MAR 19720008: BIGHORN

Received date: Dec 31, 1972

Public release date: Jan 01, 1974

KINTLA EXPLORATIONS LIMITED

GEOLOGICAL REPORT NO. B1

SPRING PROGRAM 1972

BIGHORN CLAIMS
YARROW CREEK - SPIONKOP CREEK
SOUTHWESTERN ALBERTA

WATERTON PARK, ALBERTA
September, 1972

RONALD JAMES GOBLE M.Sc.
Project Geologist

CONTENTS

INTRODUCTION

The Bighorn claim group consists of 68 full and 7 fractional claims, covering 3749 acres, the group being centred upon Latitude 49°13'N and Longitude 114°W. The claim block lies to the NE of Mount Glendowan on an area between Yarrow and Spionkop Creeks. The claims were optioned by Kintla Explorations Ltd. in January, 1972 from the Franklin Motel Co. Ltd. On the basis of property examination by Kintla geologists, assays and reports turned over to Kintla by Franklin, and the recommendations of Prof. R.D. Morton, Kintla's consultant, a program of mapping, prospecting and sampling was undertaken by a Kintla field crew in May, 1972. This report is a summary of that program.

REGIONAL SETTING

The Bighorn claims are situated within the Clarke Range of the Rocky Mountains near the Canada - United States border. The area lies approximately fifteen miles north of the southwest corner of Alberta, between latitudes 49°12'N and 49°14'N, and between longitudes 113°59'W and 114°01'W (see Fig. 1). The area is moderately rugged with maximum relief of 2500 feet. Access is via roads up Yarrow and Spionkop Creeks to the base of Spionkop Ridge. A four-wheel drive road up Spionkop Ridge is impassable at the present time. Winter access is restricted by an annual snowfall of approximately 80 inches. Ridge tops and south-facing slopes are generally accessible almost year round.

The Precambrian Appekunny, Grinnell, Siyeh, Purcell Lava, and Sheppard formations, as mapped by Price (1962), outcrop on the Bighorn claims (Fig. 2). For the most part these consist of quartzites, argillites and carbonates, with minor intercalated submarine lavas (Fig. 3). Reesor (1957) and Price (1964) 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

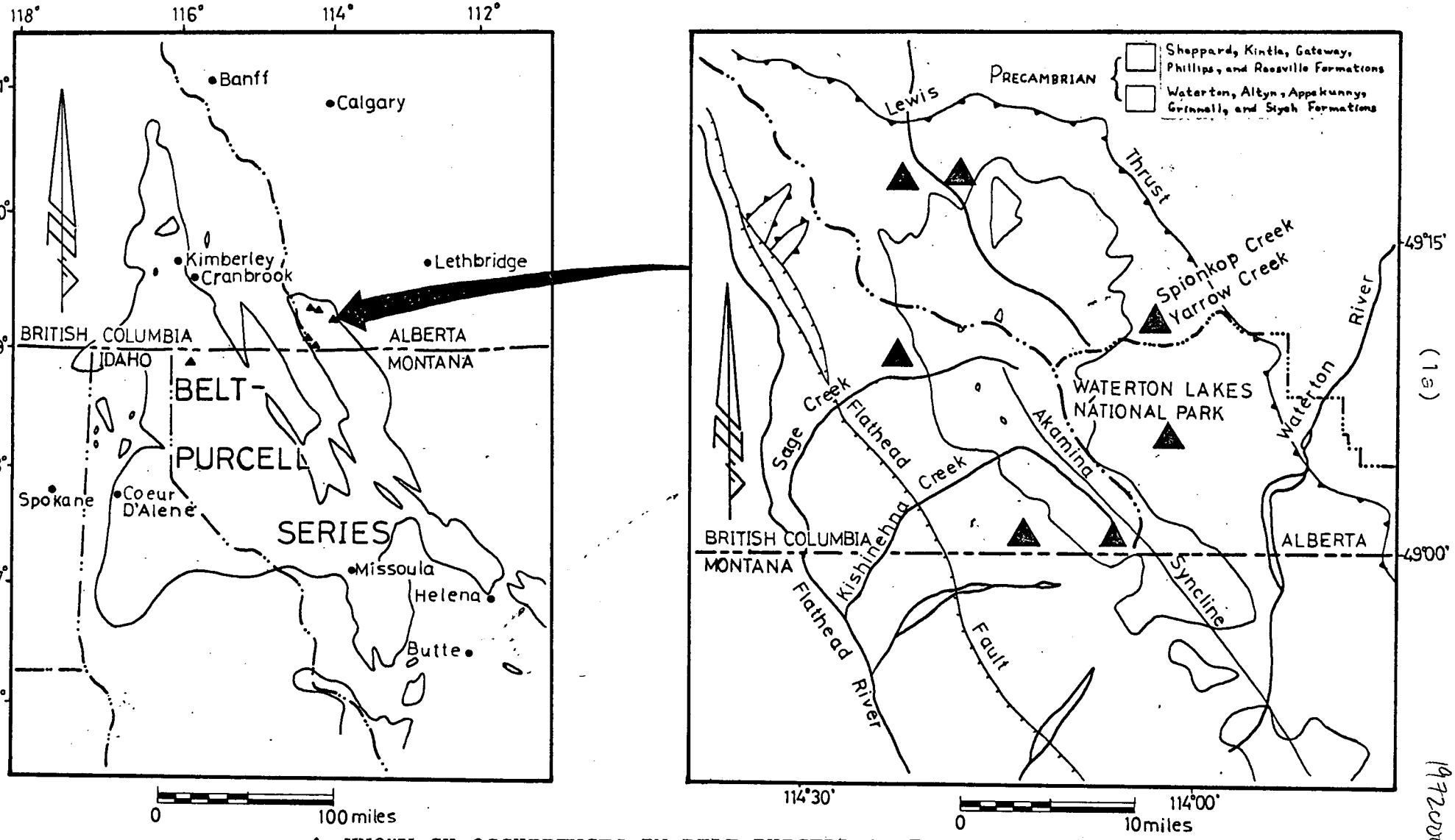


Figure 1: Geological and location map of Lewis Thrust Sheet (after Price, 1965).

(1a)

19720007

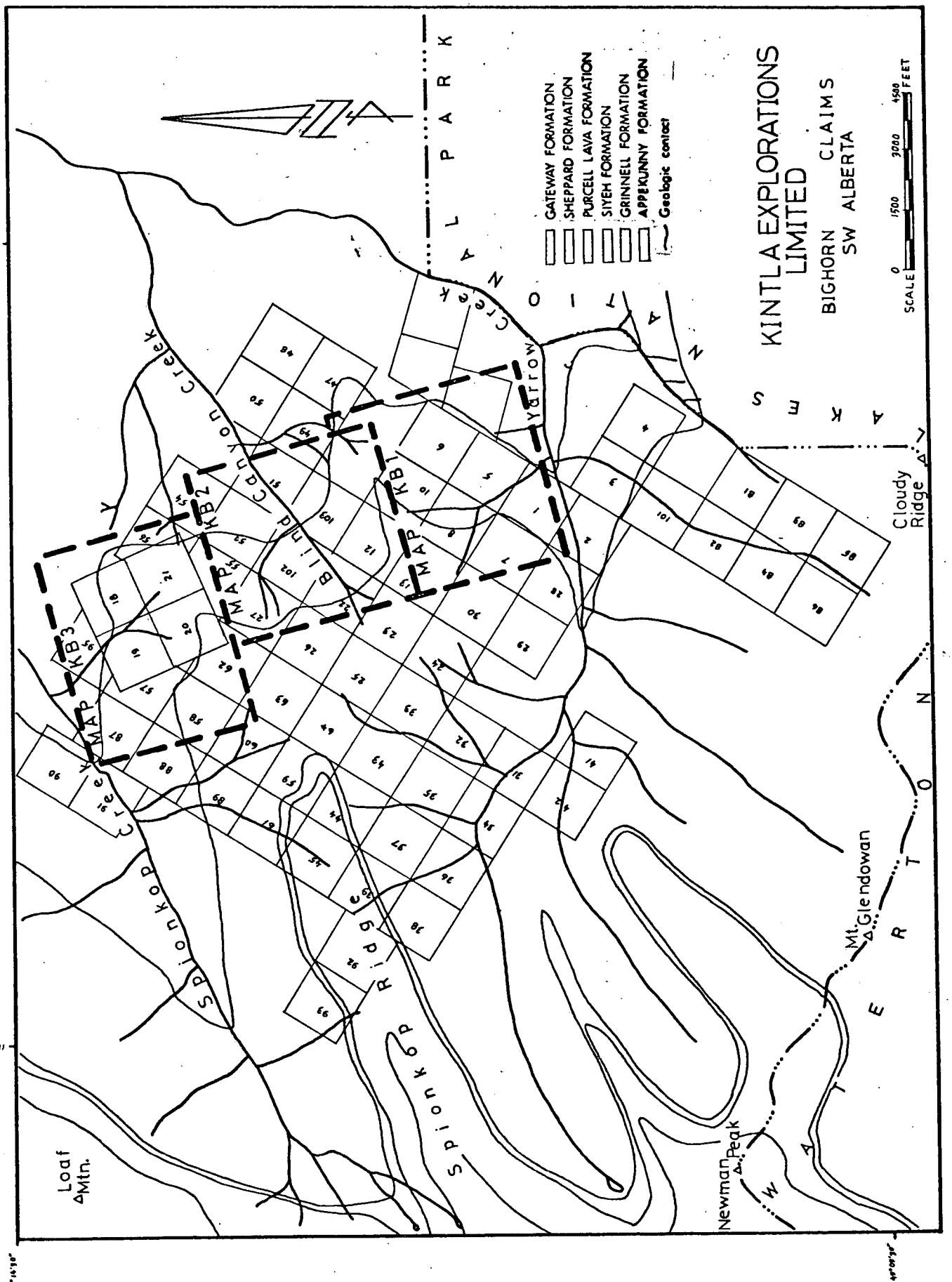


Figure 2: Geological and claim map of Bighorn Claims (after Goble and Morton, 1971).

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+

Figure 3: Stratigraphic succession of SW Canadian Precambrian (after Price, 1962).

(1c)

1922007

the base of the Siyeh formation, with the Appekunny and Grinnell formations representing the shallow-water half of the cycle.

The sediments 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 possibly contemporaneous with the extrusion of the Purcell lavas.

The Precambrian rocks in this area are present as part of the Lewis thrust sheet, in which Precambrian sediments have been thrust from the southwest over the younger Paleozoic and Mesozoic sediments. The thrust sheet is, according to Price (1962), characterized by a series of thrust faults and associated folds, cut by younger SE- or W-dipping normal faults. Price (1967) also describes a series of NE-trending transverse faults found within the Clarke Range.

PREVIOUS WORK

Outcrops of cupriferous quartzite in the Yarrow Creek area were initially staked during the first decade of the 20th Century but the claims were never recorded. In 1963 the first ten of the Bighorn claims were staked by Frank and Erik Goble and staking continued until 1966 when the then 75 Bighorn claims were optioned by Kennco Explorations (Western) Ltd. During the year that Kennco held the claims mapping and prospecting were carried out, resulting in the outlining of a possible 1,000,000 tons of up to 3½% Cu ore in a diabase sill on Spionkop Ridge. One deep and several shallow diamond drill holes on Yarrow Creek gave poor results although core recovery was too low for good reliability. The option was dropped in 1967. The claims were again optioned in 1968 by Akamina Minerals Ltd. (now Alcor Minerals Ltd.) who carried out further surface exploration and drilling on this and related copper occurrences. No reports are available for this exploration nor are the results known. The option was terminated in 1971 and in January 1972 Kintla Explorations Ltd. optioned the claim block. Academic studies carried out on the claim block during the period 1969-1971 at the University of Alberta are presented by Goble (1970),

Goble et al (1972), and Goble & Smith (1972).

OUTLINE OF 1972 SPRING PROGRAM

In May 1972 a program of mapping, prospecting, and sampling was undertaken by Kintla on the Bighorn claims. The purpose of the program was "to duplicate the original [pre-1972] good samples, to take additional samples from the same mineralized beds between the primary sampling sites, and to map and correlate the sections."[1] The main targets of the program on the Bighorn claims were:

"a) A 5-8 foot thick bornite-covellite-chalcocite mineralized quartzite bed continuous along strike from just north of Yarrow Creek, through the Blind Canyon to just south of Spionkop Creek, approximately three miles, with Cu values from 1-2½ percent...

b) A 12-30 foot thick diorite sill with a 3-8 foot chilled margin, described by R.W. Stevenson of Kennco Explorations (Western) Ltd. as containing approximately 1 million tons of mineable ore grading from 1.83-3.45 percent Cu and with up to 0.86 ounces per ton Ag...

c) A high silver showing on Yarrow Creek near the south end of the quartzite bed mentioned in a), which assayed at 59.38 ounces per ton Ag and 3.7 percent Cu; and a 2.22 ounces per ton Ag showing in the apparently unmineralized central portion of the main diorite sill where it crosses Yarrow Creek...

d) An area of old trenches where faulting has apparently pushed mineralized Appekunny strata into the Lower Grinnell...

e) An area of high bornite/covellite assays, approximately 1000 feet x 300 feet, covering roughly 200 feet of section in the upper Grinnell north of Yarrow creek, of which one (the lowest quartzite) is the southern end of the bed described in a)...

f) The numerous 6-10 foot thick diorite dykes and sills north of Yarrow Creek which carry disseminated chalcopyrite and/or bornite and chalcocite...

1 Goble, E.O. (1972): Spring program, 1972 - Bighorn, Beth, Commerce, Forum, Lin, Opal, and Sage claims. p. 2.

g) The high lead-zinc area of the Siyeh approximately 1000 feet northwest of f)...

h) A diorite dyke (8 feet x 5000 feet) cutting through the Siyeh formation on Spionkop Creek, carrying galena and sphalerite in vesicles and associated with wolframite in the adjacent Siyeh limestones...."[2]

One geologist, one prospector, three full-time and two part-time assistants were employed for approximately eight hundred and sixty man-days mapping, prospecting and sampling an area of about 925 acres covering the Grinnell formation and parts of the Siyeh and Appekunny formations on the Bighorn claims.

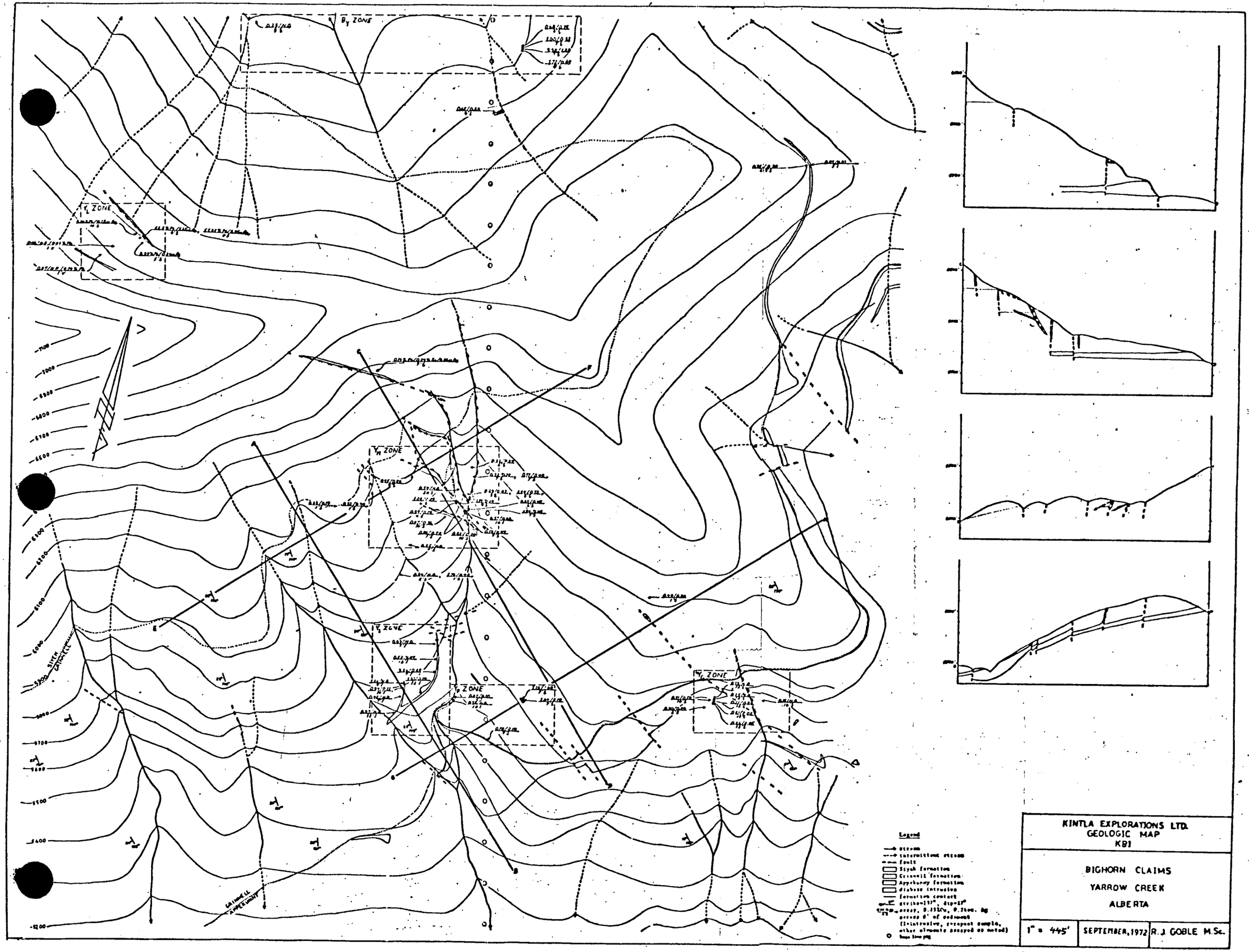
Mapping was carried out on a scale of one inch to two hundred feet with control by chain and compass. A two hundred foot-interval grid with two hundred foot stations was used on the main showings and a four hundred foot-interval grid with two hundred foot stations was used on areas of lesser interest. Elevations of stations were determined using an altimeter having a precision of approximately ten feet. The altimeter was adjusted each day to the first base line peg (Y_o peg) having an assumed elevation of 5130 feet (based upon a first day reading with the altimeter set at 4200 feet at Waterton townsite).

Some eighty-five samples were collected and assayed for copper (Cu), silver (Ag), lead (Pb), zinc (Zn), gold (Au), and/or molybdenum (Mo). Values ranged up to 6.40% Cu, 5.25 oz Ag, 57.35% Pb, 1,80% Zn, with trace quantities of Au and Mo being detected in some samples.

RESULTS

Mapping on the Bighorn claims was confined to the Grinnell formation except in areas where prospecting revealed mineralized horizons in the Appekunny or Siyeh formations. Maps KB1, KB2, KB3 (KINTLA-BIGHORN- No. 1, 2, 3) show local geology and sample locations and values for Yarrow Creek, Blind Canyon, and Spionkop Creek map areas, resepctively.

2 Goble, E.O. (1972): Spring program, 1972. pp.2-5



KINTLA EXPLORATIONS LTD.
GEOLOGIC MAP
KBI

BIGHORN CLAIMS
YARROW CREEK
ALBERTA

1" = 445'	SEPTEMBER, 1972	R. J. GOBLE M.Sc.

YARROW CREEK

Eleven samples of intrusives, two samples of veins and forty samples of sediments were assayed from the Yarrow Creek map area. These samples can be grouped according to location into the Y_M zone (YARROW-MAIN ZONE), the Y_I zone (YARROW-INTRUSIVE ZONE), the Y_G zone (YARROW-GOSSAN ZONE), the Y_P zone (YARROW-PIT ZONE), and the Y_L zone (YARROW-LEAD ZONE). These zones are shown on map KB1. Five samples lie outside these zones and will be considered separately.

GEOLOGY

The stratigraphic succession in the Yarrow Creek map area is Appekunny formation, Grinnell formation, Siyeh formation, moving upwards. The Appekunny formation consists of dominantly green and white argillites and quartzites, grading over a short interval into the dominantly red argillites of the lower Grinnell. Reddish quartzites and minor white and greenish quartzites become more prevalent in the upper Grinnell formation and grade into the black shales and buff quartzites of the lower Siyeh. These in turn give way to the carbonates which make up the bulk of the Siyeh formation.

The sediments strike approximately N140°E (135°-160°) and dip at approximately 25°SW (15°-35°). Numerous diabase sills and dykes intrude the sediments, the most prominent being a large sill (up to 100 feet thick) which is found approximately 20 feet below the top of the Appekunny formation throughout the Yarrow Creek map area. A concentration of sills and dykes lies in the upper Grinnell in the Y_M zone.

The sediments in the Yarrow Creek map area are cut by numerous reverse faults striking N10°W to N60°W and dipping from 70° to 90°SW. A few thrust faults striking approximately N45°E and dipping from 15° to 25°SE are also present. Stevenson (1968) noted that some faults cut the lower Grinnell but not the diabase sill in the upper Appekunny, and concluded from this that some of the faulting was caused by the intrusion of this diabase sill into the incompetent sediments. Some of the faults cut the sills and

dykes while other fault zones are occupied by dykes, indicating that at least some of the faulting was post-intrusive.

Sections 1, 2, 3, 4 show the geologic cross sections on lines AB, CD, EF, GH, respectively (see map KB1).

Y_M ZONE

The Y_M zone includes quartzites and argillites of the upper Grinnell formation and associated quartz-diabase intrusives. Mineralization is in the form of covellite, anilite (Goble and Smith, 1972), bornite, and rarely chalcopyrite, disseminated in quartzites and in the chilled margins of the diabase sills and dykes. Bornite and covellite are frequently present as grains within argillite pebbles found throughout the quartzite beds.

The diabase sills and dykes intrude the fault planes of SW- or W-dipping normal, or more frequently, reverse faults. A major overthrust of the upper Grinnell over the basal Siyeh occurs in the northern part of the Y_M zone. Faults in the Y_M zone are believed to connect with faults in the Y_G zone and possibly in the Y_L zone (see map KB1).

Samples from the Y_M zone may be further grouped according to stratigraphic horizon as follows:

Horizon		% Cu	oz. Ag	Thickness	Remarks
upper beds	1	0.62	0.19	1'	quartzite
	1a	0.32	0.48	1'	repeat of (1)
	2	0.59	0.47	?'	float, quartzite
intermediate beds	3	0.25	0.24	6'	quartzite
	4	0.54	N.D.	20'	quartzite
YS bed	5	0.32	0.14	7'	quartzite
	5a	0.71	0.48	7'	repeat of (5)
	6	0.29	0.07	8'	quartzite, 110' S of (5)
	6a	1.20	0.72	8'	repeat of (6)
	7	1.39	0.24	9'	quartzite, 100' S of (6)
	8	1.08	0.29	6'	quartzite, 10' S of (7)
	9	0.89	0.19	4'	quartzite, 5' S of (8)
	10	0.37	0.02	10'	intrusive, contacts (9)
	11	0.45	0.26	9'	quartzite, 290' S of (9)
intermediate beds	12	0.47	0.36	10'	quartzite
	13	0.25	N.D.	7'	quartzite, 210' S of (12)
lower beds	14	0.65	0.48	6'	quartzite
	15	1.84	0.48	7'	quartzite, below (14)
	16	0.86	0.72	1'	quartzite } included in
	17	0.82	0.24	10'	quartzite } (14) & (15)

Y_I ZONE

The Y_I zone consists of an interconnected diabase sill and dyke intruded into the lower Grinnell red argillites and mineralized with chalcocite and covellite. Samples taken for analysis are as follows:

Location		% Cu	oz. Ag	Thickness	Remarks
sill	1	0.69	N.D.	7'	
	2	0.52	0.07	12'	90' S of (1)
	3	3.26	0.24	7'	70' S of (2)
	4	1.30	0.14	12'	140' S of (3)
	5	0.97	N.D.	12'	190' S of (4)
dyke	6	0.42	N.D.	7'	90' N of (5)
	7	0.94	0.12	10'	60' N of (6)
	8	1.26	N.D.	9'	20' N of (7)

Y_G ZONE

The Y_G zone includes quartzites and argillites of the upper Appekunny formation as well as diabase sills and dykes. A conspicuous fault cuts through the center of the mineralized area, offsetting one of the diabase sills. Mineralization is in the form of disseminated chalcopyrite and fracture fillings of chalcopyrite within quartzites. Leaching appears to be heavy. Five twelve foot stratigraphically-adjacent samples were taken across the sixty foot mineralized area, with a further sample being taken to either side. These samples assayed as follows:

Location		% Cu	oz. Ag	Thickness	Remarks
W of main mineralization	1	0.30	0.24	6'	50' W of (2) - (7)
main mineralization	2	0.13	N.D.	12'	
	3	0.15	N.D.	12'	below (2)
	4	0.11	0.24	12'	below (3)
	5	0.21	0.02	12'	below (4)
	6	0.26	0.05	12'	below (5)
	7	0.31	0.12	10'	included in (2) - (6)
E of main mineralization	8	0.11	N.D.	16'	220' E of (2) - (7)

Y_P ZONE

The Y_P zone includes quartzites and argillites of the upper Appekunny and lower Grinnell formations as well as diabase sills and dykes. The central mineralized area is an extensively broken-up and leached outcrop of covellite- and bornite-bearing

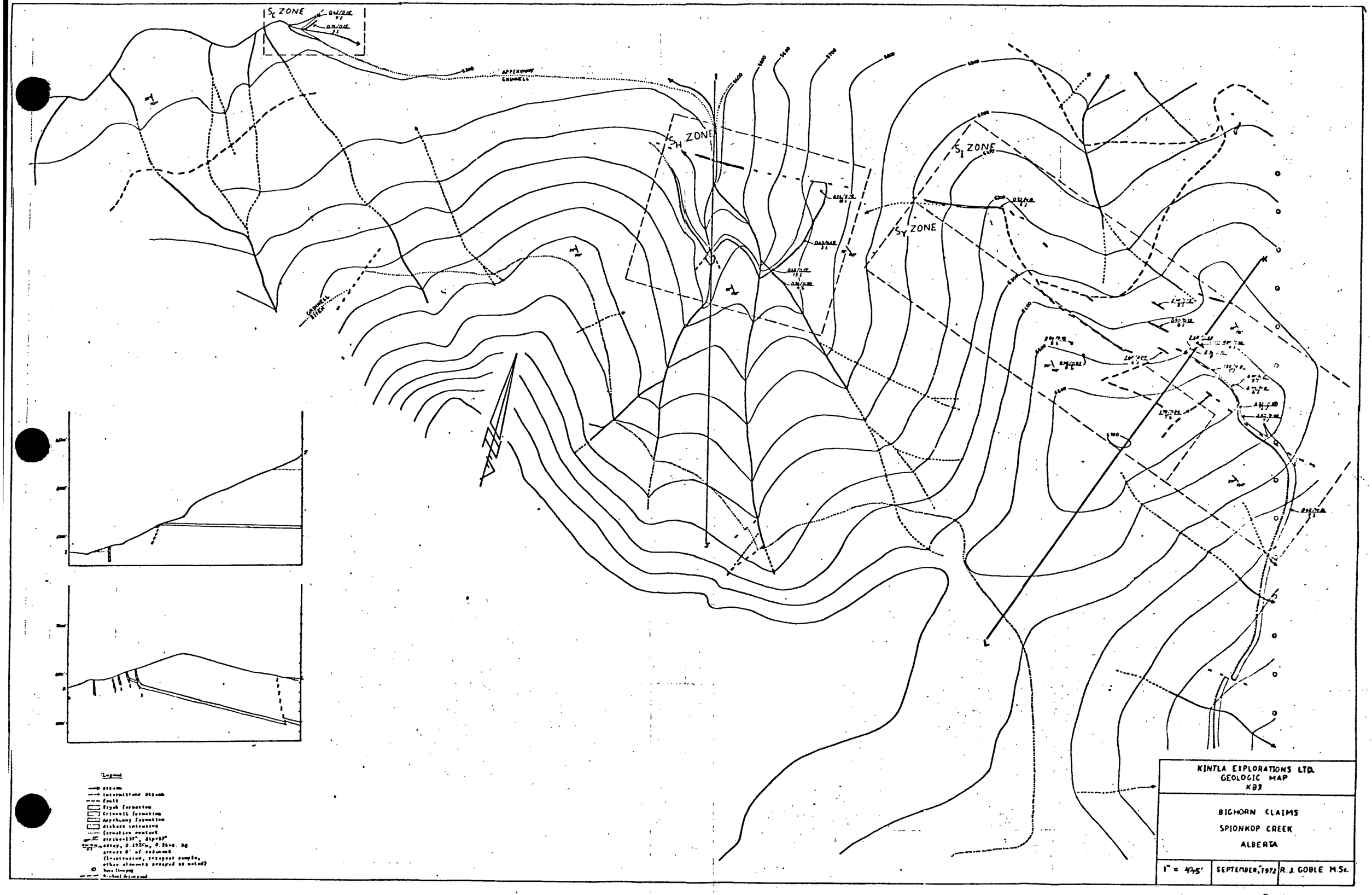
quartzite. These quartzites are believed to be Appekunny quartzites faulted into their present position as shown in section number 4. This hypothesis is based upon the nature of the quartzites, their position within the essentially quartzite-barren lower Grinnell, and proximity of the fault shown in map KB1 to the outcrop. Mineralization within the upper Appekunny quartzites is known from the Y_G zone to the east and within chalcopyrite-bearing quartzites to the south and west. Assays from these areas are given below:

Location		% Cu	oz. Ag	Thickness	Remarks
pit	1	1.16	1.68	?'	quartzite
	2	1.04	0.19	?'	quartzite
W of pit	3	0.07	0.10	5'	quartzite, 320' W of (1)
	4	0.38	N.D.	10'	intrusive, adjacent to (3)
S of pit	5	0.10	0.19	7'	quartzite, 250' S of (1)

Y_L ZONE

The Y_L zone is an exposure of galena-bearing lower Siyeh carbonates northwest of the Y_M zone. The main mineralization is in the form of disseminated galena and fracture-filling galena in an extensive shatter-zone above a galena-bearing diabase dyke. Minor veins of galena, chalcopyrite, and sphalerite occur above the main mineralized area. A northwesterly trending fault extends through the zone and may connect with a similar northwesterly trending fault near the Y_M zone. Both faults are partially occupied by diabase dykes. Minor lead mineralization also occurs 1300 feet southeast of the main lead zone alongside the fault mentioned above. This is in the form of disseminated galena within lower Siyeh limestones and mudstones. Assays are as given below:

Location		% Pb	oz. Ag	Thickness	Remarks
main area	1	4.96	0.12	10'	carbonate
	2	57.35	2.35	4'	carbonate, adjacent to (1)
	2a	52.20	5.25	4'	carbonate, repeat of (2)
	3	3.38	0.24	5'	carbonate, adjacent to (2)
veins	4	0.62	N.D.	1'	0.48% Cu, 100' above (1)
	5	0.14	N.D.	1'	0.07% Cu, 200' above (1)
SE of main Pb	6	0.14	0.06	?'	0.24% Zn, 1200' SE of (1)



Legend

- stream
- intermittent stream
- fault
- Flysch formation
- Crowsell formation
- Apperhoof formation
- diabase intrusive
- formation contact
- strike=137°, dip=52°
- assay, 0.192oz, 0.24oz. Ag across 6' of sediment (limestone, prospect samples, other elements assayed as noted)
- bore (imaging)
- school drive road

KINTLA EXPLORATIONS LTD.
GEOLOGIC MAP
KB3

BIGHORN CLAIMS
SPIONKOP CREEK
ALBERTA

1" = 4/5'	SEPTEMBER, 1972	R. J. GOBLE M.Sc.

19720007

OTHER YARROW ASSAYS

An additional five samples were sent in for assay from the Yarrow Creek map area. Three of these consisted of assays taken on small quartzite beds outcropping within the upper Grinnell formation. An additional sample was taken on a small diabase dyke outcropping to the northeast of the Y_M zone. The final sample is from a small quartzite bed in contact with this dyke. The assays are as follows:

Location		% Cu	oz. Ag	Thickness	Remarks
200' S of Y_M zone	1	0.84	N.D.	2'	quartzite
	1a	1.76	0.48	1'	repeat of (1)
500' N of Y_G zone	2	0.49	0.26	1'	quartzite
2400' NE of Y_M zone	3	0.95	0.30	0.3'	quartzite
	4	0.85	0.21	5'	intrusive, contacts (3)

SPIONKOP CREEK

Eighteen samples of intrusives and four samples of sediments were assayed from the Spionkop Creek map area. These samples can be grouped according to location into the S_I zone (SPIONKOP-INTRUSIVE ZONE), the S_H zone (SPIONKOP-HANGING VALLEY ZONE), the S_Y zone (SPIONKOP-YS BED ZONE), and the S_C zone (SPIONKOP-CREEK ZONE). These zones are shown on map KB3.

GEOLOGY

The stratigraphic succession in the Spionkop Creek map area is, as in the Yarrow Creek map area, Appekunny formation, Grinnell formation, Siyeh formation, upwards. The sediments are similar, although in the S_H zone there is a noteable scarcity of mud cracks within the Grinnell sediments as compared to the Grinnell sediments in the Yarrow Creek area.

The sediments strike approximately N140°E (124°-152°) and dip at approximately 25°SW (15°-35°). The large diabase sill found near the top of the Appekunny formation in the Yarrow Creek map area is again present in the southeast and northwest sectors of the map area. In the S_I zone, however, the sill transgresses up through the Grinnell formation as a dyke, splits, and outcrops

within the upper Grinnell as six cupriferous diabase dykes. One or more of these outcrops may represent faulted segments of the same dyke but there is evidence for at least 3 separate cupriferous dykes. Other minor Cu-bearing sills and dykes outcrop in this same area.

The sediments in the Spionkop Creek map area are cut by numerous reverse faults striking from N10°W to N90°W and dipping from 70° to 90°SW. A few reverse faults and thrust faults striking approximately N45°E are also present. As in the Yarrow Creek map area some faults cut the diabase sills and dykes while others are occupied by the dykes. The dominant fault is a high angle reverse fault striking approximately N90°W and dipping approximately 85°S with a displacement of approximately 300 feet. This fault cuts the Appekunny and lower Grinnell in the S_H zone and is believed to pass through the west end of the S_I zone. There is evidence that splays from this fault may be occupied by the dykes of the S_I zone.

Sections 5, 6 show the geologic cross sections on lines IJ, KL, respectively (see map KB3).

S_I ZONE

The S_I zone includes argillites of the lower Grinnell formation, quartzites and argillites of the upper Grinnell formation, and associated quartz-diabase intrusives. Minor mineralization is encountered in the form of disseminated covellite, anilite, bornite, and chalcopyrite in the quartzites of the upper Grinnell. The dominant mineralization is in the form of covellite and anilite disseminated throughout the chilled margins of the diabase sills and dykes where these intrude the upper Grinnell.

The diabase dykes are believed to occupy the fault planes of S-dipping reverse faults splayed from a large reverse fault cutting the northern part of the zone. At least three and possibly six or more such dykes are present, outcropping over distances from ten to more than one thousand feet. Grades and thicknesses vary from 6.40% Cu over 2 feet to 1.88% Cu over 7 feet and 2.32% Cu over 12 feet in the more heavily mineralized sections and drop

to 0.32% Cu over 5 feet and 0.62% Cu over an undetermined width to the north and south of the main intrusive zone.

Assays are as follows:

Location		% Cu	oz. Ag	Thickness	Remarks
north	1	0.32	N.D.	5'	separate dyke
	2	2.48	0.12	8'	separate dyke
	3	0.90	0.12	8'	separate dyke
	4	1.60	0.07	5'	separate dyke
south	5	4.80	0.66	5'	separate dyke
north	6	2.36	0.10	9'	main dyke
	7	2.68	0.22	4'	included in (6)
	8	1.88	N.D.	7'	main dyke, 175' S of (6)
	9	2.44	N.D.	6'	main dyke, 125' S of (8)
	10	6.40	N.D.	2'	included in (9)
	11	2.32	0.10	12'	main dyke, 110' S of (9)
	12	2.52	0.02	7'	main dyke, 25' S of (11)
south	13	0.62	N.D.	?'	main dyke, 600' S of (12)

S_H ZONE

The S_H zone consists of a 20-100 foot thick diabase sill intruded into the sediments near the top of the Appekunny formation. This sill occupies the same position stratigraphically as does the diabase sill in the Yarrow Creek map area. Mineralization is in the form of chalcopyrite, chalcocite and bornite disseminated throughout the chilled margins of the sill and throughout the black argillites in contact with the sill. Samples taken for analysis are as follows:

Location		% Cu	oz. Ag	Thickness	Remarks
east	1	0.56	0.10	18'	sill
	2	0.63	0.28	3'	sill, 175' W of (1)
	3	0.62	0.17	13'	sill, 125' W of (2)
west	4	0.30	0.10	4'	argillite, contacts (3)

S_Y ZONE

The S_Y zone is adjacent to the S_I zone and includes quartzites and argillites of the upper Grinnell formation. The dominant mineralization is in the form of disseminations and pods of anilite, chalcocite, covellite and bornite throughout a 7-8 foot thick quartzite bed near the top of the Grinnell. This is believed to be the 'YS' bed from the Yarrow Creek map area. Samples are as follows:

KINTLA EXPLORATIONS LTD.
GEOLOGIC MAP
KB2

BIGHORN CLAIMS
BLIND CANYON
ALBERTA

1" = 440'

SEPTEMBER, 1972

LE M.Sc.

B1 ZONE

B2 ZONE

B3 ZONE

B4 ZONE

T1

T2

T3

T4

T5

Legend

Location		% Cu	oz. Ag	Thickness	Remarks
north	1	0.86	0.12	8'	quartzite
	2	0.98	0.21	8'	quartzite, 75' S of (1)
south	3	1.78	0.24	7'	quartzite, 600' S of (2)

S_C ZONE

One sample was taken from the diabase sill near the top of the Appekunny formation where it crosses Spionkop Creek. This sill occupies the same stratigraphic position as the sill in the Yarrow Creek map area and the sill in the S_H zone. An additional sample was taken from a small diabase sill located immediately below the main sill. The results are as follows:

Location		% Cu	oz. Ag	Thickness	Remarks
Spionkop Creek	1	0.62	0.15	4'	north of creek
	2	0.76	0.15	8'	below (1)

BLIND CANYON

Three samples from intrusives and seven from quartzites were taken from the Blind Canyon map area. These can be grouped into the B_Y zone (BLIND CANYON-YS BED ZONE), the B_F zone (BLIND CANYON-FAULT ZONE), and the B_I zone (BLIND CANYON-INTRUSIVE ZONE) as shown on map KB2.

GEOLOGY

The geology of the Blind Canyon map area is similar to that of the Yarrow and Spionkop Creek map areas. The formations of interest are once again the Appekunny, Grinnell and Siyeh formations with diabase sills and dykes intrusive into the sediments of these formations. The main diabase sill near the top of the Appekunny formation extends throughout most of the area but is absent in some portions of it. Reverse and thrust faults continuous with or similar to those found in the Yarrow Creek and Spionkop Creek map areas are found in the Blind Canyon map area.

B_Y ZONE

The YS quartzite bed encountered in the Yarrow and Spionkop Creek map areas is again mineralized in portions of the Blind Canyon. Mineralization within the YS bed in the B_Y zone is in the form of disseminated covellite, anilite, and bornite with

some concentration of bornite and covellite in argillite pebbles within the quartzite. Mineralization may be continuous to the Y_M zone. Samples are as follows:

Location		% Cu	oz. Ag	Thickness	Remarks
Kooy zone	1	0.68	0.15	4'	quartzite
	2	1.00	0.32	7'	quartzite
	3	3.38	1.20	7'	quartzite
	4	1.72	0.64	4'	quartzite
W of Kooy zone	5	0.28	N.D.	8'	quartzite, 1200' W of (1)

B_F ZONE

Additional mineralized upper Grinnell quartzites occur in the highly faulted B_F zone. The intense faulting makes correlation difficult but it is believed that these beds are higher in the stratigraphic section than the YS bed. Results are as follows:

Location		% Cu	oz. Ag	Thickness	Remarks
south	1	1.03	0.15	7'	quartzite
north	2	0.52	0.12	8'	quartzite, 100' N of (1)

B_I ZONE

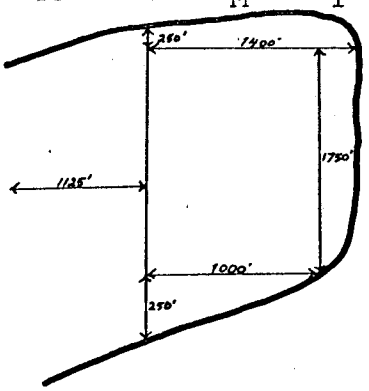
Two samples were taken from small diabase sills intrusive into the upper Grinnell in the Blind Canyon. An additional sample was taken from the main sill near the top of the Appekunny formation. Mineralization is in the form of disseminated chalcopyrite or bornite and covellite within the chilled margins of the intrusives. Results are as follows:

Location		% Cu	oz. Ag	Thickness	Remarks
south wall	1	0.65	0.24	4'	sill
	2	0.42	0.02	5'	sill
main sill	3	0.17	N.D.	20'	sill

INTERPRETATION AND CONCLUSIONS

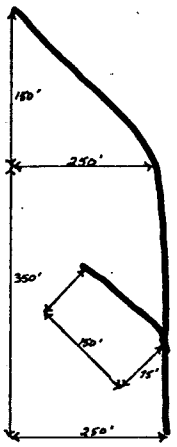
While for the most part results are too scant for more than tentative guesswork as to grade and tonnage estimates, possible orebodies may be outlined for further work. These targets for future exploration may again be grouped according to location and host-rock type.

1. YS bed - Y_M & B_Y zones



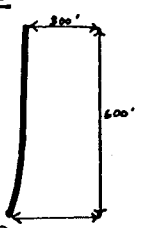
possible tonnage (assume continuous 'ore' from Y_M zone to B_Y zone, along probable outcrop and ½ distance between samples downdip; thickness ≃ 8')
≃ (1000x1750 + 400x1750/2 + 250x1400 + 250x1000/2 + 2250x1125)x8/12
≃3.4×10^6 tons.
grade ≃ 1.0 - 1.4% Cu, 0.4 - 0.5 oz. Ag.

2. Y_I zone



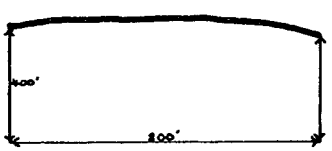
a) sill
possible tonnage (average thickness ≃ 9')
≃ (350x250 + 250x150/2)x9/12
≃ 80,000 tons.
grade ≃ 1.0% Cu, ⁄0.1 oz. Ag.
b) dyke
possible tonnage (average thickness ≃ 9')
≃ (150x75)x9/12
≃ 8,000 tons.
grade ≃ 1.0% Cu, ⁄0.1 oz. Ag.
c) combined tonnage ≃ 88,000 tons
grade ≃ 1.0% Cu, ⁄0.1 oz. Ag.

3. S_H zone



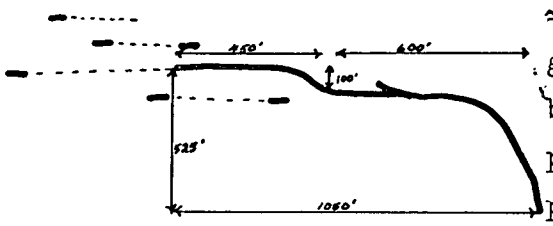
possible tonnage (average thickness ≃ 15')
≃ (600x300)x15/12
≃ 225,000 tons.
grade ≃ 0.6% Cu, 0.2 oz. Ag.

4. S_Y zone



possible tonnage (average thickness ≃ 8')
≃ (800x400)x8/12
≃315,000 tons.
grade ≃ 1.0% Cu, 0.2 oz. Ag.

5. S_I zone



a) main dyke

possible tonnage (average thickness ≃ 8')
≃ (450x525 + 600x425)x8/12
≃ 325,000 tons.
grade ≃ 2.0% Cu, ∠0.1 oz. Ag.

b) adjacent dykes

possible tonnage (based upon interpretation as being a set of 4 parallel dykes, see sketch)
≃ 400x200x5/12 + 400x200x7/12 + 400x200x8/12
≃ 135,000 tons.
grade ≃ 2.0% Cu, ∠0.1 oz. Ag.

c) combined tonnage ≃ 460,000 tons.
grade ≃ 2.0% Cu, ∠0.1 oz. Ag.

NOTE: This estimate based upon outcrops. If adjacent dykes are as extensive as main dyke and there are actually 4 dykes there would be up to 1,250,000 tons of 2.0% Cu ore.

Other areas of interest for which data are insufficient for even tentative tonnage estimates are:

1. Y_M zone - lower beds
   average grade across 13' ≃ 1.25% Cu, 0.48 oz. Ag.
2. Y_P zone
   average grade (sampled sections) of pit ≃ 1.10% Cu, 0.45 oz. Ag.
   mineralized thickness known from drilling to be 730'.
3. Y_L zone
   grade across one 19' section ≃ 15% Pb, 0.5 oz. Ag.
4. Y_G zone
   average grade across 60' ≃ 0.17% Cu, ∠0.1 oz. Ag.

It is apparent from the results of the spring program that there are three basic types of mineralization on the Bighorn claims. The first of these is the stratabound copper mineralization in the quartzites of the upper Grinnell and Appekunny formations. The second is the copper found within the chilled margins of the diabases intrusive into the Grinnell formation.

The third is the lead found as fracture fillings in shattered limestones and disseminated in the limestones of the Siyeh formation.

There is a possibility that a major orebody (≃3,500,000 tons of 1.0 - 1.4% Cu) is present in the YS quartzite bed in the Yarrow Creek map area. A similar but smaller orebody (preliminary indications are ≃300,000 tons of 1.0% Cu) may be present in the YS quartzite bed in the Spionkop Creek map area. There is a good chance that these 'orebodies' may be extended beyond the limits presently placed upon them.

A small high grade orebody (≃500,000 tons of 72% Cu) is indicated by the results from the S_I zone with a strong possibility of a much larger tonnage being present in this area. An additional 100,000 tons of ore grading 1% Cu may be present in the sill and dyke exposed in the Y_I zone on Yarrow Creek. The S_H zone with its 250,000 tons of 0.6% Cu should also be considered because of the possibility of raising both the tonnage and the grade.

The assays taken to date represent only the surface showings. A strong possibility exists that an increase in grade will take place as unweathered rock is sampled. This has been found to be the case at a similar prospect at Bear Creek in northwestern Montana. Also, it should be noted that all of the samples from the spring program on the Bighorn claims were sent to Alberta Laboratory Services Ltd. for analysis. Several of the initial assays were suspected of being incorrect and the beds in question were resampled in the same manner at the same place. The results (see page 6) showed changes by up to a factor of 4 for Cu and up to a factor of 10 for Ag. It is therefore felt that many of the assays listed may be too low (or high), and in any case, must be suspect until confirmed.

RECOMMENDATIONS

The following recommendations are made on the basis of the author's examination of the Bighorn claims during the Spring Program, 1972.

1) No further samples be sent to Alberta Laboratory Services Ltd. because of the unreliability of their results.
2) Resample areas of interest as outlined below to remove doubt regarding grades.
3) Either convert claims to quarter-sections or locate the claims accurately on the maps, relinquishing those claims not located on mineralized or potentially mineralized areas.
4) Sample the YS bed in Y_M and B_Y zones at a set interval (50') to establish an average grade.
5) Sample the sills and dykes in the Y_I zone at a set interval (50') to establish an average grade.
6) Sample the dykes in the S_I zone at a set interval (50') to establish an average grade.
7) Sample the YS bed in the S_Y zone at a set interval (50') to establish an average grade.
8) Resample all beds or intrusives other than those above that may be of economic interest to check the original assays.
9) Map the Y_M zone in detail (1" = 25').
10) Map the S_I zone in detail (1" = 25').
11) Map the Y_L zone in detail (1" = 25').
12) Check for the pre-1972 high-Ag assays.
13) Prospect the Siyeh formation for further Pb-Zn occurrences.
14) Trench the probable outcrop of the YS bed between the exposure in the Y_M zone and the exposure in the B_Y zone to check for continuity of mineralization.
15) Drill the copper occurrence in the Y_P zone.
16) Trench and sample the Pb occurrence in the Y_L zone.
17) Drill the Cu occurrence in the Y_G zone if results from other areas indicate that this is warranted.

REFERENCES

GOBLE, E.O. (1972): Spring program, 1972 - Bighorn, Beth, Commerce, Forum, Lin, Opal and Sage claims. Kintla Explorations Ltd. company report.

GOBLE, R.J. (1970): The Yarrow Creek - Spionkop Creek copper deposit, Southwest Alberta. Unpublished M.Sc. thesis, University of Alberta.

.....MORTON, R.D., & FRITZ, P. (1972): Copper sulfide deposits in the Precambrian Lewis Series of S.W. Alberta, Canada. Unpublished research paper, University of Alberta.

.....& SMITH, D.G.W. (1972): Electron microprobe investigation of copper sulfides in the Precambrian Lewis series of S.W. Alberta, Canada. Unpublished research paper, University of Alberta.

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, 399-426.

.....(1967): The tectonic significance of mesoscopic subfabrics in the Southern Rocky Mountains of Alberta and British Columbia. Can. Jour. Earth Sci. 4, 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. Can. Spec. Pub. No. 2, 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.

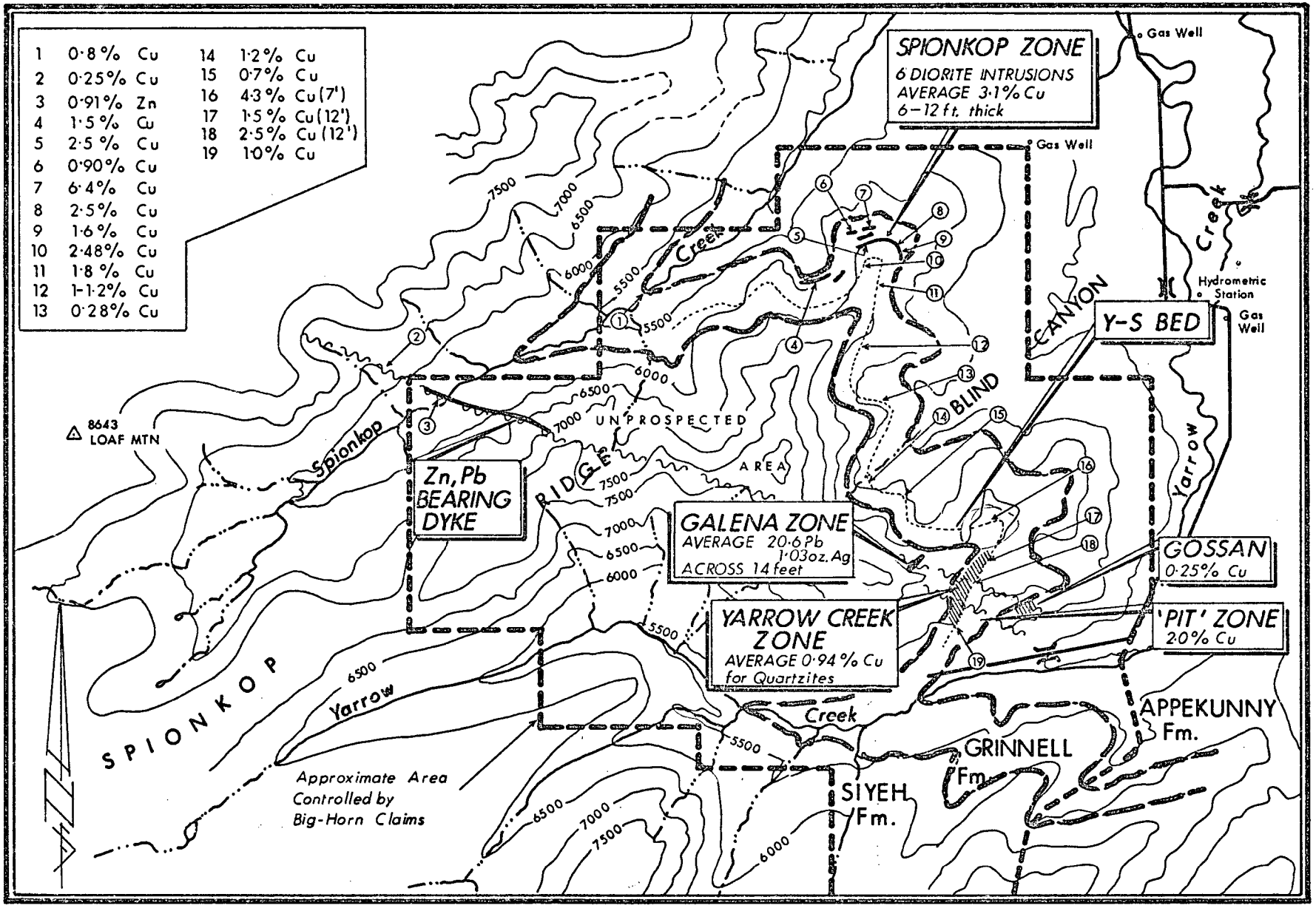
STEVENSON, R.W. (1968): Final report - 1967, Waterton Copper project, Waterton Area, Alberta. Kennco Explorations (Western) Limited report.

GRINNELL TYPE SECTION - YARROW CREEK

Unit #	Thickness	Description
27	5'	massive white quartzite - TOP OF FRINNELL
26	18'	reddish clastic quartzite, minor red argillite
25	12'	dominantly red argillite, minor red clasty quartzite with ripple marks
24	9'	bedded reddish quartzite, bottom 2' limy bed (somewhat rusty) with very well developed load casts; quite massive, ripple marks on top MINERALIZATION DETECTED
23	21'	soft, clasty poorly bedded red quartzite, minor red argillite; topped by 6" of red argillite, quartzite immediately below having good ripple marks MINERALIZATION DETECTED 14' BELOW TOP
22	10'	dominantly red argillite, two thin bands of reddish clasty quartzite
21	14'	poorly bedded soft red clasty quartzite, one 2' band of bedded greenish quartzite in center
20	8½'	mainly red argillite, one 1' band of clasty red quartzite in middle
19	7'	mainly hard greenish-white quartzite top 2' - coarse grained massive 'cap' showing large irregular flute casts and good cross bedding, much darker than 3' directly below next 3' - very massive hard green quartzite weathering reddish on bottom half, some cross bedding next 1' - less massive dirtier quartzite with some cross-bedding, few pebbles bottom 1' - soft thin bedded quartzite containing green argillite pebbles, coarse grained MINERALIZATION DETECTED
18	30'	poorly bedded clasty red quartzite, bottom 1½' cross bedded hard white quartzite, one band of hard white quartzite 1' thick in middle
17	3'	mainly red argillite with two thin quartzite beds in middle
16	7'	top 5' - massive hard greenish quartzite, weathers reddish; some green pebbles middle 1' - red argillite bottom 1' - massive dirty clasty reddish quartzite
15	23'	mainly red argillite with minor clasty red quartzite; 2' band of massive greenish quartzite 10' from base

Unit #	Thickness	Description
14	8'	three bands of hard white quartzite separated by distinct bands of red argillite top 1¼' - top of band hard massive white quartzite with some green pebbles, bottom of band reddish clasty quartzite with good cross bedding; good ripple marks on top of band next 3' - red argillite middle 1' - hard white quartzite with green argillite pebbles, weathers reddish next 1¼' - red argillite bottom 1½' - hard white quartzite
13	45'	red clasty quartzite, red argillite; resistant bands of quartzite up to 1' thick occur at 20' from base MINERALIZATION DETECTED 20' FROM BASE
12	7½'	massive greenish and reddish quartzite, weathered colour light red; minor black-red argillite pebbles near base, greenish quartzite tends to be in middle; minor interbedded discontinuous red argillite bands
11	7'	mainly red argillite, band of 1½' of quartzite through center, band consists of two beds of greenish quartzite topped by one bed of clasty red quartzite with very well developed ripple marks
10	5½'	top 3½' - massive reddish quartzite with minor pebbles, top 1' cleaner and harder with good ripple marks middle ½' - red argillite bottom 1½' - massive greenish quartzite with irregular ripple marks, some green argillite pebbles
9	15'	reddish clasty quartzite and red argillite, no definite beds
8	5'	massive greenish white quartzite; top 2' dark reddish clasty quartzite with cross bedding; next 2½' massive greenish white quartzite with very good cross bedding; bottom 6" heavily weathered greenish white quartzite with green argillite pebbles and poorly developed ripple marks MINERALIZATION DETECTED
7	5½'	mainly red argillite, minor bands of red quartzite
6	7'	three beds of white quartzite separated by 1'-2' of red argillite top 2' - clasty reddish quartzite with red argillite pebbles next 1½' - red argillite middle 1½' - top 3"-5" hard reddish quartzite with irregular ripple marks and flute casts, middle 6" hard reddish quartzite with good ripple marks, bottom 4"-8" clasty reddish quartzite with red and green argillite pebbles

Unit #	Thickness	Description
		next 1¼' - red argillite bottom 3/4' - hard swell sorted white quartzite with green argillite pebbles near bottom; ripple marks
5	26½'	mainly red argillite with irregular bands of soft clasty red quartzite; eight definite bands of reddish quartzite up to 8" thick, quartzite beds better developed near base
4	1½'	reddish clasty quartzite, ripple marks
3	7'	mainly red argillite, two 2"-3" beds of reddish quartzite
2	10'	fine grained very well sorted hard reddish white quartzite; top 8' massive reddish white quartzite, next 1' red argillite, bottom 1' clasty red quartzite tipped with moderately sorted ripple marked red quartzite
1	250'-280' ?	LOWER GRINNELL mainly red argillite, minor greenish argillite, and reddish quartzite



SCALE 0 1 2 MILES

E. Goble July, 1972.

KINTLA EXPLORATIONS LTD

ZONES OF MINERALIZATION

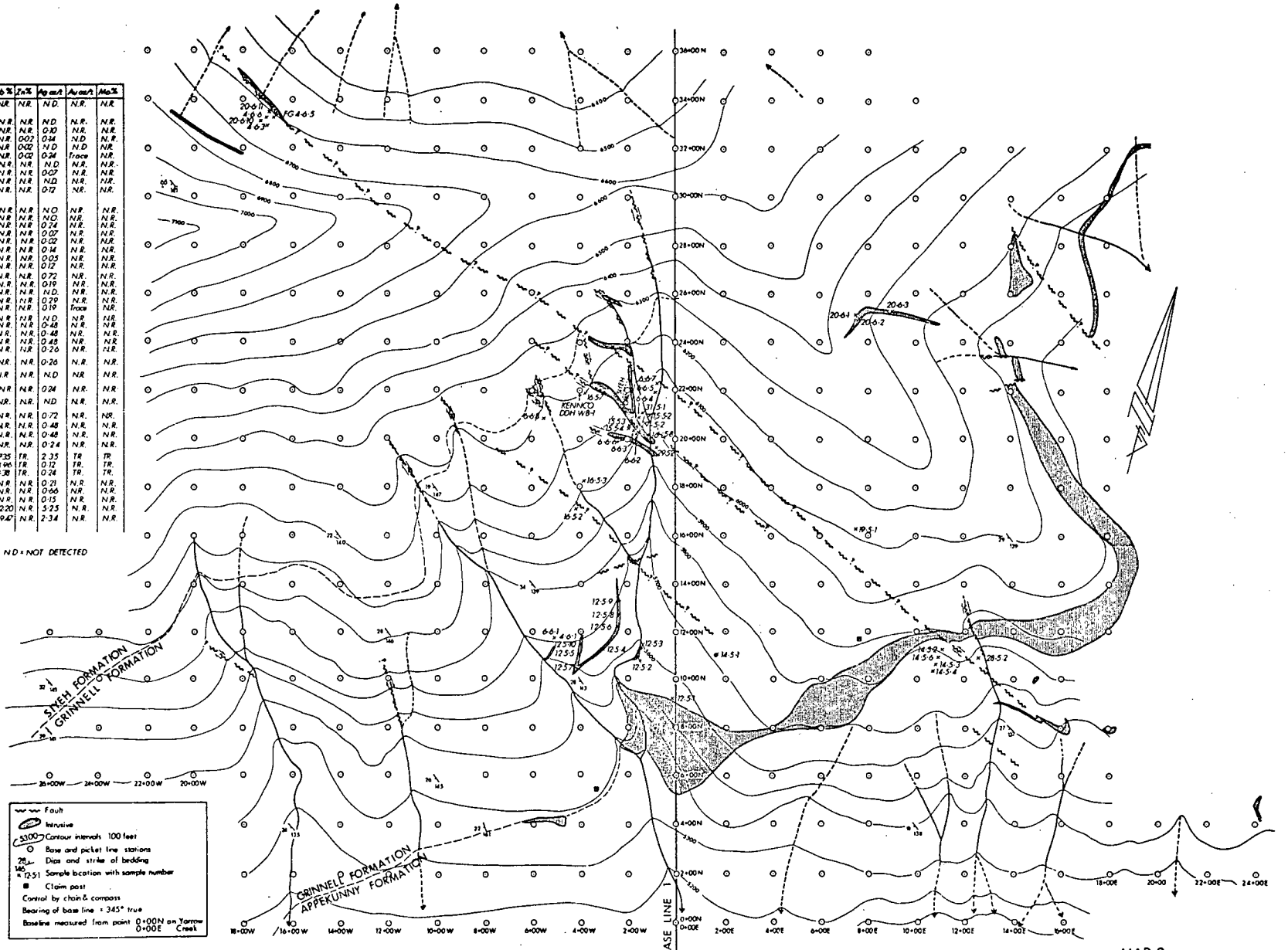
BIG-HORN CLAIMS

Map 1.

19720007

Sample	Thick.	Cu %	Pb %	Zn %	Ag oz/t	Au oz/t	Mo %
4-6-1	9'	1.26	N.R.	N.R.	N.D.	N.R.	N.R.
12-5-2	10'	0.38	N.R.	N.R.	N.D.	N.R.	N.R.
12-5-3	5'	0.07	N.R.	N.R.	0.10	N.R.	N.R.
12-5-4	12'	1.30	N.R.	0.02	0.34	N.D.	N.R.
12-5-5	7'	0.42	N.R.	0.02	N.D.	N.D.	N.R.
12-5-6	7'	3.26	N.R.	0.02	0.24	Trace	N.R.
12-5-7	12'	0.97	N.R.	N.R.	N.D.	N.R.	N.R.
12-5-8	12'	0.52	N.R.	N.R.	0.07	N.R.	N.R.
12-5-9	7'	0.69	N.R.	N.R.	N.D.	N.R.	N.R.
12-5-10	10'	0.94	N.R.	N.R.	0.17	N.R.	N.R.
M-5-2		0.15	N.R.	N.R.	N.D.	N.R.	N.R.
M-5-2 #2	60'	0.13	N.R.	N.R.	N.D.	N.R.	N.R.
M-5-2 #4		0.11	N.R.	N.R.	0.24	N.R.	N.R.
M-5-2 #3		0.29	N.R.	N.R.	0.07	N.R.	N.R.
M-5-2 #5		0.21	N.R.	N.R.	0.02	N.R.	N.R.
		0.32	N.R.	N.R.	0.14	N.R.	N.R.
M-5-2 #6		0.26	N.R.	N.R.	0.05	N.R.	N.R.
M-5-3	10'	0.39	N.R.	N.R.	0.12	N.R.	N.R.
6-6-5	7'	1.20	N.R.	N.R.	0.72	N.R.	N.R.
14-5-1	8'	1.04	N.R.	N.R.	0.19	N.R.	N.R.
13-5-2	8'	0.84	N.R.	N.R.	N.D.	N.R.	N.R.
15-5-3	6'	1.08	N.R.	N.R.	0.29	N.R.	N.R.
13-5-4	4'	0.89	N.R.	N.R.	0.19	Trace	N.R.
16-5-3	7'	0.25	N.R.	N.R.	N.D.	N.R.	N.R.
6-6-6	10'	0.51	N.R.	N.R.	0.48	N.R.	N.R.
6-6-7	6'	0.32	N.R.	N.R.	0.48	N.R.	N.R.
6-6-8	12'	1.76	N.R.	N.R.	0.48	N.R.	N.R.
10-5-7	9'	0.45	N.R.	N.R.	0.26	N.R.	N.R.
19-5-1	12'	0.49	N.R.	N.R.	0.26	N.R.	N.R.
28-5-2	16'	0.11	N.R.	N.R.	N.D.	N.R.	N.R.
29-5-2	9'	1.39	N.R.	N.R.	0.24	N.R.	N.R.
31-5-1	20'	0.54	N.R.	N.R.	N.D.	N.R.	N.R.
6-6-1	10'	0.86	N.R.	N.R.	0.72	N.R.	N.R.
6-6-2	7'	1.84	N.R.	N.R.	0.48	N.R.	N.R.
6-6-3	6'	0.65	N.R.	N.R.	0.48	N.R.	N.R.
6-6-4	10'	0.82	N.R.	N.R.	0.24	N.R.	N.R.
4-6-6	4'	0.07	5735	TR.	2.35	TR	TR
4-6-5	10'	0.05	4.9%	TR	0.12	TR.	TR.
4-6-3	5'	0.02	3.3%	TR.	0.24	TR.	TR.
20-6-1	1'	0.98	N.R.	N.R.	0.21	N.R.	N.R.
20-6-2	5'	4.80	N.R.	N.R.	0.66	N.R.	N.R.
20-6-3	5'	1.03	N.R.	N.R.	0.15	N.R.	N.R.
20-6-10	4'	N.R.	52.2%	N.R.	5.25	N.R.	N.R.
20-6-11	4'	N.R.	69.4%	N.R.	2.34	N.R.	N.R.

N.R. = NOT REQUIRED , N.D. = NOT DETECTED
TR = TRACE



● SHELL WATERTON NO.

MAP 2.

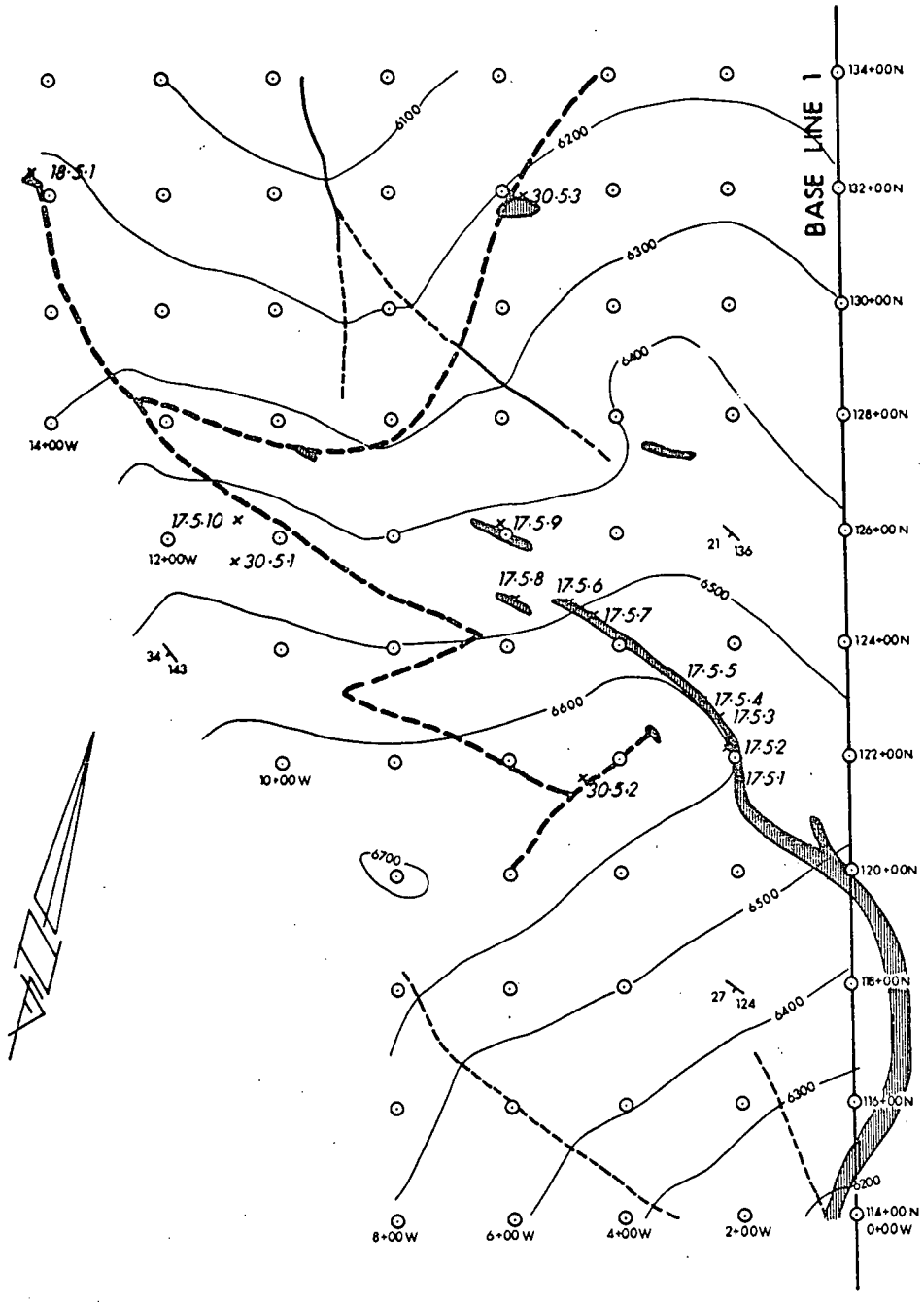
KINTLA EXPLORATIONS LTD.

SAMPLE LOCATION MAP
ZONE 1
Big Horn - Claims — Yarrow Creek Area
SW.-Alberta

SCALE 0 200 400 FEET

R.Gubbs June 1972

19720007



Sample	Thick.	Cu %	Zn %	Au oz/t	Ag oz/t.
17-5-1	7'	2·52	N.R.	N.R.	0·02
17-5-2	30'	2·32	N.R.	N.R.	0·10
17-5-3	2'	6·48	N.R.	N.R.	N.D.
17-5-4	6'	2·44	N.R.	N.R.	N.D.
17-5-5	7'	1·88	N.R.	N.R.	N.D.
17-5-6	4'	2·68	N.R.	N.R.	0·22
17-5-7	9'	2·36	N.R.	N.R.	0·10
17-5-8	5'	1·60	N.R.	N.R.	0·07
17-5-9	8'	0·90	N.R.	N.R.	0·12
17-5-10	8'	2·48	N.R.	N.R.	0·12
18-5-1	5'	0·32	N.R.	N.R.	N.D
30-5-1	8'	0·86	N.R.	N.R.	0·12
30-5-2	7'	1·78	N.R.	N.R.	0·24
30-5-3	10'	0·62	N.R.	N.R.	N.D.

N.R. = NOT REQUIRED
N.D. = NOT DETECTED

Intrusive
6400 Contour intervals 100 ft.
Base and picket line stations
21 Dips and strike of bedding
136
17-5-8 Sample location with sample number
4 wheel drive road
Control by chain & compass
Bearing of base line = 345° true
Base line measured from point 0+00N on Yarrow
0+00E Creek

MAP 3.

KINTLA EXPLORATIONS LTD.

SAMPLE LOCATION MAP

ZONE 2

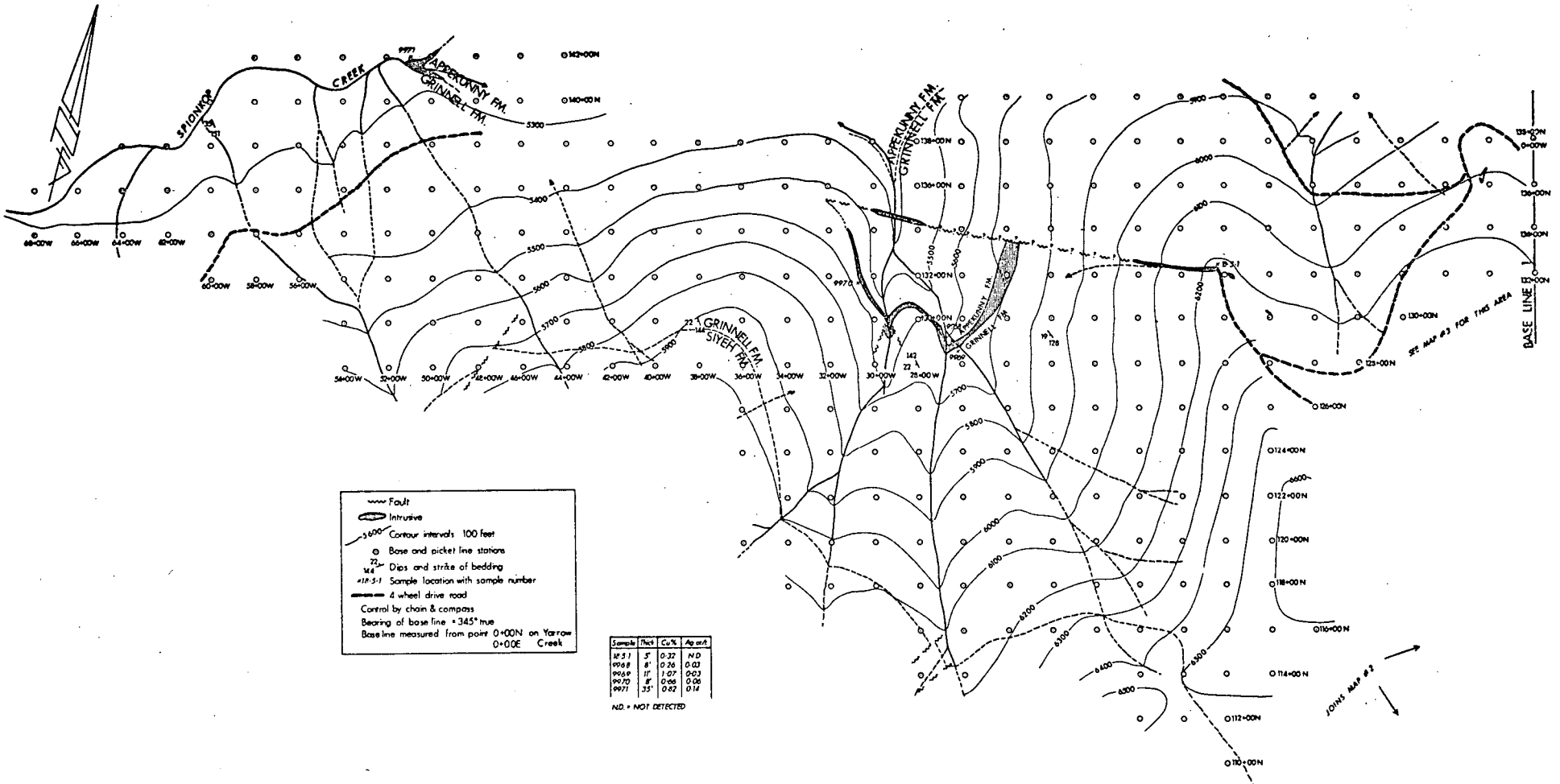
Big Horn - Claims — Spionkop Ridge Area

SW.-Alberta

0 200 400
SCALE FEET

R. Goble — June 1972

19720007



MAP 4.

KINTLA EXPLORATIONS LTD.

SAMPLE LOCATION MAP

ZONE 2

Big Horn-Claims — Spionkop Creek Area

SW.-Alberta

SCALE 0 200 400 FEET

R. Goble - July, 1972

19720007