section of black shale.



Samples 7, 9, and 51 represent a copper bearing siltstone in the uppermost Sheppard Formation which has been traced from the head of Yarrow Valley to Barnaby Ridge, a strike length of 34 miles. The described samples are:

- 7 - Sheppard Formation, Spionkop Ridge; chalcocite in a four foot thick siltstone at the top of the Sheppard Formation, traced continuously to Barnaby Ridge (approximately 34 miles of outcrop); 0.3 to 0.78 % copper.
- 8 - Sheppard Formation, Spionkop Ridge; chalcopyrite in an 8 foot thick siltstone, 100 feet lower in the section than # 7.
- 9 - Sheppard Formation, Drywood Mountain; same bed and grade as # 7.
- 51 - Sheppard Formation, Lys Ridge; same bed as #'s 7, 9 and continuous between the three samples; 0.33 % copper. The intervening locations were not sampled when crossed on a traverse.

## CONCLUSIONS:

The three areas of concentration of mineralization, the Pincher Ridge Grinnell - Appekunny showings, the Table Mountain - Gladstone Mountain - North Kootenay Pass Sheppard showings, and the Barnaby Ridge-Grinnell showings should each be examined in more detail. Although the copper - silver occurrences are not extremely rich, they are still encouraging, especially in consideration of their excellent lateral continuity. In addition most of these showings exhibit very strong leaching. Academic research done at the University of Alberta on samples from this area indicate that the percentage of copper minerals removed by surface leaching is between 65 and 90 %. This is borne out by the increase in grade of the Grizzly Creek showing at depth by a factor of 2 1/2; and by the increase in grade at depth of Kennecott Copper Ltd.'s Bear Creek Mine at Troy Montana. In stratigraphically equivalent rocks in the Bear Creek Mine Kennecott found a 2 to 3 fold increase in copper content between the leached surface outcrops and the unleached rocks at depths of 60 to 100 feet below surface.

The discovery of conformable apparently syngenetic lead - zinc - silver mineralization in the Siyeh Formation in the North Kootenay Pass area greatly enhances the possibilities of lead - zinc occurrences being found elsewhere in the Siyeh. No additional massive lead - zinc - silver similar to that found on the Big Horn claims was found on the permits, but in view of the relatively few traverses made and the large areas involved such discoveries should not be ruled out. In fact, the massive lead - silver vein on the Big Horn claims is within 1,000 feet of the main copper - silver zone where work has been going on since 1963, and this occurrence was only discovered in the spring of 1972. The surface of the vein is almost completely altered to anglesite, and must be broken to distinguish it from the adjacent limestones.

Most of the permit area remains to be prospected, even cursorily, and should definitely be examined in the light of the discoveries made with such a modest field program in 1972.

RECOMMENDATIONS:

- 1 - Prospect the Sheppard and Siyeh Formations for conformable lead - zinc - silver mineralization utilizing ultra violet lamps.
- 2 - Prospect the remainder of the Siyeh Formation for lead - zinc - silver mineralization similar to that found on the Big Horn claims.
- 3 - Prospect the entire area between Table Mountain - Mount Gladstone and Pincher Creek for copper, lead, zinc AND mercury which is reported to have been found on Mill Creek.
- 4 - Map and prospect in detail the Pincher Ridge - Drywood Creek copper - silver showings.
- 5 - Carry out a geochemical survey on the western slope of Barnaby Ridge above showings 36, 37, 38, and 39 to cover the upper portion of the Grinnell Formation and the lower Siyeh Formation.

## REFERENCES

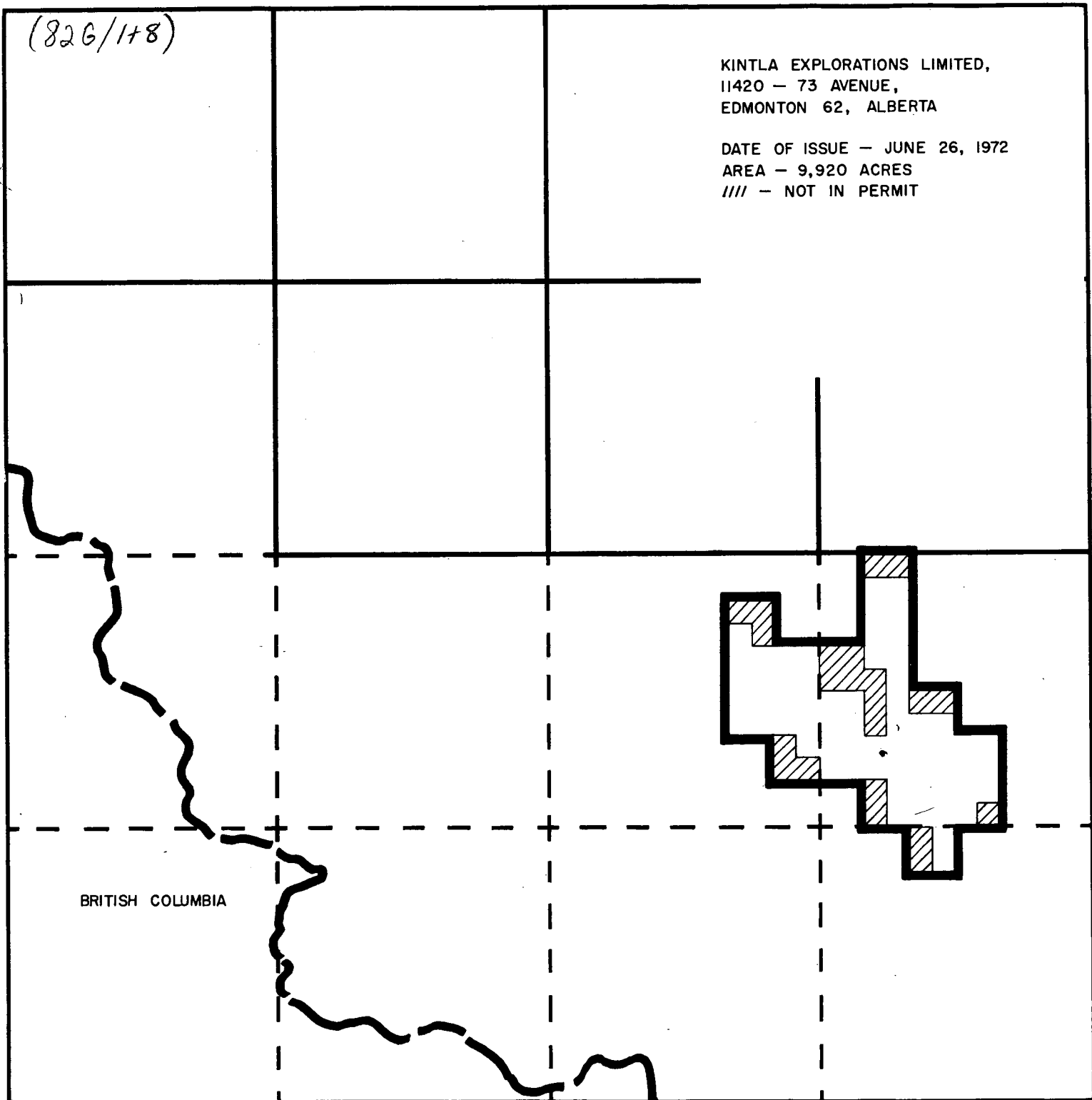
- BALLY, A.W., GORDY, P.L., and STEWART, G.A., 1966: Structure, seismic data, and orogenic evolution of the Southern Canadian Rocky Mountains, Bull. Can. Petrol. Geol. 14, pp. 337-381.
- CLARKE, A.L., 1970: Stratabound copper sulfides in the Precambrian Belt Supergroup, Northern Idaho and Northwestern Montana. Proceedings of I.M.A.-I.A.G.O.D. Meetings, Japan, p. 98.
- DAWSON, G.M., 1886: Preliminary report on the physical and geological features of that portion of the Rocky Mountains between Latitudes 49° and 51° 30'. Geol. Surv. Can. Ann. Rept. 1, pt. B.
- HUME, G.S., 1932: Waterton Lakes - Flathead Valley area, Alberta and British Columbia. Geol. Surv. Can. Summ. Rept., pt. B, pp. 1-20.
- PRICE, R.A., 1962: Fernie map-area, east half, Alberta and British Columbia, Geol. Surv. Can. Paper 61-24.
- .....1964: The Precambrian Purcell System in the Rocky Mountains of Southern Alberta and British Columbia, Bull. Can. Petrol. Geol. 12, pp. 399-426.
- .....1967: The tectonic significance of mesoscopic subfabrics in the Southern Rocky Mountains of Alberta and British Columbia. Can. Jour. Earth Sci. 4, pp. 39-70.
- REESOR, J.E., 1957: The Proterozoic of the Cordillera in Southeastern British Columbia and Southwestern Alberta in The Proterozoic in Canada. Roy. Soc. Canada, Spec. Pub. no. 2, pp. 150-177.
- SMITH, A.G., BARNES, W.C., 1966: Correlation of and facies changes in the carbonaceous, calcareous, and dolomitic formations of the Precambrian Belt-Purcell Supergroup. Geol. Soc. Amer. Bull. 77, 1399-1426.
- STEVENSON, R.W., 1968: Final Report - 1967, Waterton Copper Project, Waterton area, Alberta. Kennco Explorations (Western) Ltd., Report.

# QUARTZ MINERAL EXPLORATION PERMIT No. 171

(826/1+8)

KINTLA EXPLORATIONS LIMITED,  
11420 - 73 AVENUE,  
EDMONTON 62, ALBERTA

DATE OF ISSUE - JUNE 26, 1972  
AREA - 9,920 ACRES  
/// - NOT IN PERMIT



BRITISH COLUMBIA

TP.4

TP.3

R.2

R.1 W.5 M.

# QUARTZ MINERAL EXPLORATION PERMIT No. 172

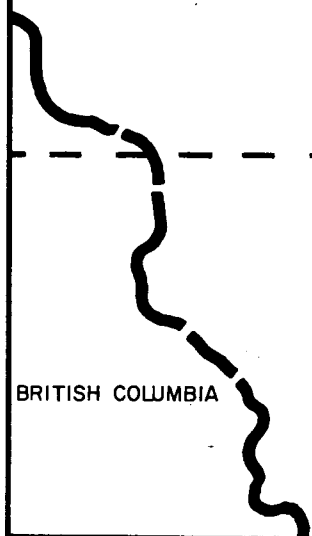
(826/8)

KINTLA EXPLORATIONS LIMITED,  
11420 - 73 AVENUE,  
EDMONTON 62, ALBERTA

DATE OF ISSUE - JUNE 26, 1972

AREA - 9,920 ACRES

//// - NOT IN PERMIT



BRITISH COLUMBIA

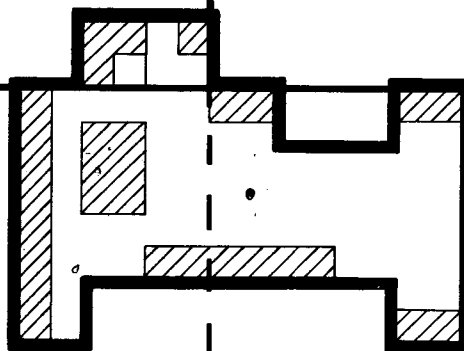
TP. 5

TP. 4

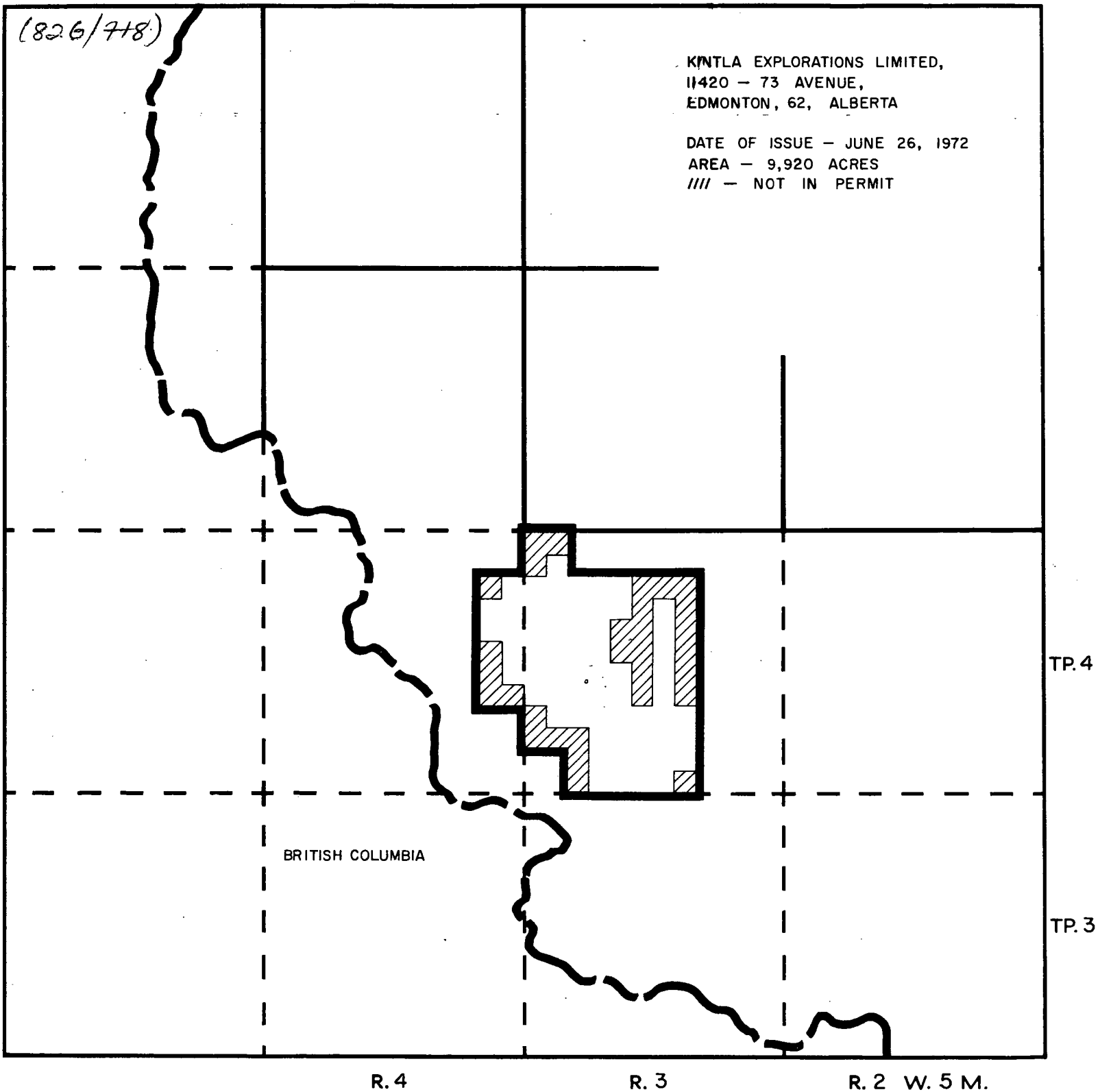
R. 3

R. 2

R. 1 W. 5 M.



# QUARTZ MINERAL EXPLORATION PERMIT No. 173



19730001

ECONOMIC MINERALS

FILE REPORT No.

PB-AF-010(1)

KINTLA EXPLORATIONS LIMITED

GEOLOGICAL REPORT # V - P 1

JUNE - SEPTEMBER 1972

PERMIT AREAS # 171, 172, 173, 174

SOUTHWESTERN ALBERTA

E. Goble,

February, 1973.



CONTENTS:

	PAGE
INTRODUCTION.....	1
REGIONAL SETTING.....	1
REGIONAL GEOLOGY.....	2
PREVIOUS HISTORY OF EXPLORATION.....	5
OUTLINE OF THE 1972 PROSPECTING PROGRAM.....	7
RESULTS.....	9
DRYWOOD CREEK - PINCHER CREEK AREA.....	9
INTERPRETATION AND CONCLUSIONS.....	11
TABLE MOUNTAIN - GLADSTONE MOUNTAIN -	
NORTH KOOTENAY PASS.....	12
INTERPRETATION AND CONCLUSIONS.....	15
GRIZZLY CREEK - WHISTLER MOUNTAIN - BARNABY RIDGE...	16
INTERPRETATION AND CONCLUSIONS.....	18
CENTRAL PORTION OF THE AKAMINA SYNCLINE.....	19
INTERPRETATION AND CONCLUSIONS.....	20
ADDITIONAL SHOWINGS OF INTEREST.....	21
CONCLUSIONS.....	23
RECOMMENDATIONS.....	24
REFERENCES.....	25

INTRODUCTION

The Kintla - Vestor prospecting permit areas, numbers 171, 172, and 173, are three contiguous mineral exploration permits of 9,920 acres each, covering a total area of 29,760 acres, centred upon latitude 49° 20' N and longitude 114° 15' W. The permit areas lie approximately 15 miles southwest of Pincher Creek, Alberta in an arc from South Drywood Creek to West Castle River, covering the northern exposure of Grinnell, Siyeh, Purcell Lava, and Sheppard Formations (of the Precambrian Belt Series) in the Akamina Syncline. The permits were obtained by Kintla Explorations Limited and Vestor Explorations Ltd. in June of 1972 following Kintla's discovery of high-grade lead-silver mineralization in the Siyeh Formation on Kintla's Big horn claims, 4 miles southeast of Permit 171. A prospecting program was undertaken on the permits during the summer of 1972. This is a summary of that program.

REGIONAL SETTING

The Kintla - Vestor prospecting permits are situated within the Clarke Range of the Rocky Mountains some 20 miles north of the Canada - United States border. The permit areas are bounded by longitudes 114° 3' W and 114° 25' W, and latitudes 49° 15' N and 49° 22' N, covering a total area of 46.5 square miles.

The permit areas are situated in mountainous terrain typical of the Lewis Range of the southern Canadian Rockies. Relief in the area is rugged with valley bottoms between 4,000 and 6,000 feet above sea-level, and mountain peaks between 7,500 and 9,000 feet above sea-level. Access is good via forestry roads along all valleys except Mill and Gladstone Valleys, and with a passable 4-wheel drive road up Mill Creek. Gladstone Valley is accessible only on foot. Winter access is restricted by annual snowfalls of 80 to 90 inches, but ridge tops and the southern faces of the mountains

are generally open almost all year.

#### REGIONAL GEOLOGY

The permit areas are situated within a region underlain by Precambrian rocks of the Lewis Series. The stratigraphic succession of the area is given in Table 1 (after Price, 1962). The areas of the permits are for the most part underlain by quartzites, argillites, and carbonate horizons, with minor intercalated submarine lavas. The Appekunny, Grinnell, Siyeh, Purcell Lava, Sheppard, and Gateway Formations outcrop on the permit areas (see Figure 1).

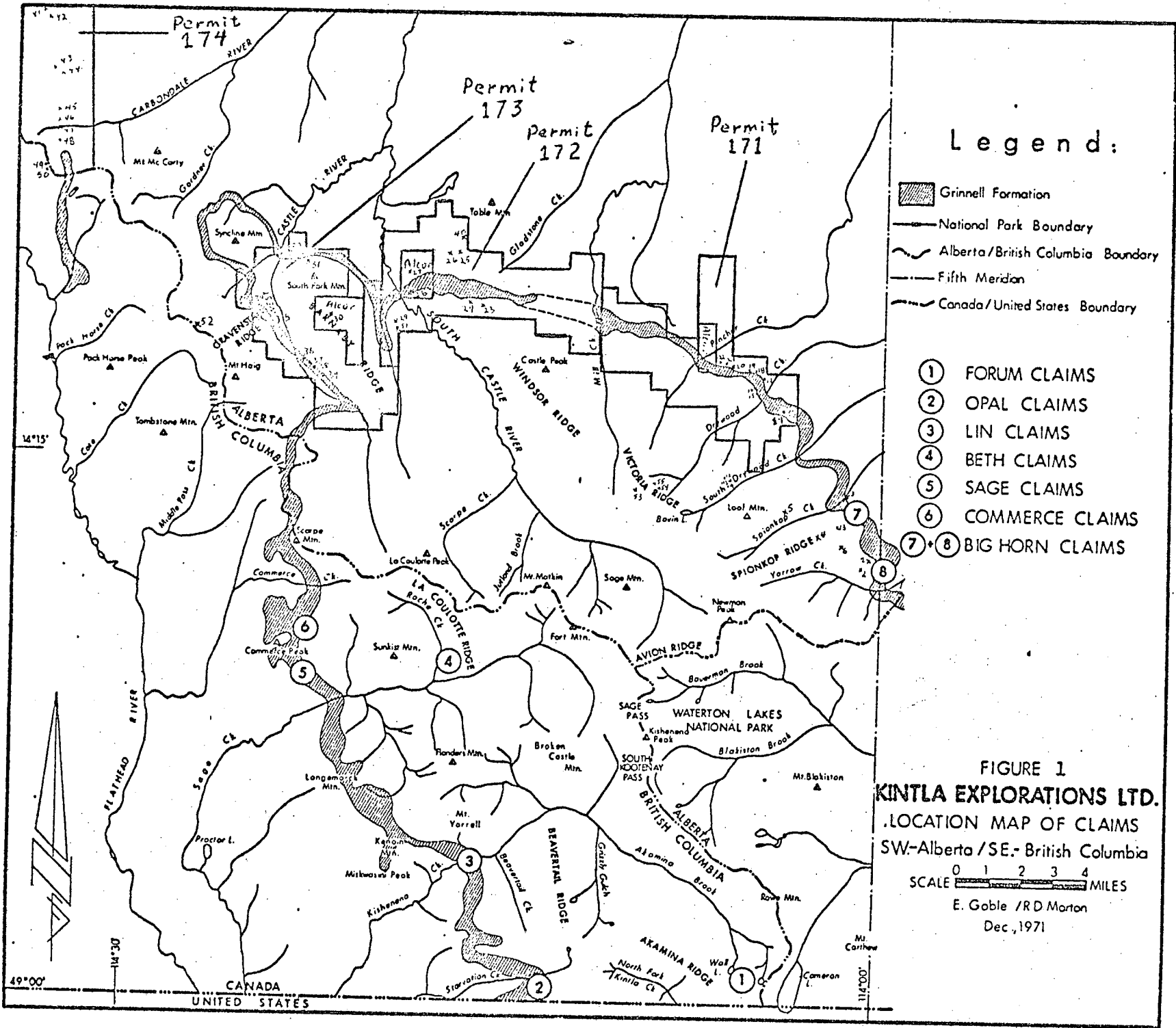
Reesor (1957), Price (1964), and Harrison (1972) postulate that the Lewis Series sediments of which these are a part, were deposited in the shallow waters of a deltaic basin and were in part of subaerial origin. Smith and Barnes (1966) recognize cyclic deep - shallow water depositional phases in the Montana equivalents of the Lewis Series. One such cycle terminates at the base of the Siyeh Formation with the Appekunny and Grinnell Formations representing the shallow water half of the cycle. The next cycle begins at the base of the Siyeh Formation with black marcasitic shales, continues through the carbonate sequence of the central and upper Siyeh, and terminates after the upper red beds of the Sheppard, Gateway, and Phillips Formations.

The Appekunny, Grinnell, Siyeh, and Sheppard Formations have been intruded by a series of amygdaloidal, porphyritic quartz - diabase sills and dykes up to 100 feet thick. These are of Precambrian age and are probably contemporaneous with the extrusion of the Purcell lavas. The Siyeh, Purcell Lava, and Sheppard Formations have been intruded by a series of porphyritic trachytic syenite sills and dykes of which the age is still unknown.

The Precambrian rocks in this area are part of the Lewis thrust sheet in which the Precambrian sediments have been thrust from the southwest over the younger Paleozoic and Mesozoic sediments. According to Price (1962), the Clarke Range is characterized by a series of thrust

ERA	PERIOD OR EPOCH	GROUP FORMATION	LITHOLOGY	THICKNESS (feet)	
		EROSIONAL UNCONFORMITY			
PRECAMBRIAN	PURCELL	MOYIE INTRUSIONS	Diorite sills and dykes		
	PURCELL (LEWIS)	GATEWAY KINTLA	ROOSVILLE FORMATION	Green argillite, siltstone, sandstone, stromatolitic dolomite	3500+
			PHILLIPS FORMATION	Red sandstone, siltstone, argillite	500- 700
			GATEWAY FORMATION (upper member)	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+		

Table 1. Stratigraphic succession of SW Canadian Precambrian (after Price, 1962)



faults and associated folds, cut by younger SW- or W- dipping normal faults. Bally et al., (1966) suggest that the thrusts are of late Mesozoic to early Tertiary age and that later faults were late Tertiary listric structures, perhaps merging with thrusts at depth. Figure 2 illustrates the general structural setting of the region and the extent of the Lewis thrust sheet which is folded into a broad synclinorium (the Akamina Syncline) and truncated to the west by the Flathead fault.

#### PREVIOUS HISTORY OF EXPLORATION

Copper mineralization in Purcell lavas and diabases of the North Kootenay Pass region in southwestern Alberta was first reported by Dawson in 1886. The region was prospected for gold in the 1870's and 1880's but no mineralization was found until the oil discovery at Oil City, now in Waterton Lakes National Park concentrated activity in that area. At that time (1901 - 1903) gold was discovered on the northwestern slope of Buchanan Ridge in Appekunny Formation quartzites. No development was done and when the oil boom collapsed the claims were dropped. Gold was also discovered in the Appekunny Formation on the east side of Goat Haunt Mountain, now in Glacier National Park, Montana, at approximately this same time and was mined up to the death of the owner.

During the first decade of the 20th century, small scale mining operations were located on copper bearing diabase dykes on Blakiston Brook, Waterton Lakes, and on Chief Mountain in Glacier National Park. Outcrops of cupriferous quartzites and diabase intrusions were found and staked in the Yarrow Creek area at this same time, but these claims were never recorded. In 1963 the first 10 Big Horn claims were staked on these occurrences by Frank and Erik Goble, and by 1966 75 Big Horn group claims and 40 other claims had been staked in that area.

In 1966 Kennco Explorations (Western) Ltd. optioned the 75 Big Horn claims and during the 1967 field season carried out an exploration program on them and on the remainder of the Belt Series of southwestern Alberta and southeastern British Columbia. During the year that Kennco held the Big Horn claims an estimated 1,000,000 tons of up to 3.45% copper and 1.86 oz. per ton silver was outlined on the northern edge of the claim block. During this time Kennco located and staked the Commerce Mountain property and the Lin group of claims on Kishenena Creek. Work was confined to the upper portion of the Appekunny Formation and the Grinnell Formation and the options and claims were dropped in 1968.

In 1968 Alcor Minerals Ltd. took out leases covering almost the entire southwestern Alberta outcrop of Precambrian and after a cursory prospecting program, optioned much of the area now covered by the Kintla - Vestor permits 172 and 173 to Cominco Ltd. Cominco carried out a drill program on the Grizzly Creek copper property but dropped the option in 1971. In 1970 Canadian Superior Explorations Ltd. prospected the upper red-bed sequence of the Akamina Syncline for copper - silver mineralization and found numerous low grade showings, none of which were rich enough to warrant staking.

In 1972 the Big Horn, Commerce Mountain, Beth, Forum, Lin, and Opal claim blocks were obtained from the Goble Exploration Syndicate by Kintla Explorations Limited. A program of mapping and prospecting undertaken during the spring of 1972 on the Big Horn claims outlined a rich lead - silver showing on the southern portion of that claim block. The discovery was made in the previously unprospected Siyeh Formation on the south arm of Spionkop Ridge approximately 3/4 mile northwest of the main copper showing in the Grinnell Formation.

Prospecting and mapping located a mineralized zone in the Siyeh limestones 19 feet wide and 1000 feet long which consists of disseminated and

massive galena in limestone assaying at 16.2 % lead and 0.82 oz. silver per ton. This average includes a massive galena/anglesite vein varying from 3 1/2 to 4 1/2 feet thick assaying from 57.35 to 69.5 % lead and 2.25 to 3.87 oz. silver per ton. Similar mineralization was found in float 2,400 feet southwest along strike.

Additional prospecting subsequently carried out in the Siyeh Formation located numerous showings of 1 - 3 % lead in the Siyeh of the Big Horn and Commerce Mountain claim blocks, and in the Grinnell Formation on the Opal claims in Starvation Valley, British Columbia. The Starvation Valley property is unique in that the lead - silver - copper mineralization is found in a shatter zone in the Grinnell Formation rather than the Siyeh Formation. The mineralization occurs as disseminated galena and chalcopyrite in diabase intrusives and Grinnell Formation quartzites, as veinlets and joint plane coatings in the intrusives, and as a massive replacement of a shatter zone. The most important mineralization is a 4 to 8 foot thick replacement of the shattered base of a diabase sill. This zone has been traced on surface in excess of 800 feet, and in float for 500 feet beyond that. The average assay results from the replacement zone is 9.85 % lead, 14.75 ounces silver per ton, 0.95 % copper, and 0.015 ounces gold per ton, with the silver values ranging as high as 17.80 ounces per ton.

The three prospecting permits were taken out by Kintla and Vestor on a 50 : 50 basis following the above discoveries with the intention of examining the unprospected northeastern outcrop for possible deposits of lead - silver or copper - silver.

#### OUTLINE OF THE 1972 PROSPECTING PROGRAM

In June of 1972 a program of prospecting and sampling the permit areas was undertaken by Kintla. The purpose of the program was to determine by means of a modest field program whether or not there were sufficient



Mineralized showings on the permits to warrant a more detailed investigation. The primary targets were the quartzites of the upper portion of the Grinnell Formation, known to be favourable for deposition of copper - silver sulphides, and the overlying Siyeh Formation. No attempt was made to cover the entire area of the three permits, and only the most accessible portions with the best exposure were examined.

Forty eight good showings were found in 15 traverses with only 3 traverses not locating good mineralization. These three were:

- 1 - From West Castle River up Rainy Ridge to the Middle Kootenay Pass through the Grinnell and Siyeh Formations.
- 2 - From South Drywood Creek (end of oil road) to the top of Pincher Ridge, Siyeh Formation.
- 3 - From the pipeline heater north of Pincher Creek to the top of Prairie Bluff, through the uppermost Siyeh, Purcell Lava, and portions of the Sheppard Formation.

In no case did a traverse fail to locate some copper in the Grinnell Formation or lead - zinc in the Siyeh and Sheppard Formations. In addition, concentrations of 0.10 to 0.20 % copper were common in the flow tops of the Purcell lava, with some portions as high as 1.80 % across narrow widths.

## RESULTS

Upon commencement of prospecting it was found that the quartzitic upper portions of the Appekunny Formation and the calcareous shales of the lower Sheppard Formation carried good mineralization and were subsequently included in the traverses. The program progressed from east to west through the permits with several areas omitted due to lack of time.

Three main areas of interest were located:

- 1 - Copper showings in the Grinnell and upper Appekunny Formations between Drywood Creek and Pincher Creek, with possible extensions to Victoria Peak.
- 2 - Sheppard Formation lead - zinc - silver showings on Table Mountain, Mount Gladstone, and Lys Ridge, and the related Sheppard Formation showings in the North Kootenay Pass area.
- 3 - Grinnell Formation copper showings on Grizzly Creek, Whistler Mountain, west of Barnaby Ridge, and on Gravenstafl Ridge.

### 1 - DRYWOOD CREEK - PINCHER CREEK AREA:

The mineralization in this area consists of chalcocite and bornite with minor chalcopyrite in quartzites of the upper portion of the Appekunny Formation and lower Grinnell Formation. The showings are extensive, with one quartzite bed in the upper Appekunny continuously mineralized for 2 1/4 miles. Only the southernmost showing is associated with intrusive activity as is common in the Yarrow Creek - Spionkop Ridge, Grizzly Creek, and Starvation Valley occurrences.

This group of showings is as follows:

- 14 - Grinnell Formation, Drywood Mountain, massive bornite and chalcocite in argillites and quartzites, 0.75 to 3.0 % copper; associated with diorite intrusions also containing copper (up to

- 1.0 % copper). Quartzites 3 - 4 feet thick, argillites 7 - 8 feet thick, exposed 350 feet along the west side of the valley.
- 15 - Grinnell Formation, Pincher Ridge, 4 foot thick quartzite bed containing disseminated bornite and chalcocite, continuous with # 16; 0.6 % copper, 3/4 mile northwest of # 14.
- 16 - Grinnell Formation, Pincher Ridge, 4 1/2 foot thick quartzite bed containing veins of bornite and chalcocite, 0.9 to 1.25 % copper, 175 feet north of sample # 15.
- 17 - Appekunny Formation, Pincher Ridge, 10 foot thick quartzite and argillite sample; individual beds from 2 inches to 3 feet thick, 0.24 % copper, 0.06 oz. silver; heavily leached. 1/4 mile northeast of # 16.
- 18 - Appekunny Formation, Pincher Ridge, 3 foot channel sample of green argillites and dirty quartzites, with chalcocite replacing argillite pebbles and disseminated in the quartzites. The base of the bed is not exposed; 500 feet north of # 17; 1.01 % copper, 0.26 oz. silver.
- 19 - Appekunny Formation, Pincher Ridge, 10 foot channel sample of the same bed as # 18; mineralization is zoned with chalcopyrite in the lower 2.5 feet, bornite for 1 foot, and chalcocite across the remaining 6.5 feet; 0.61 % copper, 0.18 oz. silver; 275 feet north of # 18.
- 20 - Appekunny Formation, Pincher Ridge, 8 foot exposed width of the same bed as #'s 18, 19; 1.55 % copper, 0.3 oz. silver; 1/2 mile north of # 19.
- 21 - Appekunny Formation, Pincher Ridge, 3 1/2 foot exposed width of same bed as #'s 18, 19, 20; 0.9 % copper, 0.16 oz. silver. This appears to be the lower portion of the bed; 1 mile north of # 20.

22 - Appekunny Formation, Pincher Ridge, 11 foot channel sample  
30 to 35 feet lower in the section than the bed sampled in #'s  
18, 19 20, 21, that bed not exposed at location 22; dirty  
quartzites interbedded with green argillites, 0.30 % copper,  
0.13 oz. silver; 400 feet north of # 21.

INTERPRETATION AND CONCLUSIONS - DRYWOOD CREEK AND PINCHER CREEK AREA

These samples represent a very continuous 2 1/4 mile long exposure of copper mineralization generally between 0.6 and 1.1 % copper with minor associated silver. The bed apparently continues some 1 1/2 to 2 miles to the north of Pincher Creek as Alcor holds a 480 acre lease there on a high geochemical anomaly in the lower Appekunny Formation (G. Talbot, pers. comm.). There has been copper mineralization reported at the head of the southeast fork of Whitney Creek but this has never been investigated.

This area definitely represents a target for further prospecting as the very rich copper showing in the side valley south of Drywood Creek has never been thoroughly prospected, mapped, or drilled, and the quartzite in the upper Appekunny north of Drywood Creek should be examined in detail.

- TABLE MOUNTAIN - GLADSTONE MOUNTAIN - NORTH KOOTENAY PASS:

This mineralization was first discovered on Table Mountain and subsequent traverses were extended to cover the Sheppard Formation. Stratabound lead - zinc - silver was located where ever the Sheppard Formation was traversed, with the highest silver values in the North Kootenay Pass area and with the lead - zinc percentage consistent over the entire area. Subsequent to the discovery on Table Mountain, NO traverses were made through the Sheppard Formation to the south east, and this area should definitely be prospected in the future.

The mineralization is difficult to recognize, with the lead - zinc - silver being definitely sedimentary and confined to the black shale bands within grey shale sections of the lower 75 feet of the Sheppard Formation. This mineralization can occassionally be seen as fine galena coatings along joint planes, but appears as hydrozincite, a white carbonate of zinc extremely easy to confuse with the common calcareous coating on the rocks in the area. The prospecting teams finally resorted to the use of ultra violet lamps in the field and were able to locate the mineralization in this manner. Individual bands of the black shale contain as much as 10 % combined lead-zinc with up to 5 ounces of silver per ton.

All lead - zinc - silver showings found in the Sheppard are within the same 10 to 20 foot horizon. After the lead - zinc - silver of the Sheppard was located and traced from Mount Gladstone to North Lost Creek, a section was taken through the Siyeh Formation in the North Kootenay Pass area with the express purpose of checking the black shales of the Siyeh. Showing # 48 was found on the only Siyeh traverse made when checking the black shales with an ultra violet light. Most of the Sheppard and Siyeh Formations of southwestern Alberta are covered by the 3 permit areas, and

remains to be examined with more detailed prospecting. The samples from this zone are as follows:

- 23 - Sheppard Formation, Mount Gladstone, 12 foot section of inter-bedded shales and siltstones containing chalcopryrite and galena in streaks and blebs; 1.26 % lead, 0.4 % zinc, 0.72 % copper; exposed for 150 feet along the ridge.
- 24 - Sheppard Formation, Mount Gladstone, same beds as # 23; 3 foot section of argillaceous dolostone in the center of the mineralized zone 3.25 % lead, 0.8 % zinc, trace copper. The remainder of the mineralized zone not assayed, but was apparently 0.25 to 0.5 % lead, 0.5 to 0.75 % copper. These beds are exposed 1/4 mile northwest of # 23.
- 25 - Sheppard Formation, Table Mountain, same beds as #'s 23, 24; 15 foot section of siltstones and dolomitic siltstones containing:
  - 14 inches of dolomitic siltstone with galena in streaks and blebs assaying at 3.5 % combined lead - zinc;
  - 4 feet of chalcopryrite - galena bearing siltstone, approximately 0.75 to 1.0 % lead, 0.4 to 0.5 % copper.
  - 2 feet of chalcopryrite bearing siltstone, 1.2 % copper.
  - several 2 inch to 4 inch beds containing lead and copper between 0.25 and 1.0 % lead, and 0.3 to 1.0 % copper.
- 26 - Sheppard Formation, Table Mountain, the same beds as #'s 23, 24, 25; 10 foot section through the entire set of beds; 2.26 % lead, 0.70 % zinc, 0.23 % copper. Contains a richer central 2 feet than is present in # 25.
- 29 - Sheppard Formation, Lys Ridge, same beds as #'s 23 - 26; 24 foot section containing galena and chalcopryrite in streaks and blebs in siltstones, 2.18 % lead and 0.44 % zinc, traces copper only; exposed for more than 600 feet on top of the ridge.

- 40 - Sheppard Formation, Table Mountain; same beds as #'s 23 - 26, and 29; not assayed, appears to contain 2 - 3 % lead.
- 41 - Sheppard Formation, North Lost Creek, same beds as #'s 23 - 26, 29, 40; 8 foot section of interbedded black shales and grey argillaceous siltstones; 3.4 % lead, 0.2 % zinc, 2.75 oz. silver.
- 42 - Sheppard Formation, North Lost Creek, same beds as # 41; 8 foot thickness of 3.2 % lead, 0.2 % zinc, 3.05 oz. silver; 1/2 mile south of # 41.
- 43 - Sheppard Formation, South Lost Creek, same beds and rock type as # 42; 7 1/2 feet thick; 2.9 % lead, 0.3 % zinc, 3.50 oz. silver, 2 miles south of # 42.
- 44 - Sheppard Formation, South Lost Creek, same bed as # 43; 9 feet thick; 3.02 % lead, 1.0 % zinc, 3.6 oz. silver; 1/2 mile southeast of # 43.
- 45 - Sheppard Formation, Carbondale River, same bed and rock type as # 44; 10 feet thick; 2.06 % lead, 1.24 % zinc, 4.43 oz. silver; 1 1/2 miles south of # 44.
- 46 - Sheppard Formation, Carbondale River, same bed and rock type as # 45; 10 feet thick; 1.80 % lead, 1.22 % zinc, 4.50 oz. silver; 1/4 mile south of # 45.
- 47 - Sheppard Formation, Carbondale River; same bed and rock type as # 46; 11 feet thick, 1.92 % lead, 1.43 % zinc, 4.75 oz. silver; 1/4 mile south of # 46 in river bottom.
- 49 - Sheppard Formation, North Kootenay Pass, NOT same bed as # 47, approximately 50 feet higher in the section; 1.2 % copper, 1.5 % lead, 0.3 % zinc; 6 feet thick.
- 50 - Purcell Lava, North Kootenay Pass, 0.95 % copper, 1.0 foot thick top of lava; same section of lava as contains 1.8 % copper immediately below # 46.

- 51 - Purcell Lava, North Kootenay Pass, 1.8 % copper across 2.5 feet, top of lava exposed approximately 50 feet below # 46.
- 48 - SIYEH FORMATION, North Kootenay Pass, 6 foot thick limey siltstone with galena in black shaley bands; 2,56 % lead, 1.40 % zinc, 2.32 oz. silver; 1/2 mile southeast of # 47.

INTERPRETATION AND CONCLUSIONS - TABLE/GLADSTONE MOUNTAINS NORTH KOOTENAY PASS:

The extreme lateral extent of this mineralization suggests very strongly that it is syngenetic in nature. The area to the southeast of Table Mountain and Gladstone Mountain should be examined in detail as this was not rechecked after the prospecting team located lead - zinc on Table Mountain. The entire outcrop of Sheppard Formation should be prospected in detail as only those sections with easy access and good exposure were prospected, and once the mineralization had been found, no sections through the Sheppard failed to show lead - zinc mineralization.

There is an increase in silver and zinc content to the south from North Lost Creek with a comparable decrease in lead content. The average total lead - zinc content remains roughly the same for the entire Sheppard, and the vast areal extent of located mineralization indicates excellent possibilities of local enrichment and thickening. The discovery of apparently syngenetic lead - zinc - silver mineralization in the Siyeh near the end of the field season greatly increases the likelihood of discovering lead - zinc in the Siyeh Formation exposed in the permit areas. However, the nature of the mineralization makes prospecting difficult and unless the prospectors are very familiar with the appearance of hydrozincite, an ultra violet lamp must be used.



- GRIZZLY CREEK - WHISTLER MOUNTAIN - BARNABY RIDGE:

The mineralization in this area was first discovered by Akamina Minerals Ltd. (now Alcor Minerals Ltd.) in 1968, was subsequently optioned to Cominco Ltd., and then converted to two leases of 1 1/2 sections each after Cominco dropped the ground. Cominco drilled the Grizzly Creek showing and hit good chalcocite - bornite mineralization in upper Grinnell Formation quartzites with thicknesses up to 20 feet. Further work was recommended by the geologist in charge, L. Nagy, but Cominco decided to drop the Alcor option (L. Nagy, pers. comm.). Cominco also found and trenched the Whistler Mountain showing, now on the extreme southern portion of Alcor's second lease. This showing consists of several thin (2 inches to 1 foot thick) high grade (2.5 to 7.5 % copper) quartzite beds mineralized with bornite and chalcocite. The beds are within a 20 to 30 foot thick section of upper Grinnell dipping to the southwest at approximately 25°.

The main showings on the Kintla - Vestor permits in the Grinnell Formation, excluding the down-dip extension of the Whistler Mountain showing, are on the west side of Barnaby Ridge, some 1.5 miles southwest of and stratigraphically equivalent to the Grizzly Creek Showing. These showings are:

- 27 - Appekunny Formation, Whistler Mountain; 1 1/2 foot thick quartzite bed exposed for roughly 400 feet north of the fire look-out; varies in grade from 1.5 to 2.5 % copper; traces of silver.
- 28 - Grinnell Formation, Whistler Mountain; one of the two main showings held by Alcor Minerals Ltd.; 6 to 8 thin (2 inches to 12 inches thick) quartzite beds exposed for 800 feet on top of ridge; assays range from 2.5 to 7.5 % copper, with only traces of silver.

- 30 - Grinnell and Siyeh Formations, Grizzly Creek; held under lease by Alcor Minerals Ltd., has been drilled ( Cominco, 1968, 1969) and contains in excess of 1 million tons of 1.5 to 2.0 % copper with traces of silver and lead; there has been no exploration work done by Alcor since 1970. Excellent surface showings on the east side of Barnaby Ridge.
- 34 - Grinnell Formation, Gravenstafl Ridge; 14 foot thick exposure of quartzite with veins of chalcocite and bornite, exposed in gulley only, 0.8 % copper.
- 35 - Grinnell Formation, Gravenstafl Ridge - Mount Haig; 8 foot exposed thickness of same bed as # 34, 80 foot strike length exposed; 0.91 % copper, trace silver.
- 36 - Grinnell Formation, Barnaby Ridge; in excess of 8 foot thickness containing disseminated chalcopyrite in grey quartzite and replacing green argillite pebbles; 0.6 to 0.8 % copper; exposed in gulley only.
- 37 - Grinnell Formation, Barnaby Ridge; 10 foot thickness, lower 8 feet of which is equivalent to # 36, upper 2 feet contains bornite and chalcocite replacing argillaceous pebbles; 0.9 to 1.2 % copper, exposed in gulley only; 1/2 mile south of # 36. Top of bed not exposed.
- 38 - Grinnell Formation, Barnaby Ridge; 2 1/2 foot thick exposed width of massive white quartzite bed with large inclusions of massive bornite in a narrow band within the quartzite; 1.00 % copper up to 1.68 % copper and 0.25 to 0.37 oz. silver (two assays). Also a more than 3 foot thick green argillite bed immediately below the quartzite contains chalcocite in blebs; 0.20 % copper, 0.08 oz. silver; about 1 mile southeast # 37.

39 - Grinnell Formation, Barnaby Ridge; green argillites only, no exposure of the quartzites, 0.21 % copper, trace silver, #'s 36 to 39 are exposed in the bottoms of gulleys along the west side of the ridge and are apparently stratigraphically equivalent to the lower portion of the Grizzly Creek showing on the east side of the ridge.

31 - Siyeh Formation, Barnaby Ridge; Siyeh Float containing an estimated 1.0 % lead and traces of copper.

INTERPRETATION AND CONCLUSIONS - GRIZZLY CREEK - WHISTLER MOUNTAIN - BARNABY RIDGE

The mineralization located on the western edge of the northwestern nose of the Akamina Syncline is lithologically identical and stratigraphically equivalent with the lower portions of the Grizzly Creek showing held by Alcor Minerals Ltd. That portion of the Grinnell Formation which is equivalent to the upper portions of the Grizzly Creek showing is not exposed on the western side of Barnaby Ridge. There is no outcrop above the sampled sections of samples 36, 37, 38, and 39. This area will have to be checked with a detailed geochemical survey and subsequent drilling if indicated.

CENTRAL PORTION OF THE AKAMINA SYNCLINE:

The central portion of the syncline (not covered by the three permits) is represented by samples 10, 11, 12, 53, 54, and 55. The mineralization in that area is typically a pyrite - chalcopyrite assemblage disseminated in the arenaceous sedimentary rocks and almost entirely absent from the argillaceous sedimentary rocks. Approximately one foot in one hundred and fifty feet of section in the entire syncline will test positive for copper or heavy metals using a Holman kit (excluding the calcareous portions which all test positive). However, economic or near economic concentrations appear to be completely absent from the Gateway, Phillips, and Roosville Formations.

The samples representing this portion of the syncline are:

- 10 - Gateway Formation, Drywood Mountain; 12 inch bed of siltstone containing chalcocite replacing argillite pebbles.
- 11 - Gateway Formation, Drywood Mountain; 7 foot bed of siltstone containing disseminated chalcopyrite and bornite, 125 feet above # 10.
- 12 - Gateway Formation, Drywood Mountain; 2 foot thick bed of dirty quartzite with disseminated chalcopyrite and bornite, 50 feet above # 12. #'s 10, 11, and 12 contain 0.3 to 0.5 % copper.
- 53 - Roosville Formation, Victoria Ridge; (possibly Cambrian basal conglomerate); lower 18 inches contains sporadic veins of bornite; 0.68 % copper.
- 54 - Roosville Formation, Victoria Ridge; siltstone 6 1/2 feet thick exposure exposed on surface for 200 to 300 feet around the shoulder of the mountain; 0.39 % copper, disseminated and veined chalcopyrite.
- 55 - Roosville Formation, Victoria Ridge; siltstone 4 feet thick, exposed for 400 feet along the ridge, 0.20 % copper.

INTERPRETATION AND CONCLUSIONS - CENTRAL PORTION OF AKAMINA SYNCLINE:

The upper red-beds (Gateway, Phillips, and Roosville Formation) contain widespread but very low grade copper mineralization. There has been very little intrusive activity in this area, with subsequently little remobilization of low grade widespread deposits into economic deposits. The mineralization in the Yarrow Creek - Spionkop Ridge, Commerce Mountain, Grizzly Creek, Starvation Mountain, and Starvation Valley areas is associated with intrusions in each case, indicating remobilization and redeposition of initially syngenetic deposits.

ADDITIONAL SHOWINGS OF INTEREST:

- 52 - Waterton Formation, Syncline Mountain; fossil river channel, 50 feet by 650 feet, 0.01 oz. gold, 0.10 % copper.
- 5 - Siyeh Formation, Loaf Mountain; 0.25 % copper in Siyeh limestone float.

Samples 1, 2, 3, 4, and 6 represent mineralization in the north and west portion of Kintla's Big Horn claims:

- 1 - Siyeh Formation, Spionkop Ridge; massive galena vein in a shatter zone, 57.3 to 69.5 % lead and 2.25 to 3.87 oz. silver, across 3 1/2 to 4 1/2 foot widths; traced on surface in excess of 800 feet. Adjacent 5 feet average 6 % lead, and next 14 feet average 4 % lead.
- 2 - Siyeh Formation, Spionkop Ridge; massive and veined galena float in Siyeh limestone found in a talus slope 1,200 feet southwest of # 1; not located in place.
- 3 - Grinnell Formation, Spionkop Creek; 0.25 to 1.1 % copper in the upper 3 to 5 feet of a diabase intrusion at the base of the Grinnell Formation; 3,000 feet west of Kintla's main copper showing north of Spionkop Ridge.
- 4 - Siyeh Formation, Spionkop Ridge; 0.91 % zinc associated with chalcopyrite, wolframite, and galena in a shatter zone in the Siyeh limestone.
- 6 - Siyeh Formation, Spionkop Ridge; massive bornite replacing black shales in the upper portion of the Siyeh Formation, not assayed, visible bornite estimated at 0.5 to 0.75 % copper in a 10 to 15 foot section of black shale.

amples 7, 9, and 51 represent a copper bearing siltstone in the uppermost Sheppard Formation which has been traced from the head of Yarrow Valley to Barnaby Ridge, a strike length of 34 miles. The described samples are:

- 7 - Sheppard Formation, Spionkop Ridge; chalcocite in a four foot thick siltstone at the top of the Sheppard Formation, traced continuously to Barnaby Ridge (approximately 34 miles of outcrop); 0.3 to 0.78 % copper.
- 8 - Sheppard Formation, Spionkop Ridge; chalcopyrite in an 8 foot thick siltstone, 100 feet lower in the section than # 7.
- 9 - Sheppard Formation, Drywood Mountain; same bed and grade as # 7.
- 51 - Sheppard Formation, Lys Ridge; same bed as #'s 7, 9 and continuous between the three samples; 0.33 % copper. The intervening locations were not sampled when crossed on a traverse.

## CONCLUSIONS:

The three areas of concentration of mineralization, the Pincher Ridge Grinnell - Appekunny showings, the Table Mountain - Gladstone Mountain - North Kootenay Pass Sheppard showings, and the Barnaby Ridge Grinnell showings should each be examined in more detail. Although the copper - silver occurrences are not extremely rich, they are still encouraging, especially in consideration of their excellent lateral continuity. In addition most of these showings exhibit very strong leaching. Academic research done at the University of Alberta on samples from this area indicate that the percentage of copper minerals removed by surface leaching is between 65 and 90 %. This is borne out by the increase in grade of the Grizzly Creek showing at depth by a factor of 2 1/2; and by the increase in grade at depth of Kennecott Copper Ltd.'s Bear Creek Mine at Troy Montana. In stratigraphically equivalent rocks in the Bear Creek Mine Kennecott found a 2 to 3 fold increase in copper content between the leached surface outcrops and the unleached rocks at depths of 60 to 100 feet below surface.

The discovery of conformable apparently syngenetic lead - zinc - silver mineralization in the Siyeh Formation in the North Kootenay Pass area greatly enhances the possibilities of lead - zinc occurrences being found elsewhere in the Siyeh. No additional massive lead - zinc - silver similar to that found on the Big Horn claims was found on the permits, but in view of the relatively few traverses made and the large areas involved such discoveries should not be ruled out. In fact, the massive lead - silver vein on the Big Horn claims is within 1,000 feet of the main copper - silver zone where work has been going on since 1963, and this occurrence was only discovered in the spring of 1972. The surface of the vein is almost completely altered to anglesite, and must be broken to distinguish it from the adjacent limestones.



Most of the permit area remains to be prospected, even cursorily, and should definitely be examined in the light of the discoveries made with such a modest field program in 1972.

RECOMMENDATIONS:

- 1 - Prospect the Sheppard and Siyeh Formations for conformable lead - zinc - silver mineralization utilizing ultra violet lamps.
- 2 - Prospect the remainder of the Siyeh Formation for lead - zinc - silver mineralization similar to that found on the Big Horn claims.
- 3 - Prospect the entire area between Table Mountain - Mount Gladstone and Pincher Creek for copper, lead, zinc AND mercury which is reported to have been found on Mill Creek.
- 4 - Map and prospect in detail the Pincher Ridge - Drywood Creek copper - silver showings.
- 5 - Carry out a geochemical survey on the western slope of Barnaby Ridge above showings 36, 37, 38, and 39 to cover the upper portion of the Grinnell Formation and the lower Siyeh Formation.

## REFERENCES

- BALLY, A.W., GORDY, P.L., and STEWART, G.A., 1966: Structure, seismic data, and orogenic evolution of the Southern Canadian Rocky Mountains, Bull. Can. Petrol. Geol. 14, pp. 337-381.
- CLARKE, A.L., 1970: Stratabound copper sulfides in the Precambrian Belt Supergroup, Northern Idaho and Northwestern Montana. Proceedings of I.M.A.-I.A.G.O.D. Meetings, Japan, p. 98.
- DAWSON, G.M., 1886: Preliminary report on the physical and geological features of that portion of the Rocky Mountains between Latitudes 49° and 51° 30'. Geol. Surv. Can. Ann. Rept. 1, pt. B.
- HUME, G.S., 1932: Waterton Lakes - Flathead Valley area, Alberta and British Columbia. Geol. Surv. Can. Summ. Rept., pt. B, pp. 1-20.
- PRICE, R.A., 1962: Fernie map-area, east half, Alberta and British Columbia, Geol. Surv. Can. Paper 61-24.
- .....1964: The Precambrian Purcell System in the Rocky Mountains of Southern Alberta and British Columbia, Bull. Can. Petrol. Geol. 12, pp. 399-426.
- .....1967: The tectonic significance of mesoscopic subfabrics in the Southern Rocky Mountains of Alberta and British Columbia. Can. Jour. Earth Sci. 4, pp. 39-70.
- REESOR, J.E., 1957: The Proterozoic of the Cordillera in Southeastern British Columbia and Southwestern Alberta in The Proterozoic in Canada. Roy. Soc. Canada, Spec. Pub. no. 2, pp. 150-177.
- SMITH, A.G., BARNES, W.C., 1966: Correlation of and facies changes in the carbonaceous, calcareous, and dolomitic formations of the Precambrian Belt-Purcell Supergroup. Geol. Soc. Amer. Bull. 77, 1399-1426.
- STEVENSON, R.W., 1968: Final Report - 1967, Waterton Copper Project, Waterton area, Alberta. Kennco Explorations (Western) Ltd., Report.

## INTRODUCTION

The Kintla - Vestor prospecting permit areas, numbers 171, 172, and 173, are three contiguous mineral exploration permits of 9,920 acres each, covering a total area of 29,760 acres, centred upon latitude 49° 20' N and longitude 114° 15' W. The permit areas lie approximately 15 miles southwest of Pincher Creek, Alberta in an arc from South Drywood Creek to West Castle River, covering the northern exposure of Grinnell, Siyeh, Purcell Lava, and Sheppard Formations (of the Precambrian Belt Series) in the Akamina Syncline. The permits were obtained by Kintla Explorations Limited and Vestor Explorations Ltd. in June of 1972 following Kintla's discovery of high-grade lead-silver mineralization in the Siyeh Formation on Kintla's Big horn claims, 4 miles southeast of Permit 171. A prospecting program was undertaken on the permits during the summer of 1972. This is a summary of that program.

## REGIONAL SETTING

The Kintla - Vestor prospecting permits are situated within the Clarke Range of the Rocky Mountains some 20 miles north of the Canada - United States border. The permit areas are bounded by longitudes 114° 3' W and 114° 25' W, and latitudes 49° 15' N and 49° 22' N, covering a total area of 46.5 square miles.

The permit areas are situated in mountainous terrain typical of the Lewis Range of the southern Canadian Rockies. Relief in the area is rugged with valley bottoms between 4,000 and 6,000 feet above sea-level, and mountain peaks between 7,500 and 9,000 feet above sea-level. Access is good via forestry roads along all valleys except Mill and Gladstone Valleys, and with a passable 4-wheel drive road up Mill Creek. Gladstone Valley is accessible only on foot. Winter access is restricted by annual snowfalls of 80 to 90 inches, but ridge tops and the southern faces of the mountains

are generally open almost all year.

## REGIONAL GEOLOGY

The permit areas are situated within a region underlain by Precambrian rocks of the Lewis Series. The stratigraphic succession of the area is given in Table 1 (after Price, 1962). The areas of the permits are for the most part underlain by quartzites, argillites, and carbonate horizons, with minor intercalated submarine lavas. The Appekunny, Grinnell, Siyeh, Purcell Lava, Sheppard, and Gateway Formations outcrop on the permit areas (see Figure 1).

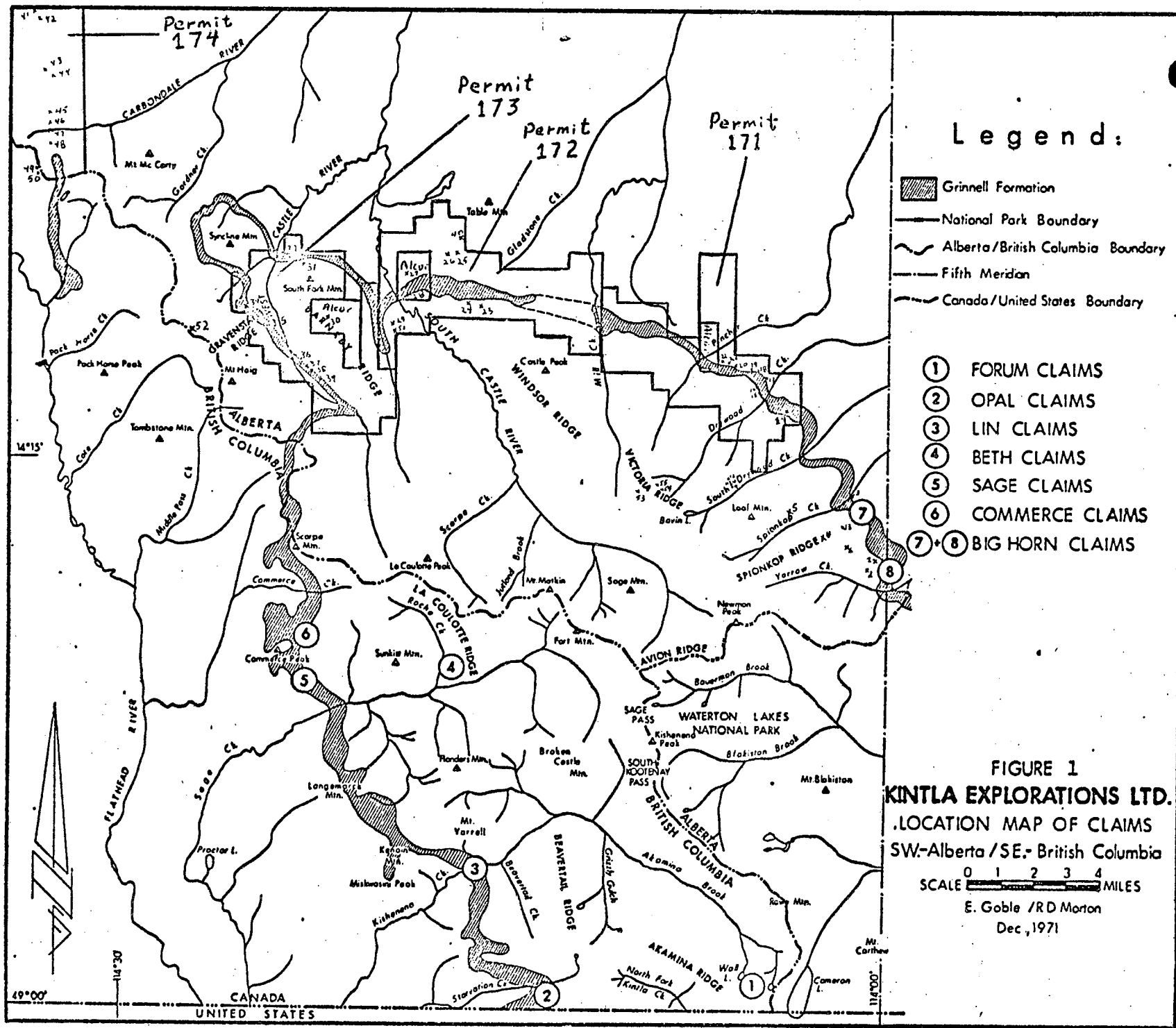
Reesor (1957), Price (1964), and Harrison (1972) postulate that the Lewis Series sediments of which these are a part, were deposited in the shallow waters of a deltaic basin and were in part of subaerial origin. Smith and Barnes (1966) recognize cyclic deep - shallow water depositional phases in the Montana equivalents of the Lewis Series. One such cycle terminates at the base of the Siyeh Formation with the Appekunny and Grinnell Formations representing the shallow water half of the cycle. The next cycle begins at the base of the Siyeh Formation with black marcasitic shales, continues through the carbonate sequence of the central and upper Siyeh, and terminates after the upper red beds of the Sheppard, Gateway, and Phillips Formations.

The Appekunny, Grinnell, Siyeh, and Sheppard Formations have been intruded by a series of amygdaloidal, porphyritic quartz - diabase sills and dykes up to 100 feet thick. These are of Precambrian age and are probably contemporaneous with the extrusion of the Purcell lavas. The Siyeh, Purcell Lava, and Sheppard Formations have been intruded by a series of porphyritic trachytic syenite sills and dykes of which the age is still unknown.






The Precambrian rocks in this area are part of the Lewis thrust sheet in which the Precambrian sediments have been thrust from the southwest over the younger Paleozoic and Mesozoic sediments. According to Price (1962), the Clarke Range is characterized by a series of thrust

ERA	PERIOD OR EPOCH	GROUP FORMATION	LITHOLOGY	THICKNESS (feet)	
		EROSIONAL UNCONFORMITY			
PRECAMBRIAN	PURCELL	MOYIE INTRUSIONS	Diorite sills and dykes		
	PURCELL (LEWIS)	GATEWAY KINTLA	ROOSVILLE FORMATION	Green argillite, siltstone, sandstone, stromatolitic dolomite	3500+
			PHILLIPS FORMATION	Red sandstone, siltstone, argillite	500- 700
			GATEWAY FORMATION (upper member)	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+		

Table 1. Stratigraphic succession of SW Canadian Precambrian (after Price, 1962)




**Legend:**

-  Grinnell Formation
-  National Park Boundary
-  Alberta/British Columbia Boundary
-  Fifth Meridian
-  Canada/United States Boundary

- ① FORUM CLAIMS
- ② OPAL CLAIMS
- ③ LIN CLAIMS
- ④ BETH CLAIMS
- ⑤ SAGE CLAIMS
- ⑥ COMMERCE CLAIMS
- ⑦+⑧ BIG HORN CLAIMS

**FIGURE 1**  
**KINTLA EXPLORATIONS LTD.**  
 .LOCATION MAP OF CLAIMS  
 SW-Alberta /SE- British Columbia

SCALE  MILES

E. Goble /RD Morton  
 Dec., 1971

faults and associated folds, cut by younger SW- or W- dipping normal faults. Bally et al., (1966) suggest that the thrusts are of late Mesozoic to early Tertiary age and that later faults were late Tertiary listric structures, perhaps merging with thrusts at depth. Figure 2 illustrates the general structural setting of the region and the extent of the Lewis thrust sheet which is folded into a broad synclinorium (the Akamina Syncline) and truncated to the west by the Flathead fault.

#### PREVIOUS HISTORY OF EXPLORATION

Copper mineralization in Purcell lavas and diabases of the North Kootenay Pass region in southwestern Alberta was first reported by Dawson in 1886. The region was prospected for gold in the 1870's and 1880's but no mineralization was found until the oil discovery at Oil City, now in Waterton Lakes National Park concentrated activity in that area. At that time (1901-- 1903) gold was discovered on the northwestern slope of Buchanan Ridge in Appekunny Formation quartzites. No development was done and when the oil boom collapsed the claims were dropped. Gold was also discovered in the Appekunny Formation on the east side of Goat Haunt Mountain, now in Glacier National Park, Montana, at approximately this same time and was mined up to the death of the owner.

During the first decade of the 20th century, small scale mining operations were located on copper bearing diabase dykes on Blakiston Brook, Waterton Lakes, and on Chief Mountain in Glacier National Park. Outcrops of cupriferous quartzites and diabase intrusions were found and staked in the Yarrow Creek area at this same time, but these claims were never recorded. In 1963 the first 10 Big Horn claims were staked on these occurrences by Frank and Erik Goble, and by 1966 75 Big Horn group claims and 40 other claims had been staked in that area.

In 1966 Kennco Explorations (Western) Ltd. optioned the 75 Big Horn claims and during the 1967 field season carried out an exploration program on them and on the remainder of the Belt Series of southwestern Alberta and southeastern British Columbia. During the year that Kennco held the Big Horn claims an estimated 1,000,000 tons of up to 3.45% copper and 1.86 oz. per ton silver was outlined on the northern edge of the claim block. During this time Kennco located and staked the Commerce Mountain property and the Lin group of claims on Kishenena Creek. Work was confined to the upper portion of the Appekunny Formation and the Grinnell Formation and the options and claims were dropped in 1968.

In 1968 Alcor Minerals Ltd. took out leases covering almost the entire southwestern Alberta outcrop of Precambrian and after a cursory prospecting program, optioned much of the area now covered by the Kintla - Vestor permits 172 and 173 to Cominco Ltd. Cominco carried out a drill program on the Grizzly Creek copper property but dropped the option in 1971. In 1970 Canadian Superior Explorations Ltd. prospected the upper red-bed sequence of the Akamina Syncline for copper - silver mineralization and found numerous low grade showings, none of which were rich enough to warrant staking.

In 1972 the Big Horn, Commerce Mountain, Beth, Forum, Lin, and Opal claim blocks were obtained from the Goble Exploration Syndicate by Kintla Explorations Limited. A program of mapping and prospecting undertaken during the spring of 1972 on the Big Horn claims outlined a rich lead - silver showing on the southern portion of that claim block. The discovery was made in the previously unprospected Siyeh Formation on the south arm of Spionkop Ridge approximately 3/4 mile northwest of the main copper showing in the Grinnell Formation.

Prospecting and mapping located a mineralized zone in the Siyeh limestones 19 feet wide and 1000 feet long which consists of disseminated and



massive galena in limestone assaying at 16.2 % lead and 0.82 oz. silver per ton. This average includes a massive galena/anglesite vein varying from 3 1/2 to 4 1/2 feet thick assaying from 57.35 to 69.5 % lead and 2.25 to 3.87 oz. silver per ton. Similar mineralization was found in float 2,400 feet southwest along strike.

Additional prospecting subsequently carried out in the Siyeh Formation located numerous showings of 1 - 3 % lead in the Siyeh of the Big Horn and Commerce Mountain claim blocks, and in the Grinnell Formation on the Opal claims in Starvation Valley, British Columbia. The Starvation Valley property is unique in that the lead - silver - copper mineralization is found in a shatter zone in the Grinnell Formation rather than the Siyeh Formation. The mineralization occurs as disseminated galena and chalcopryrite in diabase intrusives and Grinnell Formation quartzites, as veinlets and joint plane coatings in the intrusives, and as a massive replacement of a shatter zone. The most important mineralization is a 4 to 8 foot thick replacement of the shattered base of a diabase sill. This zone has been traced on surface in excess of 800 feet, and in float for 500 feet beyond that. The average assay results from the replacement zone is 9.85 % lead, 14.75 ounces silver per ton, 0.95 % copper, and 0.015 ounces gold per ton, with the silver values ranging as high as 17.80 ounces per ton.

The three prospecting permits were taken out by Kintla and Vestor on a 50 : 50 basis following the above discoveries with the intention of examining the unprospected northeastern outcrop for possible deposits of lead - silver or copper - silver.

#### OUTLINE OF THE 1972 PROSPECTING PROGRAM

In June of 1972 a program of prospecting and sampling the permit areas was undertaken by Kintla. The purpose of the program was to determine by means of a modest field program whether or not there were sufficient

mineralized showings on the permits to warrant a more detailed investigation. The primary targets were the quartzites of the upper portion of the Grinnell Formation, known to be favourable for deposition of copper - silver sulphides, and the overlying Siyeh Formation. No attempt was made to cover the entire area of the three permits, and only the most accessible portions with the best exposure were examined.

Forty eight good showings were found in 15 traverses with only 3 traverses not locating good mineralization. These three were:

- 1 - From West Castle River up Rainy Ridge to the Middle Kootenay Pass through the Grinnell and Siyeh Formations.
- 2 - From South Drywood Creek (end of oil road) to the top of Pincher Ridge, Siyeh Formation.
- 3 - From the pipeline heater north of Pincher Creek to the top of Prairie Bluff, through the uppermost Siyeh, Purcell Lava, and portions of the Sheppard Formation.

In no case did a traverse fail to locate some copper in the Grinnell Formation or lead - zinc in the Siyeh and Sheppard Formations. In addition, concentrations of 0.10 to 0.20 % copper were common in the flow tops of the Purcell lava, with some portions as high as 1.80 % across narrow widths.

## RESULTS

Upon commencement of prospecting it was found that the quartzitic upper portions of the Appekunny Formation and the calcareous shales of the lower Sheppard Formation carried good mineralization and were subsequently included in the traverses. The program progressed from east to west through the permits with several areas omitted due to lack of time.

Three main areas of interest were located:

- 1 - Copper showings in the Grinnell and upper Appekunny Formations between Drywood Creek and Pincher Creek, with possible extensions to Victoria Peak.
- 2 - Sheppard Formation lead - zinc - silver showings on Table Mountain, Mount Gladstone, and Lys Ridge, and the related Sheppard Formation showings in the North Kootenay Pass area.
- 3 - Grinnell Formation copper showings on Grizzly Creek, Whistler Mountain, west of Barnaby Ridge, and on Gravenstafel Ridge.

### 1 - DRYWOOD CREEK - PINCHER CREEK AREA:

The mineralization in this area consists of chalcocite and bornite with minor chalcopyrite in quartzites of the upper portion of the Appekunny Formation and lower Grinnell Formation. The showings are extensive, with one quartzite bed in the upper Appekunny continuously mineralized for 2 1/4 miles. Only the southernmost showing is associated with intrusive activity as is common in the Yarrow Creek - Spionkop Ridge, Grizzly Creek, and Starvation Valley occurrences.

This group of showings is as follows:

- 14 - Grinnell Formation, Drywood Mountain, massive bornite and chalcocite in argillites and quartzites, 0.75 to 3.0 % copper; associated with diorite intrusions also containing copper (up to

- 1.0 % copper). Quartzites 3 - 4 feet thick, argillites 7 - 8 feet thick, exposed 350 feet along the west side of the valley.
- 15 - Grinnell Formation, Pincher Ridge, 4 foot thick quartzite bed containing disseminated bornite and chalcocite, continuous with # 16; 0.6 % copper, 3/4 mile northwest of # 14.
- 16 - Grinnell Formation, Pincher Ridge, 4 1/2 foot thick quartzite bed containing veins of bornite and chalcocite, 0.9 to 1.25 % copper, 175 feet north of sample # 15.
- 17 - Appekunny Formation, Pincher Ridge, 10 foot thick quartzite and argillite sample; individual beds from 2 inches to 3 feet thick, 0.24 % copper, 0.06 oz. silver; heavily leached. 1/4 mile northeast of # 16.
- 18 - Appekunny Formation, Pincher Ridge, 3 foot channel sample of green argillites and dirty quartzites, with chalcocite replacing argillite pebbles and disseminated in the quartzites. The base of the bed is not exposed; 500 feet north of # 17; 1.01 % copper, 0.26 oz. silver.
- 19 - Appekunny Formation, Pincher Ridge, 10 foot channel sample of the same bed as # 18; mineralization is zoned with chalcopyrite in the lower 2.5 feet, bornite for 1 foot, and chalcocite across the remaining 6.5 feet; 0.61 % copper, 0.18 oz. silver; 275 feet north of # 18.
- 20 - Appekunny Formation, Pincher Ridge, 8 foot exposed width of the same bed as #'s 18, 19; 1.55 % copper, 0.3 oz. silver; 1/2 mile north of # 19.
- 21 - Appekunny Formation, Pincher Ridge, 3 1/2 foot exposed width of same bed as #'s 18, 19, 20; 0.9 % copper, 0.16 oz. silver. This appears to be the lower portion of the bed; 1 mile north of # 20.

22 - Appekunny Formation, Pincher Ridge, 11 foot channel sample  
30 to 35 feet lower in the section than the bed sampled in #'s  
18, 19 20, 21, that bed not exposed at location 22; dirty  
quartzites interbedded with green argillites, 0.30 % copper,  
0.13 oz. silver; 400 feet north of # 21.

INTERPRETATION AND CONCLUSIONS - DRYWOOD CREEK AND PINCHER CREEK AREA

These samples represent a very continuous 2 1/4 mile long exposure of copper mineralization generally between 0.6 and 1.1 % copper with minor associated silver. The bed apparently continues some 1 1/2 to 2 miles to the north of Pincher Creek as Alcor holds a 480 acre lease there on a high geochemical anomaly in the lower Appekunny Formation (G. Talbot, pers. comm.). There has been copper mineralization reported at the head of the southeast fork of Whitney Creek but this has never been investigated.

This area definitely represents a target for further prospecting as the very rich copper showing in the side valley south of Drywood Creek has never been thoroughly prospected, mapped, or drilled, and the quartzite in the upper Appekunny north of Drywood Creek should be examined in detail.

2 - TABLE MOUNTAIN - GLADSTONE MOUNTAIN - NORTH KOOTENAY PASS:

This mineralization was first discovered on Table Mountain and subsequent traverses were extended to cover the Sheppard Formation. Stratabound lead - zinc - silver was located where ever the Sheppard Formation was traversed, with the highest silver values in the North Kootenay Pass area and with the lead - zinc percentage consistent over the entire area. Subsequent to the discovery on Table Mountain, NO traverses were made through the Sheppard Formation to the south east, and this area should definitely be prospected in the future.

The mineralization is difficult to recognize, with the lead - zinc - silver being definitely sedimentary and confined to the black shale bands within grey shale sections of the lower 75 feet of the Sheppard Formation. This mineralization can occassionally be seen as fine galena coatings along joint planes, but appears as hydrozincite, a white carbonate of zinc extremely easy to confuse with the common calcareous coating on the rocks in the area. The prospecting teams finally resorted to the use of ultra violet lamps in the field and were able to locate the mineralization in this manner. Individual bands of the black shale contain as much as 10 % combined lead-zinc with up to 5 ounces of silver per ton.

All lead - zinc - silver showings found in the Sheppard are within the same 10 to 20 foot horizon. After the lead - zinc - silver of the Sheppard was located and traced from Mount Gladstone to North Lost Creek, a section was taken through the Siyeh Formation in the North Kootenay Pass area with the express purpose of checking the black shales of the Siyeh. Showing # 48 was found on the only Siyeh traverse made when checking the black shales with an ultra violet light. Most of the Sheppard and Siyeh Formations of southwestern Alberta are covered by the 3 permit areas, and

remains to be examined with more detailed prospecting. The samples from this zone are as follows:

- 23 - Sheppard Formation, Mount Gladstone, 12 foot section of inter-bedded shales and siltstones containing chalcopyrite and galena in streaks and blebs; 1.26 % lead, 0.4 % zinc, 0.72 % copper; exposed for 150 feet along the ridge.
- 24 - Sheppard Formation, Mount Gladstone, same beds as # 23; 3 foot section of argillaceous dolostone in the center of the mineralized zone 3.25 % lead, 0.8 % zinc, trace copper. The remainder of the mineralized zone not assayed, but was apparently 0.25 to 0.5 % lead, 0.5 to 0.75 % copper. These beds are exposed 1/4 mile northwest of # 23.
- 25 - Sheppard Formation, Table Mountain, same beds as #'s 23, 24; 15 foot section of siltstones and dolomitic siltstones containing:
- 14 inches of dolomitic siltstone with galena in streaks and blebs assaying at 3.5 % combined lead - zinc;
  - 4 feet of chalcopyrite - galena bearing siltstone, approximately 0.75 to 1.0 % lead, 0.4 to 0.5 % copper.
  - 2 feet of chalcopyrite bearing siltstone, 1.2 % copper.
  - several 2 inch to 4 inch beds containing lead and copper between 0.25 and 1.0 % lead, and 0.3 to 1.0 % copper.
- 26 - Sheppard Formation, Table Mountain, the same beds as #'s 23, 24, 25; 10 foot section through the entire set of beds; 2.26 % lead, 0.70 % zinc, 0.23 % copper. Contains a richer central 2 feet than is present in # 25.
- 29 - Sheppard Formation, Lys Ridge, same beds as #'s 23 - 26; 24 foot section containing galena and chalcopyrite in streaks and blebs in siltstones, 2.18 % lead and 0.44 % zinc, traces copper only; exposed for more than 600 feet on top of the ridge.

- 40 - Sheppard Formation, Table Mountain; same beds as #'s 23 - 26, and 29; not assayed, appears to contain 2 - 3 % lead.
- 41 - Sheppard Formation, North Lost Creek, same beds as #'s 23 - 26, 29, 40; 8 foot section of interbedded black shales and grey argillaceous siltstones; 3.4 % lead, 0.2 % zinc, 2.75 oz. silver.
- 42 - Sheppard Formation, North Lost Creek, same beds as # 41; 8 foot thickness of 3.2 % lead, 0.2 % zinc, 3.05 oz. silver; 1/2 mile south of # 41.
- 43 - Sheppard Formation, South Lost Creek, same beds and rock type as # 42; 7 1/2 feet thick; 2.9 % lead, 0.3 % zinc, 3.50 oz. silver, 2 miles south of # 42.
- 44 - Sheppard Formation, South Lost Creek, same bed as # 43; 9 feet thick; 3.02 % lead, 1.0 % zinc, 3.6 oz. silver; 1/2 mile southeast of # 43.
- 45 - Sheppard Formation, Carbondale River, same bed and rock type as # 44; 10 feet thick; 2.06 % lead, 1.24 % zinc, 4.43 oz. silver; 1 1/2 miles south of # 44.
- 46 - Sheppard Formation, Carbondale River, same bed and rock type as # 45; 10 feet thick; 1.80 % lead, 1.22 % zinc, 4.50 oz. silver; 1/4 mile south of # 45.
- 47 - Sheppard Formation, Carbondale River; same bed and rock type as # 46; 11 feet thick, 1.92 % lead, 1.43 % zinc, 4.75 oz. silver; 1/4 mile south of # 46 in river bottom.
- 49 - Sheppard Formation, North Kootenay Pass, NOT same bed as # 47, approximately 50 feet higher in the section; 1.2 % copper, 1.5 % lead, 0.3 % zinc; 6 feet thick.
- 50 - Purcell Lava, North Kootenay Pass, 0.95 % copper, 1.0 foot thick top of lava; same section of lava as contains 1.8 % copper immediately below # 46.



51 - Purcell Lava, North Kootenay Pass, 1.8 % copper across 2.5 feet, top of lava exposed approximately 50 feet below # 46.

48 - SIYEH FORMATION, North Kootenay Pass, 6 foot thick limey siltstone with galena in black shaley bands; 2,56 % lead, 1.40 % zinc, 2.32 oz. silver; 1/2 mile southeast of # 47.

INTERPRETATION AND CONCLUSIONS - TABLE/GLADSTONE MOUNTAINS NORTH KOOTENAY PASS:

The extreme lateral extent of this mineralization suggests very strongly that it is syngenetic in nature. The area to the southeast of Table Mountain and Gladstone Mountain should be examined in detail as this was not rechecked after the prospecting team located lead - zinc on Table Mountain. The entire outcrop of Sheppard Formation should be prospected in detail as only those sections with easy access and good exposure were prospected, and once the mineralization had been found, no sections through the Sheppard failed to show lead - zinc mineralization.

There is an increase in silver and zinc content to the south from North Lost Creek with a comparable decrease in lead content. The average total lead - zinc content remains roughly the same for the entire Sheppard, and the vast areal extent of located mineralization indicates excellent possibilities of local enrichment and thickening. The discovery of apparently syngenetic lead - zinc - silver mineralization in the Siyeh near the end of the field season greatly increases the likelihood of discovering lead - zinc in the Siyeh Formation exposed in the permit areas. However, the nature of the mineralization makes prospecting difficult and unless the prospectors are very familiar with the appearance of hydrozincite, an ultra violet lamp must be used.

3 - GRIZZLY CREEK - WHISTLER MOUNTAIN - BARNABY RIDGE:

The mineralization in this area was first discovered by Akamina Minerals Ltd. (now Alcor Minerals Ltd.) in 1968, was subsequently optioned to Cominco Ltd., and then converted to two leases of 1 1/2 sections each after Cominco dropped the ground. Cominco drilled the Grizzly Creek showing and hit good chalcocite - bornite mineralization in upper Grinnell Formation quartzites with thicknesses up to 20 feet. Further work was recommended by the geologist in charge, L. Nagy, but Cominco decided to drop the Alcor option (L. Nagy, pers. comm.). Cominco also found and trenched the Whistler Mountain showing, now on the extreme southern portion of Alcor's second lease. This showing consists of several thin (2 inches to 1 foot thick) high grade (2.5 to 7.5 % copper) quartzite beds mineralized with bornite and chalcocite. The beds are within a 20 to 30 foot thick section of upper Grinnell dipping to the southwest at approximately 25°.

The main showings on the Kintla - Vestor permits in the Grinnell Formation, excluding the down-dip extension of the Whistler Mountain showing, are on the west side of Barnaby Ridge, some 1.5 miles southwest of and stratigraphically equivalent to the Grizzly Creek Showing. These showings are:

- 27 - Appekunny Formation, Whistler Mountain; 1 1/2 foot thick quartzite bed exposed for roughly 400 feet north of the fire look-out; varies in grade from 1.5 to 2.5 % copper; traces of silver.
- 28 - Grinnell Formation, Whistler Mountain; one of the two main showings held by Alcor Minerals Ltd.; 6 to 8 thin (2 inches to 12 inches thick) quartzite beds exposed for 800 feet on top of ridge; assays range from 2.5 to 7.5 % copper, with only traces of silver.

- 30 - Grinnell and Siyeh Formations, Grizzly Creek; held under lease by Alcor Minerals Ltd., has been drilled ( Cominco, 1968, 1969) and contains in excess of 1 million tons of 1.5 to 2.0 % copper with traces of silver and lead; there has been no exploration work done by Alcor since 1970. Excellent surface showings on the east side of Barnaby Ridge.
- 34 - Grinnell Formation, Gravenstafl Ridge; 14 foot thick exposure of quartzite with veins of chalcocite and bornite, exposed in gulley only, 0.8 % copper.
- 35 - Grinnell Formation, Gravenstafl Ridge - Mount Haig; 8 foot exposed thickness of same bed as # 34, 80 foot strike length exposed; 0.91 % copper, trace silver.
- 36 - Grinnell Formation, Barnaby Ridge; in excess of 8 foot thickness containing disseminated chalcopyrite in grey quartzite and replacing green argillite pebbles; 0.6 to 0.8 % copper; exposed in gulley only.
- 37 - Grinnell Formation, Barnaby Ridge; 10 foot thickness, lower 8 feet of which is equivalent to # 36, upper 2 feet contains bornite and chalcocite replacing argillaceous pebbles; 0.9 to 1.2 % copper, exposed in gulley only; 1/2 mile south of # 36. Top of bed not exposed.
- 38 - Grinnell Formation, Barnaby Ridge; 2 1/2 foot thick exposed width of massive white quartzite bed with large inclusions of massive bornite in a narrow band within the quartzite; 1.00 % copper up to 1.68 % copper and 0.25 to 0.37 oz. silver (two assays). Also a more than 3 foot thick green argillite bed immediately below the quartzite contains chalcocite in blebs; 0.20 % copper, 0.08 oz. silver; about 1 mile southeast # 37.

39 - Grinnell Formation, Barnaby Ridge; green argillites only, no exposure of the quartzites, 0.21 % copper, trace silver, #'s 36 to 39 are exposed in the bottoms of gulleys along the west side of the ridge and are apparently stratigraphically equivalent to the lower portion of the Grizzly Creek showing on the east side of the ridge.

31 - Siyeh Formation, Barnaby Ridge; Siyeh Float containing an estimated 1.0 % lead and traces of copper.

INTERPRETATION AND CONCLUSIONS - GRIZZLY CREEK - WHISTLER MOUNTAIN - BARNABY RIDGE

The mineralization located on the western edge of the northwestern nose of the Akamina Syncline is lithologically identical and stratigraphically equivalent with the lower portions of the Grizzly Creek showing held by Alcor Minerals Ltd. That portion of the Grinnell Formation which is equivalent to the upper portions of the Grizzly Creek showing is not exposed on the western side of Barnaby Ridge. There is no outcrop above the sampled sections of samples 36, 37, 38, and 39. This area will have to be checked with a detailed geochemical survey and subsequent drilling if indicated.

CENTRAL PORTION OF THE AKAMINA SYNCLINE:

The central portion of the syncline (not covered by the three permits) is represented by samples 10, 11, 12, 53, 54, and 55. The mineralization in that area is typically a pyrite - chalcopyrite assemblage disseminated in the arenaceous sedimentary rocks and almost entirely absent from the argillaceous sedimentary rocks. Approximately one foot in one hundred and fifty feet of section in the entire syncline will test positive for copper or heavy metals using a Holman kit (excluding the calcareous portions which all test positive). However, economic or near economic concentrations appear to be completely absent from the Gateway, Phillips, and Roosville Formations. The samples representing this portion of the syncline are:

- 10 - Gateway Formation, Drywood Mountain; 12 inch bed of siltstone containing chalcocite replacing argillite pebbles.
- 11 - Gateway Formation, Drywood Mountain; 7 foot bed of siltstone containing disseminated chalcopyrite and bornite, 125 feet above # 10.
- 12 - Gateway Formation, Drywood Mountain; 2 foot thick bed of dirty quartzite with disseminated chalcopyrite and bornite, 50 feet above # 12. #'s 10, 11, and 12 contain 0.3 to 0.5 % copper.
- 53 - Roosville Formation, Victoria Ridge; (possibly Cambrian basal conglomerate); lower 18 inches contains sporadic veins of bornite; 0.68 % copper.
- 54 - Roosville Formation, Victoria Ridge; siltstone 6 1/2 feet thick exposure exposed on surface for 200 to 300 feet around the shoulder of the mountain; 0.39 % copper, disseminated and veined chalcopyrite.
- 55 - Roosville Formation, Victoria Ridge; siltstone 4 feet thick, exposed for 400 feet along the ridge, 0.20 % copper.

INTERPRETATION AND CONCLUSIONS - CENTRAL PORTION OF AKAMINA SYNCLINE:

The upper red-beds (Gateway, Phillips, and Roosville Formation) contain widespread but very low grade copper mineralization. There has been very little intrusive activity in this area, with subsequently little remobilization of low grade widespread deposits into economic deposits. The mineralization in the Yarrow Creek - Spionkop Ridge, Commerce Mountain, Grizzly Creek, Starvation Mountain, and Starvation Valley areas is associated with intrusions in each case, indicating remobilization and redeposition of initially syngenetic deposits.

ADDITIONAL SHOWINGS OF INTEREST:

52 - Waterton Formation, Syncline Mountain; fossil river channel, 50 feet by 650 feet, 0.01 oz. gold, 0.10 % copper.

5 - Siyeh Formation, Loaf Mountain; 0.25 % copper in Siyeh limestone float.

Samples 1, 2, 3, 4, and 6 represent mineralization in the north and west portion of Kintla's Big Horn claims:

1 - Siyeh Formation, Spionkop Ridge; massive galena vein in a shatter zone, 57.3 to 69.5 % lead and 2.25 to 3.87 oz. silver, across 3 1/2 to 4 1/2 foot widths; traced on surface in excess of 800 feet. Adjacent 5 feet average 6 % lead, and next 14 feet average 4 % lead.

2 - Siyeh Formation, Spionkop Ridge; massive and veined galena float in Siyeh limestone found in a talus slope 1,200 feet southwest of # 1; not located in place.

3 - Grinnell Formation, Spionkop Creek; 0.25 to 1.1 % copper in the upper 3 to 5 feet of a diabase intrusion at the base of the Grinnell Formation; 3,000 feet west of Kintla's main copper showing north of Spionkop Ridge.

4 - Siyeh Formation, Spionkop Ridge; 0.91 % zinc associated with chalcopyrite, wolframite, and galena in a shatter zone in the Siyeh limestone.

6 - Siyeh Formation, Spionkop Ridge; massive bornite replacing black shales in the upper portion of the Siyeh Formation, not assayed, visible bornite estimated at 0.5 to 0.75 % copper in a 10 to 15 foot section of black shale.

Samples 7, 9, and 51 represent a copper bearing siltstone in the uppermost Sheppard Formation which has been traced from the head of Yarrow Valley to Barnaby Ridge, a strike length of 34 miles. The described samples are:

- 7 - Sheppard Formation, Spionkop Ridge; chalcocite in a four foot thick siltstone at the top of the Sheppard Formation, traced continuously to Barnaby Ridge (approximately 34 miles of outcrop); 0.3 to 0.78 % copper.
- 8 - Sheppard Formation, Spionkop Ridge; chalcopyrite in an 8 foot thick siltstone, 100 feet lower in the section than # 7.
- 9 - Sheppard Formation, Drywood Mountain; same bed and grade as # 7.
- 51 - Sheppard Formation, Lys Ridge; same bed as #'s 7, 9 and continuous between the three samples; 0.33 % copper. The intervening locations were not sampled when crossed on a traverse.



## CONCLUSIONS:

The three areas of concentration of mineralization, the Pincher Ridge Grinnell - Appekunny showings, the Table Mountain - Gladstone Mountain - North Kootenay Pass Sheppard showings, and the Barnaby Ridge Grinnell showings should each be examined in more detail. Although the copper - silver occurrences are not extremely rich, they are still encouraging, especially in consideration of their excellent lateral continuity. In addition most of these showings exhibit very strong leaching. Academic research done at the University of Alberta on samples from this area indicate that the percentage of copper minerals removed by surface leaching is between 65 and 90 %. This is borne out by the increase in grade of the Grizzly Creek showing at depth by a factor of 2 1/2; and by the increase in grade at depth of Kennecott Copper Ltd.'s Bear Creek Mine at Troy Montana. In stratigraphically equivalent rocks in the Bear Creek Mine Kennecott found a 2 to 3 fold increase in copper content between the leached surface outcrops and the unleached rocks at depths of 60 to 100 feet below surface.

The discovery of conformable apparently syngenetic lead - zinc - silver mineralization in the Siyeh Formation in the North Kootenay Pass area greatly enhances the possibilities of lead - zinc occurrences being found elsewhere in the Siyeh. No additional massive lead - zinc - silver similar to that found on the Big Horn claims was found on the permits, but in view of the relatively few traverses made and the large areas involved such discoveries should not be ruled out. In fact, the massive lead - silver vein on the Big Horn claims is within 1,000 feet of the main copper - silver zone where work has been going on since 1963, and this occurrence was only discovered in the spring of 1972. The surface of the vein is almost completely altered to anglesite, and must be broken to distinguish it from the adjacent limestones.

Most of the permit area remains to be prospected, even cursorily, and should definitely be examined in the light of the discoveries made with such a modest field program in 1972.

RECOMMENDATIONS:

- 1 - Prospect the Sheppard and Siyeh Formations for conformable lead - zinc - silver mineralization utilizing ultra violet lamps.
- 2 - Prospect the remainder of the Siyeh Formation for lead - zinc - silver mineralization similar to that found on the Big Horn claims.
- 3 - Prospect the entire area between Table Mountain - Mount Gladstone and Pincher Creek for copper, lead, zinc AND mercury which is reported to have been found on Mill Creek.
- 4 - Map and prospect in detail the Pincher Ridge - Drywood Creek copper - silver showings.
- 5 - Carry out a geochemical survey on the western slope of Barnaby Ridge above showings 36, 37, 38, and 39 to cover the upper portion of the Grinnell Formation and the lower Siyeh Formation.

## REFERENCES

- BALLY, A.W., GORDY, P.L., and STEWART, G.A., 1966: Structure, seismic data, and orogenic evolution of the Southern Canadian Rocky Mountains, Bull. Can. Petrol. Geol. 14, pp. 337-381.
- CLARKE, A.L., 1970: Stratabound copper sulfides in the Precambrian Belt Supergroup, Northern Idaho and Northwestern Montana. Proceedings of I.M.A.-I.A.G.O.D. Meetings, Japan, p. 98.
- DAWSON, G.M., 1886: Preliminary report on the physical and geological features of that portion of the Rocky Mountains between Latitudes 49° and 51° 30'. Geol. Surv. Can. Ann. Rept. 1, pt. B.
- HUME, G.S., 1932: Waterton Lakes - Flathead Valley area, Alberta and British Columbia. Geol. Surv. Can. Summ. Rept., pt. B, pp. 1-20.
- PRICE, R.A., 1962: Fernie map-area, east half, Alberta and British Columbia, Geol. Surv. Can. Paper 61-24.
- .....1964: The Precambrian Purcell System in the Rocky Mountains of Southern Alberta and British Columbia, Bull. Can. Petrol. Geol. 12, pp. 399-426.
- .....1967: The tectonic significance of mesoscopic subfabrics in the Southern Rocky Mountains of Alberta and British Columbia. Can. Jour. Earth Sci. 4, pp. 39-70.
- REESOR, J.E., 1957: The Proterozoic of the Cordillera in Southeastern British Columbia and Southwestern Alberta in The Proterozoic in Canada. Roy. Soc. Canada, Spec. Pub. no. 2, pp. 150-177.
- SMITH, A.G., BARNES, W.C., 1966: Correlation of and facies changes in the carbonaceous, calcareous, and dolomitic formations of the Precambrian Belt-Purcell Supergroup. Geol. Soc. Amer. Bull. 77, 1399-1426.
- STEVENSON, R.W., 1968: Final Report - 1967, Waterton Copper Project, Waterton area, Alberta. Kennco Explorations (Western) Ltd., Report.

19730001

APPENDIX

KINTLA EXPLORATIONS LIMITED

GEOLOGICAL REPORT #V-P1

JUNE - SEPTEMBER 1972

PERMIT AREAS # 171, 172, 173, 174  
SOUTHWESTERN ALBERTA

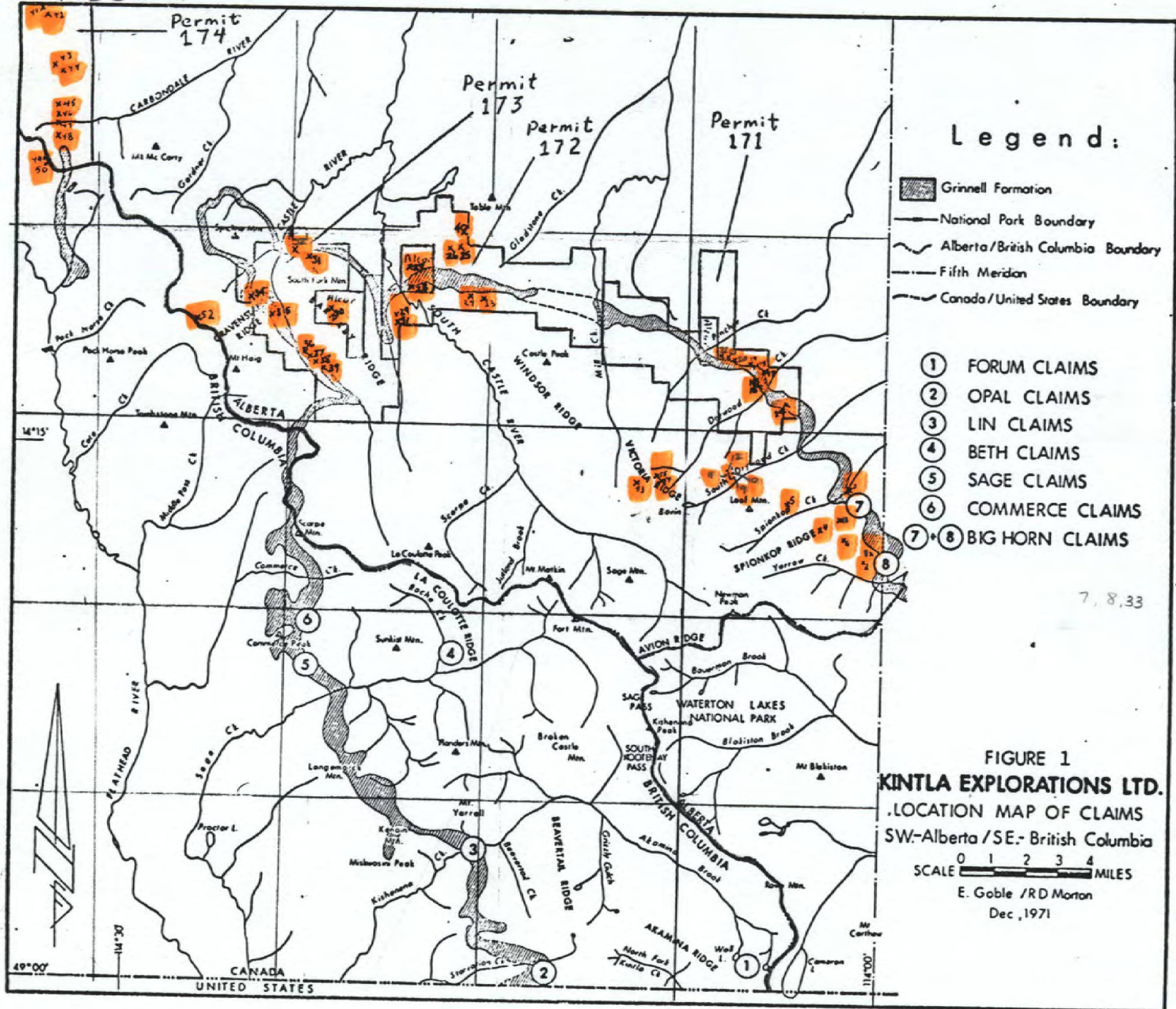
E. Goble,

February, 1973.

CONTENTS:

	PAGE
INTRODUCTION.....	1
REGIONAL SETTING.....	1
REGIONAL GEOLOGY.....	2
PREVIOUS HISTORY OF EXPLORATION.....	5
OUTLINE OF THE 1972 PROSPECTING PROGRAM.....	7
RESULTS.....	9
DRYWOOD CREEK - PINCHER CREEK AREA.....	9
INTERPRETATION AND CONCLUSIONS.....	11
TABLE MOUNTAIN - GLADSTONE MOUNTAIN -	
NORTH KOOTENAY PASS.....	12
INTERPRETATION AND CONCLUSIONS.....	15
GRIZZLY CREEK - WHISTLER MOUNTAIN - BARNABY RIDGE...	16
INTERPRETATION AND CONCLUSIONS.....	18
CENTRAL PORTION OF THE AKAMINA SYNCLINE.....	19
INTERPRETATION AND CONCLUSIONS.....	20
ADDITIONAL SHOWINGS OF INTEREST.....	21
CONCLUSIONS.....	23
RECOMMENDATIONS.....	24
REFERENCES.....	25

19730001



19730001