

MAR 19710010: SOUTHWESTERN ALBERTA

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COMINCO LTD.

EXPLORATION
82 G/8

WESTERN DISTRICT
August 31st, 1971

FINAL REPORT

NORTH CARBONDALE PROJECT - 1970

SUMMARY:

The North Carbondale project is a zinc - lead prospect within Permit 159, located 30 miles due west of Pincher Creek in southwestern Alberta.

The mineralized beds lie in the upper part of the Sheppard formation within a sequence of unmetamorphosed Precambrian sediments. The Sheppard formation here consists largely of grey and green dolomite, green and red sandstone, green and black siltstone, and argillaceous siltstone and stromatolitic dolomite. The main concentration of sphalerite and galena is located in the lower two feet of a black siltstone and the upper six feet of the underlying grey dolomite about 80 feet above the Sheppard contact with the Purcell lava.

The evaluation program involved detailed geological mapping using chain compass and altimeter, and one diamond drill hole 43 feet long.

The results of the surface chip samples and diamond drill core samples were low. The average grade indicated in the drill hole across 14.0 feet is 0.09% Pb and 0.33% Zn.

INTRODUCTION:

The North Carbondale project area is located 30 miles due west of Pincher Creek in the southwest corner of Alberta. The western edge of the permit is the Alberta - British Columbia boundary. The project consists of Quartz Mineral Exploration Permit 159, located at Latitude 49°28' N, Longitude 114°34' W, Township 6, Alberta.

In the period from August 5th, 1970, to September 15th, 1970, Cominco carried out an evaluation program involving geological mapping and a limited amount of short hole diamond drilling under the supervision of A. B. Mawer.

GEOLOGY:

REGIONAL GEOLOGY:

The Flathead area was mapped by R. A. Price, 1956; R. A. Price and D. U. Wise, 1957; and compiled by R. A. Price in 1959. The project area lies to the east of the Continental Divide at North Kootenay Pass, south of the Crowsnest Pass, and is covered by G. S. C. Map 1154A in Memoir 336.

The area is underlain by a series of Precambrian, Paleozoic, and Mesozoic sediments which are unmetamorphosed and have been displaced by a series of thrust faults from their normal stratigraphic positions. Within the actual permit area,

the sediments range in age from Lower Precambrian to Cretaceous.

Precambrian (Proterozoic):

The Precambrian in this region consists of sediments of the Purcell series including, from oldest to youngest, the Grinnell formation, Siyeh formation, Purcell lava, Sheppard formation, and Kintla formation.

1. Grinnell Formation: The Grinnell formation consists of red argillite, white and light green quartzite with zones of red argillite, pebble conglomerate, and red siltstone and quartzite. There is only a small wedge of the Grinnell exposed in the southern part of Permit 71.
2. Siyeh Formation: Grey, finely crystalline dolomite and sandy dolomite; and green, red, and black argillite characterize the Siyeh formation. It contains a very prominent 30 foot - 50 foot unit of Cryptozoan-type stromatolites, and at least one very persistent concordant diabasic sill about 25 feet thick which occurs about 400 feet below the Purcell lava. The Siyeh formation is about 1,100 feet thick in the Carbondale area.
3. Purcell Lava: The Purcell lava is a chloritic, basaltic lava averaging 320 feet thick with subordinate pillowed basalt in a matrix of tuff breccia. It is normally dark green to reddish or purplish green, equigranular, and medium-grained to fine-grained. The main pillow structure is observed only at its base.
4. Sheppard Formation: These strata average 140 feet thick and are largely grey and green dolomites, green and red sandstones, green and black siltstones, and argillaceous siltstone and stromatolitic dolomite. The favourable dolomite containing zinc - lead mineralization occurs near the upper part of the Sheppard formation, about 800 feet from the base.
5. Kintla Formation: The Kintla consists of red siltstone and argillite, green dolomite and dolomitic argillite, and red quartzite and sandstone. The thickness varies from 1,600 feet in North Kootenay Pass to 600 feet in Goat Creek, about seven miles north.

Paleozoic:

The Paleozoic in the permit area is represented mainly by dolomites and limestones ranging in age from Cambrian to Lower Mississippian. The Paleozoic conformably overlies the Precambrian rocks in this region.

1. Cambrian: The Cambrian, comprising the Elko and Flathead formations, consists of massive light grey and dark grey mottled dolomite and limestone, and grey and brown quartzite and quartzitic sandstone. The Flathead formation is 140 feet thick, a Middle Cambrian shale unit is 220 feet thick, and the Elko formation is 200 feet thick.
2. Hollebeke Formation (Devonian): The Hollebeke formation consists of massive, grey, finely crystalline limestone with some grey and brown, finely crystalline, platy dolomite. This formation is 400 feet thick on Mount Borsato at North Kootenay Pass.

3. Fairholme Group (Devonian): The Fairholme group comprises the Perdin, Borsato, Mount Hawk, and Southeast formations; and consists of brown and grey bedded dolomites, grey massive dolomites, grey argillaceous and silty limestone, and black shale. In the Fernie map area, the Fairholme group is 950 feet - 1,500 feet thick.
4. Alexo Formation (Devonian): This formation consists of silty laminated dolomite and limestone, limestone and dolomite breccia, and minor sandstone. The Alexo formation may be anywhere from 20 feet to 490 feet thick.
5. Palliser Formation (Devonian): Mottled brown crystalline limestone and dolomite, and minor dolomite breccia characterize this formation. The Palliser is 650 feet - 750 feet thick.

Mesozoic:

The Mesozoic in the permit area comprises rocks of Cretaceous age. These dark sandstones, mudstones, and shales lie unconformably below the Siyeh formation on the east (down thrust) side of the Lewis thrust fault.

1. Kootenay Formation (Jurassic and Cretaceous?): This formation is composed of dark grey carbonaceous sandstone, siltstone, shale, and conglomeritic sandstone with some coal. This unit can vary widely in thickness from 75 feet to 3,530 feet.
2. Cretaceous: The Cretaceous in this region comprises the Alberta group consisting of the Wapiabi, Cardium, and Blackstone formations; the Crowsnest formation; and the Blairmore group. The Alberta group is dominantly dark grey shale, silty shale, siltstone, and sandstone. Within the Crowsnest formation are a series of volcanic tuffs, sandstones, and mudstones. The Blairmore group is mainly grey and greenish-grey sandstone and mudstone, conglomerate, and minor dark brown limestone.

LOCAL GEOLOGY:

The mineralized beds occur within the Sheppard formation. This formation lies conformably between the lower member of the Kintla formation above, and the Purcell lava below. Zinc - lead mineralization is restricted to a zone averaging about 15 feet thick within a black siltstone, and the upper ten feet of the underlying grey dolomite. This zone occurs approximately 80 feet above the contact with the Purcell lava.

Purcell Lava:

The Purcell lava is an amygdaloidal basalt which maintains an average thickness in this area of approximately 320 feet. The abundant amygdules are most often filled with calcite or chlorite, but are occasionally quartz-filled. At the base of the Purcell lava is a 40 foot to 50 foot unit of pillow structure.

In the vicinity of North Kootenay Pass and South Lost Creek, the basal unit of the Sheppard formation is an arkosic sandstone. Chalcopyrite is scattered through the sandstone, as well as through the upper one foot to two feet of the Purcell lava. Thin strom. units containing spectacular chalcopyrite are developed on top of the Purcell lava in North

Kootenay Pass. Elsewhere, a green, thinly bedded siltstone lies immediately above the Purcell lava. A discontinuous isolated dolomitic conglomerate occurs at the contact with the Sheppard formation in the South Lost Creek area.

Sheppard Formation:

In the area of North Kootenay Pass and Lost Creek, the Sheppard formation is somewhat thinner than to the east. Within the map area, the Sheppard formation was never greater than 190 feet, and averaged about 140 feet. Lithologies within the Sheppard at Carbondale are very persistent.

In the vicinity of South Lost Creek, a light green, medium-grained to coarse-grained, lithic or arkosic sandstone overlain by a green, fissile to flaggy, siltstone and argillaceous siltstone and argillaceous siltstone lies on top of the Purcell lava. To the north, the sandstone is not present. In more than 50% of the sections, this siltstone grades into a green dolomite siltstone.

Overlying the green siltstone is a thick-bedded unit of quartzite, quartzitic sandstone, and sandstone. The facies changes to some extent along strike, though actual compositions remain consistent. The sandstones and quartzites are dirty with a predominance of quartz over feldspar. They are medium-grained and well sorted, and the majority of grains are rounded to sub-rounded. The quartzites and sandstones were distinguished on the basis of degree of induration.

The quartzite/sandstone unit is overlain by a green to white siliceous and, in part, stromatolitic and oolitic dolomite which grade up into a grey dolomite. Throughout the permit area, the majority of zinc - lead mineralization occurs in the upper six feet to eight feet of this grey, buff-weathering, flaggy to blocky dolomite, and the black, thinly laminated siltstone above it. The dolomite is alternately thin-bedded and thick-bedded. Within it are thin discontinuous bands of dolomitic siltstone. These silt-rich layers and lenses generally contain the best Zn - Pb values. There are two to three intraformational conglomerates in the grey dolomite containing elongate dolomite pebbles from 1 mm. - 10 mm. long and oriented parallel to bedding. Lead and copper values are usually higher than zinc values in these conglomerates.

The upper contact of the grey dolomite is gradational into a black, thinly laminated, rusty weathering siltstone. As the contact is crossed, the proportion of silty bands increases and the rock becomes less dolomitic. The sphalerite and galena mineralization persists into the black siltstone. This unit provides an excellent marker bed as it varies little from the mean thickness of about six feet. The siltstone contains thin discontinuous quartzitic and sandy layers containing pale sphalerite.

A thick bedded, grey to green, buff-weathering dolomite overlies the black siltstone. It generally contains scattered chalcopyrite and traces of galena. In most sections, there is a 10-foot to 15-foot interbed of green, flaggy, gritty siltstone in this dolomite. The dolomite often becomes a pink or pale brown colour at the contact with the Kintla formation.

Kintla Formation:

The lower member of the Kintla formation is described by R. A. Price as the Gateway formation. It directly overlies the uppermost dolomites of the Sheppard formation and consists of dark red to maroon, thinly bedded siltstones, sandy siltstones, argillites, and argillaceous siltstones. Hematite was observed as a coating on red siltstone. Salt casts and mud cracks are common in argillaceous siltstone, and cross-bedding and ripple marks were noted in sandy material.

MINERAL OCCURRENCE AND LOCALIZING FEATURES:

The principal sulphide minerals are sphalerite and galena. These occur in stratabound concentrations within the favourable grey dolomite and the overlying black siltstone of the Sheppard formation. Chalcopyrite is present in minor amounts in the grey dolomite, an overlying green dolomite, and a basal arkosic sandstone. Traces of pyrite were also observed. There is one section about 3,000 feet south of North Lost Creek in which the favourable horizons are barren. Overall, the zinc - lead grade was disappointingly low.

Zinc - lead values are concentrated in a 10-foot to 15-foot thick zone, occurring about 80 feet above the contact with the Purcell lava, in a grey, buff-weathering dolomite and the overlying black siltstone. The predominance of the zinc - lead sulphides are in the grey dolomite, but the black siltstone frequently has some high grade bands. Sphalerite and galena occur in thin discontinuous lenses and laminae which are rarely more than 1.5 inches thick.

Sphalerite occurs in a variety of colours and textural relationships. Most commonly, sphalerite is a pale grey, but it may also be brown and, rarely, white. The pale grey and brown varieties usually occur as spots or disseminations, and the white variety occurs along stringers or in fractures.

In North Lost Creek, sphalerite occurs as patches up to 3 mm. - 4 mm. in diameter. In these patches, neither the quartz content nor the grain size increases, but the dolomite all but disappears. In thinly laminated, dense dolomite, no sphalerite was observed.

Galena occurs with intergrown sphalerite as streaks parallel to bedding in the conspicuous silty bands. It also forms well crystallized cores about which sphalerite is formed. In intraformational pebble conglomerates, lead and copper values are higher than zinc values. Galena and sphalerite occur with chalcopyrite along conjugate fracture sets. Galena was also observed in a green dolomite overlying the black siltstone, and in a basal, stromatolitic dolomite overlying the Purcell lava.

Hydrozincite, $2\text{ZnCO}_3 \cdot 3\text{Zn}(\text{OH})_2$, is a common stain on the weathered surface of the grey dolomite and black siltstone, and makes the presence of the otherwise nearly indistinguishable zinc mineralization more apparent.

EXPLORATION AND DEVELOPMENT:

Geological mapping was done by K. M. Carter and R. W. Lane at a scale of 1" = 1,000', and detailed mapping was done in areas of particular interest. Stratigraphic sections were measured at regular intervals along the strike length by A. B. Mawer and R. W. Lane at a scale of 1" = 40'. All geological mapping was done with the aid of chain, compass, and altimeter.

Surface chip samples were taken in conjunction with geological mapping. In most cases, samples were cut across five foot widths, beginning in the black siltstone and ending at the lower limit of mineralization in the grey dolomite.

One 43-foot hole (C - 8) was diamond drilled on Permit 159. See attached drill log for details.

EXPLORATION RESULTS:

The assays for zinc and lead were much lower than estimated for most samples. The extremely fine-grained nature of the sphalerite undoubtedly accounts for part of the error in grade estimation. The short hole diamond drilling showed that the character of mineralization changed very little away from the weathered surface.

Initial surface chip sampling gave assays of 0.09% Pb and 1.28% Zn across 3.0' at North Lost Creek. However, subsequent sampling yielded values of less than 1% combined.

Report by: _____

K. M. Carter

Endorsed: _____

En _____
W. T. Irvine
Manager
Exploration
Western District

KMC:RJN: jr
Vancouver Office
September 1st, 1971

Distr.: Alberta Department of Mines and Minerals ✓
Administration
Western District

Attach.: Drill Log C - 8
Carb - 1: Geological plan showing measured sections and drill hole locations. 1" = 1 mile
Carb - 2: North - south longitudinal section - correlation diagram of measured sections. vertical 1" = 40'; horizontal 1" = 2,640'
Carb - 3 - 6: Diamond drill hole section. 1" = 10'
Carb - 4: Geological plan of Sheppard formation. 1" = 1,000'

Refs.: G. S. C. Memoir 336 and Paper 61 - 24; R. A. Price



Drill Hole Record

Property North Carbondale (Permit-159) District Pincher Creek, Alberta) Hole No. C-8

Commenced September 2, 1970

Location North Lost Creek

Tests at

Hor. Comp. 19'

Completed September 6, 1970

Core Size AQ

Corr. Dip

Vert. Comp. 39'

Co-ordinates

True Brg.

Logged by ABM

Objective Mineralized horizons in Sheppard Fm.

% Recov. 80%

Date September 7, 1970

Claim

T Brg. 070°

Collar Dip - 64°

Elev. 5700'

Length 43.5'

Hole No. C-8

Sheet 1

Footage From To	Description	Sample No.	Length	Analysis			
				Ag	Pb	Zn	Cu
0.0 - 4.7	Siltstone: light grey, thin bedded, bedding @ 045° to core axis fine disseminations of pyrite and chalcopryrite, 10% hairline fractures filled with white dolomite @ 005° to core axis. @ 4.7' few thin laminations of .05 mm diam. xline pyrite.						
4.7 - 6.0	Dolomite: medium grey very fine grained, thin bedded, with dark silty paper thin laminations few thin laminations of 0.05 mm diam xline pyrite, 1/8" dolomite filled fracture @ 005° to core axis. The bedding crumpled and cross bedded, probably convolute cross bedding.						
	Sample - 0.0 - 6.0	33865	6.0	-	0.02	Tr.	0.05
6.0 - 15.5	Siltstone: black, fine laminated with light grey, very fine grained quartzite interlamina, bedding contorted but generally @ 080° to core axis. @ 6.0-7.0 very fine disseminated chalcopryrite and pyrite in thin quartzitic lamina @ 7.5' hairline fractures with white dolomite, straw coloured sphalerite, galena, chalcopryrite. @ 7.6' disseminated pale buff sphalerite band cut by mineralized hairline fractures. @ 12.1'-12.3' disseminated pale buff sphalerite @ 14.0 light grey dolomite section with fine disseminated sphalerite. @ 14.5' a 5 mm band of disseminated pale sphalerite @ 15.0-16.0 thin interbands of dolomitic siltstone with thin bands of disseminated pale sphalerite.						

Drill Hole Record



Property	District	Hole No.		Claim	T Brg.	Collar Dip	Elev.	Length	Hole No.	Sheet
Commenced	Location	Tests at	Hor. Comp.							
Completed	Core Size	Corr. Dip	Vert. Comp.							
Co-ordinates		True Brg.	Logged by							
Objective		% Recov.	Date							

Footage		Description	Sample No.	Length	Analysis			
From	To				Ag	Pb	Zn	Cu
		Samples - 6.0 - 11.0	33866	5.0	-	0.08	0.07	-
		11.0 - 15.0	33867	5.0	-	0.12	0.36	-
15.5	37.0	Dolomite: dark to light grey, very fine grained, silty, laminated to thin bedded with 20% interbedded medium beds. The mineralization (sp) is confined to the thin laminated sections, fine laminations of very fine pyrite and sections of 10% fine xline pyrite. @ 16.0-18.0 a fracture nearly parallel to core with a lot of adjacent hairline fractures, minor sphalerite and galena, this fracturing cuts bands of disseminated sphalerite. @ 17.0 small area of framboidal sphalerite. @ 23.0 - 23.1 light grey fine laminated siltstone with disseminated pale sphalerite. @ 29.0 pale grey thin dense beds very sileceous having a tuffaceous look (cherty tuffs?) @ 31.0-32.0 thin bedded pale grey argillite with thin interbeds of very fine xline pyrite.						
		Samples 15.0 - 20.0	33868	5.0	-	0.09	0.30	-
		20.0 - 25.0	33869	5.0	-	0.07	0.32	-
		25.0 - 30.0	33860	5.0	-	0.02	0.01	-
		30.0 - 35.0	33871	5.0	-	0.02	Tr	-
		35.0 - 40.0	33872	5.0	-	0.03	Tr.	-

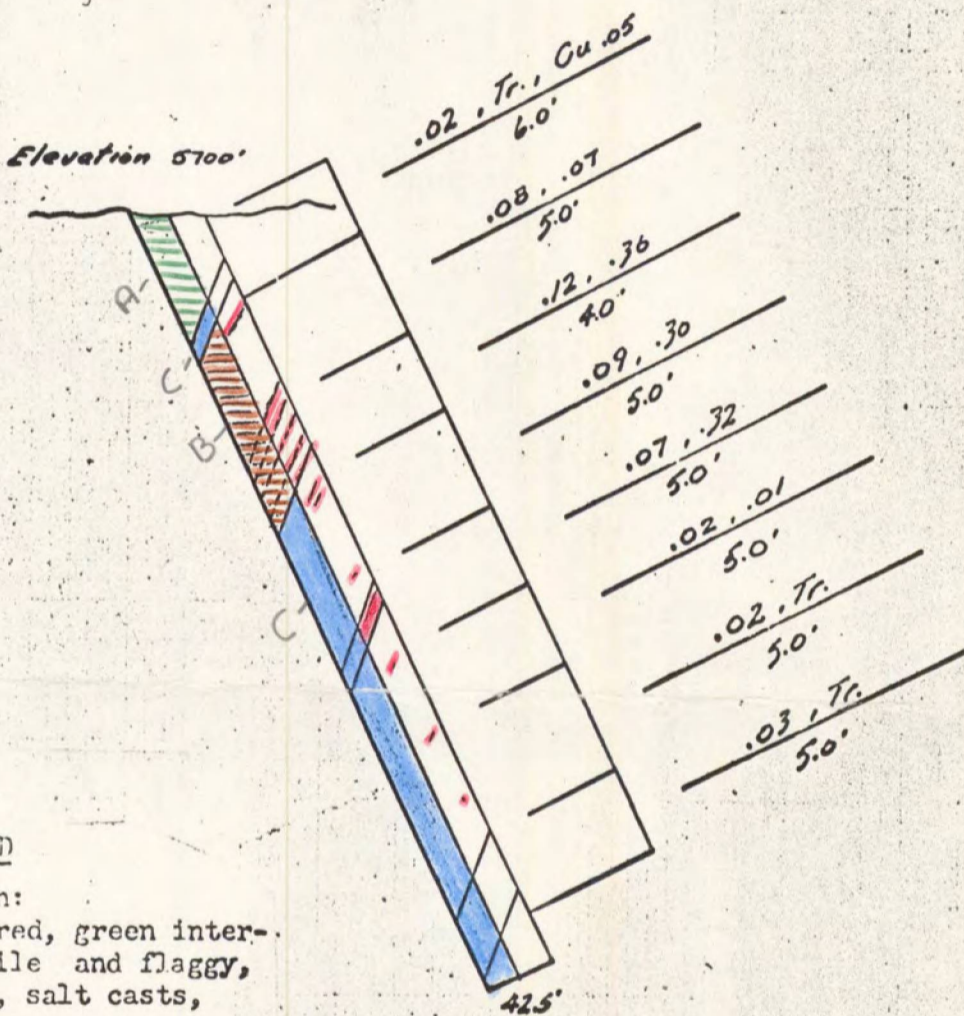
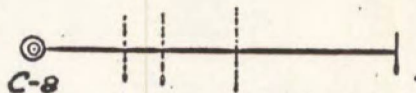
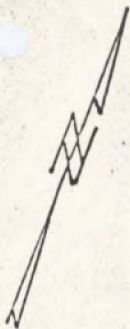


Drill Hole Record

Scale
Colour Plot
& Dips

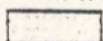
Property	District	Hole No.	
Commenced	Location	Tests at	Hor. Comp.
Completed	Core Size	Corr. Dip	Vert. Comp.
Co-ordinates		True Brg.	Logged by
Objective		% Recov.	Date

Footage From To	Description	Sample No.	Length	Analysis			
				Ag	Pb	Zn	Cu
37.0 - 40.0	Dolomite: light grey, very fine grained, thin to medium bedded in part sandy @ 37.0 - 38.0 - 5% thin interbands of very fine grained pyrite, hairline fractures, bedding @ 080° to core axis.						
40.0 - 43.5	Dolomite: light grey and greeny-grey, very dense, large stromatolites, @ 40.0 - 42.0 interformational breccia with dolomite and strom debris in sandy greeny matrix. @ 42.0 - 43.5 large stromatolites, very dense and siliceous.						
	End of Hole						
	Samples: 0.0 - 6.0	33865	6.0	-	0.02	Tr	0.05
	6.0 - 11.0	33866	5.0	-	0.08	0.07	-
	11.0 - 15.0	33867	4.0	-	0.12	0.36	-
	15.0 - 20.0	33868	5.0	-	0.01	0.30	-
	20.0 - 25.0	33869	5.0	-	0.07	0.32	-
	25.0 - 30.0	33870	5.0	-	0.02	0.01	-
	30.0 - 35.0	33871	5.0	-	0.02	tr.	-
	35.0 - 40.0	33982	5.0	-	0.03	tr.	-
	11.0 - 25.0		14.0	-	0.09	0.33	-

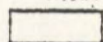



LEGEND


Kintla Formation:


 Siltstone: red, green interbeds, fissile and flaggy, arenaceous, salt casts, ripple marks.

Shepard Formation:

 Dolomite: green to brown, buff weathering, thick bedded, silty, some cpy. and py.

A  Siltstone: green, thin to med. bedded, flaggy, sandy, ripple marks.

B  Siltstone: black, thin bedded rusty, sphalerite and galena in lower 2'.

C  Dolomite: grey, med. to thick bedded, buff weathering, sphalerite and galena in upper 6'.

Carbondale



Drawn by: <i>ABM</i>		Traced by: <i>KMC</i>	
Revised by	Date	Revised by	Date
<i>KMC</i>	<i>Sept 70</i>		

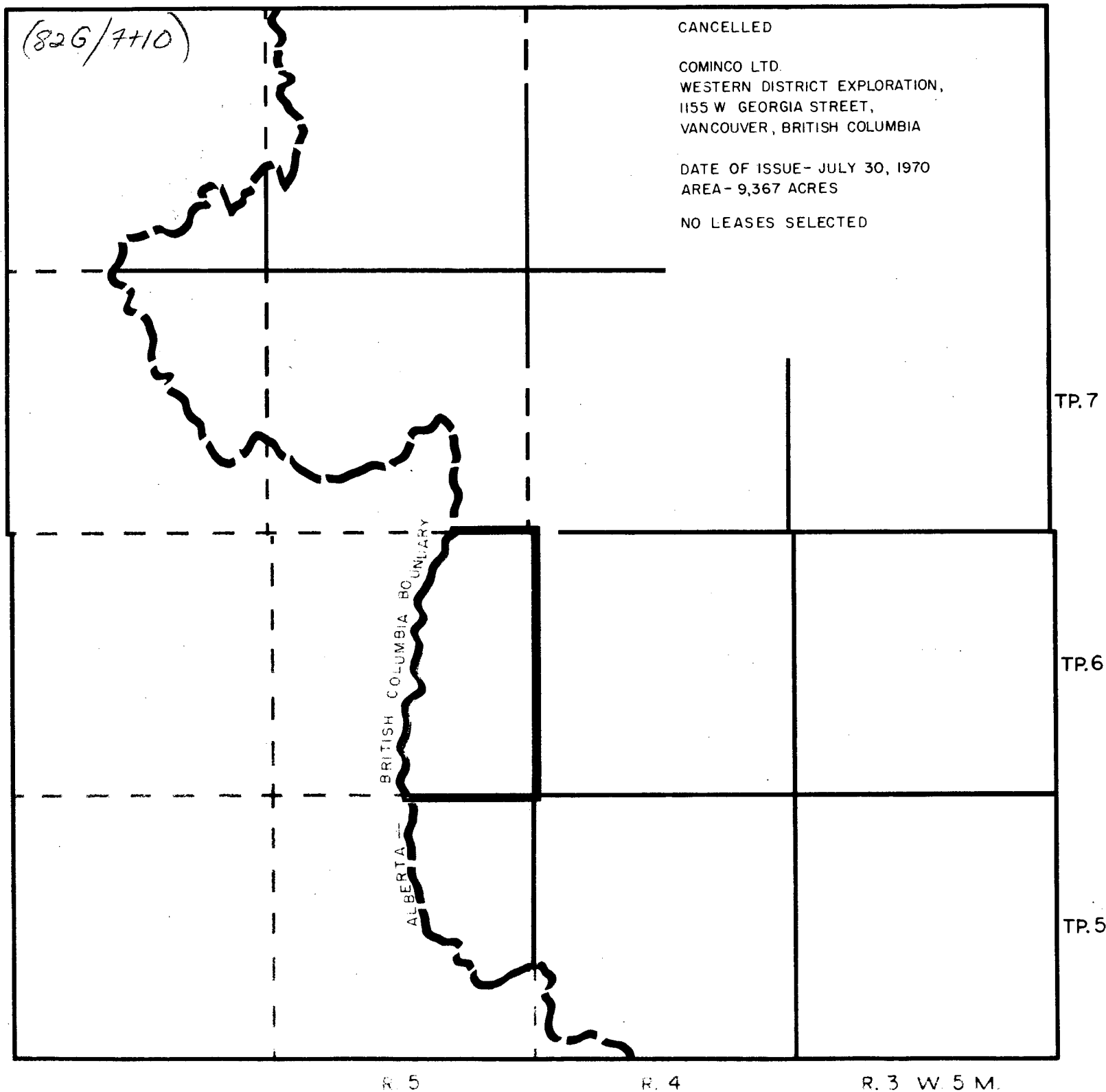
D.D.H. C-8

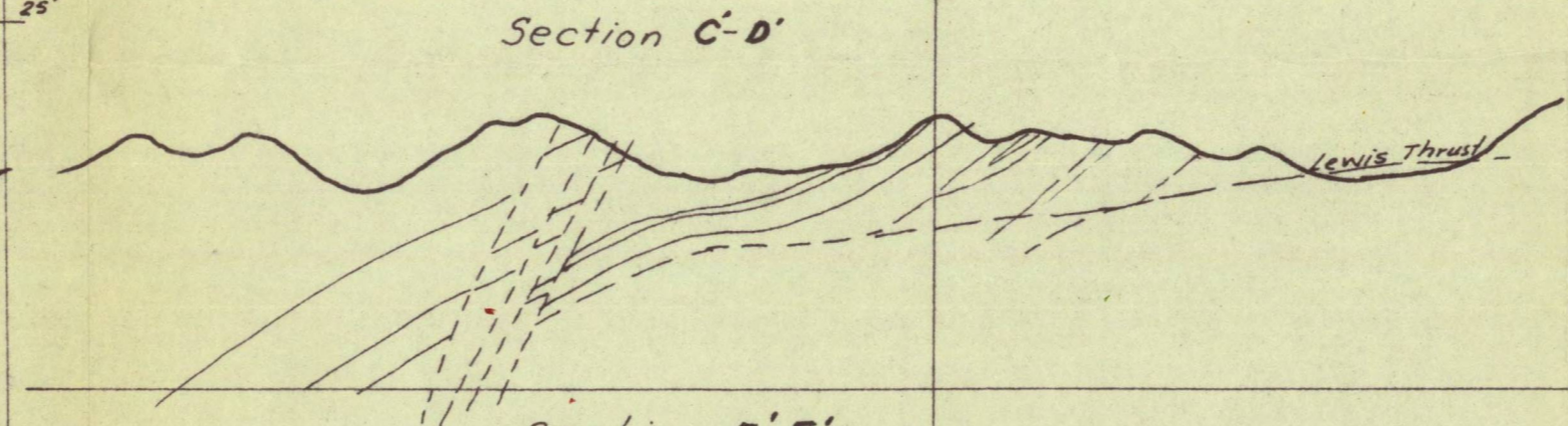
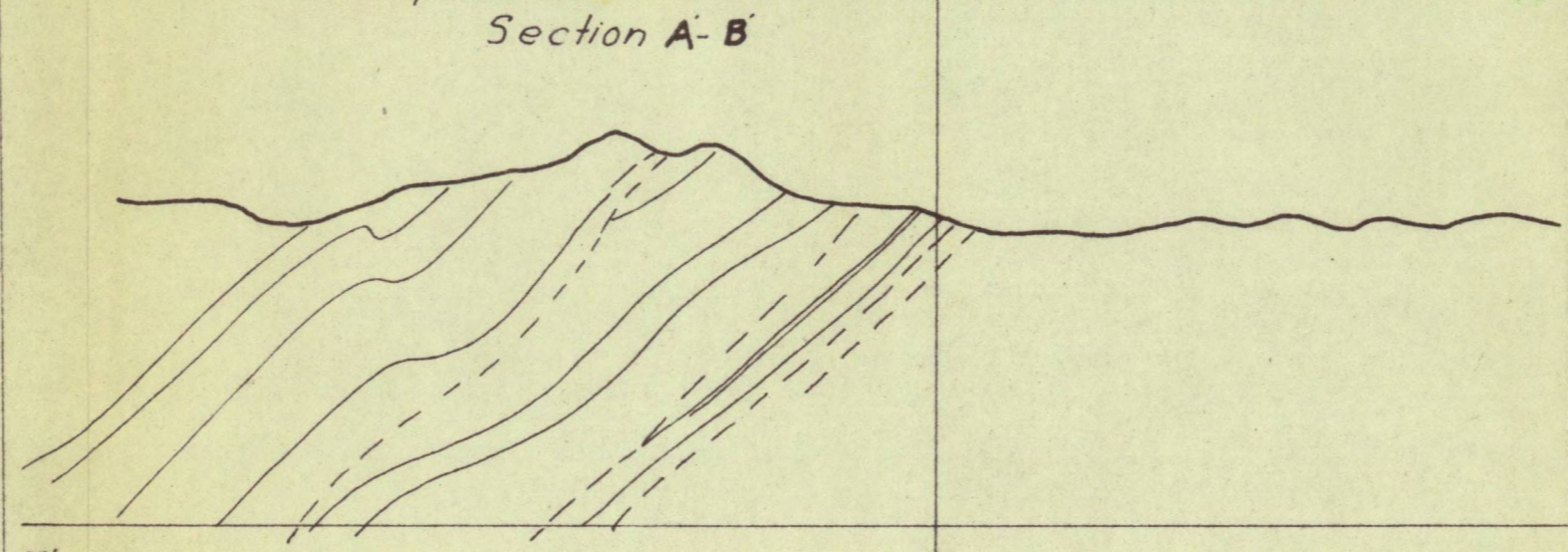
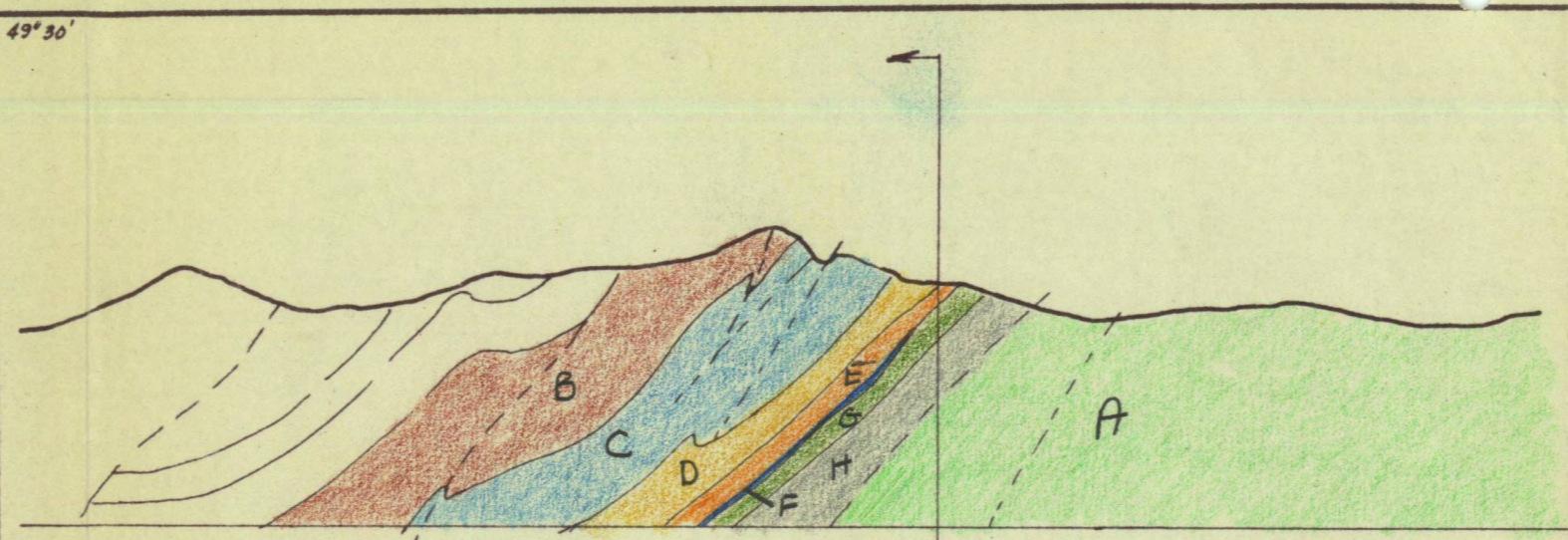
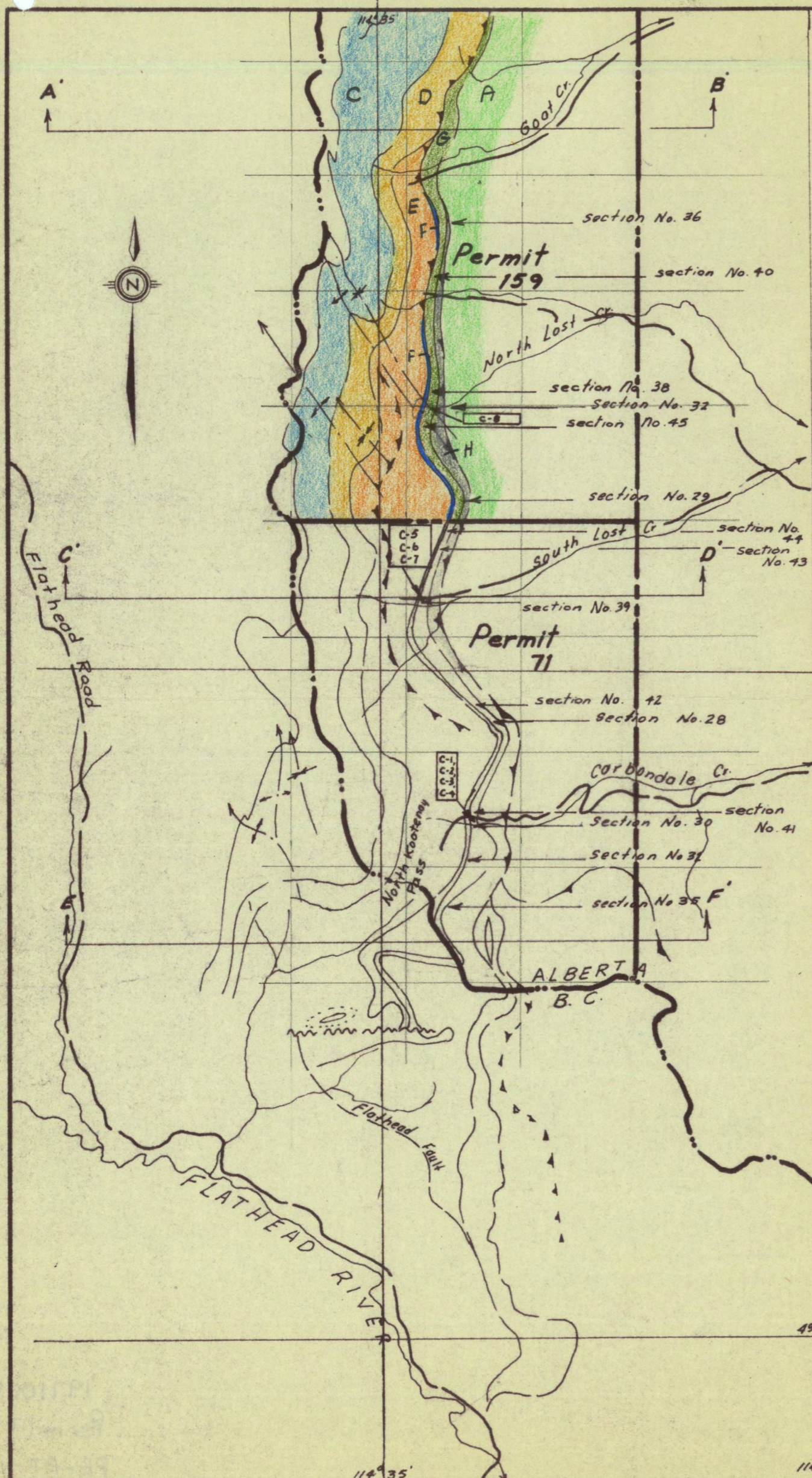
Scale: 1" = 10'

Date: *September - 70*

Plate *Carb-3-b*

QUARTZ MINERAL EXPLORATION PERMIT No. 159





- A Cretaceous
- B Mississippian
- C Devonian
- D Cambrian
- Pre C
- E Kintla - (Gateway)
- F Sheppard
- G Purcell
- H Siyeh
- I Grinnell

--- Permit No 71 area (McMartin) (Carbondale)
 --- Permit Area-North. (North Carbondale)

Carbondale

Drawn by: R.A. Price		Traced by:	
Revised by	Date	Revised by	Date
ABM	Jun. /70		
KC	Sept /70		

Geological Plan showing measured sections and diamond drill holes

Sheppard Formation, North Kootenay Pass to Goat Cr., S.W. Alberta

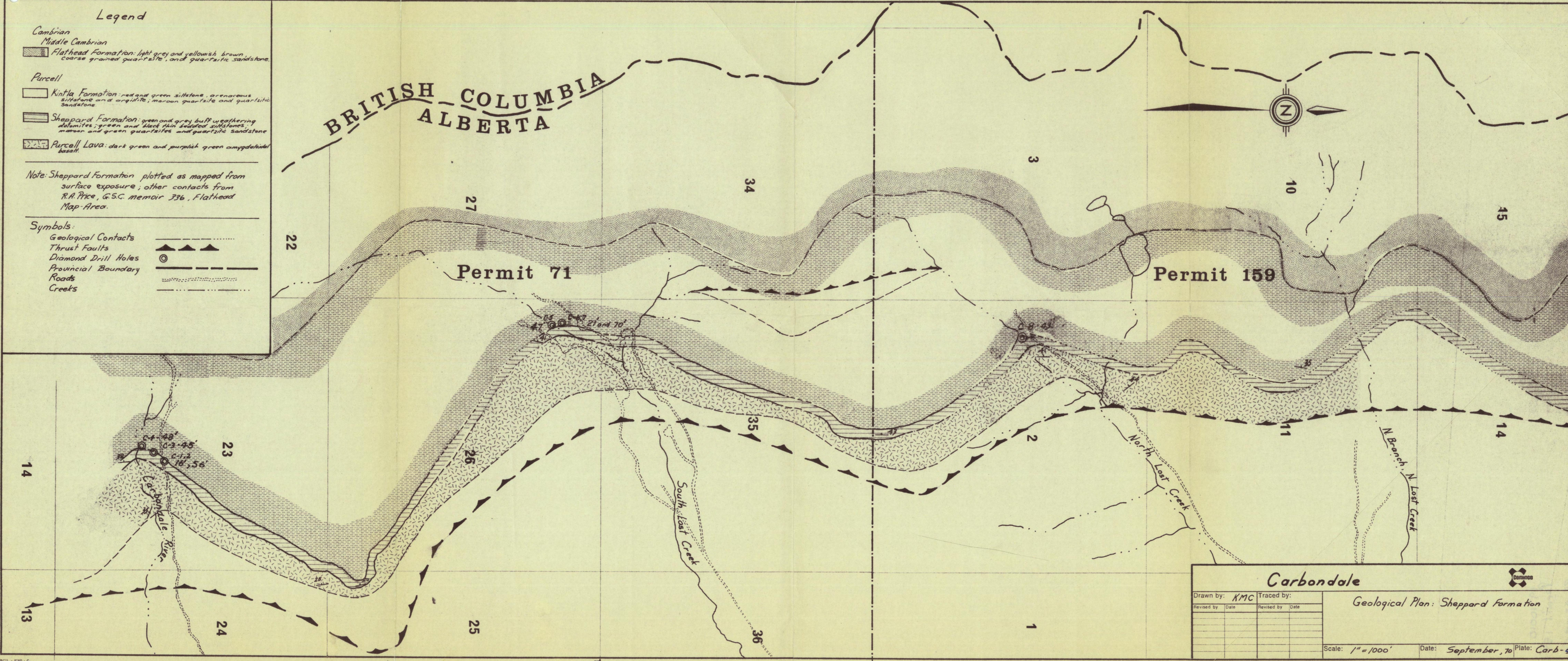
Scale: 1" = 1 mile Date: July, 70 Plate: Carb-1

Legend

- Cambrian**
Middle Cambrian
 Flathead Formation: light grey and yellowish brown, coarse grained quartzite, and quartzitic sandstone.
- Purcell**
 Kintla Formation: red and green siltstone, arenaceous siltstone and argillite, maroon quartzite and quartzitic sandstone.
 Sheppard Formation: green and grey buff weathering dolomites; green and black thin bedded siltstones, maroon and green quartzites and quartzitic sandstone.
 Purcell Lava: dark green and purplish green amygdaloidal basalt.

Note: Sheppard Formation plotted as mapped from surface exposure; other contacts from R.A. Price, G.S.C. memoir 336, Flathead Map Area.

- Symbols:**
 Geological Contacts:
 Thrust Faults:
 Diamond Drill Holes:
 Provincial Boundary:
 Roads:
 Creeks:

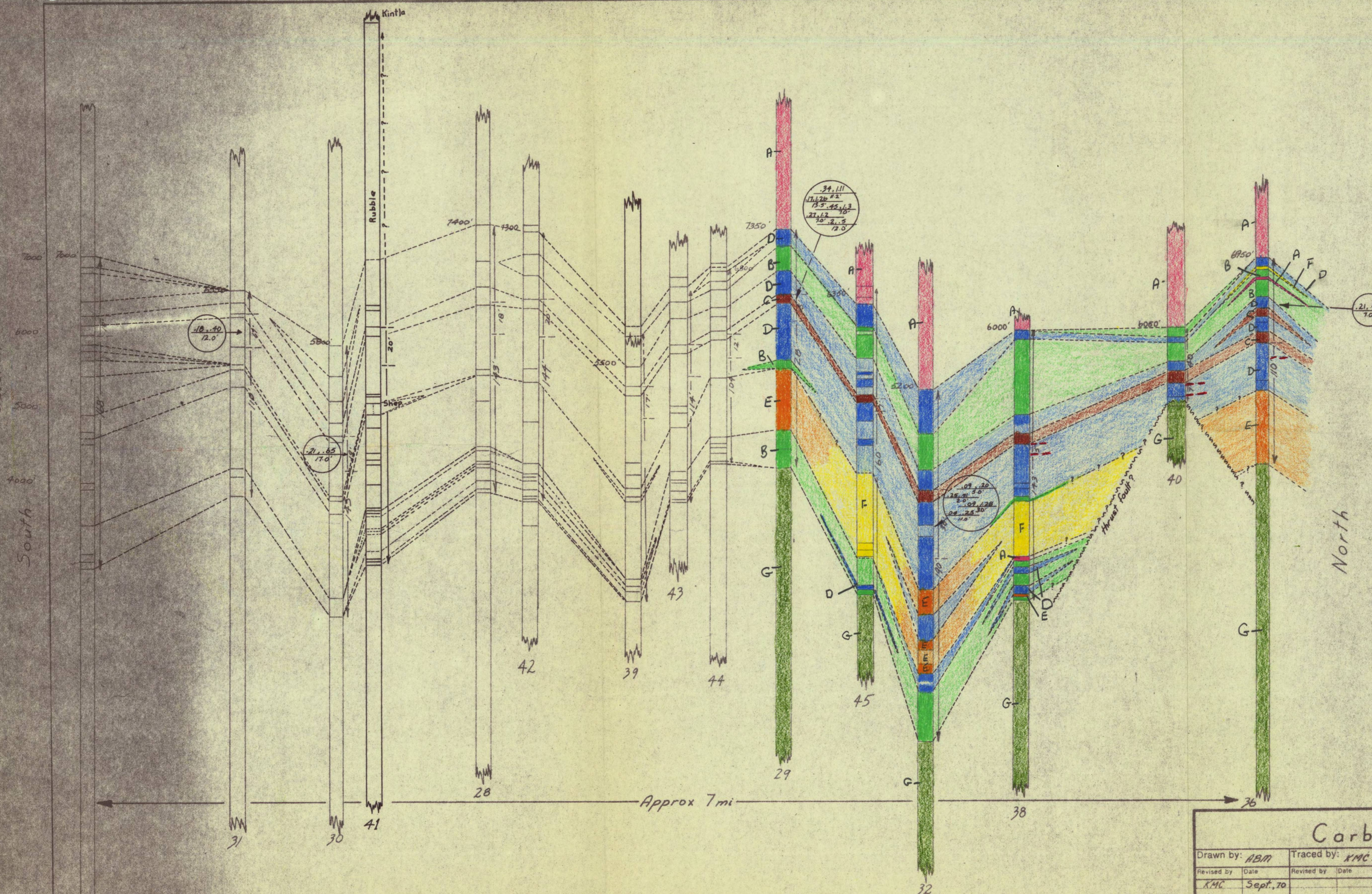


Carbondale

Drawn by: <i>KMC</i>		Traced by:	
Revised by:	Date:	Revised by:	Date:

Geological Plan: Sheppard Formation

Scale: 1" = 1000' Date: September, 70 Plate: Carb-4



- A siltstone: maroon
- B siltstone: lt green, grey
- C siltstone: black, laminated
- D dolomite: grey, green
- E quartzite
- F sandstone
- G amygdaloidal basalt

Carbondale

Drawn by: <i>ABM</i>		Traced by: <i>KMC</i>	
Revised by	Date	Revised by	Date
<i>KMC</i>	<i>Sept. 70</i>		

North - South
Longitudinal Section: Sheppard Fm
North Kootenay Pass to Goat Creek

Scale: Vertical: 1"=40'
Horizontal: 1"=2000'

Date: September, 1970 Plate: Carb-2

