BRIEF REPORT ON THE STRUCTURAL GEOLOGY AT THE FRASERGOLD PROJECT, MACKAY RIVER AREA, CENTRAL BRITISH COLUMBIA

for

AMOCO CANADA PETROLEUM CO. LTD.
MINING DIVISION

by

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1 INTRODUCTION

The gold mineralization on the Mac and Kay claims, Cariboo Mining Division, is located in black phyllitic and argillitic rocks which are believed to be Upper Triassic. These rocks are situated at the eastern margin of the Quesnel Trough and have been deformed and metamorphosed, together with older rock units of the Omineca Crystalline Belt, into a northwest plunging fold system. The purpose of this work was to examine the structural geology and determine if the mineralization was controlled or influenced by folding, fracturing or possibly quartz veining.

I was asked in particular to determine if the rock unit hosting mineralization could be isoclinally folded on the scale of 10's of meters or if quartz veining was related to any particular structure.

Four days of field work was spent on the property; September 5th to 8th, 1984. During this time I examined outcrops along the access tracks, in Grouse Creek, along trenchs in the grid area and along logging roads north and south of the Mackay River. In addition I looked at core from two holes drilled in 1983 (FBC 83-2 and 5) and holes currently being drilled (84-6a, 84-7).

2 STRUCTURAL SETTING

The project area lies on the northeastern limb of the northwest plunging Eureka syncline, whose axial trace lies along the range of hills 3 km southwest of the Mackay River. About 6 km to the northeast of the river is the axial trace of the Perseus Anticline. These folds display a change in attitude along their trend. Southeast of the project area the folds are overturned to the southwest (axial planes dip steeply northeast) whereas to the northwest the folds are upright. The Mac and Kay claims have an intermediate position, and the rock units undergo a transition from upright in the southwest part of the property, through vertical to being overturned just north of the Mackay River.

This situation is shown in Figure 1, which corresponds roughly to grid line 55 E. Field observations have been projected onto this line of section. I suspect the Mackay River valley marks a major zone of vertical or near vertical fracturing. The Upper Triassic black phyllite unit is sandwiched between two more competent units; younger intrusives and volcaniclastics above and to the southwest and older amphibolites to the northeast. In order to accomodate the transition of fold form across the line of section; i.e. the change from upright to overturned limb, structural adjustments such as shearing would be concentrated in the incompetent phyllitic unit.

3 STRUCTURAL OBSERVATIONS

3.1 Surface Exposures

Notated on Figure 11 (Frasergold Grid - West Half) are field observations. These include the following:

1. Compositional layering or bedding (S_0); general attitude striking southeast (133°), dipping 30-45° to the southwest

2. Penetrative foliation, axial plane schistosity (S_1); general attitude striking southeast (130°), dipping 35-85° to the southwest

3. Crenulation cleavage (S_2); less commonly seen than S_1, attitudes observed dipped 32 and 50° to the northwest. This cleavage formed the axial planes of coarse, widely spaced crenulations (5-10 cm spacing).

In all cases where S_0 and S_1 could be determined together, the vergence (the direction of movement and rotation during deformation) was to the northeast in the direction of the major anticlinal axis. The bedding and cleavage relations seen south of the Mackay River indicate the rocks are right-side-up. No outcrops were seen where structural inversion could be demonstrated. North of the Mackay River along the logging road there are outcrops of phyllite that are upside down, dipping steeply to the northeast. Farther up the hills northeast of Mackay River the rock units are also inverted. This is on the overturned limb of the Perseus Anticline.

In many places bedding is not discernible and the only foliation developed is the schistosity.

4. Mineral lineations produced by the intersection of S_0 on S_1 plunge at low angles (05-10°) to the northwest. These parallel the plunge of the larger fold structure.

5. Crenulations produced by the intersection of the schistosity on bedding. These have a similar orientation to the mineral lineations.

6. Coarse crenulations produced by the intersection of the crenulation cleavage (S_2) on the schistosity (S_1). These are a later development than the northwest plunging folds. They plunge 20° to 30° to the west-northwest (264-302°).

7. Larger folds were seen in three areas (noted in yellow on Figure 11); Site 5 on road #4 (L60E, 200S), Site 7 on upper road (L63E, 500S) and Site 8 on Grouse Creek (64+50E, 250S). These all had similar features, namely:

- amplitude ½ to 2 m, wavelength 1 to 10 m
- fold axes plunge at low angles to the northwest, average 5-10° to 310-315°
- vein quartz rolls, boudins in hinge areas
- parasitic folds developed on southwesterly limbs display vergence to northeast
- the folds at Sites 5 and 7 had a broad, open style, whereas those at Site 8 had a tight, similar style
- the southwesterly limbs of these folds had dips of 30° to 45° whereas the northeasterly limbs were nearly vertical. This indicates a vergence to the northeast, concurring with that of the bedding to cleavage (schistosity) relation and the sense of transport indicated by smaller parasitic folds.

Quartz veins, boudins and rolls are a common occurrence in the knotted phyllite unit. Many veins are distributed in discontinuous swarms. The great majority of veins are parallel to the schistosity where only S_1 is visible. In places where bedding can be identified the veins are subparallel to the bedding. This is particularly apparent at the zones of folding. A very few, thin (less than 2 cm thick) stringers occupy south dipping joints. The quartz is commonly milky white, compact yet often has vugs and small pockets filled with limonite. No sulphides were noted.

The veins are in most cases 2-20 cm in width and extend along strike 5-10 m. These are often disrupted, truncated or attenuated by the axial plane schistosity.

Quartz veining in surface outcrop is shown in Figure 4, drawn from detailed trench maps. Veins, rolls (small boudins, cm in scale) and boudins are best developed and most numerous in one of three folded "zones"

1 lowermost zone; near base of knotted phyllite unit,

2 middle zone; between main road and contact, and

3 upper zone; along and above main road.

These three zones are shown in Figure 4. Also shown are veins compiled from surface mapping.

3.2 Drill Core

Several sections of drill core clearly display the bedding to cleavage relation. In all such cases the cleavage dips

more steeply than the bedding indicating the rock units are not structurally inverted.

Three general cases of folding on the scale of the core can be recognized:

Type 1. Disrupted layering and foliation adjacent to quartz veins and rolls. This is a local, small scale type of folding which can be seen in outcrops of phyllite that have quartz segregations.

Type 2. Gentle, open folds with a wavelength of 15 to 30 cm and amplitude of 10 to 20 cm (Figure 2). These have an axial plane schistosity (S_1) and display a vergenge to the northeast. These are isolated folds and considered to be locally developed. Commonly there is little association with quartz veining, although quartz laminations may define S_0.

Type 3. Intensely crenulated, locally disrupted folds in argillitic and phyllitic rocks towards the end of the drill holes (Figure 3). The fold pattern is largely similar to the open, gentle style of Type 2 folds. They are distinguished by their development in series and by their more crenulated aspect.

Folded sections of core from holes 83-2 and 5 were noted on the cross section, Figure 31. The first occurrence of Type 3 folds in hole 83-5 projects up the general schistosity attitude (S_1) of 50-60° to very near that in hole 83-2. The same can be said for the top of the almost continually, intensely folded rocks in the bottom of both holes. Surface projections of these are indicated in Figure 4.

Quartz vein zones are indicated on the drill hole cross sections, Figures 29 to 32. In comparing holes 83-2 and 5, only one zone in the middle part of the core's length projects between the two holes. This is an expression of the discontinuous nature of the veining. For this reason other vein zones are not projected to the surface because of the unreliablity of such projection. Note that the quartz vein zone is projected at a shallower angle than the folded zones. This is because the veins are a bedded type and subparallel the general bedding attitude.

4 CONCLUSIONS

4.1 Folding

No repetition of rock members or units is recognized and neither is any evidence to indicate the presence of isoclinal folding. All folds observed, both on surface and in drill

core, are considered to be minor or parasitic folds subsiduary to the regional folds.

The units on the property are considered to be stratigraphically and structurally right-side-up; i.e. face to the southwest.

4.2 Quartz Veining

The quartz veins are metamorphic secretions initially developed subparallel to the compositional layering and then locally disrupted and folded by the schistosity. Some quartz veins, such as at Site 7 on the upper road, were seen developed along schistosity planes. This indicates quartz was mobile throughout the deformation event. Quartz has migrated into the hinge areas of parasitic folds forming rolls, lenses and boudins. The veins occur in swarms on the scale of 1 to 10 m. They are largely discontinuous at depth, as they are along strike.

Quartz veins are not restricted to the zones of surface folding. There appears to be a concentration of veins towards the base of the knotted phyllite unit (Figure 4) although this could be a bias of the available exposure.

4.3 Controls of Mineralization

Gold occurs as fine grains commonly associated with vein quartz (only ?) although anomalous gold values are not necessarily restricted to quartz vein zones determined in the drill core. Anomalous gold values in the core do not appear to project vertically any great distance; compare holes 83-2 and 5 for example. This is a further expression of the discontinuous and possibly local aspect of gold mineralization. Because of this feature anomalous gold values in the core are not projected to the surface for the same reason the quartz veins zones were not projected.

Zones of anomalous surface channel samples and gold in soils are compiled on Figure 4. I would conclude from this compilation that there is a spatial relation between soil anomalies, the basal contact of the knotted phyllite, middle and lower folded zones, areas of abundant quartz veining and anomalous channel samples. The stratigraphic aspect (lower part of the knotted phyllite) seems to be the predominant factor. Vein and fold zones do not project any great distance either along strike or down-dip. This is a reflection of their local nature, notwithstanding their greater abundance in the lower knotted phyllite unit. Veins are more numerous in the folded areas where they are thickest in the fold hinges. This is a common focus of migrating quartz secretions and explains the apparent, although not exclusive, relation between the folding and veining.

5 PROPOSED NEW DRILL SITES

Existing drill holes are well sited to test the extension of the lower and middle zones of surface folding and surface quartz veins.

Five proposed drill hole sites are indicated on Figure 4, A to E. Hole A is to test the soil anomaly there and possible extensions of the mineralization found in 83-2 and 5. Holes B and C are to further assess the mineralization beneath the soil anomalies and the possible geological controls of folding and quartz veining towards the base of the knotted phyllite. I would recommend that at least one hole test for veining and mineralization in the folded black phyllite unit. Hole D is to test the projection at depth (down-dip) of the veined and folded upper zone. Hole E has a similar objective in testing for mineralization at the base of the knotted phyllte unit.

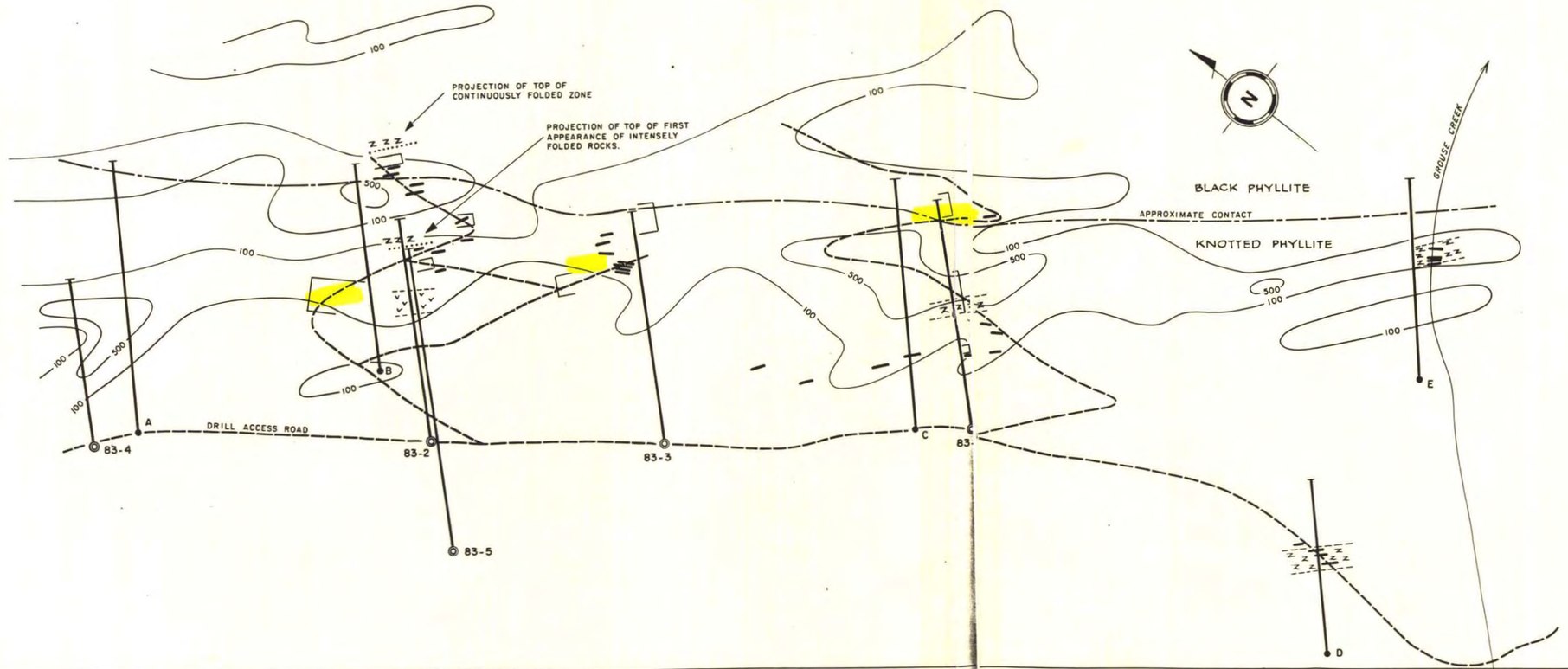
I would rate the proposed sites in the following fashion; first E, C, B, A and lastly D.

6 APPLICATION OF LOCAL GEOLOGICAL STRUCTURES

1. The bedding to cleavage relation is the most useful structural feature to determine the structural way-up. It can be applied both on surface and in core. The known general attitude of the schistosity (dipping 60° to the southwest) is used to orient core. If the bedding is shallower than the schistosity the rocks are right-side-up, if steeper they are overturned.

2. Minor folds will indicate the direction of the major anticline (in the direction of vergence) and whether or not the beds are overturned. In logging folded core (Type 2 or 3) first orient the core using S_1 and S_0 . Then look at the first fold form. If it is an antiform the vergence is to the northeast and the structure is right-side-up. An minor antiform should be followed by a minor synform. If a synform occurs first (above or up-core) then the rocks there could be overturned.

3. Project bedding using its general attitude of 45°. Because most veins are bedded, project them also at 45°. Folds and schistosity are projected at 60°.



LEGEND

- Existing drill hole
- Proposed drill hole
- 500 — Soil anomaly (ppb Au)
- Zones of anomalous channel samples
- Vein zone projected from 83-2 and 83-5
- Folded zone projected from 83-2 and 83-5
- Folded zone at surface
- Quartz veins

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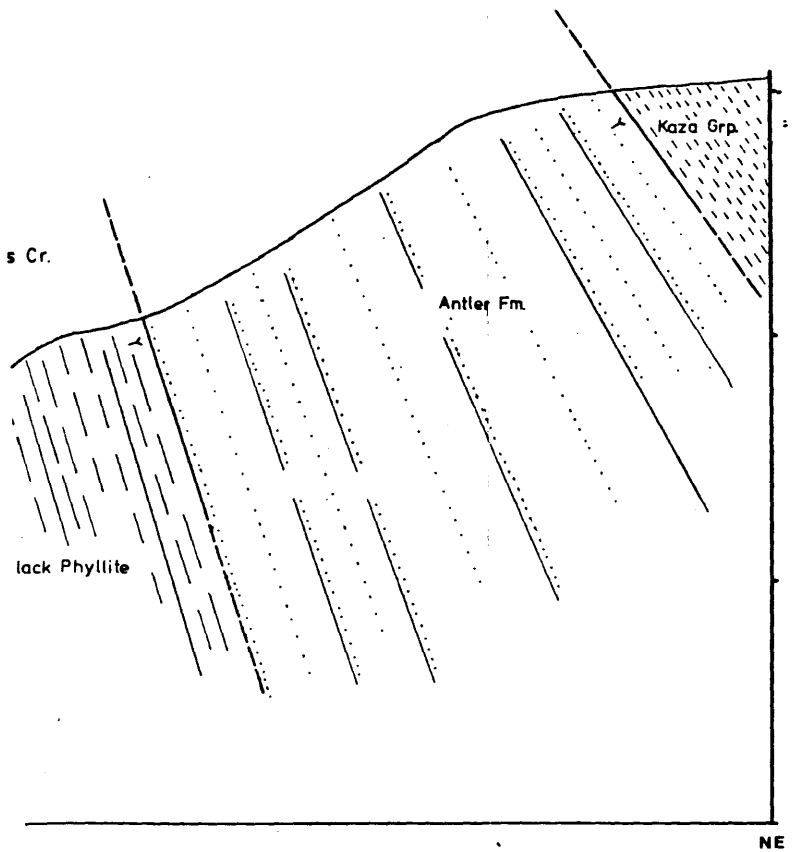
FRASERGOLD PROJECT

COMPILATION

SCALE 1:2500 0 50m	Sept. 20, 1984	93A/7
CAMPBELL & ASSOCIATES GEOLOGICAL CONSULTANTS		FIGURE 4



sense of movement

facing

minor, parasitic folds

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FRASERGOLD PROJECT

MACKAY RIVER CROSS SECTION

Scale 1:10,000 (0 — 200m)	Sept. 19, 1984	93 A/7

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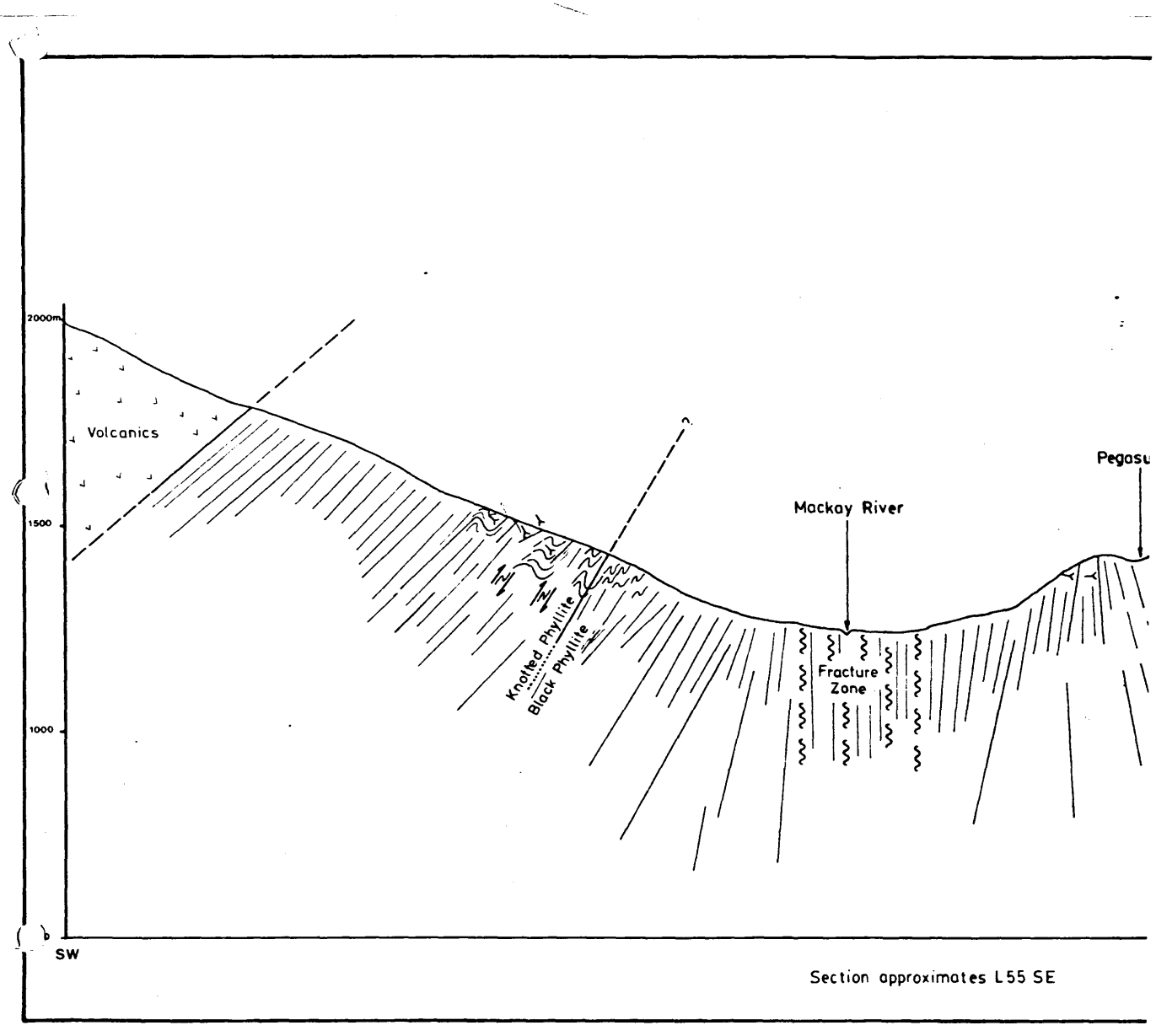
FIG. 1


2000m
1500
1000
Volcanics
Knotted Phyllite
Black Phyllite
Mackay River
Fracture Zone
Pegasu
SW
Section approximates L55 SE