BARRIERE LAKES – ADAMS PLATEAU AREA

(82L/13E; 82M/4, 5W; 92P/1E, 8E)

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INTRODUCTION

Mapping during the 1979 season was continued in the Barriere Lakes – Adams Plateau area by G. P. McLaren and P. A. Schiarizza, under the supervision of W. J. McMillan. The main effort for the season was devoted to refining the mapping done in 1978, and only a modest area north of Chu Chua Creek and northeast of Brennan Creek was added to that covered in 1978. Much attention was directed to rocks of the Fennell Formation, both in their internal relationships and in their contact relationships with Eagle Bay rocks. A study of the massive sulphide CC deposit on Chu Chua Mountain was carried out by W. J. McMillan and is reported separately. Several fill-in traverses were done in the area of Barriere Mountain, Mount Dixon, and Mount Fraser. Further work on Adams Plateau succeeded in outlining an early synformal fold in the vicinity of Nikwikwaia Lakes.

STRATIGRAPHY

The early indications of stratigraphic relationships between main rock packages that were advanced in *Geological Fieldwork, 1978* were refined and generally confirmed by the current season's fieldwork. These are shown on Figure 9 and can be summarized briefly as follows.

(1) Unit 1 – Devonian and Older (?)

A complex sequence of garnet, biotite, and, occasionally, sillimanite-bearing schists and paragneiss, amphibolite, and orthogneiss is crudely outlined in the northeast corner of the map-area. Mapping in this package is still very crude, in part because some work remains to be done and because exposures are poor. In the area between the east end of East Barriere Lake and Spa'ilem Creek metasedimentary rocks of this unit are complexly intruded (?) by an orthogneiss which has yielded zircons of Late Devonian age (Okulitch, *et al.*, 1975; Okulitch, 1979). The intruded metasedimentary rocks are therefore considered to be Late Devonian or older. The contact between this higher grade sequence and the considerably lower grade rocks of the Eagle Bay Formation trends uniformly in a northwesterly direction from Adams Lake to North Barriere Lake. The nature of this contact is poorly understood, partly because of poor exposures and partly because of incomplete mapping. The transition, however, is sharp suggesting that it might be due to a structural discontinuity.

(2) Unit 2 – Fennell Formation

Basaltic and related rocks of unit 2 crop out in the northwestern corner of the map-area. Although dips are rare, facing directions in the central and western parts of the Fennell Formation are to the west; dips and 'tops' along the eastern part are consistently steep and to the east, indicating that Fennell rocks underlie Eagle Bay sedimentary rocks. 'Tops' in this area are indicated not only by pillow basalt units but also by graded bedding in sedimentary units and by abundant clasts of units 2a, 2b, and 2c in conglomerate of unit 2d. Eagle Bay rocks crop out a short distance to the east

but no Eagle Bay clasts occur in conglomerate of unit 2d. North of Chu Chua Creek, and a short distance to the east of the Chu Chua massive sulphide deposit, conglomerate of unit 2d lies immediately east of quartz feldspar porphyry of unit 2c and contains numerous clasts of this porphyry. The same conglomerate also contains some clasts of massive sulphide mineralization identical to that of the Chu Chua deposit to the west. Pillow basalt units in this area also indicate tops to the east. The eastern, and apparently upper part of the Fennell Formation, therefore, is a transition zone from 2 to 4 kilometres wide which is characterized by abundant massive basalt with interbedded ribbon chert, cherty argillite, quartz feldspar porphyry dykes, sills, and their extrusive equivalents, and in its upper part by several units of intraformational conglomerate crowded with clasts of underlying units. This entire sequence dips steeply, faces east, and underlies black phyllite and related sedimentary rocks of unit 6.

(3) **Eagle Bay Formation (Units 3 to 12)**

Rocks of the Eagle Bay Formation are designated as units 3 to 12 on Figure 9. The arrangement of these units in the map legend is not an exact stratigraphic succession, although in most cases units of lower number are generally thought to underlie units of higher number. The following notes summarize briefly the lithology of these units and their distribution within the map-area.

Unit 3 – A complex package of interlayered grit, impure quartzite, phyllite, impure limestone, and minor greenschist has been mapped in two separate areas between Barriere River and Sinmax Creek and northeast of Johnson Lake (Fig. 9). Although at first glance one might correlate these two packages of broadly similar lithologies and thus infer significant repetitions of stratigraphy, caution in this respect is warranted for several reasons. The unit includes a great variety of lithologies which have been grouped together merely because there are few marker horizons. Between Barriere River and Sinmax Creek several lithologies of units 5, 6, 10, and 12 could be distinguished and mapped separately from rocks of unit 3. These include a prominent quartzite, several carbonate units, and three units of greenschist which was clearly derived from pillow lavas. These features do not appear in the area of unit 3 northeast of Johnson Lake. Smaller packages of unit 3, in part grading laterally into purer quartzite, have also been recognized in the central part of the map-area and on Adams Plateau.

Unit 4 – A thin unit of rusty yellow-weathering, tan to light grey, highly pyritic chloritoid-sericite-quartz and sericite-quartz schist was mapped within rocks of unit 3 west of Forest Lake. Although this unit is of modest thickness and lateral extent, it locally provides a marker horizon and is of interest to exploration geologists. Its high content of silica and pyrite strongly suggests a volcanic, probably exhalative, origin.

Unit 5 – Relatively pure, generally massive, light grey to white micaceous quartzite occurs near and north of Forest Lake, from South Barriere Lake to west of East Barriere Lake, and near Nikwikwaia Lake on Adams Plateau. This rock provides an easily recognizable, reliable marker horizon and is very useful in outlining early folds, such as the tight northeasterly plunging synform near Nikwikwaia Lake.

Unit 6 – The largest part of unit 6, a turbidite-like sequence of black phyllite and interbedded grit, sandstone, siltstone, and argillite, has recently been correlated with the Mississippian Milford Group (Okulitch, 1979). Discontinuous lenses of impure limestone occasionally occur within this sequence. One of these, a short distance south of Barriere River, has yielded an abundant and diverse collection of macrofauna and conodonts of Early Mississippian (Osagian to Early Meramecian) age (Okulitch

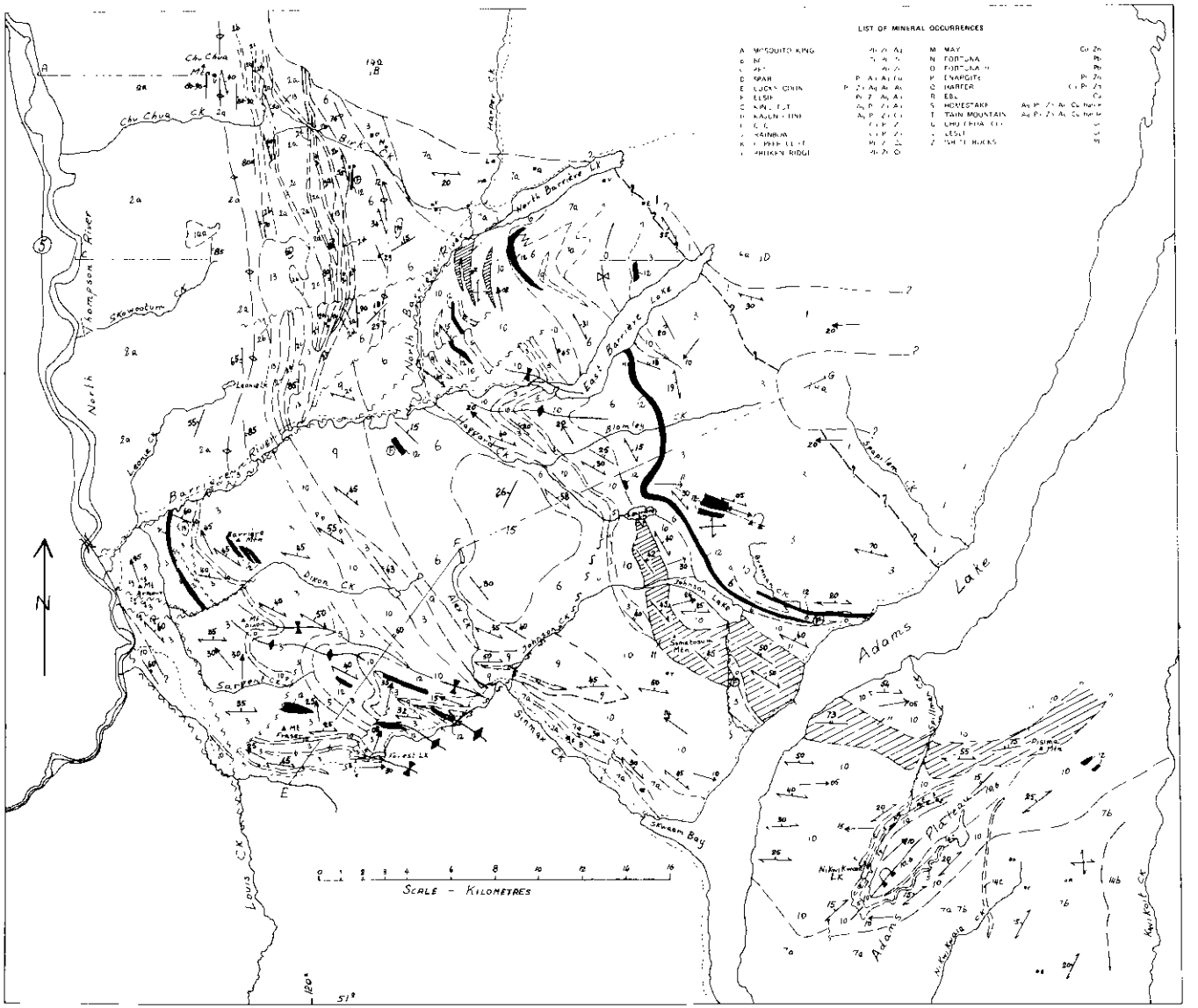

Figure 9. Generalized geological map of the Barriere Lakes—Adams Plateau area.

LEGEND

PLEISTOCENE AND/OR EARLIER

OLIVINE BASALT FLOWS, MINOR INTERBEDDED MUDSTONE

CRETACEOUS

(a) BALDY BATHOLITH: BIOTITE QUARTZ MONZONITE AND GRANITE
(b) KWIKOIT CREEK PLUTON: BIOTITE QUARTZ MONZONITE
(c) QUARTZ FELDSPAR PORPHYRY (ADAMS PLATEAU)

JURASSIC OR TRIASSIC (?)

DIORITE AND QUARTZ DIORITE

PRE–UPPER TRIASSIC (PROBABLY CARBONIFEROUS)

EAGLE BAY FORMATION

LIMESTONE: DARK TO LIGHT GREY, BANDED, MINOR DOLOMITE

TSHINAKIN LIMESTONE: MASSIVE, LIGHT GREY TO WHITE, FINELY CRYSTALLINE

GREENSCHIST DERIVED FROM MAFIC MASSIVE AND PILLOWED (p) FLOWS, BRECCIAS, AND TUFFS

DACITIC TO RHYODACITIC LITHIC TUFF AND VOLCANIC BRECCIA

HOMESTAKE SCHIST: PLATY, LIGHT RUSTY YELLOW–WEATHERING SERICITE–PYRITE–QUARTZ SCHIST
(a) INTERMEDIATE TO FELSIC SCHIST DERIVED MOSTLY FROM FELSIC TUFFS AND QUARTZ FELDSPAR PORPHYRY
(b) INTERLAYERED CHERTY TUFF, CHERT, CALC–SILICATE, AND THIN LAYERS OF IMPURE LIMESTONE

EAGLE BAY FORMATION *(CONTINUED)*

DARK GREY TO BLACK PHYLLITE; INTERBEDDED GRIT, SANDSTONE, SILTSTONE, AND ARGILLITE

RELATIVELY PURE, LIGHT GREY TO WHITE, MICACEOUS QUARTZITE

PYRITIC CHLORITOID–SERICITE–QUARTZ SCHIST AND SERICITE–QUARTZ SCHIST

INTERLAYERED GRIT, MICACEOUS QUARTZITE, PHYLLITE, CALCAREOUS QUARTZITE, IMPURE LIMESTONE, CALCAREOUS PHYLLITE AND MINOR GREENSCHIST (FOR EXAMPLE, CONGLOMERATE ON MOUNT ARMOUR)

MISSISSIPPIAN (?)

SLIDE MOUNTAIN GROUP (?)

FENNELL FORMATION
(a) MASSIVE AND PILLOW BASALT WITH MINOR INTERBEDDED CHERT AND CHERTY ARGILLITE
(b) CHERT AND RIBBON CHERT, LOCALLY BRECCIATED
(c) QUARTZ FELDSPAR PORPHYRY (SPRAGUE CREEK – BIRK CREEK AREA)
(d) CONGLOMERATE WITH PEBBLES AND COBBLES OF CHERT, ARGILLITE, QUARTZ FELDSPAR PORPHYRY AND BASALT

DEVONIAN AND OLDER (?)

ORTHOGNEISS, AMPHIBOLITE, MICACEOUS QUARTZITE, GARNET–BIOTITE SCHIST, IMPURE FINE–GRAINED MARBLE

SYMBOLS

BEDDING: TOPS KNOWN, OVERTURNED

BEDDING: TOPS NOT KNOWN

EARLY SCHISTOSITY: INCLINED, HORIZONTAL

PHASE 1 FOLD AXES

PHASE 2 FOLD AXES

INFERRED FAULT

GEOLOGICAL CONTACT

FOSSIL LOCALITY Ⓕ

MINERAL OCCURRENCE ■

EARLY AXIAL TRACE:
SYNFORM UPRIGHT, OVERTURNED
ANTIFORM UPRIGHT, OVERTURNED

LATE AXIAL TRACE:
SYNFORM UPRIGHT, OVERTURNED
ANTIFORM UPRIGHT, OVERTURNED

NOTE: The order of superposition between the Fennell Formation and the Eagle Bay Formation has been established. Units within the Eagle Bay Formation, however, are lithologic units and not lithostratigraphic units. For instance, every unit of greenschist within the Eagle Bay has been designated 10 regardless of its stratigraphic position.

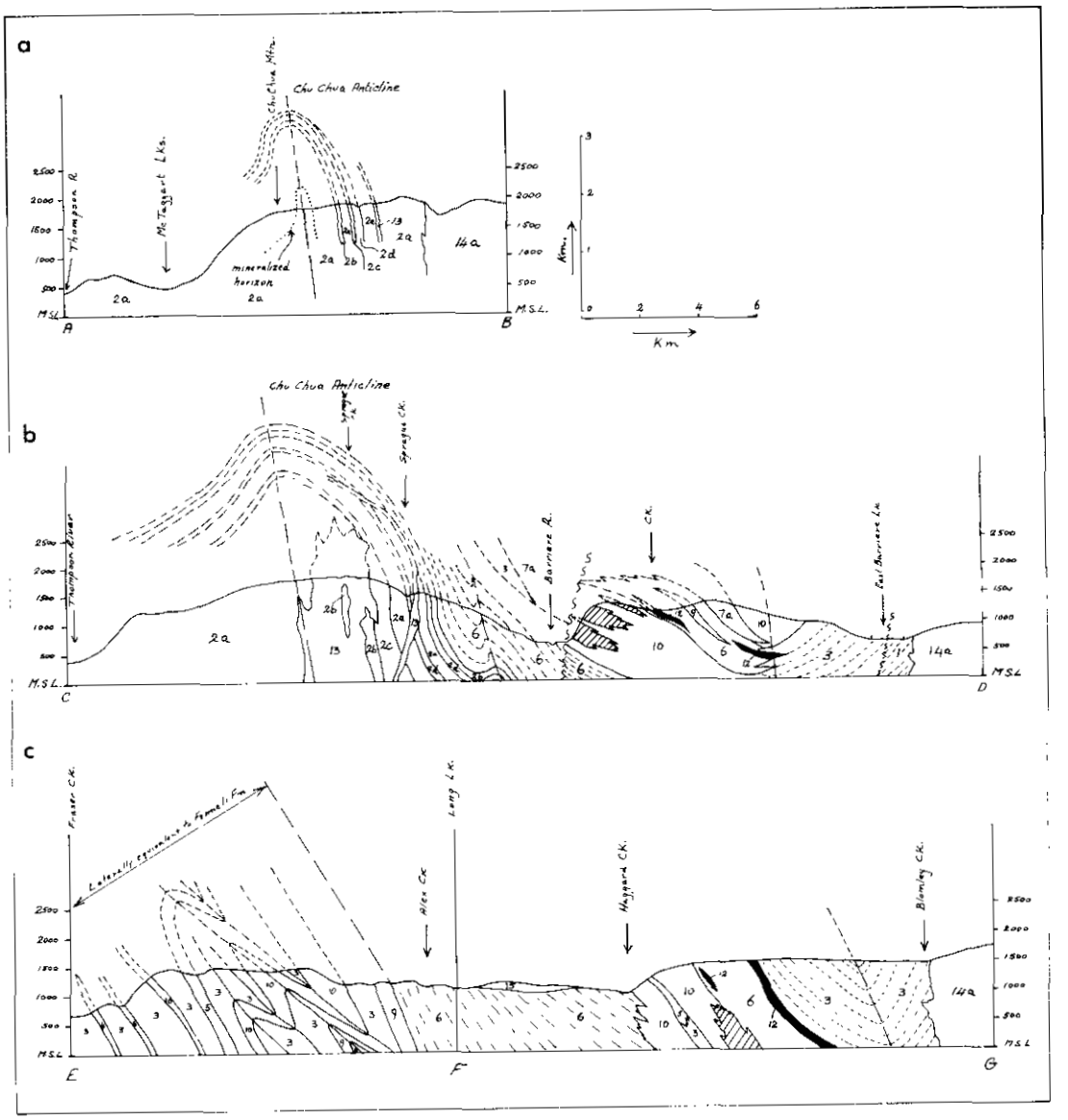

Figure 9 a, b, c: Cross-sections to accompany Figure 9.

and Cameron, 1976; Okulitch, 1979). Another limestone clearly interbedded with argillite and s ltstone, a short distance south of Birk Creek and very close to the base of the sequence has also yielded conodonts of Early Mississippian age (mid-Kinderhookian; R. B. Campbell, oral communication, November 16, 1979).

A predominantly black phyllite member of unit 6 occurs between North Barriere Lake and Johnson Lake. At its southeastern end this phyllite grades into, or is infolded with, greenschist of unit 10. Near North Barriere Lake the phyllite displays a similar relationship with felsic schist of unit 7a. A thin but laterally continuous grey to dark grey impure limestone is interlayered with the phyllite and separates it from rocks of unit 3 in the central part of the map-area.

Unit 7 – Generally pyritic, grey to rusty yellow sericite-quartz schists, commonly with eyes of bluish grey quartz occur at North Barriere Lake and near Skwaam Bay. A very extensive package of similar rocks was also mapped east of Adams Lake. East of Nikwikwaia Creek on Adams Plateau these appear to grade laterally into a rather monotonous but apparently not very thick sequence of very fine-grained cherty tuff, calc-silicate, thin layers of impure limestone, and minor argillaceous sediments (unit 7a). Although most schist of unit 7 has been pervasively recrystallized and sheared, volcanic quartz phenocrysts with deeply embayed, resorbed borders have been observed in specimens from the Birk Creek – North Barriere Lake sequence, and clearly fragmental members with numerous flattened felsic clasts crop out southeast of Nikwikwaia Lake on Adams Plateau. These features, together with the generally pyritic and felsic nature of the schist, suggest an acid volcanic origin for at least a good part of this unit. Accordingly, the distribution of the unit indicates the existence of at least two felsic volcanic centres, one near North Barriere Lake and one near, or southeast of, Skwaam Bay.

Unit 8 – Highly foliated, light rusty yellow-weathering, light grey to nearly white sericite-pyrite-quartz schist, commonly with a honeycombed aspect due to the weathering of pyrite was mapped along the north side of Sinmax Creek, near the Homestake mine. It is locally useful as a marker horizon within less pyritic schist of unit 7a. This rock is very similar in aspect, and probably in origin, to the pyritic schist of unit 4.

Unit 9 – Generally rusty grey-weathering, strongly foliated and fine-grained schist to weakly foliated coarsely fragmental volcanic breccia of dacitic to rhyodacitic composition occurs in a continuous band from Johnson Creek to Barriere River. Similar rock is found as interlayers in greenschist and black phyllite west and northwest of East Barriere Lake. Except where it is fine grained and highly foliated, this unit is generally fragmental, commonly coarsely so, and probably represents a sequence of volcanic breccia, lithic tuff, and tuff of intermediate to felsic composition.

Unit 10 – Greenschist of this unit, clearly derived from mafic massive and pillowed flows, breccias, and tuffs, is one of the more common rock types in the area, and is one of the most easily mapped. Locally, as for example in the southwest corner of the map-area, pillow structures are still beautifully preserved. Elsewhere, such as along Adams Lake, the greenschists contain abundant and widespread, flattened clasts of mafic volcanic rocks. Some greenschist units are strongly magnetic and contain clearly visible octahedra of magnetite. One such unit faithfully outlines the Nikwikwaia Lake fold in low-level aeromagnetic maps of that area.

Unit 11 – The Tshinakin limestone is a prominent, light grey to nearly white, finely crystall ne limestone. It is overlain and underlain by greenschist, is several hundred metres thick, and provides an excellent marker horizon that can be very easily followed from the vicinity of Pisima Mountain on the Adams Plateau to South Barriere Lake where it terminates abruptly. Careful searching in the

greenschist and phyllite beyond this point produced only sparse discontinuous lenses of impure limestone, but a good deal of carbonate is widely disseminated throughout the greenschist and phyllite. Because the formations that overlie and underlie the Tshinakin limestone south of South Barriere Lake continue beyond this point, it is concluded that the sudden termination of this prominent carbonate unit marks an original interruption or termination in the carbonate bank or reef complex that produced the limestone. A very similar limestone, also interlayered with greenschist, is found at Whiterocks Mountain southwest of North Barriere Lake at about the same horizon. This carbonate is considered correlative to the Tshinakin limestone and probably represents another reef complex. Despite its great extent and abundant outcrop, the Tshinakin limestone so far has yielded no fossils.

Unit 12 – Dark to light grey, banded limestone, and, to a lesser extent, orange-weathering dolomite occur interlayered with rocks of units 3, 6, and 10. Some of these lesser carbonate units are of very limited extent and of little use as marker horizons, but others could be traced for considerable distances and locally help in outlining folds. Fossil collections have been made from two carbonate lenses in unit 6. The southern of these has yielded a rich macro and microfauna of Osagian to Early Meramecian age (Okulitch and Cameron, 1976; Okulitch, 1979. The northern lens has yielded conodonts of mid-Kinderhookian age (R. B. Campbell, oral communication, November 16, 1979). Four other collections were made from two carbonate units at Brennan Creek. Reports from these are not yet available.

(4) **Unit 13 – Diorite and Quartz Diorite**

An irregularly shaped body of diorite and quartz diorite, considered to be possibly of Jurassic or Triassic age, cuts Fennell Formation rocks between the headwaters of Sprague Creek and Leonie Lake. A long, narrow, dyke-like extension of this body has been traced from upper Sprague Creek to the headwaters of Chu Chua Creek, a distance of nearly 15 kilometres. Although this intrusion clearly cuts Fennell rocks and contains many large inclusions or roof pendants of chert and quartz feldspar porphyry, it is irregularly shaped with many protrusions and re-entrants, and markedly elongated parallel to the bedding and main schistosity of the country rocks. In hand specimen and outcrop, the rock is massive, medium to coarse grained, and generally displays a considerable degree of saussuritic alteration.

A smaller body, finer grained but of similar composition, has been mapped northwest of Barriere Mountain.

(5) **Unit 14**

Post-tectonic porphyritic quartz monzonite of the Cretaceous Baldy batholith cuts Fennell and Eagle Bay rocks from Chu Chua Creek to Spapilem Creek. A smaller body of similar rock was also mapped on upper Skowootum Creek. A similar pluton and numerous related northeast-trending dykes, all probably also of Cretaceous age, cut Eagle Bay rocks along the west of Kwikoit Creek.

(6) **Unit 15**

A succession of gently dipping basaltic flows with some interbedded poorly indurated mudstone unconformably overlies Eagle Bay rocks between Haggard Creek and Alex Creek. These strata probably are of Pleistocene or Late Tertiary age (Campbell, 1963).

STRUCTURE

The general remarks on the structure of the map-area made in *Geological Fieldwork, 1978* were confirmed in 1979. In addition, fill-in traverses in several parts of the map-area were helpful in outlining a number of fold structures which are briefly discussed below.

(1) Early Folds

These structures deform the bedding and have axial surfaces that are parallel to the main schistosity. Mesoscopic structures of this generation are plentiful throughout the map-area but only a few medium to large structures could be outlined.

(a) *Nikwikwaia Lake Fold*

A synform was traced on upper Spillman Creek and in the vicinity of Nikwikwaia Lake for a strike length of at least 6 kilometres by careful mapping of a thin micaceous quartzite. The fold plunges gently to the northeast parallel to the early lineations and mesoscopic early fold axes in the area. The axial plane dips moderately to the northwest, parallel to the main schistosity. The Nikwikwaia synform is cored by a mixture of argillaceous, locally calcareous sediments and greenschist. The southeast limb is paralleled and locally truncated by a sill-like mass of quartz feldspar porphyry probably of Cretaceous age. The marker quartzite is flanked to the west, south, and east by a thick succession of greenschist which contains a strongly magnetic member along the outward perimeter of the quartzite. The magnetite-rich greenschist faithfully outlines the fold on low-level aeromagnetic maps of the area.

(b) *Mount Dixon and East Barriere Lake – Haggard Creek Areas*

Units of pillowed greenschist and quartzite outline relatively open, west to northwest-trending folds with axial surfaces parallel to the main schistosity and axes plunging north to northwest, roughly parallel to the axes of early mesocopic folds. These structures are only outlined approximately because exposures are generally poor and widely scattered. In the vicinity of Barriere Mountain graded bedding in some members of map unit 3 indicates that the strata here are upright and face northeast. If the same relationship can be applied to the Mount Dixon area, then the structures shown on the map become a syncline-anticline pair, overturned to the southwest.

(2) Late Folds

A late generation of mesoscopic folds clearly warps the main schistosity, has axes parallel to a pronounced and widespread crenulation lineation, and generally upright axial planes parallel to a pronounced crenulation cleavage. These folds, though widespread, are not evenly distributed but tend to occur in clusters that are of generally limited lateral extent but are fairly continuous along strike. One such cluster with a general anticlinal configuration runs in a northerly direction through the middle of map unit 6 west of North Barriere River and south of Birk Creek. Axial planes are upright or only slightly overturned to the west, and fold axes plunge gently north.

A similar fold, or package of folds, probably accounts for the opposing dips and facing directions near the Chu Chua massive sulphide deposit, and might provide for a repetition of the mineralized horizon.

MINERAL DEPOSITS

Numerous base metal occurrences, many of which clearly are stratabound massive sulphide deposits syngenetic with their host rocks, are found in the map-area (Fig. 9), especially in the Birk Creek – North Barriere Lake region, along Sinmax Creek near Skwaam Bay, and on the Adams Plateau. All of these deposits, which are briefly referred to in *Geological Fieldwork, 1978,* are polymetallic deposits, commonly with associated barite and with precious metal values. They are also invariably associated with schists that were derived from acid volcanic and/or high-level intrusive rocks.

The Chu Chua deposit, which was explored by drilling in late 1978 – early 1979, represents a different type of massive sulphide mineralization and is reported on separately (McMillan, 1979). This mineralization consists essentially of massive pyrite and chalcopyrite in basic pillow basalts of the Fennell Formation. The mineralization occurs near the top of the basaltic pile just below the zone of transition between the Fennell and Eagle Bay Formations. Opposing dips and facing directions near the Chu Chua deposit may be due to a late phase anticline.

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