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EXPLORATION POTENTIAL IN THE CHILLIWACK GROUP SW BRITISH COLUMBIA AND ADJACENT N. WASHINGTON

LOCATION AND ACCESS

The Chilliwack Group underlies the eastern side of Harrison Lake in southwest B. C., extending southwards across the Fraser Valley to the U.S. border and beyond into Washington (Fig. 1).

Despite very rugged terrain with numerous peaks between 5000' and 8000', the Chilliwack Group belt is readily accessible. North of the Fraser River access is via logging roads up the east side of Harrison Lake. Harrison Lake itself provides direct water access to Vancouver (see Fig. 1), 80 km to the west.

South of the Fraser River access is via the Chilliwack Lake road from Vedder Crossing and thence by numerous logging roads which extend to the border.

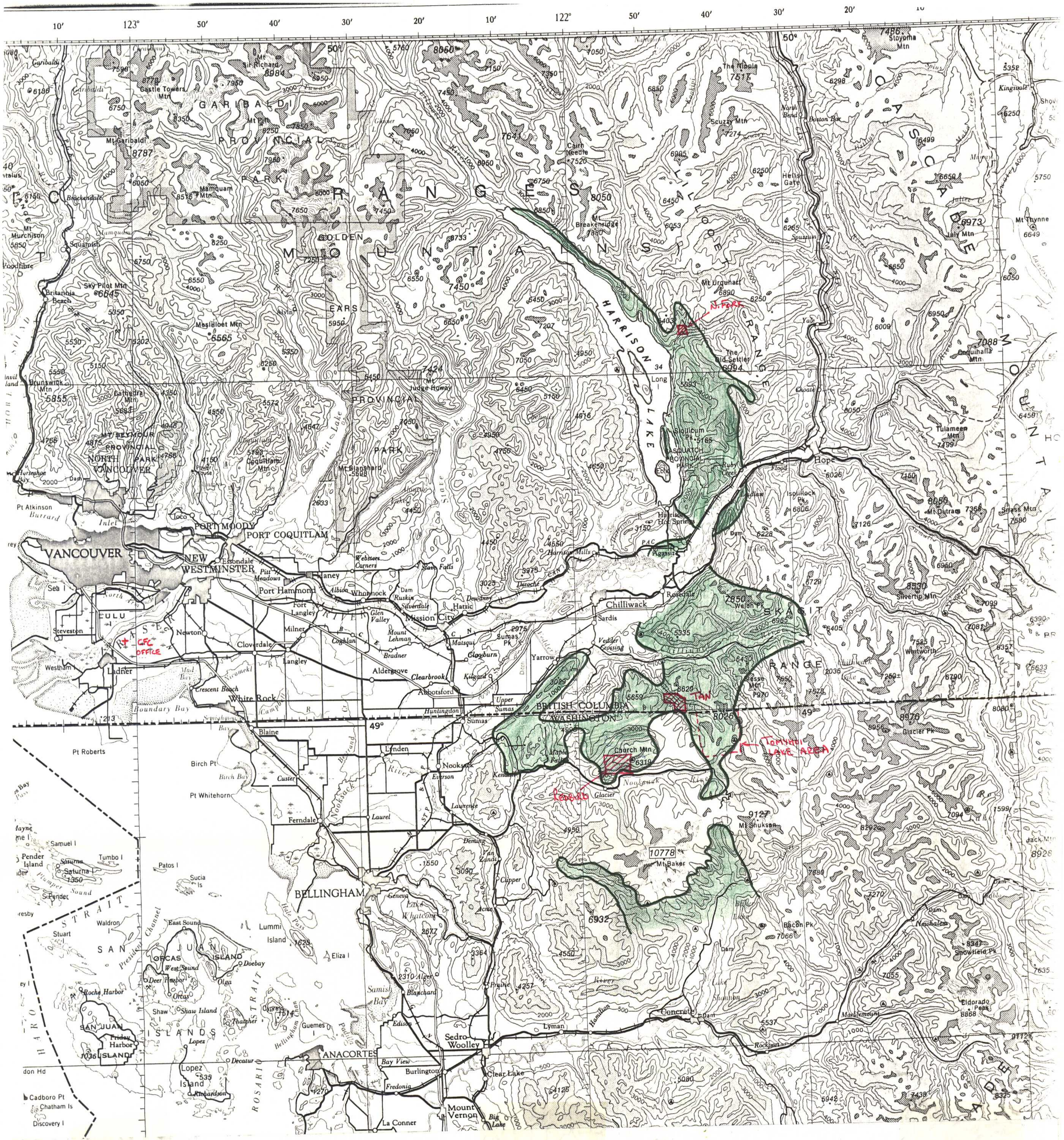
In Washington access is via route 542 and thence by logging roads which run from there, northwards to the border.

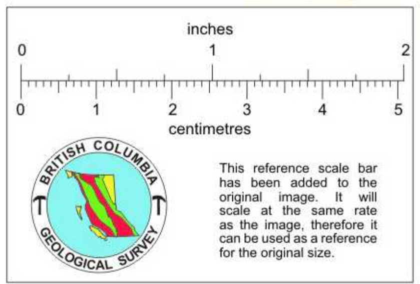
At no point are rocks of the Chilliwack Group more than 5 km from maintained roads.

GENERAL GEOLOGY

Like the massive sulphide hosting Sicker Group of Vancouver Island and the Shasta District of Northern California, the Chilliwack Group consists of volcanics and sediments of Upper Palaeozoic age (Figs. 2a, 2b).

The type area for the group is in the valley of the Chilliwack River some 70 km east of Vancouver. Monger (1969) has divided it into 5 lithologic and stratigraphic

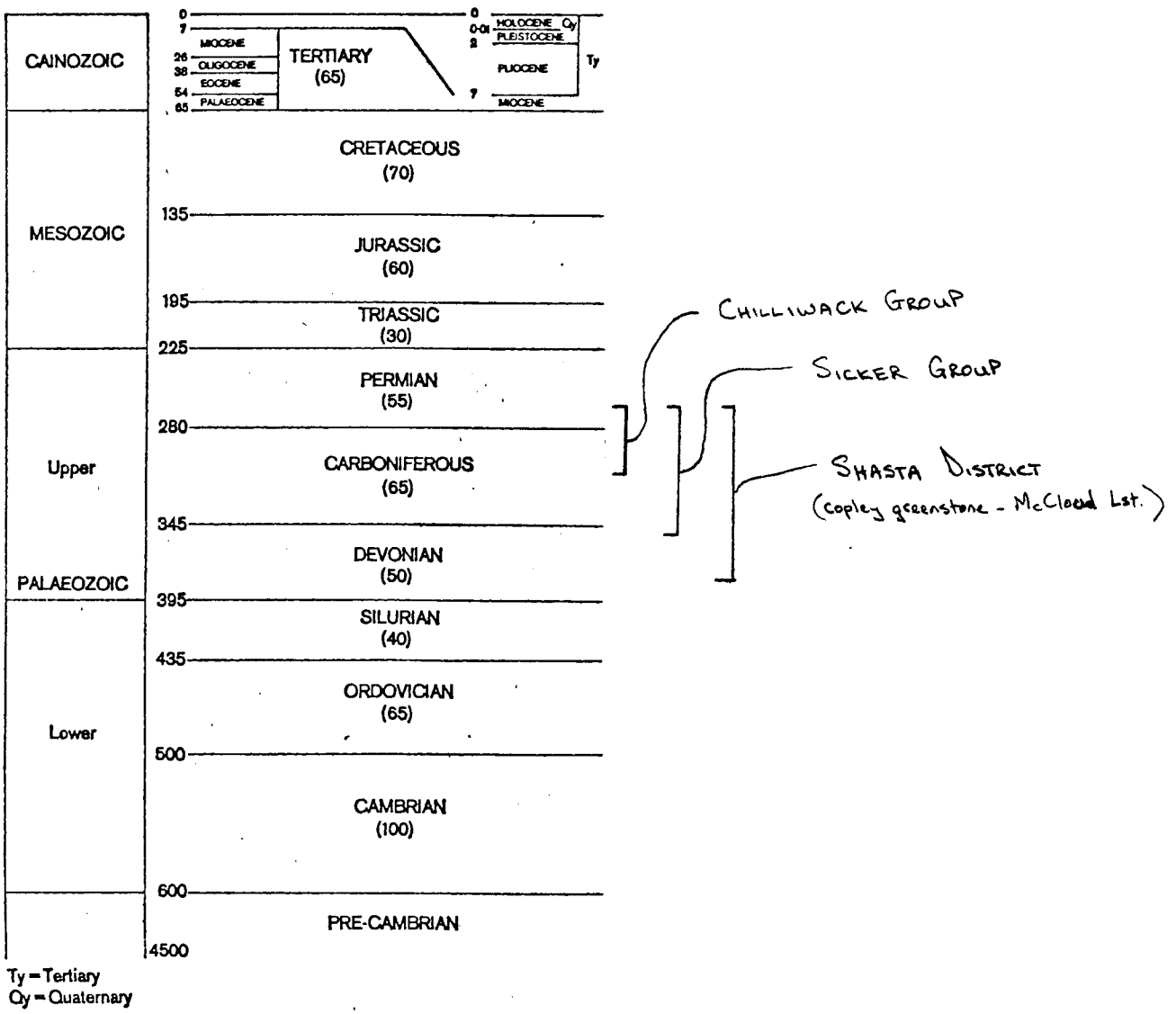




0 5 10 15 20
km
1:500,000

approx. extent of Chilliwack group rocks. (Sediments and Volcanics)

Figure 1.



The geological time-scale in millions (10^6) of years.

Figure 2a

Table 1

Vancouver Island (SICKER)	Shasta District
Buttle Lake Formation Bedded to massive calcarenite, crinoidal limestone. chert; calcareous siltstone; 150-450 m Middle Pennsylvanian to Early Permian	McCloud limestone Thin- to thick-bedded fossiliferous limestone with chert nodules; 150-800 m Early Permian and (?) Late Pennsylvanian
Sediment-sill Unit Bedded argillite, siltstone, chert; diabase sills	Kennett Formation Siliceous siltstone, tuff; thick lenses of limestone in upper part; 0-12 m; Middle Devonian
Myra Formation Bedded siliceous siltstone, argillite, rhyodacite tuff and breccia, quartz porphyry; 600-900 m Late Devonian to Early Mississippian	Balaklala Rhyolite Porphyritic and non-porphyritic rhyolite and rhyolitic pyroclastic rocks; 300 m ±; Middle Devonian
Nitinat Formation Basaltic uralite-porphyry, agglomerate and pillow lava, actinolite-chlorite-albite schist	Copley Greenstone Greenstone, keratophyre, pyroclastic rocks

Late Jurassic Middle Jurassic Early Jurassic Late Triassic		CHILLIWACK VALLEY CULTUS FORMATION 4,000	Fine to medium grained volcanic arenites, argillites and slates; very minor flows
		disconformity	
Early Permian (Leonardian)	CHILLIWACK GROUP (as presently established)	Permian volcanic sequence 2,000 - 700 (conformable)	Altered basic to intermediate flows, tuffs, minor chert and minor argillite
Early Permian (Leonardian)		Permian limestone 300 (conformable)	Limestone, typically cherty; in part laterally equivalent to the Permian volcanic sequence
Permian and (?) Pennsylvanian		Upper clastic sequence 800-450 (conformable)	Coarse to medium-grained volcanic arenites, argillites, local conglomerates, tuffaceous towards top. This sequence may include one or more disconformities
Lower Pennsylvanian (Morrowan)		Red Mountain Limestone (restricted from Danner, 1957) 100 (conformable)	Limestone, typically argillaceous
Lower Pennsylvanian (?)		Lower clastic sequence 2,900	Argillites, fine to medium-grained volcanic arenites
		-BASE NOT RECOGNISED-	
Unknown age (Possibly equivalent in part to pre-Middle Devonian basement of Danner and Misch)		Amphibolitic rocks	Rocks of possible diverse origin and age

Figure 26.

units (Fig. 2b & Map 1). Four of these (65% of the pile) are predominantly sedimentary with only minor tuffaceous material. The uppermost unit is volcanic (600 m maximum thickness).

A generally subaqueoes environment is indicated by the presence of a marine fauna in the sediments and pillow lavas in the volcanics amongst other things. However, there is some suggestion of subaerial environments locally (e.g. welding in tuffaceous units) and the top of the sequence is marked by a distinct unconformity which separates the volcanic rocks from Upper Triassic or Jurassic Cultus Formation sediments. A scenario involving an emerging volcanic island arc may be drawn.

Significant amounts of alteration and mineralization are reported in the area south of the Chilliwack valley. Alteration is in the form of silicification, sericitization and chloritization. Mineralization includes pyrite, pyrrhotite, chalcopyrite, sphalerite, galena and native gold described in various forms from disseminated to massive including veins, 'stringers', stratiform lenses, etc.

PREVIOUS EXPLORATION (Figure 1)

The great majority of recorded exploration in the area is south of the Chilliwack River, on both sides of the International Boundary. This is described in the sections on the Tan property, the Redbird property and in the general section on exploration in northern Washington (includes Tomyhoi Lake area).

Around the Fraser Valley numerous occurrences of matallic minerals are recorded on the B. C. Mineral Inventory map (92H/SW), but most are in adjacent intrusions and none are considered of any significance.

On the east side of Harrison Lake past exploration has concentrated upon the Ni-Cu potential of the mafic intrusions which bound the Chilliwack Group to the east. During these investigations some information has been obtained on the adjacent sediments and volcanics as described in the section on the North Fork area.

TAN PROPERTY

The Tan property, consisting of the Tan and Dane claims, is situated immediately north of the International Boundary 20 km southeast of Chilliwack (Fig. 1). Access is via the Chilliwack Lake road and the Tamihi Creek logging road.

Mineralization was first found in the early 1960's, but was not staked until 1972. Since that time various companies, as well as the property owners, have carried out exploration as summarized below.

1972: Minor trenching by the owners.

1972: Falconbridge - geological mapping and soil sampling prior to making an option decision.

1972: Cominco - soil and stream silt sampling and geological mapping.

1973: Cominco - induced polarization survey, road building and diamond drill site preparation.

1975: Great Plains Development - geological mapping, geochemical surveys, electromagnetic survey (Maxmin II), road building and diamond drilling.

1976: Great Plains Development - geological mapping, soil profile studies, trenching, induced polarization and electromagnetic surveying, diamond drilling and, off the property, a regional stream sediment geochemical survey.

1977: Great Plains Development - Scintrex Helicopter-borne EM & MAG.

1979: Consultants Report (W. G. Smitheringale) for owners - limited mapping & follow up recommendations.

1980: IP Survey, minor diamond drilling.

1981: Lornex Acquisition: VLF survey, MAG, drilling, limited geological mapping.

Where possible, the location of this exploration work has been included on Map 2.

The geology of the property area is nicely described by Garratt (1975) in a report for Great Plains. This description is appended (App. 1). He interprets the environment of deposition in the area as being that of a "volcanic knoll" which was the centre for a diverse assemblage of volcanic flows and, often coarse, volcanic breccias. Evidence indicates variation from very shallow water (~30 m, possibly subaerial locally) to deeper basins with volcanic arenites and pyroclastic flows. However, because of the reconnaissance nature of most of the mapping, no attempt was made to define or interpret stratigraphic facies variations which might assist in finding potential ore hosting locales.

A black to grey chert with ubiquitous pyrite, described as a silicified and pyritized water lain tuff, is denoted as a mineralized horizon (it sounds like it might be exhalative!). It has been mapped and trenched in the main showing area (see map) and elsewhere is defined by soil geochem.

Alteration in the form of silicification, chloritization and local sericitization is quite abundant. In Garratt's 'Upper Series' this occurs in discrete zones. In the lower series it is more widespread, associated with the intrusion of a feldspar-quartz porphyry of dacitic composition.

Great Plains' follow up approach was to drill coincident geochem/IP anomalies. Seven holes were drilled near the Tamihi Creek/Falls Creek intersection. (This would put them in their Lower Series.) Although disseminated sulphides were encountered which they considered sufficient to explain the IP anomalies, no significant intersections were made. Their logs, however, do note banded, sulphide bearing sections which may represent exhalites. (Three of the holes were prematurely stopped above 15m whilst one failed to reach bedrock.)

Two holes were drilled in their mineralized horizon, one near the main showing, one near Fumarole Creek (exact location unknown). These failed to intersect significant mineralization. Their results caused them to reinterpret the 'mineralized horizon' as an altered stratiform structure rather than a stratigraphic horizon.

Before dropping their option on the property Great Plains flew a Scintrex Helicopter-borne Mag/EM survey. The quality of the prints obtained from assessment file microfiche is insufficient to define the exact area flown, but no EM anomalies were found within it and there is no record of them having done any follow up.

In the summer of 1979 a consultant for the owners reported upon the economic possibilities of the property. By that time, logging road construction had unearthed sulphide bearing float in several places in the southeast part of the property. Boulders up to 1.5m in diameter comprised of felsic pyroclastics with up to 75% py (cp-sp) were found. As well as remarking upon the significance of this, the consultant also concluded that previous work may have underestimated the influence of folding and hence that stratigraphic interpretations may have been misguided.

In 1980 the owners had an IP survey run in the area of the sulphide float. A zone of strong chargeability response was obtained. Lornex then optioned the property in order to test this. They encountered disseminated and fracture controlled sulphides (mainly pyrite) in sufficient quantities to explain the IP anomaly, but were not encouraged enough to continue exploration. They concluded that there is generally too much sulphide around for IP to be of much use.

It is evident from the available data that the Tan property area has excellent Kuroko-type deposit potential. The Chilliwack group volcanics were deposited in a submarine environment and show numerous signs of hydrothermal alteration. Sulphide occurrences are numerous and include sphalerite and chalcopyrite locally.

Work to date has failed to produce an adequate map of the local geology and the drilling of coincident IP/soil geochem anomalies has been unsuccessful. The area begs for a detailed geological - lithogeochemical approach for meaningful drill target definition. Because of the relatively flat lying stratigraphy a large area of potentially favourable volcanics is available. Outcrop exposure, although locally poor, should be adequate for such an approach.

NORTH FORK AREA

The North Fork property is located on the east side of Harrison Lake about 30 km north of Harrison Hot Springs (Fig. 1). Access is via a logging road up the east side of the lake.

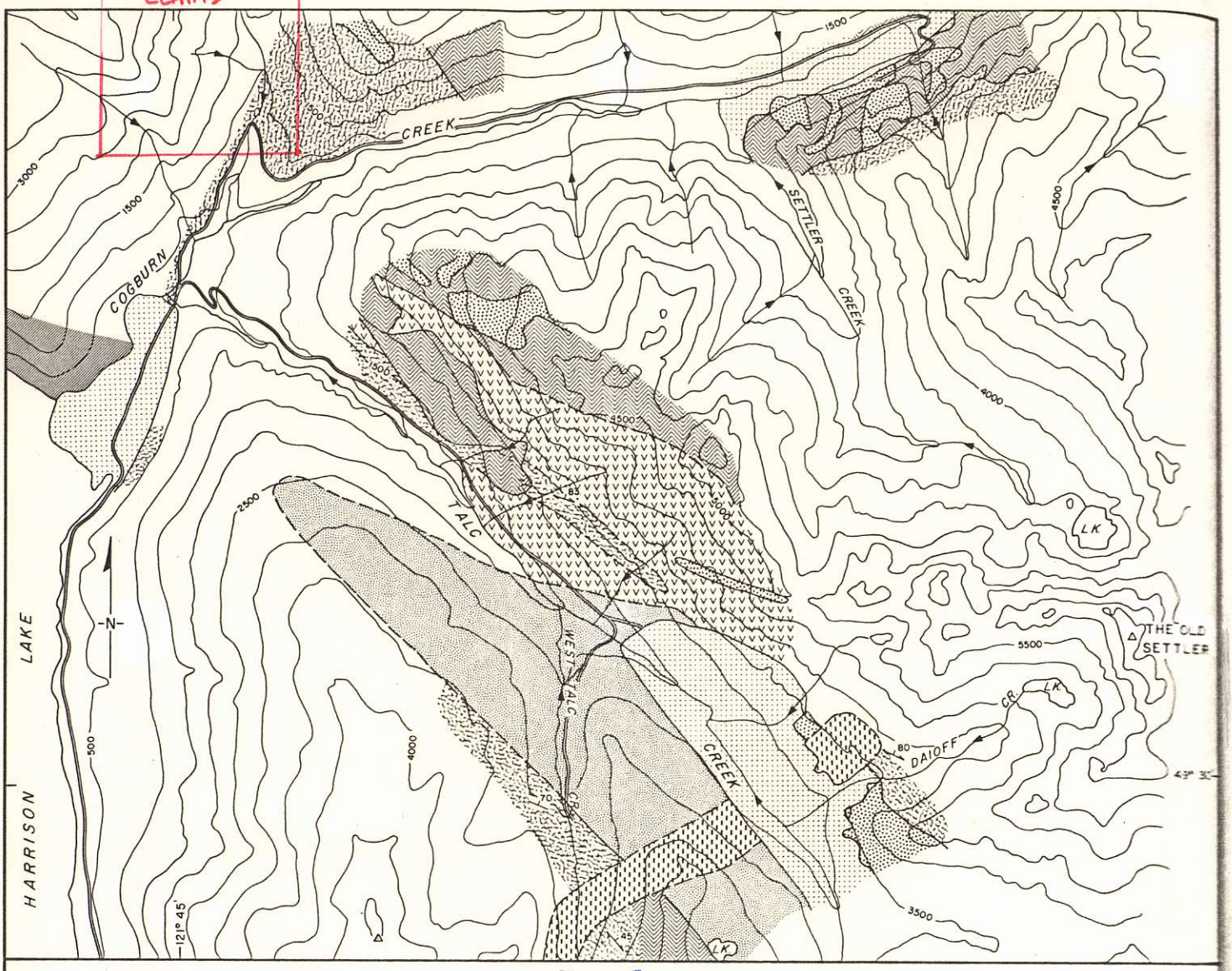


Figure 4

GEOLOGICAL SKETCH MAP OF THE COGBURN – TALC CREEKS AREA

- Drift and alluvium
- Granodiorite, orbicular in part
- Quartz diorite, diorite
- Diorite, gabbro, norite, hornblendite. Includes small patches of pyroxenite
- Pyroxenite, peridotite
- Altered pyroxenite and peridotite
- Metavolcanic (?) rocks
- Metasedimentary rocks
- Contact; defined, assumed
- Bedding
- Schistosity

Scale 1/2 0 1/2 1 1 1/2 2 Miles

Scale 1 0 1 2 3 4 Kilometers

Figure 3.

Previous exploration has been entirely directed toward the discovery of nickel-copper mineralization and was carried out by Nickel Syndicate, a joint venture vehicle of Giant Explorations and Giant Mascot Mines Ltd. Until it's closure in 1974, Giant Mascot owned and operated the Pride of Emory Ni-Cu Mine some 12 km to the southeast.

The area is described in BCDM GEM 1971 as being underlain by a complex array of metasediments, probable metavolcanics and intrusive rocks (Figure 3). The sediments and volcanics are largely schistose, while the intrusions range from ultramafic to granodiorite. Disseminated and shear related sulphides are reported to be sparingly distributed through all rock types.

Several sulphide occurrences, believed to be related to mafic and ultramafic intrusions, were discovered by the Nickel Syndicate. However, because nickel values were generally low, they gradually lost interest in the area.

Renewed interest has been sparked by the discovery of massive sulphides assaying 3.28% Cu, 1.27% Zn, 1.28 oz/t Ag and 0.006 oz/t Au (grab sample) during road construction. The available data on this (North Fork property), has been reviewed by A. J. Davidson (internal memo, March 3rd, 1983) and a property visit is pending.

NORTHERN WASHINGTON

Since the International Boundary is an artificial constraint and not a geological one, the Chilliwack group rocks of the area north of Mount Baker in northern Washington are included in this report. The group actually continues south into Oregon and California but the Tertiary and Quaternary volcanic cover that is Mount Baker forms a convenient demarcation line (Figure 4).

In general geology these Chilliwack group rocks are very similar to their counterparts in Canada. The major difference is the presence of Devonian age rocks at the base of the group. These are presumed not to be exposed in Canada because of thrusting. Major base and precious metal showings such as the Redbird (see separate section) may actually be of Devonian age but this is uncertain at this time.

Apart from the Redbird prospect, the only data currently available on the mineral deposits in the area is from a 1969 Washington Department of Natural Resources Bulletin (#57) on the Mines and Mineral Deposits of Whatcom County. Figure 4 shows the names and locations of various occurrences associated with the Chilliwack group while synopses of each are provided in Appendix 2.

The greatest concentration of occurrences is in the eastern part of the area. Although most are described as veins in shear zones little confidence can be placed in that interpretation (the Redbird (see next section) is also described as a vein!). Several are past producers, though none are believed to be currently active. All the past production was in gold despite some quite spectacular silver, copper, zinc and even lead values being reported. For example, the Silver Tip Mine has reported assays of up to 6% Cu, 20% Zn, 50 oz/t Ag and 0.4 oz/t Au.

LEGEND

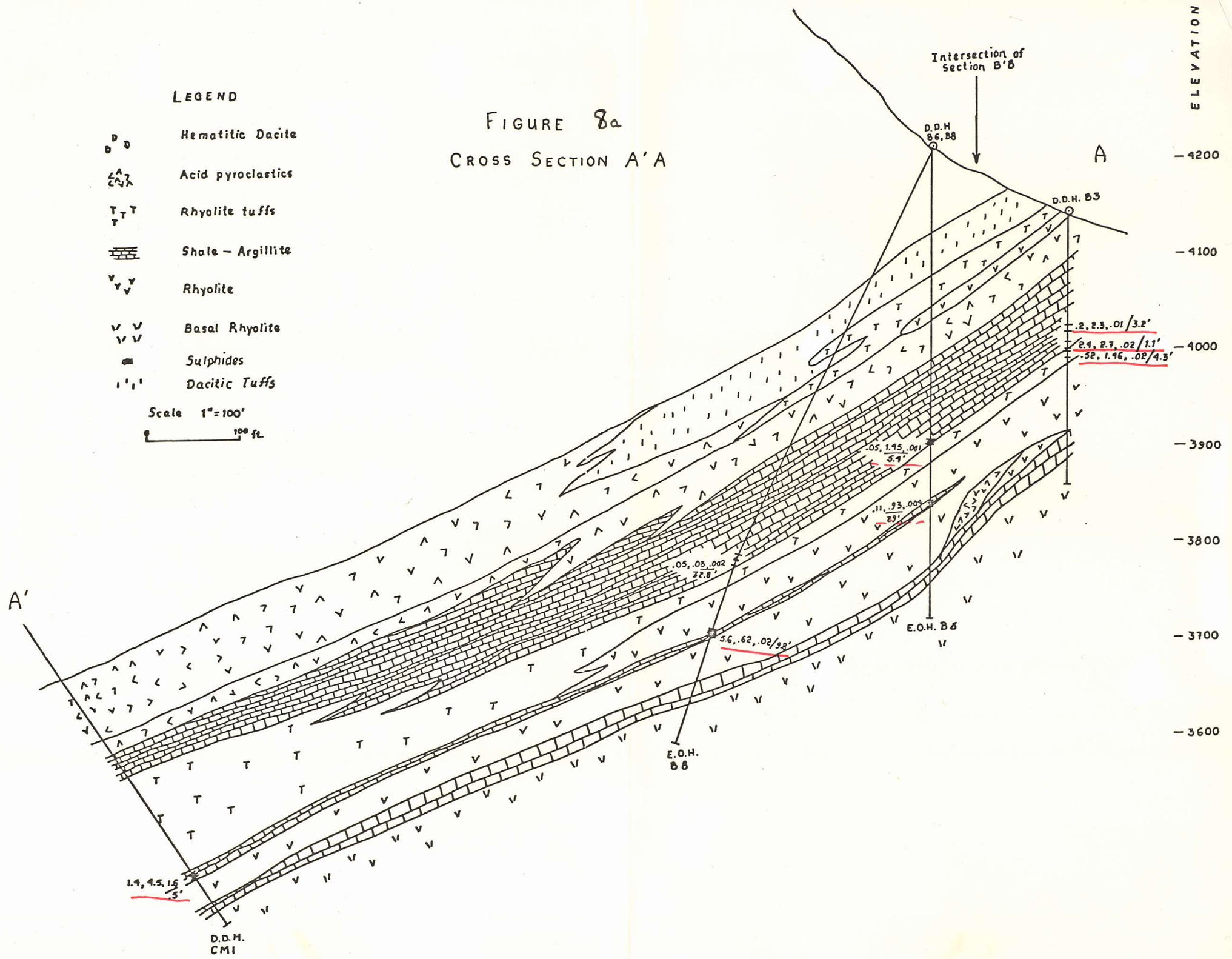
- Hematitic Dacite
- Acid pyroclastics
- Rhyolite tuffs
- Shale – Argillite
- Rhyolite
- Basal Rhyolite
- Sulphides
- Dacitic Tuffs

Scale 1"=100'

100 ft.

FIGURE 8a

CROSS SECTION A'A



B

B'

D.D.H. 89

D.D.H. 87

Intersection of Section A'A

D.D.H 82

D.D.H 84

Upper Andesite

.3, .6, tr/2.9'

.05, .1, .01/4'

.13, .15, tr/3.4'

.03, .1, .01/4.9'

ELEVATION

4500

4400

4300

4200

4100

4000

FIGURE 8b

CROSS SECTION B'B

Scale 1" = 100'

0 100 feet

LEGEND

- Hematitic Dacite
- Acid pyraclastics
- Rhyolite tuffs
- Shale – Argillite
- Rhyolite
- Basal Rhyolite
- Dacitic Tuffs

REDBIRD PROPERTY

The Redbird property is located just north of highway 542, some 5 km east of Glacier (Fig. 4).

Mineralization there has been known since the early 1900's but wasn't staked until 1956, at which time some trenching was done and a single 18' (6 m) diamond drillhole put down.

In 1973 Birch Creek Resources Ltd. (Texasgulf) optioned the property and conducted geological and geochemical surveys culminating in a drill program believed to consist of at least 6500' in 9 holes. They terminated their option in 1975.

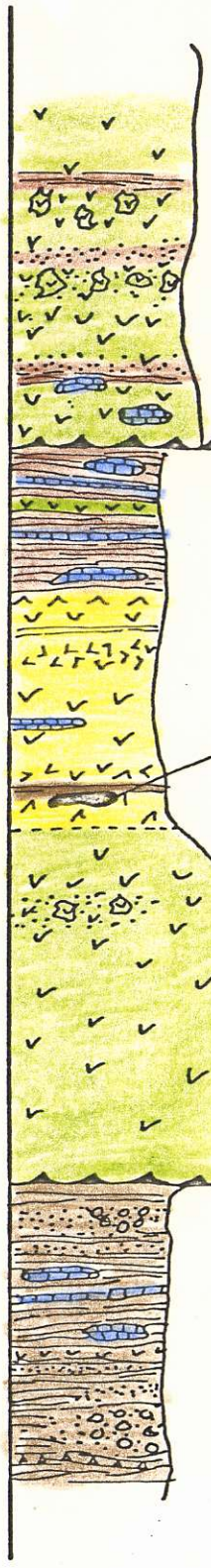
United Mineral Services Ltd. then conducted a stream sediment survey in the area and optioned the claims. In 1977 this option was transferred to Serem who did extensive staking, mapping and soil sampling and a limited vector PEM survey. Despite encouraging results and a proposal of joint venture with Texasgulf, they dropped the option in 1979.

The exposed mineralization consists of a banded massive pyrite, chalcopyrite and sphalerite lens from 1 - 3' thick and 9' long. A 3' chip sample assayed 7.75% Cu, 7.15% Zn and 2.55 oz/t Ag (Au?). Two smaller lenses of massive pyrite (no assays available) are also exposed nearby.

The immediate host rocks are described as locally siliceous, pyritic black shales (Fig. 5). Footwall units are andesitic volcanics in which primary textures have been obscured by chlorite-epidote alteration. Approaching the mineralized horizon these become increasingly siliceous. Hangingwall units are a complex mixture of rhyolites, 'quartzose tuffs', pyroclastic breccias, banded cherts and bedded barite.

Figure ~~4.~~ Generalized Stratigraphic Section, Church Mountain

Dec. 1970 J.G.



Chilliwack Group.

C_3 Andesite flows, often pillowed, tuff agglomerate, breccia and associated sedimentary rocks: greywacke, minor shale, conglomerate; limestone lenses near base.

> 1200'

Thrust with probable minor displacement

C_2 Complex unit containing dacite to rhyolite flows, tuffs and breccias. Upper part is dominantly shale, limestone and chert. Also thin andesite flows. Abundant pyrite.

150-500'

Main Redbird Showing

Gradational Contact

C_1 Massive fine-grained andesite. minor agglomerate and breccia.

200-600'

Church Mountain Thrust

Nooksack Group

Carbonaceous shale, chert, greywacke, turbidites, minor conglomerate, limestone lenses and thin interbeds. Rare volcanic layers.

> 2000'

Fig. 5.

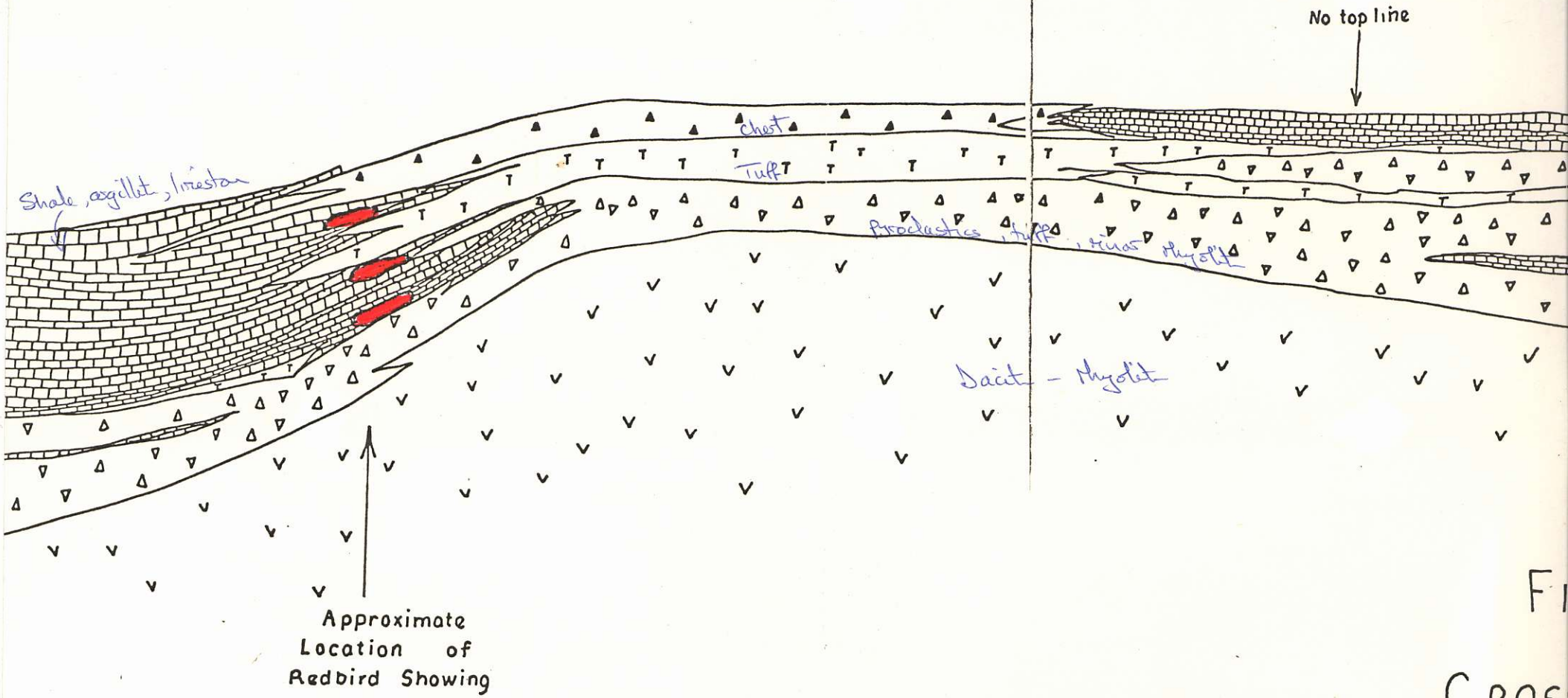
Texasgulf interpreted the sulphides to be lying on the flanks of a dome-like feature in classical Kuroko fashion (Fig. 6). They intersected significant sulphides at at least 3 horizons. Although eliminating potential for an elephant contiguous with the surface showing, they by no means eliminated the potential of the area as a whole.

Figure 7 shows the locations of Texasgulf diamond drillholes in relation to the Redbird showing. Figures 8a and 8b are the sections indicated. They show a complex stratigraphy typical of volcanic vent areas with rapid and numerous stratigraphic facies variations.

Figure 9 is a rough long section constructed from the available data. The spacing of the holes leaves considerable scope for good size lenses of massive sulphides as well as excellent down dip potential. Adding to this potential is a large mercury anomaly which Texasgulf are reported to have found to the north (Fig. 10). They tried to tempt Serem into a joint venture with this information, but because it would involve deep drilling (2000'+) in rugged terrain, Serem declined.

CONCLUSIONS & RECOMMENDATIONS

The Chilliwack group of southern B. C. and northern Washington is a readily accessible belt with very good massive sulphide potential. Within the belt, three levels of exploration priority may be assigned based upon available data.


No top line
Shale, argillit, limestan
chert
Tuff
Dacit - Rhyolit
Approximate
Location of
Redbird Showing

Figwe 6.

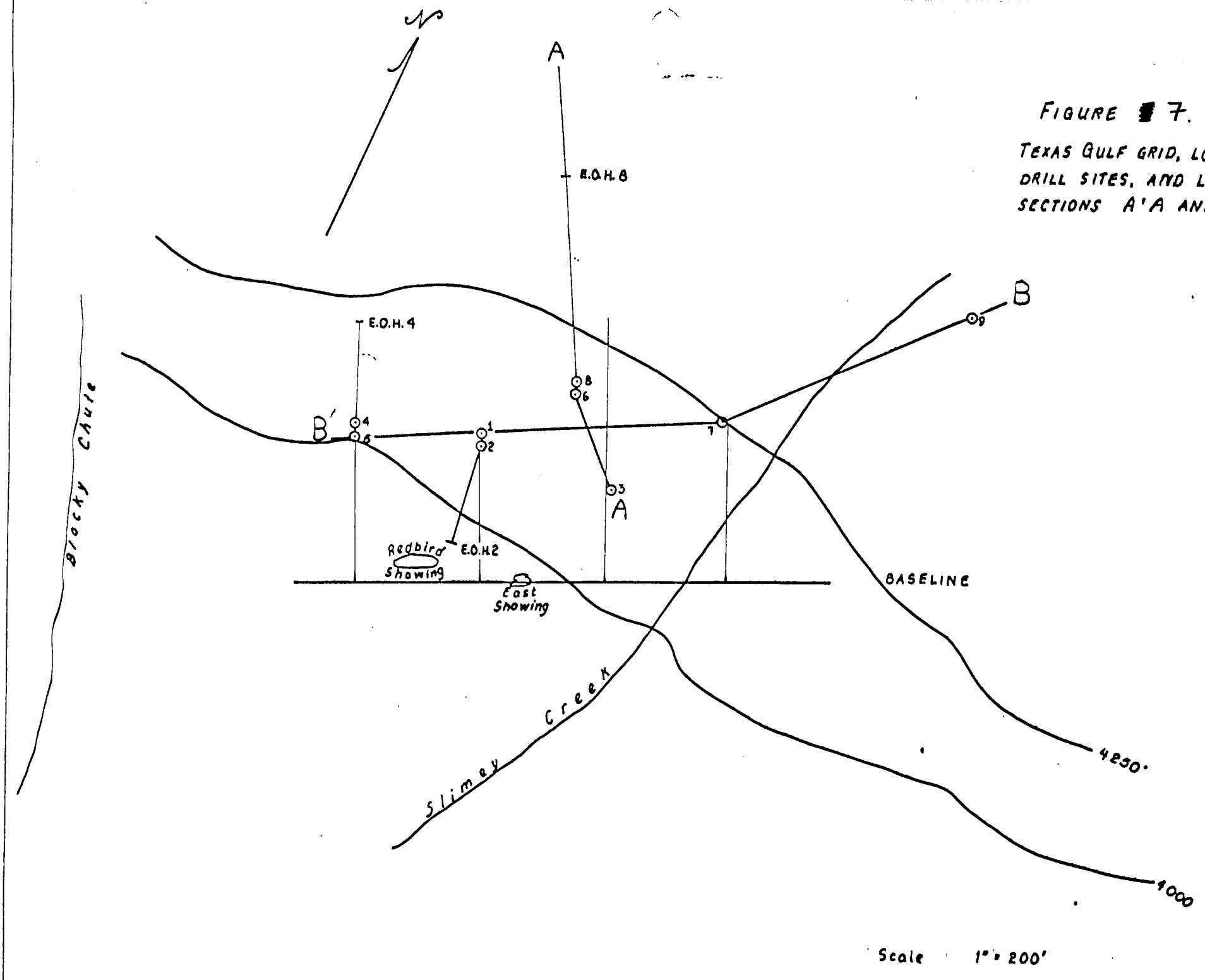


FIGURE 7.

TEXAS GULF GRID, LOCATION OF DRILL SITES, AND LOCATION OF SECTIONS A'A AND B'B

Scale 1" = 200'

Priority 1

Area between Chilliwack River (B. C.) and highway 542 (N. Washington) - contains both massive sulphide and gold mineralization including the Tan and Redbird showings and various prospects and minor producers in the Tomyhoi Lake area. Geology is poorly understood in detail, but recognized in a general sense as being favourable for Kuroko style massive sulphides.

Priority 2

North Fork area, east of the middle of Harrison Lake - geology poorly understood. Volcanics suspected to be present. Rocks often highly sheared. Massive sulphides of uncertain origin locally present and poorly explored. No past producers.

Priority 3

Rest of belt - geology very poorly known. Abundance of volcanics unknown. Almost no mineral occurrences.

Similar opportunities to become established are present in both priority 1 and 2 areas due to currently available properties and relatively open ground position. The Tan - Redbird - Tomyhoi Lake area is given higher priority mainly because of the abundance of occurrences. North Fork area is somewhat more of an unknown quantity. Priority 3 areas are not recommended until such time as we have a geological model to work with based upon more detailed work in the area. It is a purely grassroots target which is unjustified in our current position.

The following steps are recommended to pursue our interest in the Chilliwack Belt.

1. Tan property evaluation to continue with high priority.
2. Visit North Fork property.
3. Continue Redbird enquiries (attempts to contact owners underway; approach to Texasgulf may be necessary later, but should be avoided for the time being).
4. Visit Bellingham to establish claim ownerships in the Tomyhoi Lake area and attempt to discover claims status.
5. Continue research into the Chilliwack group further south into Washington.

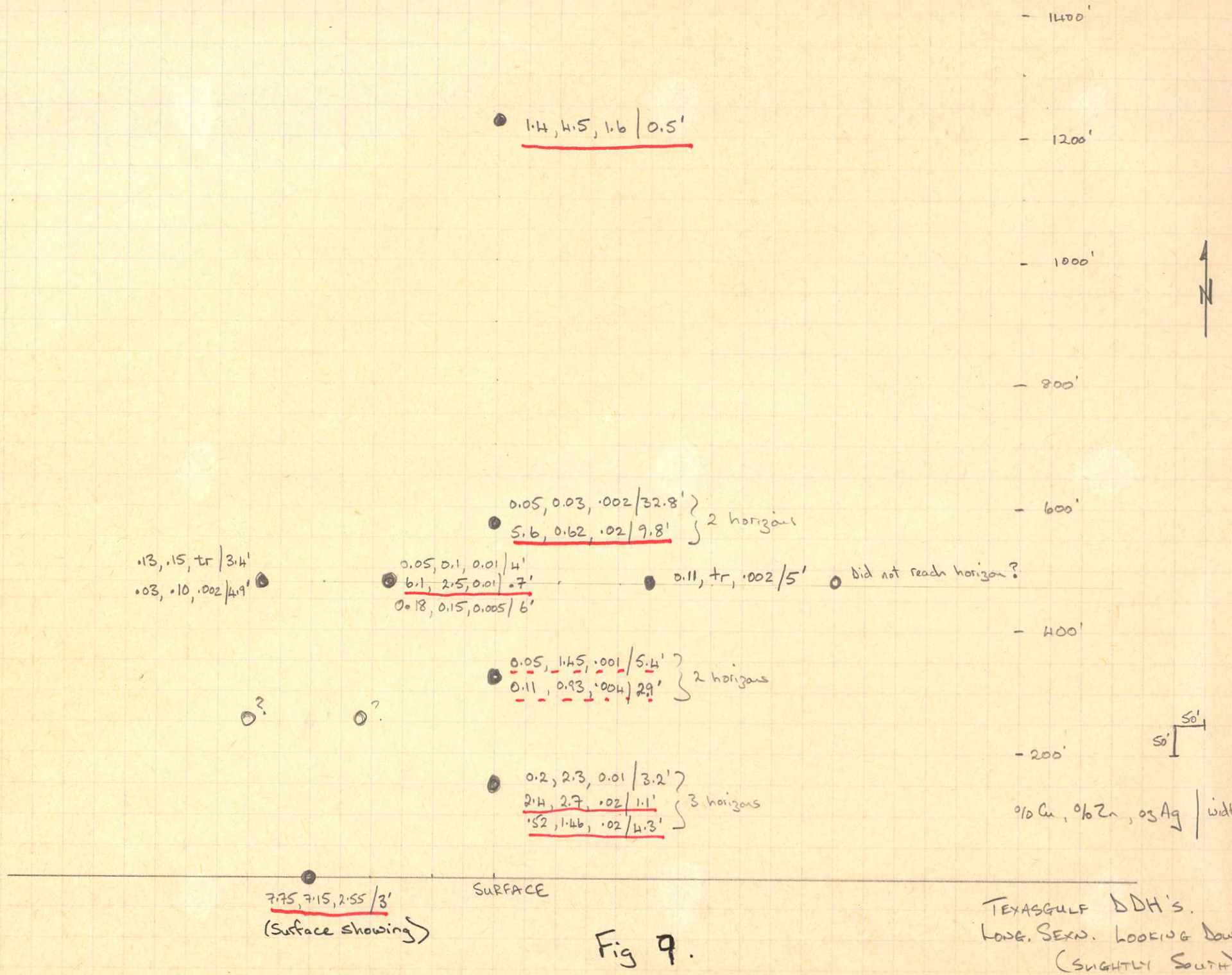


Fig 9.

TEXASGULF DDH's.
LONG. SECN. LOOKING DOWN
(SLIGHTLY SOUTH)

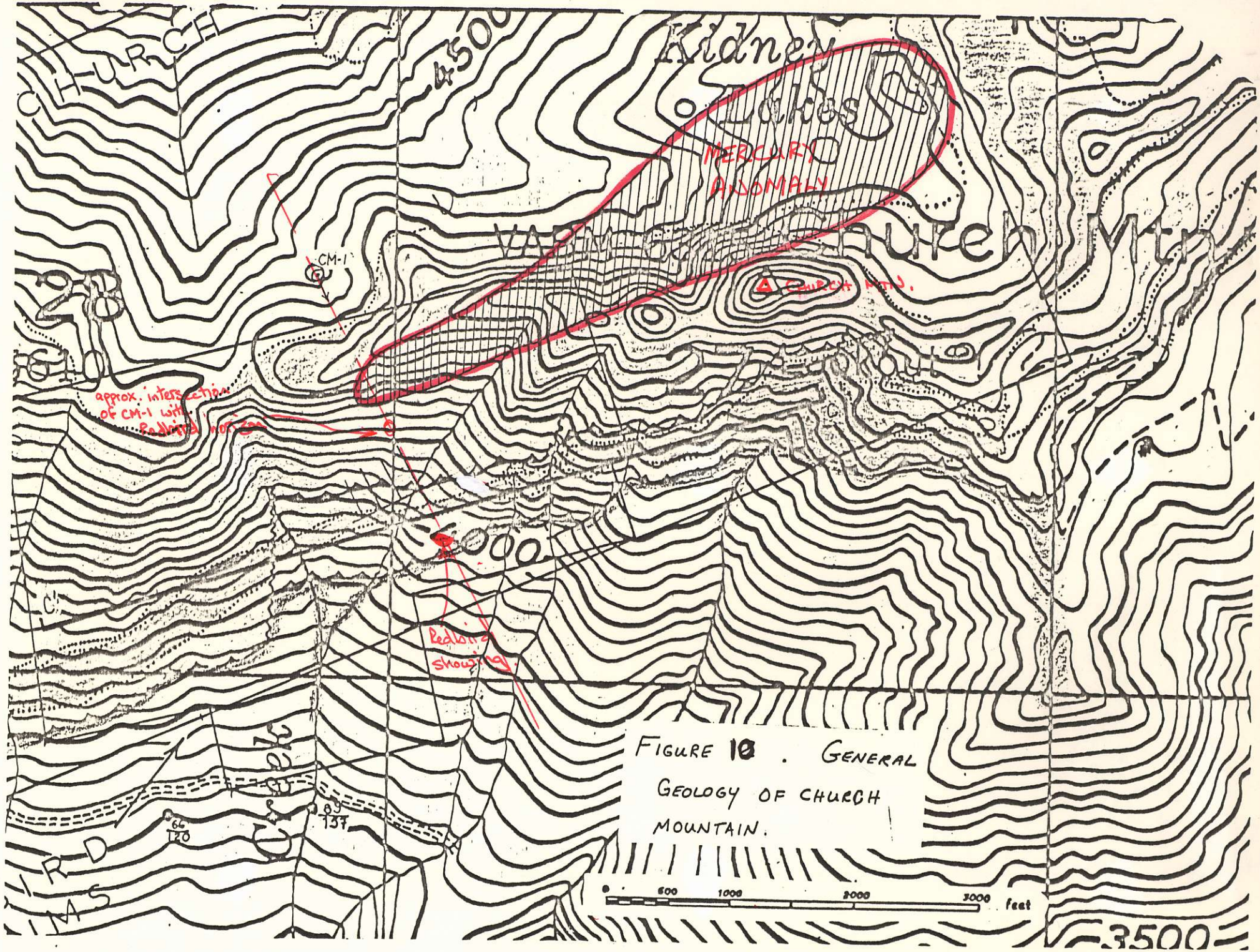


FIGURE 10. GENERAL GEOLOGY OF CHURCH MOUNTAIN.