BILLITON CANADA LIMITED

ASSESSMENT REPORT

GEOLOGICAL SURVEYS

JOUMBIRA CLAIMS 41 TO 56

AUGUST/SEPTEMBER 1981

105-M-13

63°51'N 135°50'W

091053

Vancouver, B.C.
3 May, 1982

Brian Paul
Daniel Rota

This report has been examined by the Geological Evaluation Unit under Section 53 (4) Yukon Quartz Mining Act and is allowed as representation work in the amount of $ 6,400—

for Regional Manager, Exploration and Geological Service for Commissioner of Yukon Territory.

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INTRODUCTION

The JOUMBIRA claim group is located in the Mayo Mining District, central Yukon, some 18 kilometres southwest of the town of Elsa. It consists of 56 claims, covering an area of 1.17 square kilometres on the southeastern slopes of Mt. Haldane (Plate 1). The claims are owned in their entirety by CCH Minerals Ltd. of Toronto, Ontario.

During August and September of 1981, much of the JOUMBIRA group was remapped at 1:5000 scale and detailed geochemical surveys carried out over several target areas on the property. From a total expenditure of $22,669.00, a sum of $6400.00 has been claimed for assessment purposes on JOUMBIRA claims 41 to 56.

EXPLORATION HISTORY

Prior to 1977, almost all of the exploration activity in the area of Mt. Haldane was directed towards the discovery of Pb-Zn-Ag vein systems similar to those being mined at Keno Hill. Scheelite occurs in a number of localities on Mt. Haldane, and probably was recognized during the early stages of exploration.

During the period 1918 to 1920, the Yukon Silver-Lead Mining Company was active in Bighorn Gulch on a showing probably discovered about fifteen years earlier. Their target consisted of a number of N/S trending, steep westerly dipping breccia veins containing significant amounts of sphalerite and galena. Two hundred and eighty-four metres of underground development were completed, and 27 tons of direct shipping ore (59% Pb, 90 oz/t Ag) were removed before the operation was shut down. The workings were reopened for a brief period during 1964 and 1965 by Silver Titan Mines Ltd. whose operations are still in evidence on Bighorn Creek.

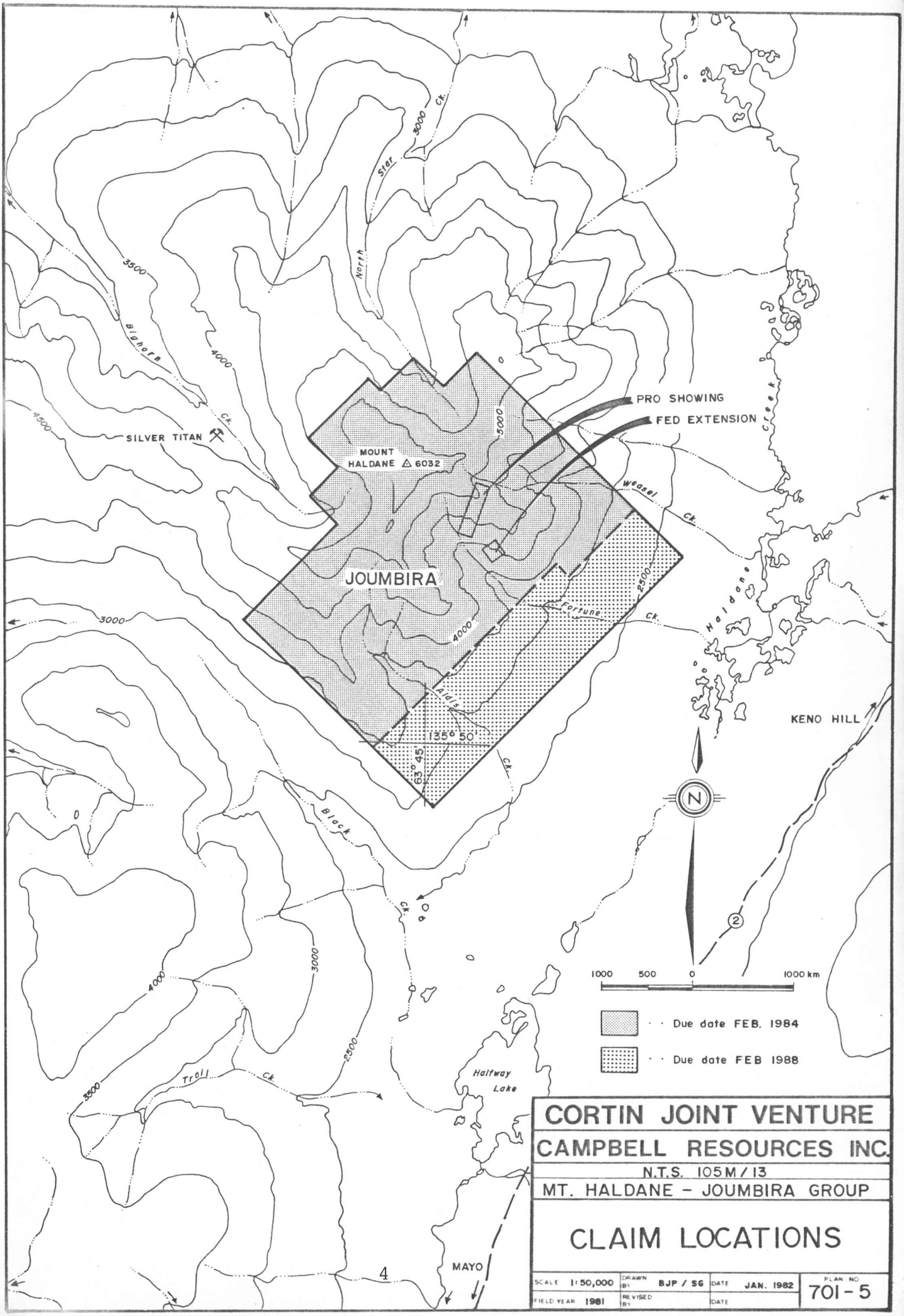
The Geological Survey of Canada completed a stream geochemical and heavy mineral survey in the Keno Hill area in 1964, during which several tin/tungsten/copper/lead/zinc/silver/arsenic/molybdenum highs were identified in Fortune Creek. These anomalies were later followed up by CCH Resources Ltd., who staked the original block of JOUMBIRA claims during 1977.

During 1965, the H group was staked on the northeastern slopes of Mt. Haldane by United Keno Hill Mines Ltd., who conducted an exploration program consisting primarily of soil geochemical surveys. A galena bearing quartz vein assaying as much as 10.8% Pb and 180 oz/t Ag was discovered near the summit of the mountain, but the claims were eventually allowed to lapse.

The Fort George Mining and Exploration Co. Ltd., actively explored a block of 34 claims on the southeastern slopes of the mountain during 1967. A quartz/siderite vein containing small amounts of galena, chalcopyrite and pyrite was discovered and eventually drilled. Much the same area was examined by Canadian Reserve Oil and Gas, who staked the NORTH and STAR groups during 1971. Soil geochemical and geophysical surveys were employed during evaluation of these claim groups.

As mentioned previously, the initial group of 16 claims forming the JOUMBIRA group was staked by CCH Resources Ltd. during 1977. Stream sediment sampling was completed along Aldis, Fortune and Weasel Creeks, and cassiterite was identified from the Pro showing during prospection of the adjacent ridge crests. During 1978, an extensive program of geological mapping, soil geochemical sampling and hand trenching was carried out, and an additional forty claims were added to the claim group. Cassiterite was discovered in a sheeted fracture system at the Fed showing, and additional geochemical targets were outlined. A limited program of soil geochemical sampling and prospecting was carried out in 1979, which resulted in the discovery of a small area of vuggy, scheelite bearing

Plate 1: The southeastern side of Mount Haldane, as seen from Mayo. Aldis Creek and Fortune Creek appear on the left side and in the centre of the mountain, respectively.



CORTIN JOINT VENTURE

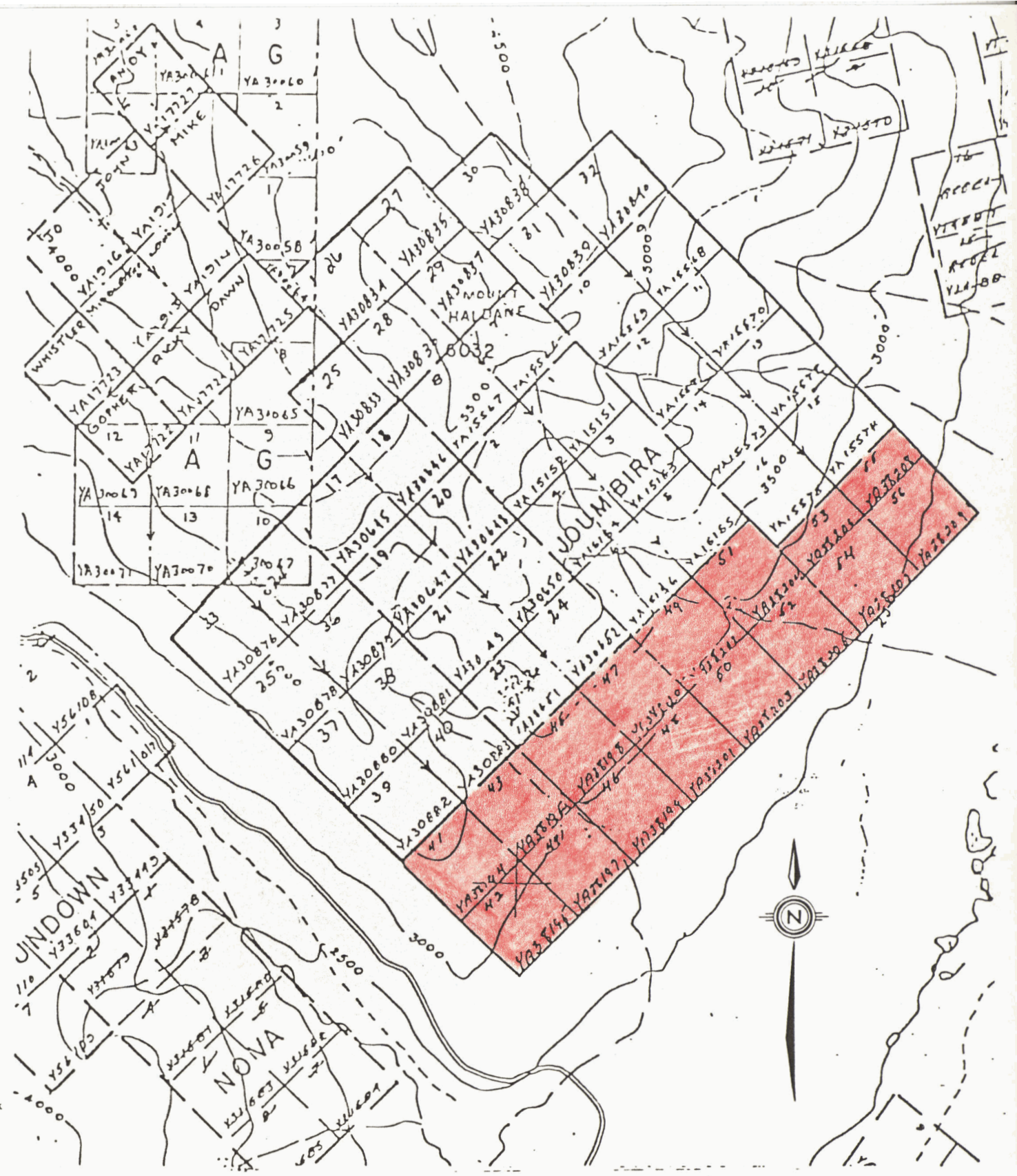
CAMPBELL RESOURCES INC.

N.T.S. 105M/13

MT. HALDANE - JOUMBIRA GROUP

CLAIM LOCATIONS

SCALE 1:50,000	DRAWN BY BJP / SG	DATE JAN. 1982	PLAN NO. 701-5
FIELD YEAR 1981	REVISED BY	DATE	



CLAIM SKETCH MAP

CAMPBELL RESOURCES INC.

JOUMBIRA GROUP
105-M-13

SCALE ½ mile = 1 in.

quartz veins above Aldis Creek. No ground work was attempted during 1980, but the area was reflown in order to produce an accurate orthophoto map of the property. During the 1981 field season, much of the property was remapped at 1:5000 scale, utilizing the new orthophotographic base. Detailed soil geochemical surveys were completed in the vicinity of the Pro showing, and on the southeastern portion of the Fed showing in the Fortune Creek basin. Only the geological surveys are described in the balance of the present report.

GEOLOGY

A summary of the geology shown on Map 701-8 is provided in the following few pages. These maps are largely self-explanatory and contain much information not discussed in the body of the report. The JOUMBIRA group was first mapped in the summer of 1978 and the geology discussed in an assessment report covering the surveys of that year. The lack of detail on, and somewhat misleading nature of the initial geological map (TY-7) prompted the repetitive mapping during 1981.
The present survey data was plotted on a 1:5000 orthophoto map (ten metre contour interval) utilizing a photographic base for topographic control.

BEDDED ROCKS

The JOUMBIRA claims are underlain almost entirely by rocks of Unit 18, the Keno Hill Quartzite. Rocks comprising Unit 17, the Lower Schist, and Unit 3, the Upper Schist, are exposed only outside the property limits. These units have been numbered to correspond with mapping done by the Geological Survey of Canada (Green, 1972).

Upper Schist (Unit 3)

Rocks of this unit are exposed on the ridge crest southwest of Bighorn Creek where they are in fault contact with the Keno Hill Quartzite. Where observed,

they consist of lightly rusted quartz-mica schists with alternating quartz and sericite-rich laminae. Mapped as the Upper Schist in the Keno Hill area, these rocks are correlative with the "Grit" Division meta-sediments which underlie most of the Mayo-McQuesten area. A Precambrian and/or Cambrian age is assumed for both units.

Lower Schist (Unit 17)

The rocks of Unit 17 are well exposed in the creek beds north of the property but were not observed during the course of the present survey. Jurassic in age, they are comprised of interbedded black graphitic shale and phyllite, and dark grey to grey thin-bedded phyllitic quartzite and siltstone. The contact between the Lower Schist and Keno Hill Quartzite occurs towards the base of Mt. Haldane and has potential as a "trap" structure for tin mineralization beneath the Fortune Creek basin.

Keno Hill Quartzite (Unit 18)

Rocks of this unit underlie nearly all of the map area. They occur as dark grey to bluish-grey quartzites in beds several feet to ten feet in thickness, separated by thinner bedded quartzites, slate and phyllite. The thinly bedded rocks occur both as thin partings between the beds of massive quartzite and as wider bands of indeterminate thickness (Plate 2). The impression was given in earlier reports of a massive quartzite unit many hundreds of metres in thickness, but this is not really the case. Contacts between the quartzite and more phyllitic rocks occur in abundance throughout Unit 18. A Lower Cretaceous age is assumed for rocks belonging to this unit.

INTRUSIVE ROCKS

Intrusive rocks of several varieties are found within the map area. All are assumed to be Cretaceous in age.

"Greenstone" (Unit 20)

Several sills of dioritic to gabbroic composition are found within the rocks of Unit 18. The smallest of these are easily recognizable as sills and the larger bodies, although more irregular, are thought to take the same form. There appear to be no differences between the greenstones on this property and those mapped as Precambrian and/or Cambrian in the Mayo-McQuesten area. In their original state, these rocks are comprised of relatively equal amounts of plagioclase feldspar and clinopyroxene with accessory amounts of hornblende and quartz. Pervasive secondary alteration is widespread with chlorite and actinolite being the most common products. The more highly altered greenstones tend to have a pronounced foliation, parallel to that in the enclosing metasediments.

Biotite Quartz Monzonite (Unit 21a)

The rocks of Unit 21a occur as a small (900 x 400 metre) elongate stock in the Fortune Creek basin, as well as in a number of small dykes peripheral to the main stock. These rocks are thought to be quartz monzonitic in composition and a full chemical analysis of a sample from the marginal phase of the main stock is shown on the following page. Surprising in the light of the known occurrences in this area of scheelite and cassiterite, is the fact that the quartz monzonite does not appear to be particularly differentiated in comparison to other granitoid rocks in the Mayo-McQuesten area (Paul and Rota, 1982). The central area of the main stock is typically porphyritic, the rocks being comprised of large euhedral "blebs" of greyish quartz ($\leq$10mm) set in a fine-grained saccharoidal groundmass of quartz and feldspar. Biotite is abundant in small euhedral plates and pyrite is commonly present as an accessory mineral. The marginal areas of the main stock tend to be fine-grained hypidiomorphic granular, as do the small dykes

Plage 2: Boudinaged quartz vein, paralleling schistosity in phyllitic rocks of Unit 18, the Keno Hill Quartzite.

TABLE 1: CHEMICAL ANALYSIS OF A SAMPLE (H-81-50) FROM THE MAIN GRANITOID BODY IN THE FORTUNE CREEK BASIN, JOUMBIRA CLAIM GROUP.

	wt%		ppm		
SiO_2	70.80	Li	4	K/Rb	324
		Rb	108	Rb/K_2O	26
Al_2O_3	14.60	Cs	5	K/(Cs 100)	70
		Be	6	K/Ba	42
TiO_2	0.15	Sr	192	Ba/Rb	7.6
		Ba	824	Ba/Sr	4.3
Fe_2O_3	1.22			Rb/Sr	0.6
MnO	0.03	Zr	42	Mg/Li	693
		Sn	< 3	Zr/Sn	-
MgO	0.46	W	< 4		
		F	309		
CaO	1.64	B	9		
		Cu	2		
Na_2O	3.30	Zn	190		
		Mo	2		
K_2O	4.21	Y	13		
P_2O_5	< 0.06				
	96.41				

outside the central body.

Age dates of 78 to 122 Ma have been obtained from granitic rocks in the Keno Hill - Galena Hill area (Sinclair et al, 1980), and the quartz monzonites on Mt. Haldane are thought to occur on the lower side of this range. Two dates have been determined on dyke rocks from this area, which were misplaced at the time of writing. The intrusive rocks within the area of Mt. Haldane may be significantly younger than the majority of intrusives within the Mayo-McQuesten area, which appear to have an average age somewhere in the vicinity of 90 Ma.

Aplite Quartz Porphyry (Unit 21b)

Rocks of this unit occur as narrow dykes outside the main intrusive body. They grade from highly altered leucocratic quartz porphyries to slightly more biotite-rich varieties approaching the quartz monzonitic rocks in appearance and composition. The leucocratic varieties are good porphyries, having dark grey, euhedral quartz eyes to several millemetres in diameter enclosed in a fine-grained to aplitic groundmass of quartz and feldspar. Arsenopyrite is a common accessory in these rocks, and most contain above background contents of tin, tungsten and zinc (as delineated from soil geochemistry). Cassiterite and scheelite are found in several places in association with these dykes, and they were trenched in several localities during the 1978 program. The dykes are commonly bordered and shot through with quartz and quartz-muscovite veinlets as illustrated in Plate 3. They appear to be closely related to tin-tungsten mineralization and may represent late differentiates of the main mass of biotite quartz monzonite.

Aplite (Unit 21c)

Rocks of this unit, which are closely allied to porphyritic rocks of Unit 21b, occur as narrow dykes in several localities outside the main intrusive stock. Again, they

Plate 3: An aplite porphyry dyke, crosscut by secondary quartz veinlets; photographed in the talus slopes above Aldis Creek.

may represent late differentiates of the biotite quartz monzonitic rocks. Light grey to mottled brown in colour, the aplitic rocks contain appreciable (1-2%) quantities of arsenopyrite, and consequently weather to an intense orange-brown hue. The dykes are siliceous, non-porphyritic, and appear to contain large amounts of groundmass sericite. As well as elevated arsenic levels, these dykes also appear to carry above background contents of zinc.

STRUCTURE

The metasedimentary rocks belonging to the Keno Hill Quartzite strike E/W and NW/SE with moderate dips to the south and southwest. The dominant planar feature in these rocks is the (S_1) foliation which is more or less parallel to the (S_0) compositional layering. Small scale isoclinal folding is commonly observed within the metasedimentary rocks, the axial planes of the folds being parallel to bedding. The "greenstone" sills appear conformable with the compositional layering in the enclosing metasediments and were probably intruded into these rocks shortly after their deposition. A number of granitic sills and early quartz veins exhibit boudinage structures, indicating a deformational event post-dating the emplacement of these rocks. The intrusive body in the Fortune Creek basin is elongated in a WNW/ESE direction, with the associated dykes being arranged in a radial pattern around the main stock.
The majority of narrow breccia zones, minor faults and joint sets in the area trend NE/SW to N/S, similar to the trend of the Haldane Fault System in Bighorn Gulch. The fault separating rocks of Unit 3 from those of Unit 18 forms part of this system, which is mineralized in the vicinity of the Silver Titan mine.

ALTERATION

The metasedimentary rocks of Unit 18 are of low to

moderate metamorphic rank, and there is no recognizable thermal aureole around the main intrusive stock. The "greenstones" are variably altered to a secondary assemblage of actinolite and chlorite, and chlorite and tourmaline accompany cassiterite mineralization in some instances. The most striking alteration in the vicinity of Mt. Haldane consists of quartz veins and quartz-muscovite veins. The granitic dykes comprising units 21b and 21c and the marginal phases of the main intrusive stock are commonly bordered or shot through with veinlets of both varieties. The veinlets have a variety of orientations, from near vertical to horizontal, and are apparently related to the late stages of intrusive activity. There also appears to be a late set of steeply dipping quartz veins up to several metres in width which is dissociated from the intrusive rocks.

As illustrated in Plates 4 and 5, the quartzites of Unit 18 are commonly disrupted by a barren quartz vein stockwork. Stockworks of this type, which have a tight "welded" appearance, are apparently quite common in all areas underlain by the Keno Hill Quartzite. The veinlets probably represent remobilization of silica during regional metamorphism into bedding planes and crosscutting fractures within the quartzites.

MINERALIZATION

No new mineral occurrences were outlined during the 1981 surveys. Cassiterite occurs in accessory amounts on the margin of a quartz porphyry dyke at the Pro showing and in sheeted fractures with chlorite and tourmaline at the Fed showing. Scheelite occurs in a number of localities associated with the quartz porphyry dykes and also in late vuggy quartz veins in an area above Aldis Creek.

Arsenopyrite, sphalerite and galena have been identified in quartz veins and greisen veins associated with the main intrusive stock. Heavily gossaned argillite horizons occur within the Keno Hill Quartzite which also carry

Plate 4: Barren quartz-vein stockwork cutting massive, dark grey quartzite characteristic of Unit 18, the Keno Hill Quartzite. Note the thin veinlets parallel to bedding as well as the larger crosscutting veins. The quartzites are commonly iron stained, as shown in the photograph.

Plate 5: Another photograph of the quartz-vein stockwork cutting rocks of Unit 18: photograph taken above Aldis Creek, in the vicinity of a W soil anomaly.

small amounts of arsenopyrite and pyrite. Trace amounts of pyrite and chalcopyrite are found in the marginal areas of the larger "greenstone" bodies.

GEOCHEMISTRY

Since their acquisition in 1977, the JOUMBIRA claims have been more than adequately covered with a variety of soil and stream geochemical surveys. Areas of enhanced tin and tungsten in soils, as outlined from the 1978 surveys, have been shown on the enclosed geological maps (701-8a,8b) as they are thought to indicate in-situ mineralization on the property. The most recent soil geochemical surveys were conducted away from JOUMBIRA claims 41 to 56, and will not be discussed in the present report.

RECOMMENDATIONS FOR FUTURE WORK

The initial surface work on the JOUMBIRA claims was completed as of mid-September, 1981. An intrusive system containing significant amounts of tin, tungsten, zinc and arsenic has been outlined in the Fortune and Aldis Creek basins, and veinlet occurrences of cassiterite and scheelite have been identified in a number of localities. The high temperature mineralization centred on the Fortune Creek basin is surrounded by a number of low temperature, base metal vein systems in a classic zonal configuration.

The next stage of exploration would appear to be a diamond drill program. Seven hundred and fifty to nine hundred metres of diamond drilling are recommended in two holes, as outlined on the enclosed geological maps. These holes should indicate any mineralization occurring at depth on the property.

The soil geochemical anomalies and known showings may only be small occurrences related to a late generation of porphyry dykes, or they may represent leakage from

a more substantial mineralizing system at depth. The property remains attractive, and every effort should be made to test it below surface. The contact between the Keno Hill Quartzite and Lower Schist unit is only one of several targets here, the others being endogranitic mineralization and a large, low grade sheeted fracture system.

REFERENCES

Green, L.H. (1972): Geology of Nash Creek, Larsen Creek and Dawson map-areas, Yukon Territory: GSC Memoir 364. 157 pp.

Paul, Brian and Rota, D. (1982): Assessment Report. Geological/Lithogeochemical Studies, Jabberwock Claims 40,42,44,46,47 and 49 to 52, Mayo Mining District, Yukon Territory: 22 pp.

Sinclair, A.J., Tessari, O.J. and Harakal, J.E. (1980): Age of Ag-Pb-Zn mineralization, Keno Hill-Galena Hill area, Yukon Territory: CJES, v.17, pp. 1100-1103.

STATEMENT OF QUALIFICATIONS

The work described in the present report was carried out under the direction of D. Rota of Toronto, Ontario. Mr. Rota, a Project Geologist with Billiton Canada Ltd., was seconded to the Cortin Joint Venture during the 1981 season. He holds a B.Sc. degree in geology from Laurentian University in Sudbury, Ontario and has practiced his profession continuously for a period of twelve years in a variety of geological environments within Canada.
The field work on this project was carried out by Brian Paul, also an employee of Billiton Canada Ltd. Mr. Paul has been associated with the Cortin Joint Venture since May of 1979. He holds a B.Sc. (Hons) degree from the University of Western Ontario and is currently completing the requirements for an M.Sc. degree in Geology from the University of Manitoba. He is a member of the Canadian Institute of Mining and Metallurgy, the Geological Association of Canada and the Mineralogical Association of Canada.

STATEMENT OF EXPENDITURES

114 soils analyzed for Sn-W-Cu-Pb-Zn-Ag and As @ $13.75/sample	$ 1567.50
588 soils analyzed for Sn-W-Cu-Pb-Zn-Ag and As @ $15.00/sample	8820.00
31 Geologist days @ $95.00/day	2945.00
28½ Assistant days @ $45.00/day	1282.50
Food and Supplies: 59½ man days @ $12.00/day	714.00
11 hours Helicopter @ $440.00/hour	4840.00
Drafting and Interpretation	2500.00
	$22,669.00
16 claims, each for four years, or 64 claim years	6,400.00
	$16,269.00

The above work was completed during the period August 4 - September 9, 1981.

Brian Paul

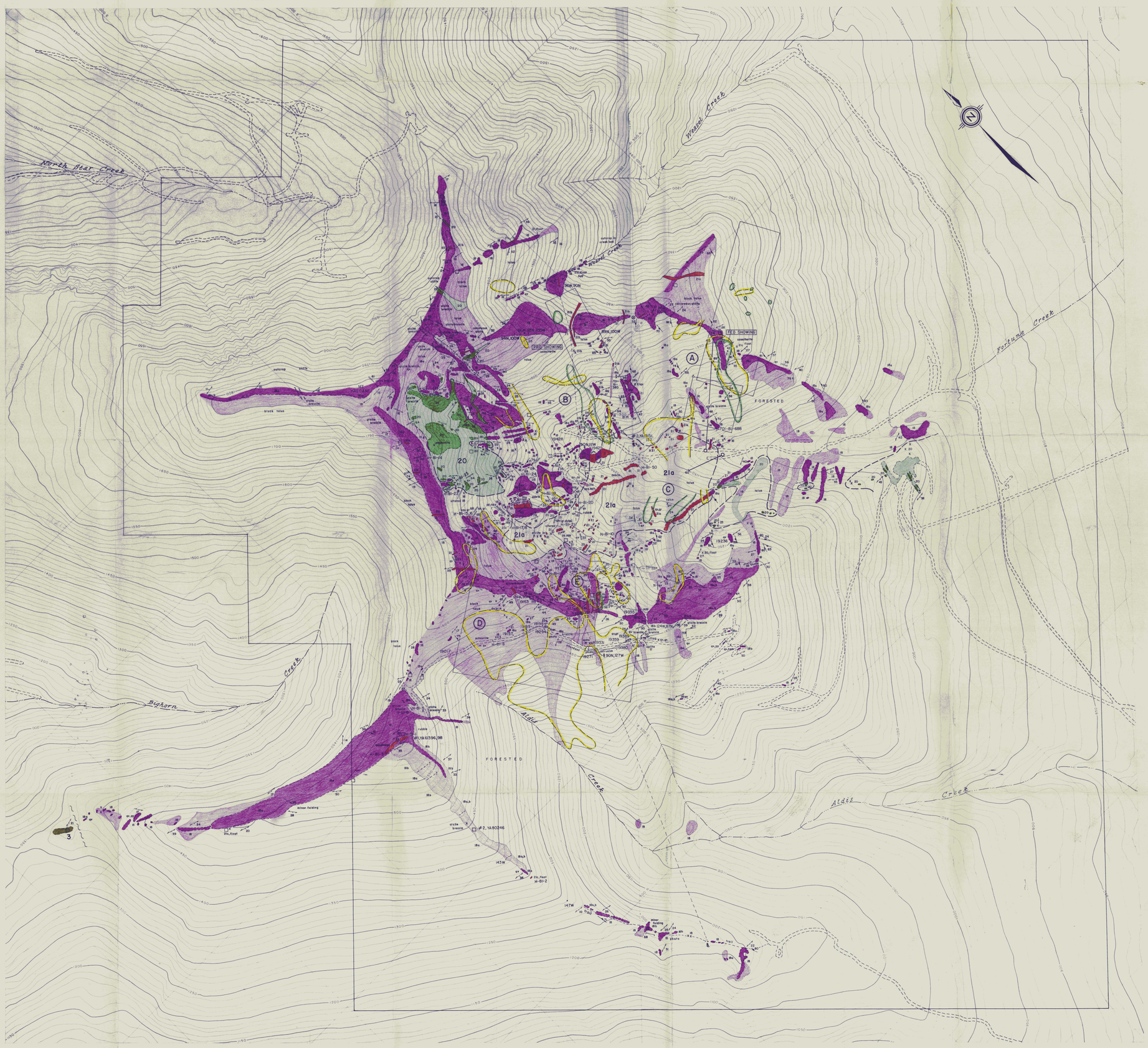
Vancouver, B.C.
3 May, 1982.

Brian Paul,
Geologist,
Billiton Canada Ltd.,
Cortin Joint Venture.

LIST OF CLAIMS

Claim Numbers	Grant Number	Location	Renewal Date
JOUMBIRA 1-6	YA15151-YA15156	Mt. Haldane	February 18/1984
JOUMBIRA 7-16	YA15566-YA15575	Mt. Haldane	"
JOUMBIRA 17-24	YA30645-YA30652	Mt. Haldane	"
JOUMBIRA 25-32	YA30833-YA30840	Mt. Haldane	"
JOUMBIRA 33-40	YA30876-YA30883	Mt. Haldane	"
JOUMBIRA 41-56	YA38194-YA38209	Mt. Haldane	February 18/1988

Assessment work has been filed on JOUMBIRA claims 41 to 56 sufficient to hold these claims until February 18, 1988, for which this report is representation.



LEGEND

CRETACEOUS

- 21 — 21 undivided
  - 21a biotite quartzite monzonite, including porphyritic varieties
  - 21b aplite quartz porphyry
  - 21c aplite
- 20 — "GREENSTONE" diorite and gabbro; altered equivalents
- 18 — KENO HILL QUARTZITE
  - 18 undivided
  - 18a massive quartzite
  - 18b thin-bedded phyllitic quartzite, argillaceous quartzite, graphitic slate and phyllite

PRECAMBRIAN AND/OR CAMBRIAN

- 3 — UPPER SCHIST: Quartz schist, quartz-sericite schist

apy	arsenopyrite		contact: inclined, vertical
gal	galena		foliation (S_1): inclined
gr	greisen alteration		minor fold axis: plunging
hem	hematite		joints, fractures: inclined, vertical
py	pyrite		fault
qv	quartz vein		contact: definite, assumed
sph	sphalerite		outcrop
	talus	x	small outcrop, rubble
π	porphyry	△	cairn
■ □	claim post: JOUMBIRA, other		anomalous soil geochem: Sn > 50 ppm
	hand trench		" " " : W > 50 ppm
	camp location		detailed soil geochem. coverage: 1978, 1979, 1981
	bulldozer road, trenching	A	geochem. target areas: 1978
	helicopter pad	90W,27N	flagging: 1978 base line
	JOUMBIRA claim boundary	1923	" 1979 soil sample location
	DDH: proposed	701-81-633	" 1981 " " "
		H-81-50	rock specimen location

SCALE 1:5,000

100 0 100 200 300 400

METRES

Contour interval.....10 Metres

CORTIN JOINT VENTURE

JOUMBIRA GROUP

NTS 105 M/13

091053

GEOLOGY

SCALE	1:5,000	DRAWN BY	kaml	DATE	May 1982
FIELD YEAR	1981	REVISED BY		DATE	

PLAN No. 701-8