CLEARWATER AREA

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

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INTRODUCTION

Geological mapping of the Fennell and Eagle Bay Formations between Clearwater and Chu Chua Mountain was initiated in 1980 (Schiarizza, 1981) and completed during the 1981 field season. Little new ground was covered this season; the main effort was devoted to refining and filling in details of the area covered previously. Extensive sampling of cherty sediments within the Fennell Formation was carried out in an effort to find microfossils. Results from this sampling are not yet available. Structural interpretations advanced after the first seasons' fieldwork were generally confirmed by this year's work. An early stage syncline was outlined with the Lower Fennell Formation between Clearwater and Granite Mountain. Improved understanding of the internal stratigraphy and structure of the Eagle Bay Formation confirms that the bulk of this formation is in discordant fault with adjacent Fennell rocks.

STRATIGRAPHY

EAGLE BAY FORMATION (UNITS 1 TO 4)

Considerable time was spent mapping within the Eagle Bay Formation. The work allowed significant refinement and regrouping of Eagle Bay stratigraphy compared to that advanced by the writer previously.

The structurally highest unit within the formation (unit 4; units 3 and 4 of Schiarizza, 1981) consists mostly of rusty weathering, greenish grey feldspathic chlorite-sericite schists. An attempt to map darker green, more chloritic schists as a separate unit (Schiarizza, 1981) proved untenable, although rocks in the lower part of the unit do seem to be generally more chloritic. Igneous textures are clearly displayed in weakly schistose specimens from this unit and discrete feldspar grains evident throughout the unit appear to be relict igneous grains. Fragmental rocks occur in the lower parts of the unit, but are rare. A light grey relatively pure quartzite (4a) was traceable for a little over 1 kilometre just south of Foghorn Mountain. However, the bulk of this unit is monotonously uniform. It may have been derived from a series of flows, or may represent an intrusive body.

Structurally beneath unit 4 is a unit dominated by schists of felsic to intermediate volcanic origin (unit 3). The unit is best exposed along lower McDougal and Foghorn Creeks. Along McDougal Creek these rocks are mainly light silvery grey quartz-sericite schists. Substantial chlorite is present in places, and chloritoid porphyroblasts were observed at a number of localities. 'Eyes' of clear quartz are often evident. Thin sections show that these are embayed quartz phenocrysts. Sedimentary interlayers of dark grey phyllite found throughout this section range up to a few tens of metres in thickness. These same rock types also comprise the succession along Foghorn Creek. There, however, the unit is more varied and includes not only medium green chlorite schist and light grey platy sericitic quartzite but also trachytic rock which hosts mineralization at the Rexspar uranium deposit (Preto, 1978). Fragmental rocks that probably represent volcanic breccia are also present, particularly near the Rexspar deposit. Immediately north of the Baldy Batholith at Granite Mountain, outcrops of fine to medium-grained biotite-quartz gneiss with interlayered amphibolite and pelitic hornfels (3a) may be the contact metamorphosed equivalent of unit 3.

Unit 2 consists of medium green chlorite schist with interbedded grey phyllite and limestone. It structurally underlies unit 3 along upper Foghorn Creek. Scattered outcrops of chloritic schist immediately south of Birch Island may also belong to this unit.

Black phyllite with interbedded siltstone, sandstone, and grit (unit 1) crops out adjacent to the Fennell Formation immediately south of Clearwater. This unit is truncated on the south by a transverse northeast-trending fault. It does not crop out again until the Fennell/Eagle Bay contact emerges south of the Baldy Batholith. There, it forms a substantial unit which continues southward adjacent to and east of the Fennell Formation, and extends across the Barriere River to Johnson Creek (unit 6a of Preto, 1981). Mississippian conodonts were extracted from two lenses of limestone within this unit in the Barriere Lakes area (Okulitch and Cameron, 1976; Preto, et al., 1980). South of Clearwater, unit 1 structurally overlies rocks of the immediately adjacent, east-dipping Fennell Formation, and itself appears to be structurally overlain by felsic schists of unit 3. The nature of these contacts will be discussed in the section on Structural Geology.

FENNELL FORMATION (UNITS 5 AND 6)

The Fennell Formation has been divided into an upper unit consisting almost entirely of massive and pillowed greenstone; and a lower, more heterogeneous unit dominated by greenstone and cherty sediments. Fennell greenstones have suffered varying degrees of low-grade metamorphism and alteration, but appear to be dominantly of basaltic composition. M.J. Orchard has identified conodonts extracted from Fennell Formation cherts in the Barriere Lakes area. They range in age from Late Mississippian or Early Pennsylvanian to Permo-Triassic (V.A. Preto, pers. comm., April, 1981). Chert samples from the Clearwater area are presently being analysed for microfossils.

LOWER FENNELL (UNIT 5)

A wide variety of rock types comprise the Lower Fennell Formation. Individual units are generally discontinuous and often intercalated on a scale that is too fine to be represented at the mapping scale. Greenstone (5a) predominates. It ranges from aphanitic to very coarse grained and includes both intrusive and extrusive phases. Because of metamorphism, the two are generally indistinguishable; consequently they have not been separated on the accompanying map (Figure 1). Recognizable extrusive varieties are generally aphanitic to fine grained; these may be pillowed, but most are massive. Obviously intrusive dioritic to gabbroic units generally occur as concordant sill-like bodies, although irregular discordant masses are also present.

Chert to cherty mudstone (5b) is the dominant sedimentary rock type present. It is generally well bedded; beds range up to 15 centimetres thick and are separated by thinner argillaceous partings or interbeds. As with all units within the Lower Fennell, chert horizons tend to lens out and be discontinuous; however, in places individual chert units are persistent and provide the best local marker units within the succession.

Two substantial concordant layers, and a number of smaller bodies of light grey, massive to weakly foliated quartz-feldspar porphyry (5c) occur in unit 5. These appear to be mainly of extrusive origin; some were eroded and occur as clasts in overlying conglomerate.

Conglomerate (5d) forms discontinuous lenses throughout the Lower Fennell, but is most common in a belt that extends from the vicinity of Axel Lake north-northwestward to Blackpool. Clasts appear to have been derived entirely from surrounding Fennell units; they are dominantly chert, greenstone, and argillite.

Bodies of sandstone, argillite, and phyllite (5e) are most common in the lower part of unit 5. In places, they are well bedded and sandstone layers alternate with finer grained argillite or phyllite; more commonly, bedding is disrupted, giving the rock a lensey to conglomeratic appearance.

Limestone (5f) is a minor component of the Lower Fennell. It is present as small, discontinous lenses in the lower part of the formation adjacent to the Eagle Bay contact.

UPPER FENNELL (UNIT 6)

The Upper Fennell consists mainly of aphanitic to fine-grained greenstone. Pillows are commonly present, and the greenstone appears to be largely of extrusive origin. Small discontinuous pods of chert are present in places, and two somewhat larger bodies of bedded chert (6a) were traceable for short distances.

Although it was not exposed, the contact between the Lower and Upper Fennell appears to be stratigraphic rather than tectonic. Traverses across the contact zone along Joseph Creek and on the slopes west of the Baldy Batholith show a gradual transition, marked by decrease in the

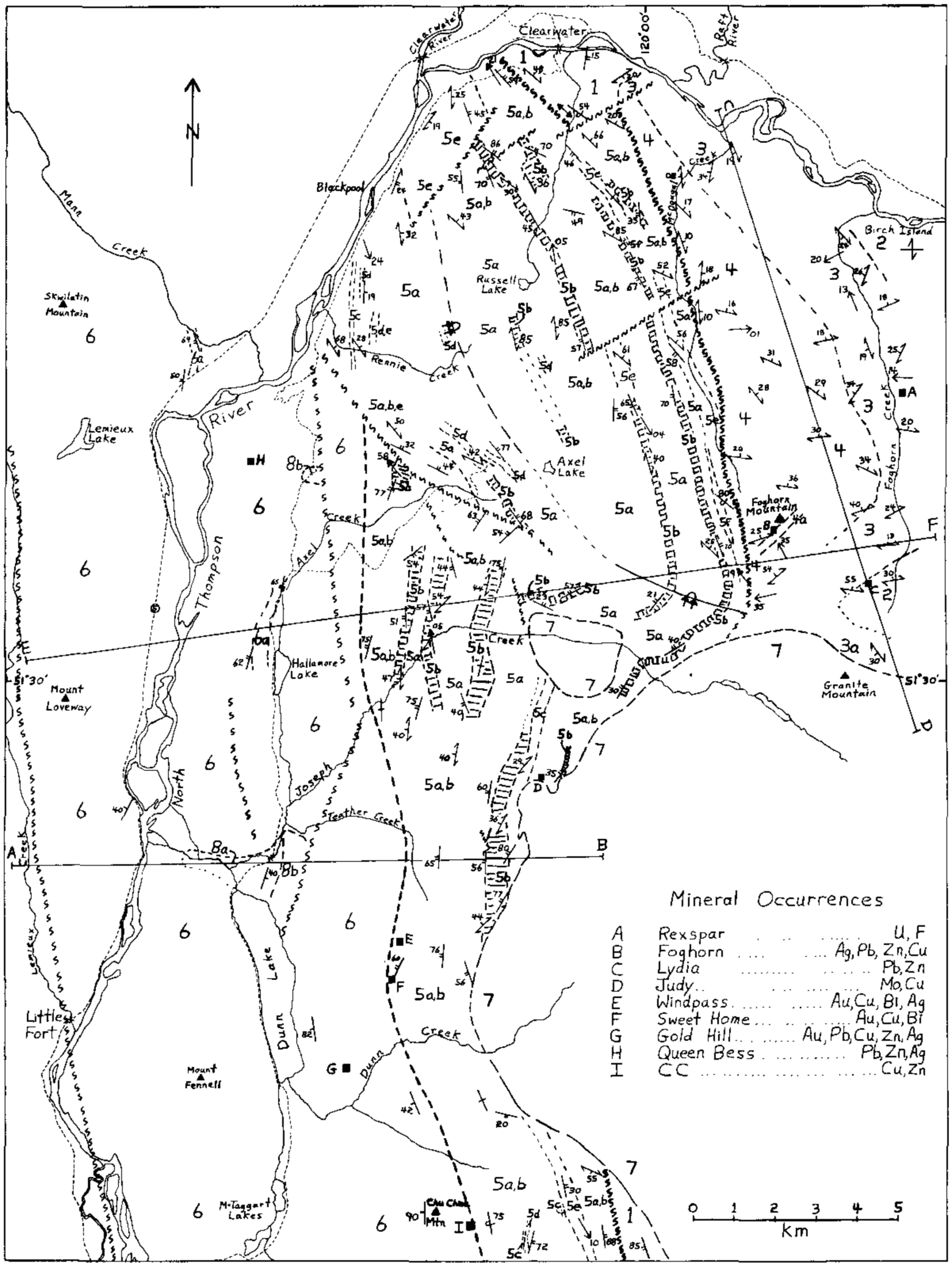

Figure 1. Generalized geological map of the Clearwater-Chu Chua area.

LEGEND

EOCENE AND LATER (?)

8 (b) Skull Hill Formation: vesicular andesite
(a) Chu Chua Formation: conglomerate, sandstone, shale

CRETACEOUS

7 Biotite quartz monzonite of Baldy Batholith and Joseph Creek stock

UPPER PALEOZOIC

FENNELL FORMATION

6 Upper Fennell Formation: pillowed and massive greenstone, minor chert
6a: bedded chert

5 Lower Fennell Formation
(f) limestone
(e) sandstone, argillite, phyllite
(d) conglomerate
(c) quartz feldspar porphyry
(b) bedded chert
(a) greenstone

Eagle Bay Formation
4 Rusty weathering, greenish grey, feldspathic chlorite-sericite schist
4a: quartzite
3 Quartz-sericite schist with interbedded dark grey phyllite; minor chlorite schist, platy sericitic quartzite, and trachyte
3a: biotite-quartz gneiss, amphibolite, pelitic hornfels
2 Chlorite schist, minor grey phyllite and limestone
1 Black phyllite with interbedded siltstone, sandstone, and grit

Symbols

Bedding: tops known, overturned; tops not known ....
Schistosity: inclined; horizontal ....
Early mesoscopic fold axis ....
Late mesoscopic fold axis ....
Inferred fault ....
Early synclinal axial trace, overturned ....
Geological contact ....
Mineral occurrence ....

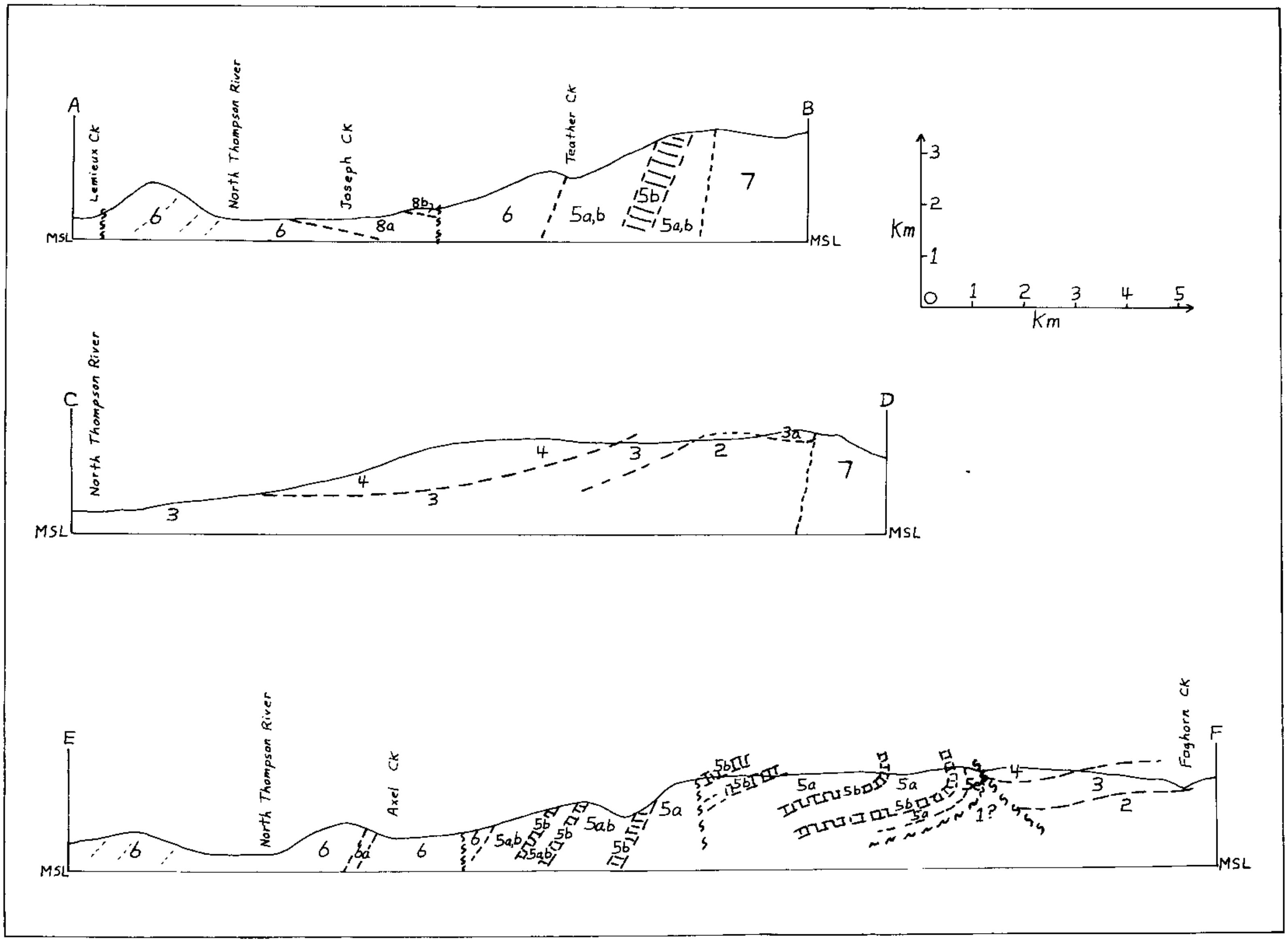

Figure 2. Vertical cross-sections to accompany Figure 1.

thickness and number of chert horizons until the succession consists almost entirely of greenstone.

UNIT 7

The Middle Cretaceous (Wanless, et al., 1966) Baldy Batholith occupies the southeast corner of the map-area where it cuts the Fennell/Eagle Bay contact. A small body of similar rock outcrops in the Joseph Creek valley just northwest of the batholith. Coarse-grained biotite quartz monzonite comprises much of the batholith. It is commonly porphyritic, with K-feldspar phenocrysts up to a few centimetres in size. The contact with adjacent country rocks is sharp, steeply inclined, and, with some exceptions, fairly regular in orientation.

UNIT 8

Conglomerate, sandstone, and shale of the Eocene (Campbell and Tipper, 1971) Chu Chua Formation (8a) and overlying vesicular andesite of the Skull Hill Formation (8b) unconformably overlie the Fennell Formation in Joseph Creek valley immediately north of Dunn Lake. A smaller exposure of Skull Hill Formation occurs 9 kilometres to the north. Bedding within the Chu Chua Formation dips consistently at moderate angles to the east, apparently due to rotation along late faults that lie east of exposures of the unit.

STRUCTURE

Three phases of folding are indicated by mesoscopic structures within the area. Early folds generally plunge to the northwest. The associated axial planar schistosity has been variably reoriented by later structures. Phase 2 folds plunge northwest or southeast, while phase 3 folds plunge at low angles east or westward. Axial surfaces of the later fold sets are relatively upright; axial planar strain slip cleavage developed locally during second phase folding, but is not pervasive throughout the map-area.

A westerly overturned phase 1 syncline in the Lower Fennell Formation dominates the macroscopic structure between Clearwater and upper Joseph Creek. This syncline is outlined by the stratigraphy immediately north of the Baldy Batholith. There it plunges shallowly toward the north-northwest and the axial surface dips gently toward the north-northeast for several kilometres, then swings and takes on a more northerly trend. The location of the axial trace is approximate because outcrops are sparse, Fennell stratigraphy is discontinuous, and massive greenstone, from which little structural data could be obtained, predominates.

West of the Baldy Batholith, in the southern half of the area, the Fennell Formation comprises a west-dipping and facing homocline. Bedding/schistosity relationships and minor fold asymmetry suggest that this homo cline is the result of a late (phase 2 ?), antiformal deflection of the western (upright) limb of the phase 1 syncline. Stratigraphic units could not be traced around this antiform, however, because there appears to be a zone of faulting between Joseph and Axel Creeks. This faulting may be related to, or post-date, the second phase of folding.

Units 2 through 4 of the Eagle Bay Formation comprise a relatively flat-lying plate which appears to be discordant with the adjacent Fennell Formation. Previously (Schiarizza, 1981) a gentle northerly plunging synform was tentatively outlined in this package. However, the zone actually appears to represent a slight upturning as it contacts the Fennell Formation. This contact may be an east-dipping thrust fault that post-dates the phase 1 syncline within the Fennell Formation.

Immediately south of Clearwater, unit 1 of the Eagle Bay Formation appears to be roughly concordant with rocks of the adjacent Fennell Formation, and to have been subjected to the same (phase 1) westerly overturned folding. Farther east, felsic schists of unit 3 appear to overlie unit 1, although the contact was not exposed. Units 1 and 3 may be separated by the same east-dipping fault which has been inferred to separate units 2 through 4 of the Eagle Bay Formation from the Fennell Formation. The position where the Fennell/Eagle Bay (unit 1) contact emerges south of the Baldy Batholith suggests that this contact was folded along with rocks of the Fennell Formation. As was the case south of Clearwater, the metasediments of unit 1 appear to be approximately conformable with adjacent Fennell units. However, an apparent thinning (truncation ?) of the Lower Fennell southward along the contact, the presence of a tectonized zone between unit 1 and the Fennell Formation immediately south of the Baldy Batholith, and the absence of feeder sills or dykes of the Fennell Formation within unit 1, suggest that this contact may be a fault. Since the contact appears to have been folded by a phase 1 fold, the fault would pre-date this folding.

In addition to those previously discussed, conspicuous faults within the area have two dominant orientations. Late faults, in places marked by brecciated zones, trend northerly and occur mainly along the western side of the map-area. These may be more common than indicated on the map and occupy a number of northerly trending valleys, including the North Thompson River valley. Outliers of the Tertiary Chu Chua and Skull Hill Formations appear to have been preserved, at least in part, as a result of movement along this system of faults. Northeast-trending faults in the northeast corner of the map-area are inferred on the basis of abrupt structural discordances and truncation of stratigraphic units. These also appear to be relatively late features, imposed after the dominant structural geometry had already been established. Intrusion of the Baldy Batholith (Middle Cretaceous) apparently post-dated most of the folding in the area. However, there is some deflection and reorientation of contacts and structures near its contact.

MINERAL DEPOSITS

The locations of the most important mineral showings in the area are indicated on the geological map (Figure 1). The most significant of these are the Rexspar (U, F) (Preto, 1978) and CC (Cu, Zn) (McMillan, 1980) deposits. Mineralization in each of these deposits appears to be syngenetic with the enclosing volcanic host rocks. In contrast, other showings in the area occur in crosscutting quartz or quartz-carbonate veins which formed late in the geological history of the area. These are often associated with local shear zones, such as at the Queen Bess (Pb, Zn, Ag) and Gold Hill (Au, Pb, Cu, Zn, Ag) properties, where Fennell greenstones are cut by steep easterly trending shear zones and altered to rusty ferrodolomite.

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