CLEARWATER AREA
(82M/12W; 92P/8E, 9E)

By Paul Schiarizza

INTRODUCTION

During the 1980 field season approximately 325 square kilometres between Chu Chua Mountain and Clearwater were mapped at a scale of 1:15 840. This mapping is an extension of the Barriere Lakes-Adams Plateau project initiated in 1978 under the direction of V. A. Preto (Preto, 1979; this report; Preto, *et al.*, 1980). The area is underlain primarily by rocks of the Late Paleozoic Fennell Formation. The mapping was aimed at a better understanding of the internal stratigraphy and structure of this formation as well as its relationships with rocks of the Eagle Bay Formation which contact it to the east. In contrast to the interpretation of Fennell/Eagle Bay contact relationships advanced by Preto, *et al.* (1980), evidence from this area suggests that the Fennell Formation overlies the Eagle Bay, although the contact, at least locally, may be a fault.

This study forms part of a graduate thesis being undertaken at the University of Calgary and supported, in part, by the British Columbia Ministry of Energy, Mines and Petroleum Resources.

STRATIGRAPHY

EAGLE BAY FORMATION (UNITS 1 TO 6)

Rocks of the Eagle Bay Formation underlie an area of generally poor outcrop in the northeast corner of the map-area (Fig. 56). Immediately south of Clearwater westernmost exposures of the Formation are of dark grey to black phyllite with interbeds of siltstone, sandstone, and grit (unit 6). This unit is very similar to Eagle Bay rocks immediately east of the Fennell Formation in the Barriere Lakes area (unit 6 of Preto, *et al.*, 1980). There, early Mississippian conodonts (Okulitch and Cameron, 1976; Preto, *et al.*, 1980) were extracted from two lenses of limestone in unit 6. Okulitch (1979) correlates this unit with the carboniferous Milford Group of the Kootenay Arc and suggests that it unconformably overlies the bulk of the Eagle Bay Formation. South of Clearwater unit 6 dips to the northeast and structurally overlies rocks of the Fennell Formation; however, rare graded beds within the unit suggest that it is overturned. Overturning is also suggested by bedding/cleavage relationships (bedding dipping more steeply northeast than cleavage) within this unit and in immediately adjacent bedded chert of the Fennell Formation.

To the east, black phyllite of unit 6 appears to be interbedded with and structurally overlain by light silvery green quartz-sericite schists and pyrite-quartz-sericite schists (unit 5). 'Eyes' of clear quartz are sometimes present and may represent volcanic quartz phenocrysts. Also within unit 5 are somewhat more massive feldspathic rocks with relic textures that suggest they were coarse-grained felsic intrusive rocks.

Unit 6 apparently pinches out to the south and, in the vicinity of Foghorn Mountain and upper Foghorn Creek, the Eagle Bay Formation consists of rusty weathering, greenish grey, moderately to weakly foliated

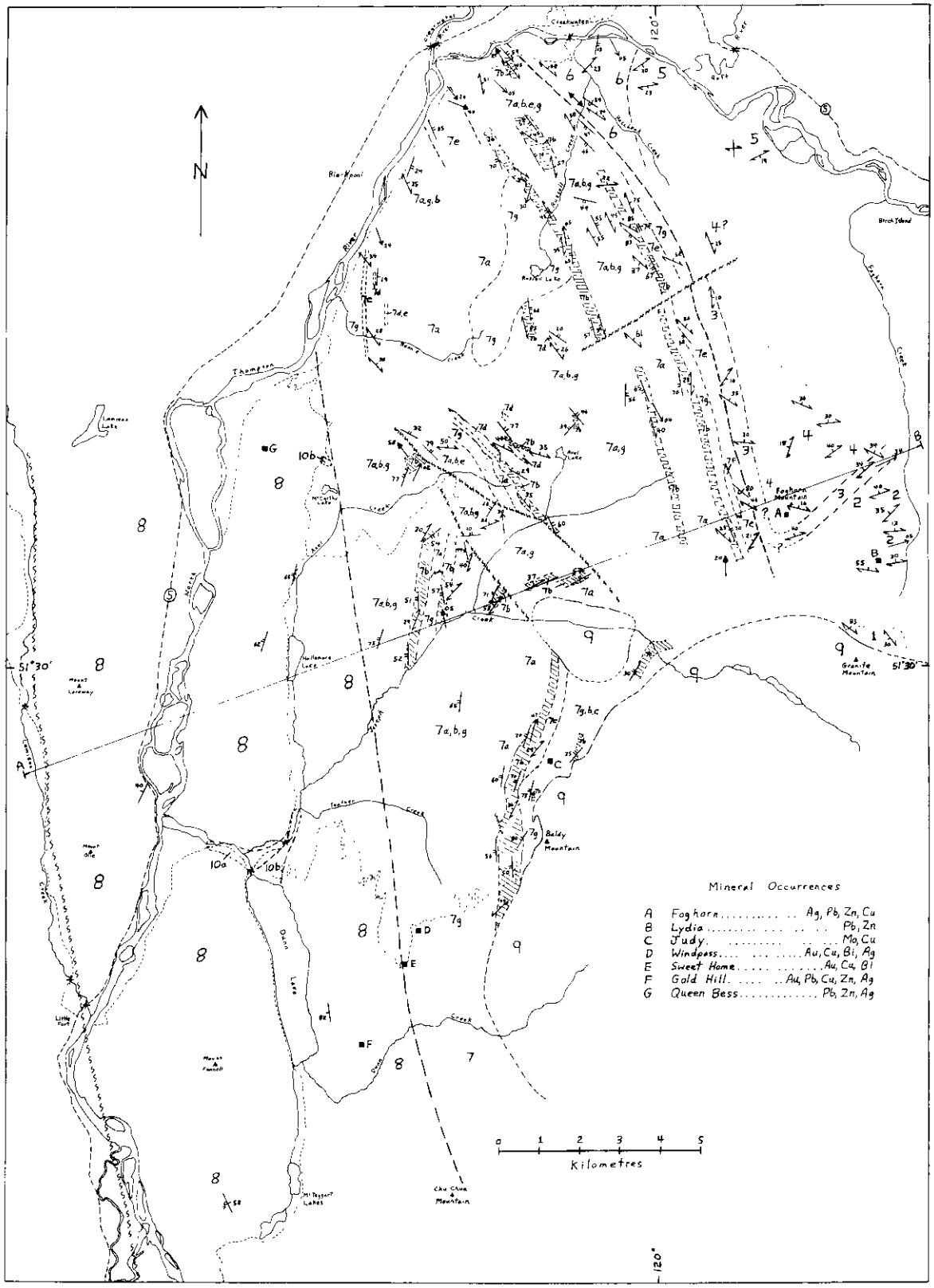

Figure 56. Generalized geological map of the Clearwater area.

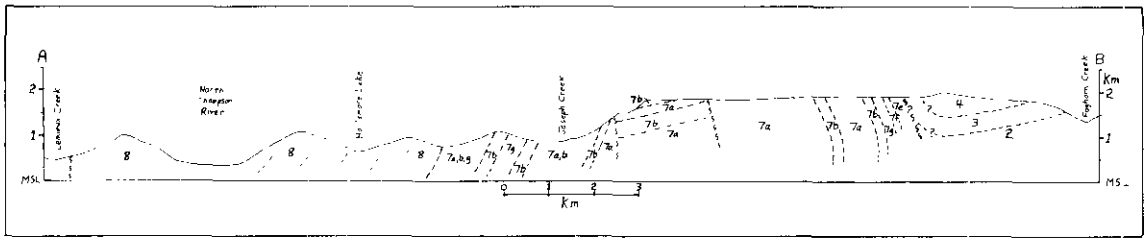

Figure 57. Vertical cross-section to accompany Figure 56.

LEGEND

EOCENE AND LATER (?)

10 (b) SKULL HILL FORMATION: VESICULAR ANDESITE
(a) CHU CHUA FORMATION: CONGLOMERATE, SANDSTONE, SHALE

CRETACEOUS

9 BIOTITE QUARTZ MONZONITE OF BALDY BATHOLITH AND JOSEPH CREEK STOCK

MISSISSIPPIAN (?) AND/OR LATER (?)

FENNELL FORMATION

8 WESTERN (UPPER ?) FENNELL FORMATION: PILLOWED AND MASSIVE BASALT, MINOR CHERT, AND BASALT BRECCIA

7 EASTERN (LOWER ?) FENNELL FORMATION

(g) GABBROIC AND DIORITIC ROCKS
(f) LIMESTONE
(e) ARGILLITE, PHYLLITE; MINOR SANDSTONE AND QUARTZITE
(d) CONGLOMERATE
(c) QUARTZ FELDSPAR PORPHYRY
(b) BEDDED CHERT
(a) MASSIVE AND PILLOWED BASALT

MISSISSIPPIAN (?) AND EARLIER (?)

EAGLE BAY FORMATION

6 DARK GREY TO BLACK PHYLLITE WITH INTERBEDDED SILTSTONE, SANDSTONE, AND GRIT

5 LIGHT SILVERY GREEN (±PYRITE)–QUARTZ–SERICITE SCHIST

4 RUSTY WEATHERING, GREENISH GREY, FELDSPATHIC CHLORITE–SERICITE SCHIST: IN PLACES FRAGMENTAL. MINOR SANDSTONE AND QUARTZITE

3 DARK TO MEDIUM GREEN CHLORITE SCHIST

2 LIGHT GREEN SILICEOUS PHYLLITE; MINOR GREY PHYLLITE AND LIMESTONE

1 FINE TO MEDIUM-GRAINED BIOTITE–QUARTZ GNEISS; MINOR AMPHIBOLITE AND PELITIC HORNFELS

SYMBOLS

BEDDING: TOPS KNOWN, OVERTURNED
BEDDING: TOPS NOT KNOWN
SCHISTOSITY: INCLINED, HORIZONTAL
EARLY MESOSCOPIC FOLD AXIS
LATE MESOSCOPIC FOLD AXIS
INFERRED FAULT
GEOLOGICAL CONTACT
MINERAL OCCURRENCE

feldspathic chlorite-sericite schists (in places fragmental) with minor amounts of interbedded sandstone and quartzite (unit 4), medium to dark green chlorite schists (unit 3), and light green siliceous phyllites with interbedded medium to dark grey phyllite and minor limestone (unit 2). Unit 2 is primarily of sedimentary origin, whereas units 3 and 4 appear to be mainly of volcanic origin. The rocks are poorly exposed so the contact relationships and outcrop patterns of these units were not established with certainty. However, east of Foghorn Mountain the lithologic contacts appear to strike northeasterly and dip to the northwest and are at a high angle to those in adjacent Fennell rocks. Scattered outcrops of chlorite schist northwest of Foghorn Mountain suggest that unit 3 may swing around the mountain into a trend roughly parallel to the Fennell contact and outline a northerly plunging synform cored by unit 4.

Eagle Bay rocks adjacent to the Baldy batholith immediately north of Granite Mountain consist of fine to medium-grained biotite-quartz gneiss with minor amphibolite and dark purplish grey pelitic hornfels (unit 1).

FENNELL FORMATION (UNITS 7 AND 8)

As was the case further south (Preto, 1979; Preto, *et al.*, 1980), the Fennell Formation can be divided into an eastern unit (unit 7) consisting of massive and pillowed basalt, bedded chert, argillaceous rocks, conglomerate, quartz feldspar porphyry, and gabbroic to dioritic rocks and a western unit (unit 8) consisting almost entirely of pillowed and massive basalt. It appears that the formation as a whole faces west with unit 8 overlying unit 7, although easterly (apparently overturned) dips prevail in the eastern part of unit 7.

EASTERN FENNELL (UNIT 7)

Basalt (7a) is the most common rock type of unit 7. It may be pillowed or massive, is generally fine grained to aphanitic, and is mainly in medium to dark shades of grey to grey.

Chert (7b) is generally well bedded, with beds up to 15 centimetres thick separated by thinner argillaceous partings. It occurs in a variety of colours with light shades of grey and green predominating. Individual chert units provide the best local markers within unit 7 and have been traced for distances approaching 10 kilometres.

Two bodies of quartz feldspar porphyry (7c) were outlined in the eastern Fennell (Fig. 56); both appear to be concordant with the local stratigraphy. Clasts of similar porphyry in conglomerate (7d) overlying the quartz feldspar porphyry body south of Blackpool suggests that it may be of extrusive origin.

Discontinuous lenses of conglomerate (7d) occur in a number of places within unit 7. Clasts are generally angular and similar in composition to adjacent Fennell rocks. The best exposures of conglomerate are found at the microwave station west of Axel Lake where there are a number of lenses of conglomerate containing chert, basalt, and argillite fragments and interlayered with beds of these same rock types.

Argillite, phyllite, and interbedded sandstone and quartzite comprise a relatively minor, but locally important, proportion of the eastern Fennell. In places competent beds within this unit are broken and disrupted by what appears to have been soft sediment slumping. West of Foghorn Mountain graded bedding in a well-bedded, easterly dipping sequence of sandstone and phyllite of this unit indicates that the beds are overturned and facing west.

Two apparently discontinuous lenses of limestone were mapped in the vicinity of the Fennell/Eagle Bay contact. These limestone bodies appear to be enclosed by typical Fennell rocks and so were included in

this formation (7f) despite the fact that limestone is known to occur within the Eagle Bay Formation immediately adjacent to the Fennell contact in the Barriere Lakes area (Preto, *et al.*, 1980). Both limestone bodies are apparently unfossiliferous but will be checked for microfauna.

Medium to coarse-grained, dioritic to gabbroic rocks (7g) are common components of unit 7. These commonly occur as concordant sill-like bodies, although irregular discordant masses are also present and are presumed to be intrusive equivalents of the Fennell basalts.

WESTERN FENNELL (UNIT 8)

The western part of the Fennell Formation consists almost entirely of pillowed and massive basalt. Basalt breccia and chert are present in minor quantities. Very little structural data was obtained from these rocks, but in good exposures pillows indicate that the unit generally dips and faces to the west.

UNIT 9

Coarse-grained biotite quartz monzonite of the Cretaceous Baldy batholith underlies the southeastern corner of the map-area and cuts the Fennell/Eagle Bay contact. A smaller body of similar rock outcrops in Joseph Creek valley just northwest of the main batholith. Intrusion of these granitic bodies appears to have have postdated most or all of the deformation in the country rocks. Potassium-argon age determinations on biotites from the batholith have yielded ages of 96±5 Ma and 80±6 Ma (Wanless, *et al.*, 1966).

UNIT 10

Conglomerate, sandstone, and shale of the Chu Chua Formation (10a) and overlying vesicular andesitic volcanic rocks of the Skull Hill Formation (10b) unconformably overlie the Fennell Formation in the Joseph Creek valley immediately north of Dunn Lake. Plant fossils from the Chu Chua Formation have yielded Eocene ages (Campbell and Tipper, 1971).

STRUCTURE

A schistosity pervades rocks of the Eagle Bay Formation and sedimentary units of the Fennell Formation. Fennell basalts and gabbros are locally weakly to moderately foliated near the Eagle Bay contact but are generally not foliated. The schistosity is axial planar to early, generally northwest-plunging, tight to isoclinal mesoscopic folds of the bedding and is itself folded about two generations of later mesoscopic folds with generally southeasterly (or northwesterly) and easterly trends. Despite a complex array of mesoscopic folds, best displayed in bedded rocks of units 6, 7b, and 7e, only one macroscopic fold has been tentatively outlined in the area; it is the northerly plunging synform in Eagle Bay rocks near Foghorn Mountain. This fold exists, it is a late structure which folds schistosity along with the lithology.

As noted by Okulitch (1975, 1979), bedding/cleavage relationships in the vicinity of the Fennell/Eagle Bay contact indicate westerly overturning. 'Tops' from graded beds in units 6 and 7e adjacent to the contact confirm that these northeasterly dipping beds are in fact overturned. This suggests that an early synclinal hinge may be present in Fennell rocks west of the contact although the presence of such a hinge has not been proven. Apparent truncation of Eagle Bay against Fennell near Foghorn Mountain (Figs. 56 and 57) indicates that, at least locally, the contact may be a fault.

A pair of northwesterly trending faults between Joseph Creek and Axel Lake separates structurally discordant blocks of Fennell rocks. The age and nature of the movement on these faults are not known with cer-

tainty but they appear to be relatively late structures. Slickensided and brecciated shear zones with both northerly and easterly trends that are found throughout the area do not appear in general to have caused any significant displacement.

MINERAL DEPOSITS

Mineral showings occur in both Fennell and Eagle Bay rocks in the map area; locations of the most important of these are indicated on Figure 56. Showings were not studied in detail this season but most were visited during the course of the mapping. All appear to be in quartz or quartz-carbonate veins and many are associated with local shear zones. Among them the Queen Bess (lead, zinc, silver) and Windpass and Sweet Home (gold, copper, bismuth, silver) properties have some past production.

Also of interest are rare, massive sulphide (pyrite-chalcopyrite) clasts in conglomerate (unit 7d) at the microwave station west of Axel Lake. These clasts resemble mineralization at the CC property on Chu Chua Mountain to the south (Preto, *et al.*, 1980; McMillan, 1980). Perhaps there is similar mineralization in this area.

ACKNOWLEDGMENTS

Mark Stevens provided able assistance in the field. The writer benefitted from visits to the map-area by V. A. Preto, P. S. Simony, G.P.E. White, and E. D. Ghent.

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