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2003

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CURRENT RESEARCH

ISSN 1701-4387

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Publication approved by GSC Pacific, Sidney

Stratigraphy and structure of the Upper Arrow Lake area, southeastern British Columbia: new perspectives for the Columbia River Fault Zone[1]

Yvon Lemieux, R.I. Thompson, and Philippe Erdmer

Lemieux, Y., Thompson, R.I., and Erdmer, P., 2003: Stratigraphy and structure of the Upper Arrow Lake area, southeastern British Columbia: new perspectives for the Columbia River Fault Zone; Geological Survey of Canada, Current Research 2003-A7, 9 p.

Abstract: The Columbia River Fault Zone in the southeastern Canadian Cordillera has been interpreted as a major Eocene crustal-scale detachment having tens of kilometres of east-side-down displacement. It is one of a family of extension faults mapped in the southeastern Cordillera and interpreted to have accommodated crustal extension during the early Tertiary (ca. 50–55 Ma). Recent field investigation has suggested that an Upper Paleozoic rock succession occurs as a semicontinuous belt from west of Vernon to east of the Columbia River Fault. This belt comprises a distinctive Devonian calcareous quartzite marker unit that can be traced across Upper Arrow Lake. Field relationships of the Columbia River Fault Zone suggest that proposed displacement on the fault is inconsistent with continuity of rock units from hanging-wall to footwall exposures. The geometry and significance of the Columbia River Fault Zone along Upper Arrow Lake may be overstated.

Résumé : La zone de failles du Columbia, dans le sud-est de la Cordillère canadienne, a été interprétée comme une faille de détachement majeure le long de laquelle s'est produit à l'Éocène un mouvement de plusieurs dizaines de kilomètres, caractérisé par avec affaissement du compartiment oriental. Cette structure fait partie d'un ensemble de failles relevées dans le sud-est de la Cordillère qui rendraient compte d'une période d'extension crustale au Tertiaire précoce (env. 55-50 Ma). Cependant, de récents travaux sur le terrain suggèrent qu'une succession du Paléozoïque supérieur forme une bande semi continue d'un point situé à l'ouest de Vernon jusqu'à un autre à l'est de la zone de failles du Columbia. Cette bande de roches comporte une unité repère de quartzite calcareux du Dévonien qui peut être suivie de part et d'autre du lac Arrow supérieur. Les relations établies sur le terrain en relation avec la zone de failles du Columbia rendent donc incompatible le déplacement proposé le long de la faille avec les observations en affleurement d'une continuité des unités lithologiques du toit au mur de la zone de failles. Il est possible que, dans le secteur du lac Arrow supérieur, l'on ait surestimé le déplacement le long de la zone de failles du Columbia ainsi que l'importance de cette structure.

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[1] Contribution to the Ancient Pacific margin NATMAP Project

INTRODUCTION

The Upper Arrow Lake area, in southeastern British Columbia, is located along the southeastern flank of high-grade metamorphic rocks of the Monashee Complex and is the locus of the southern termination of the Columbia River Fault Zone. The fault zone (Read and Wheeler, 1976; Read, 1979a; Read and Brown, 1981; Lane, 1984; Lane et al., 1989) is one of a family of structures (including the Slocan Lake and Okanagan Valley–Eagle River faults; *see* Parrish, 1984; Parkinson, 1985) in the southern Canadian Cordillera that are interpreted to account for large Cenozoic crustal extension, with tens of kilometres of hanging-wall-down displacement (e.g. Parrish et al., 1988). The Columbia River Fault Zone has been interpreted as juxtaposing mid-crustal metamorphic rocks of the Shuswap Complex in its footwall, with lower grade, upper crustal rocks of the Selkirk Allochthon in its hanging wall (Colpron et al., 1996; Monger and Price, 2000). However, recent work in southern British Columbia (*see also* Glombick, 1999; Thompson et al., 2001, 2002) has revealed the presence of a belt of Late Paleozoic–Early Mesozoic strata that can be traced across the Shuswap Metamorphic Complex and are also present in the hanging walls of the Columbia River and Okanagan Valley fault zones. These recent findings are difficult to reconcile with the existing interpretation and highlight the need for further investigation. The purpose of this study was to begin mapping across the Columbia River valley as a means of assessing the location, geometry, magnitude, and timing of displacement of the Columbia River Fault Zone. This work builds on reconnaissance mapping by Thompson et al. (2002), which demonstrated that a distinctive stratigraphic succession, including a Devonian calcareous quartzite, could be mapped across the Columbia River valley near Upper Arrow Lake from footwall to hanging wall with little apparent offset. This report presents preliminary data from fieldwork conducted in 2002 along the southern segment of the Columbia River Fault Zone near Nakusp.

REGIONAL GEOLOGY

The study area is located approximately 100 km south of Revelstoke and straddles the boundary between the Vernon (82 L) and Lardeau (82 K) NTS 1:250 000 scale map areas (Fig. 1). It overlaps the area covered by Hyndman (1968; Nakusp map area), portions of Read and Wheeler's (1976) Lardeau west half and Read's (1979b) Vernon east half map sheets, and the southern portion of Reesor and Moore's (1971) map of the Thor-Odin gneiss dome.

The geology east of the southern portion of Upper Arrow Lake is characterized by Paleozoic to Lower Jurassic stratified rocks intruded by Middle Jurassic to Late Cretaceous plutons, sills, and dykes (Fig. 1, 2). These rocks were deposited on the western margin of ancestral North America and displaced and deformed during Middle Jurassic orogenic activity; they have yielded Mesozoic cooling dates (e.g. *see* Parrish et al., 1988; Carr, 1990, 1991). Carr (1991) correlated them with North American strata and allochthonous rocks of the Kootenay terrane. The rock succession west of Upper Arrow Lake, in the footwall of the Columbia River Fault Zone, is dominated by late Proterozoic and Paleozoic amphibolite-facies metamorphic rocks, locally intruded by the Late Cretaceous Whatshan Batholith. This succession has been included in the Shuswap Metamorphic Complex, interpreted to be a metamorphic core complex resulting from tectonic exhumation during Eocene crustal extension. Two crustal-scale detachments, the Columbia River Fault Zone to the east and the Okanagan Valley Fault to the west, are the hypothesized structural boundaries of the 'core complex' (Parrish et al., 1988; Johnson and Brown, 1996).

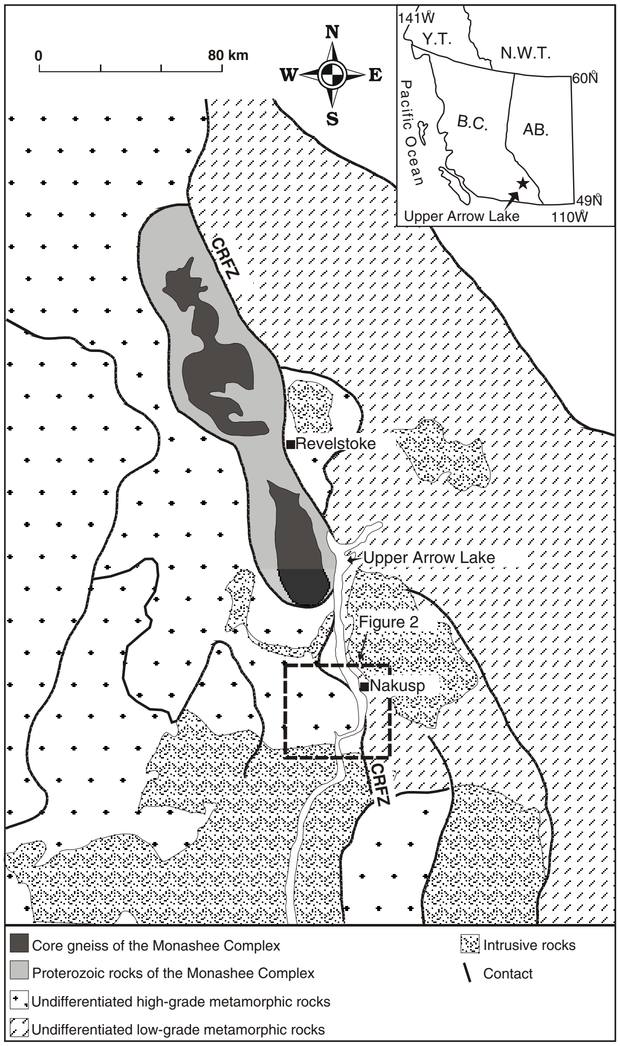

Figure 1. *Geological map of southeastern British Columbia showing the study area. Inset: Location map of the Upper Arrow Lake area. CRFZ, Columbia River Fault Zone; AB, Alberta; B.C., British Columbia; N.W.T., Northwest Territories; Y.T., Yukon Territory*

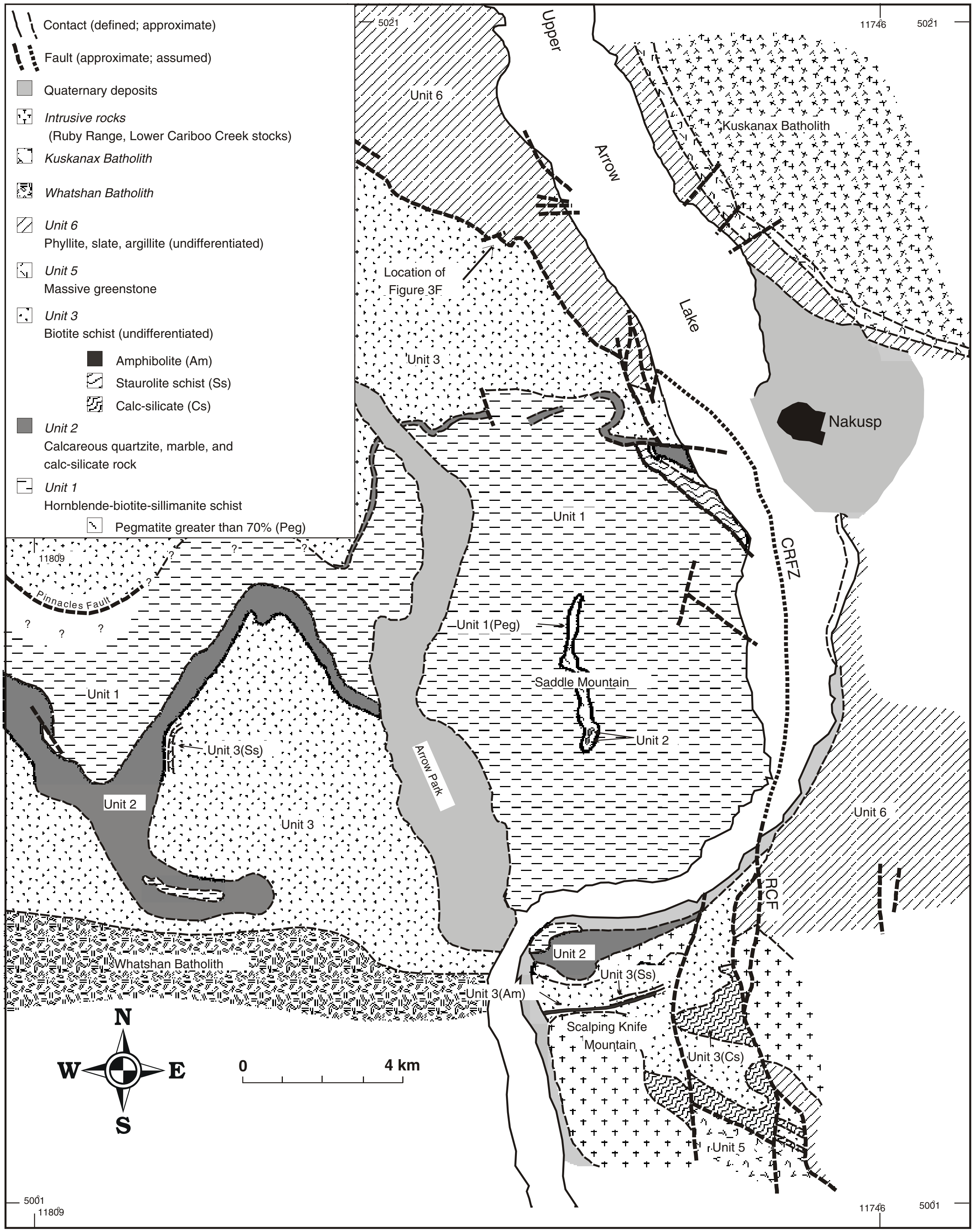

*Figure 2. Geological map of the study area (*see *Fig. 1 for location). CRFZ, Columbia River Fault Zone; RCF, Rodd Creek Fault*

The Columbia River Fault Zone has been mapped as the most prominent structure in the study area; however, most of its surface trace is covered by Upper Arrow Lake. Field relationships and isotopic-age data have led to the interpretation that the Columbia River Fault Zone was active in the Eocene (Parrish et al., 1988; Carr, 1991; Parrish, 1995) and acted as a crustal detachment exhuming the Shuswap and Monashee complexes. The most significant displacement along the fault zone (20 to 30 km of dip slip, *see* Read, 1979a; Parrish et al., 1988) was proposed for an area north of our study area, at the latitude of the Monashee Complex. South of the Monashee Complex, the fault has been interpreted to terminate against the northwestern flank of the Valhalla Complex (Lane, 1984; Brown and Journeay, 1987; Carr, 1990).

STRATIGRAPHY

Unit 1

Unit 1 is structurally the lowest of the mapped succession and contains several rock types. It is also the most strained unit in the succession, commonly featuring intrafolial mesoscopic folds. No stratigraphic directions have been observed within its rocks. As the base is not exposed and strain is present, the thickness of the unit is difficult to determine. The most abundant rock types are hornblende-biotite schist and paragneiss (±sillimanite, kyanite, garnet, and muscovite) with a well developed schistosity. A mineral lineation is ubiquitous and defined by crenulated mica or the elongation of prismatic minerals. The lineation generally plunges gently to the east. Its nature and timing are uncertain. Hand samples of the paragneiss unit are generally fine to medium grained and commonly characterized by a distinctive 'salt-and-pepper' texture. The dominant minerals in order of decreasing abundance are quartz, plagioclase, K-feldspar, hornblende, and biotite.

Calc-silicate gneiss is also present. It is light to medium purplish grey on fresh surfaces; interlayers of fine-grained quartz-feldspar melt and pegmatite are common (Fig. 3a). Calc-silicate gneiss is less foliated than the schist and paragneiss, and mineral lineation is less pervasive, although locally well developed. Hand samples show quartz and plagioclase accompanied by garnet, some of which reaches 5 to 6 mm across. Biotite is also present locally.

An amphibolite subunit can be mapped separately. It is dark greenish grey and speckled by white-weathering feldspar. The amphibolite is massive, medium-grained, and locally schistose, and is composed mainly of hornblende and biotite; garnet occurs locally.

Unit 2

Unit 2 is composed mainly of calcareous quartzite with local interlayers of marble and more rarely calc-silicate rock and noncalcareous quartzite. Its thickness varies from 10 m to over 200 m. Its contact with the underlying unit 1 is locally exposed and is marked by a sharply defined planar unconformity (Fig. 3b). The most abundant rock type is a diopside-bearing, light grey, calcareous quartzite, which weathers to a distinctive, pitted, light buff surface (Fig. 3c). Internal layering on a scale of 5 to 20 cm is highlighted by the differential weathering of calcite. In hand sample, unit 2 appears composed mainly of quartz (>60%), diopside (~10–20%), and calcite (~10%), with minor potassium feldspar, plagioclase, and small flakes of graphite. Schistosity is generally parallel to compositional layering. Lineation is poorly developed; it generally plunges to the east and is defined by elongated quartz grains a few millimetres long. The calcareous quartzite constitutes an excellent marker unit.

Unit 2 also contains interlayers of marble and more rarely of calc-silicate rock. On weathered surfaces, marble has a pitted appearance similar to the calcareous quartzite, but is dark grey to black. Calcite is the most abundant mineral (>50%) and quartz is the other dominant constituent. Marble-rich horizons occur as massive layers 5 to 30 cm thick and parallel to the main schistosity. Lineation is rare and, where present, is defined by elongated prismatic minerals.

In the study area, the calcareous quartzite of unit 2 occurs mainly west of Upper Arrow Lake, but sections over 100 m thick were also mapped east of the lake, in the north-facing cliffs on Scalping Knife Mountain (Fig. 2). Unit 2 has also been reported north of Halcyon Hot Springs (Reesor and Moore, 1971; Thompson et al., 2002) and our reconnaissance work showed that it is also exposed along the east shore of Upper Arrow Lake, south of Halfway River.

Unit 3

Unit 3 overlies the calcareous quartzite and marble of unit 2. The contact appears to be gradational over a few tens of metres with the gradual decrease of carbonates. Unit 3 is composed mainly of quartz-feldspar-biotite schist interlayered with calc-silicate rock, quartzite, minor amphibolite, and a distinctive staurolite-bearing schist. Although the exact thickness of the unit is unknown, it is estimated to reach 400 to 500 m. Quartz-feldspar-biotite schist (±muscovite and rarely sillimanite and garnet) is the dominant rock type and is marked by a well developed schistosity defined by biotite and muscovite. An east-trending lineation marked by crenulated mica is common. On fresh surfaces, this schist is light to medium grey, in places grading to shades of purple and green. Disseminated pyrite is common and leads to a distinctive, bright, almost fluorescent yellow weathering.

Calc-silicate layers were observed in unit 3; east of Upper Arrow Lake, they can be mapped separately (Fig. 2). They typically have a sugary texture, are fine grained, and contain diffuse laminations (possibly transposed bedding) that alternate from light to medium greenish grey. In hand sample, they appear to be composed of quartz, diopside, plagioclase, and K-feldspar (±calcite). Where seen, they are rarely more than a few tens of metres thick.

Scarce amphibolite occurs as subunits in unit 3, particularly on Scalping Knife Mountain, where a 30 to 40 m thick layer occurs (Unit 5 of Hyndman (1968)). The contact with the surrounding schist appears to be sharp. The amphibolite is

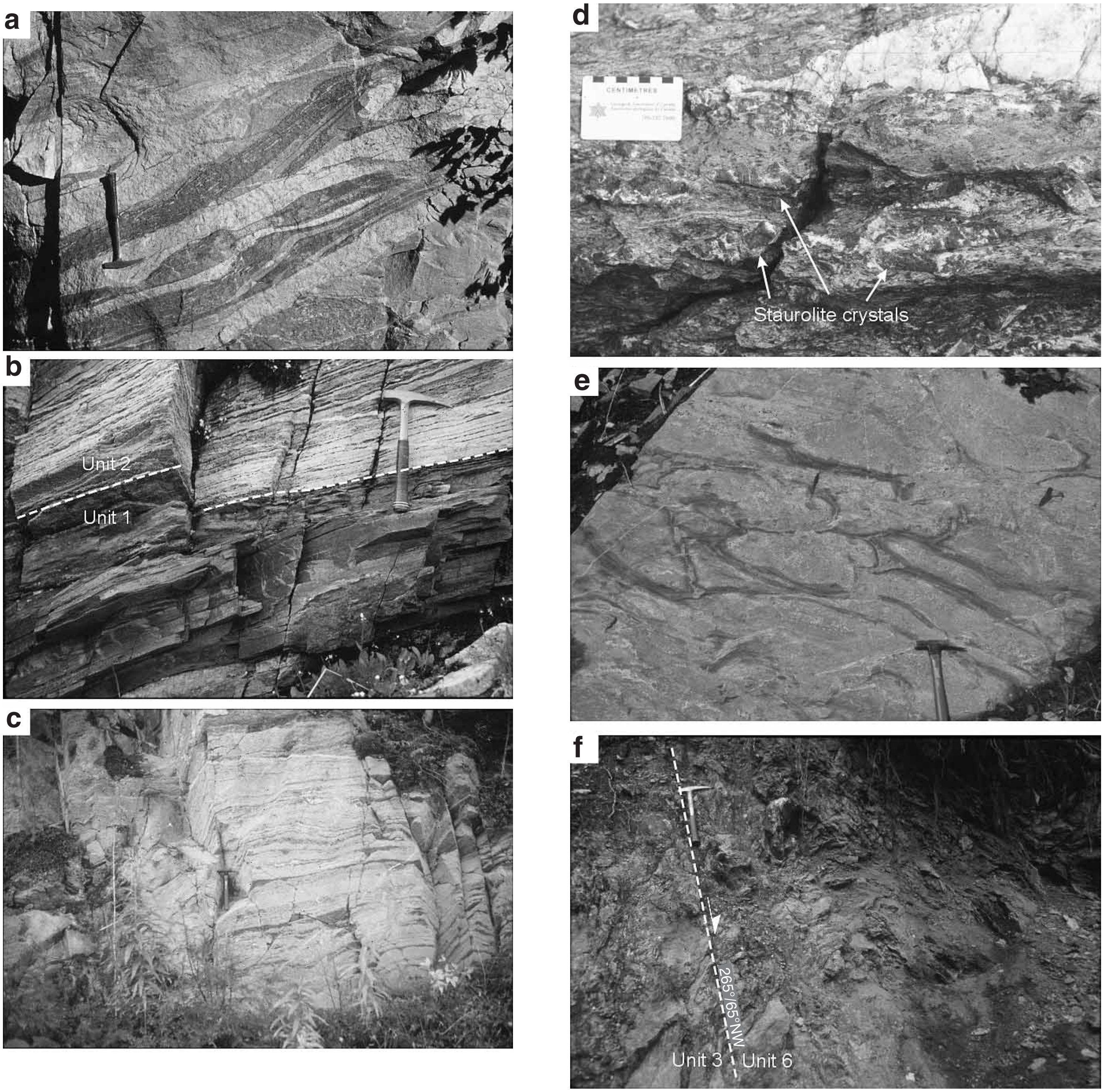

Figure 3. Field photographs of rock units from the study area. ***a****) Texture of the calc-silicate gneiss of unit 1.* ***b****) Unconformity (dashed line) between unit 1 and the calcareous quartzite of unit 2.* ***c****) Typical 'pitted' texture on the weathered surface of the marker unit (unit 2).* ***d****) Staurolite schist (subunit of unit 3) showing some staurolite crystals more than 6 to 8 cm long.* ***e****) Stretched pillow structures observed in the greenstone of unit 5.* ***f****) Exposure of the Columbia River Fault Zone west of Upper Arrow Lake. The dashed line represents a discrete fault plane; the motion and attitude of the plane are labelled.* See *Figure 2 for location of photograph.*

characteristically dark green to black on a fresh surface; it is fine to medium grained and marked by a weak schistosity, defined by the alignment of hornblende and biotite. A mineral lineation is also present. The amphibolite is composed mainly of hornblende, with quartz and plagioclase (±biotite and rare garnet). According to our observations and previous studies (e.g. Hyndman, 1968), it seems to be confined to one particular horizon within unit 3 and may therefore prove useful as a marker horizon.

The most distinctive rock type in unit 3 is staurolite-bearing schist occurring as a subunit a few tens of metres thick. It occurs approximately 100 m above unit 2. On Scalping Knife Mountain (Fig. 2), it is found below the amphibolite. The staurolite schist weathers a shiny light to medium grey and is always strongly foliated. It is composed mainly of quartz, K-feldspar, plagioclase, and biotite (±sillimanite, staurolite, kyanite, diopside, muscovite, garnet, and hornblende). Staurolite crystals are typically large (up to 8 cm long), euhedral, and commonly twinned (Fig. 3d). Although this subunit is not exposed everywhere, it always occupies the same stratigraphic level and, as such, can be considered a marker horizon.

Unit 4

This thin (3–4 m thick) limestone unit has been observed at only a few outcrops on the northeast side of Scalping Knife Mountain (Fig. 2), where it can be mapped as a separate unit. Hand samples are composed of calcite and quartz, with local plagioclase. Although marked by 2 to 5 cm thick laminae, the unit is generally massive. It is light buff on fresh surfaces and locally weathers to bright rusty orange. In places, it is interlayered with minor fine-grained quartzite and calc-silicate. Its contact with the underlying schist was not observed.

Unit 5

Unit 5 occurs adjacent to the Kuskanax Batholith (Fig. 2). It is at least 500 m thick and is intruded by the batholith. It is composed of fine-grained, massive greenstone that is resistant to hammering; at some localities, it is marked by a well developed foliation, defined by varied proportions of chlorite, biotite, and hornblende. In hand sample, quartz, plagioclase, and local epidote are observed, with minor carbonate. A few outcrops display moderately deformed pillow structures (Fig. 3e).

Unit 6

Unit 6 (possibly the Slocan Group of Little (1960)), composed of fine-grained, dark grey pelite with rarely visible individual clasts, is the most ubiquitous rock type east of Upper Arrow Lake. Although no complete section was observed in our area, its thickness is probably well over 1500 m. A thin, east-dipping panel also occurs west of Upper Arrow Lake, in the hanging wall of the Columbia River Fault Zone (Fig. 2). The boundary between unit 6 and underlying rocks is a faulted contact where it is exposed (Fig. 3f).

Following Hyndman (1968), this unit was divided into phyllitic rocks (subunit 6a; Unit 10a of Hyndman (1968)) and nonphyllitic rocks (subunit 6b; Unit 10b of Hyndman (1968)). Subunit 6a constitutes the lower member of the unit and is marked by a well developed, ‘phyllitic’ schistosity, defined by muscovite and rarely chlorite and chloritoid. Small (<1–2 mm across) and scarce biotite flakes as well as rare garnet (<1 mm across) are observed locally along the schistosity. A generally east-plunging lineation defined by crenulated phyllosilicates on schistosity planes is developed locally.

Subunit 6b is defined by more massive and less phyllitic rock types, including argillite, slate, and siltstone. Thin layers of massive volcanic rocks occur locally. As in subunit 6a, bedding is generally not seen, although locally faint compositional laminae are observed. Calcareous horizons are common. Pyrite (up to 1 cm across) is also common. It remains unclear whether the difference in phyllosilicate content between subunits 6a and 6b is compositional or reflects a strain gradient.

STRUCTURAL FRAMEWORK

Columbia River Fault Zone

The trace of the Columbia River Fault Zone on Figure 2 is *from* Read and Wheeler (1976), Read (1979a), and Read and Brown (1981). Field exposures are rare. North of our study area, the fault zone is interpreted as overprinting and truncating the base of the Selkirk Allochthon, which is interpreted to structurally overlie ‘basement’ rocks belonging to the Monashee Complex (e.g. *see* Read and Brown, 1981; Brown and Murphy, 1982). In the Nakusp area, the fault is, for the most part, located beneath Upper Arrow Lake except where it defines a hanging-wall sliver west of the lake (Fig. 2). To the south, where the fault zone emerges from Upper Arrow Lake east of the Arrow Park ferry, its trace was interpreted by Read and Brown (1981) as coinciding with the Rodd Creek Fault mapped by Hyndman (1968).

Only a few exposures of the Columbia River Fault Zone were found along the west side of Upper Arrow Lake (*see* Fig. 2 for locations). At one locality, the fault dips steeply (~65E) to the north and juxtaposes unit 3 calc-silicate rock in the footwall and unit 6b phyllite in the hanging wall (Fig. 3f). It is unclear whether this represents the main trace of the fault zone or a splay. The brittle fault zone has a maximum width of 5 m and is marked by gouge and fault breccia. Discrete slip surfaces show well developed, down-dip slickenlines; drag folds and sigmoidal deflection structures suggest a north-side-down (i.e. normal) sense of motion. Outcrop control does not permit a precise estimate of the magnitude of displacement, but the thickness of the stratigraphic section missing across the fault is a few hundred metres at the most.

Rodd Creek Fault

The Rodd Creek Fault (Hyndman, 1968), which has been interpreted as the southern extension of the Columbia River Fault Zone (Read and Brown, 1981), has been defined on the basis of a metamorphic break just south of Nakusp, on the northeastern flank of Scalping Knife Mountain. Although the main slip surface is not exposed, the combination of outcrop patterns and minor faults in the vicinity led Hyndman (1968) to propose the existence of an east-side-down normal fault.

Our mapping in the vicinity of the Rodd Creek Fault confirmed the presence of a brittle fault. Northeast of Scalping Knife Mountain, it consists of a number of branches striking north-south, parallel to small creeks. It extends southeast of Scalping Knife Mountain along Rodd and Mineral creeks, to Cariboo Creek. Where observed, the fault surface is sharp and dips moderately (40E–50E) eastward; it is locally intruded by biotite- and hornblende-rich dykes and sills of assumed Eocene age. Slickensides occur locally, featuring at least two sets of striae plunging gently (<30E) and steeply (>70E) northward. The main trace of the Rodd Creek Fault generally separates the biotite schist and calc-silicate of unit 3 in its footwall from the phyllitic and nonphyllitic rock types of unit 6. Net displacement is difficult to evaluate; however, combining fault dip with the amount of missing section suggests offset on the order of 1 km. Splays of the main fault generally juxtapose rocks of the same units on both sides, suggesting only minor offset.

Saddle Mountain Dome

Located southwest of Nakusp and forming the southeastern margin of Upper Arrow Lake, Saddle Mountain is the highest topographic summit in the study area. It exposes schist and paragneiss belonging to unit 1 (Fig. 2) with a pegmatite-rich zone (pegmatite making up to 90% of the succession) near the summit. Two outliers of calcareous quartzite (unit 2) a few tens of metres thick cap the twin summit, sharply overlying the sillimanite schist of unit 1 (*see* Fig. 3b).

Saddle Mountain lies at the centre of an elongated domal structure defined by the main fabrics dipping symmetrically away on all sides (*see* Fig. 4). Four structural domains can be

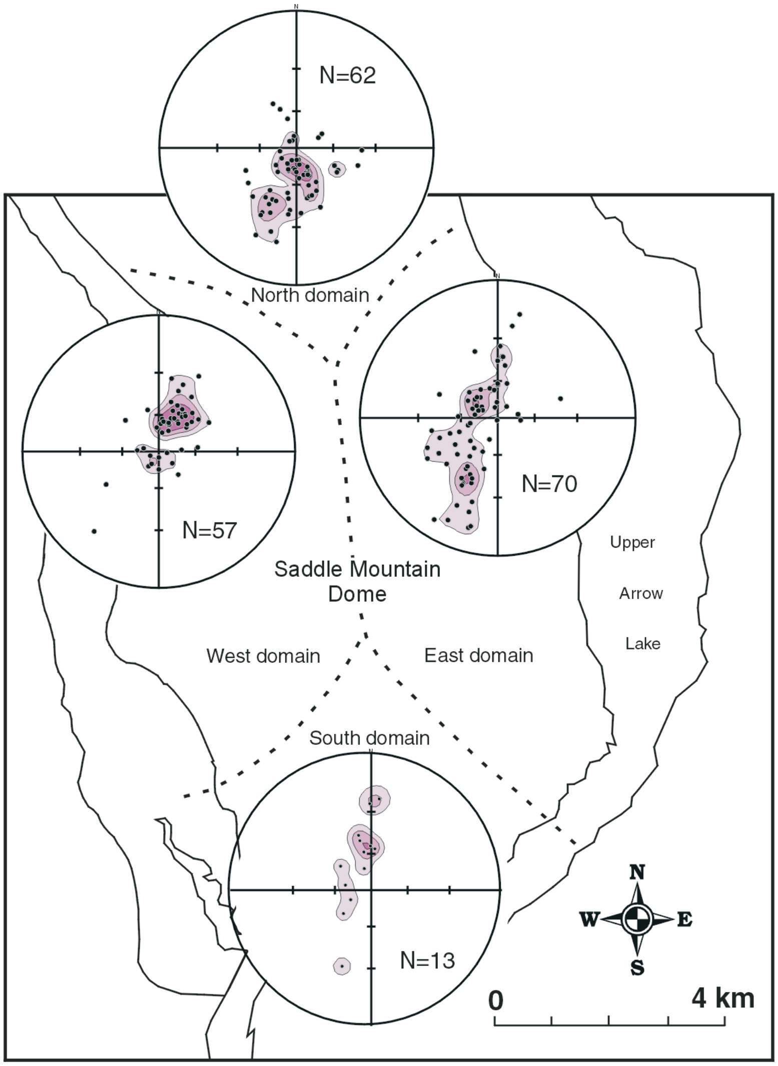

Figure 4.

Equal-angle projections of poles-to-foliation planes for the four domains of the Saddle Mountain Dome. Note the rotation of the foliation around the domal structure. Net density contours: 2, 5, 10% for 1% area.

recognized visually and each defines a flank of the dome (Fig. 4). The poles to the main foliation in the north and south domains are consistent with north- and south-dipping panels, respectively. Poles to foliation in the east domain are more scattered. Two preferred orientations can be distinguished, consistent with a progressive northeast to southeast change in regional dip along the eastern flank of the dome; this suggests that foliation was rotated along its eastern flank. Poles to foliation in the western flank of the dome show a predominantly southwest-dipping foliation. Measurements from the northern part of the western domain are scarce due to a lack of outcrop. In summary, all the structural domains around the Saddle Mountain Dome are consistent with folding of the main foliation into a domal structure. The age and origin of the dome, as well as the relationships between it and the adjacent Columbia River Fault Zone, remain to be determined.

DISCUSSION

Published estimates of displacement of the Columbia River Fault Zone span a significant range. On the basis of shallow east-dipping geometry and the juxtaposition of rocks with very different metamorphic grades, Read (1979a) and Read and Brown (1981) proposed at least 15 to 20 km, and up to 80 km, of down-to-the-east displacement. Lane (1984) and Lane et al. (1989) offered an estimate of 10 to 20 km for the fault north of Revelstoke. Parrish et al. (1988) suggested displacement in excess of 30 km. However, for the section of the fault south of Nakusp, the field data presented here appear to constrain displacement to 1 km or less. This does not rule out larger displacement along the fault zone near Revelstoke; continued mapping north of Nakusp is planned to determine whether fault displacement changes significantly along strike. Our preliminary reconnaissance in the Halcyon Hot Springs area suggests that displacement is minor as far north as Galena Bay.

Regional significance of the stratigraphic succession

The stratigraphic succession in the study area consists of a few kilometres at most of metamorphosed clastic and volcanic rocks. Metamorphosed rocks west of the Columbia River Fault Zone have been interpreted previously as part of the Eagle Bay Assemblage overlying amphibolite-facies rocks of the Shuswap Metamorphic Complex. To the east, in the hanging wall of the Columbia River Fault Zone, Paleozoic to Lower Jurassic stratified rocks have been interpreted as part of the Quesnel and Slide Mountain terranes, obducted onto the North America plate margin in the Middle Jurassic (Klepacki and Wheeler, 1985; Carr, 1991).

Thompson et al. (2001, 2002) recently reported the existence of a semicontinuous belt of Middle and Upper Paleozoic rocks that crop out from the town of Chase to east of Upper Arrow Lake. This rock succession includes a distinctive calcareous quartzite marker unit correlated with the Chase Quartzite (Jones, 1959) and is overlain by a pelitic schist unit that is correlative with the Silver Creek Formation. This middle and upper Paleozoic succession appears to directly overlies Proterozoic paragneiss and schist (Thompson et al., 2002). A Devonian age for the Chase Quartzite can be constrained from recent geochronological data (Thompson et al., 2002).

In the Upper Arrow Lake area, previous studies (*see* Hyndman, 1968; Reesor and Moore, 1971) also recognized a distinctive calcareous unit. Hyndman (1968, p. 10) stated that the diopsidic quartzite (Hyndman's Unit 2) in the Nakusp area "...should make an excellent marker horizon outside the area." Reesor and Moore (1971), in their study of the Thor-Odin area, also described a distinctive quartzitic unit (Unit F4). Our field work has shown that the calcareous quartzite mapped by Hyndman is the eastward extension of the unit mapped farther west by Thompson et al. (2002) and Reesor and Moore (1971). Additional geochronological and petrographic study is in progress on samples of the calcareous quartzite from the present study area in order to more directly confirm its age and affinity.

Implication for the Columbia River Fault Zone

South of Nakusp, the Columbia River Fault Zone links with Hyndman's (1968) Rodd Creek Fault and terminates against the northwestern flank of the Valhalla Complex (Brown and Journeay, 1987; Read and Brown, 1981). The fault has been interpreted as a major tectonic boundary in the southern Cordillera (e.g. Brown and Journeay, 1987; Parrish et al., 1988; Carr, 1991). However, our data presented here, together with data summarized by Thompson et al. (2001, 2002), show that in the Upper Arrow Lake region, several stratigraphic correlations can be made across the Columbia River Fault Zone. The calcareous quartzite marker horizon (unit 2) occurs mainly west of the lake, in the footwall of the fault zone, but it has been recognized along the east side of Upper Arrow Lake, in the hanging wall of the fault. Elsewhere in the area, along the Rodd Creek Fault, the schistose facies of unit 3 display similar relationships where they can be mapped across the fault, suggesting only minor offset of a unique succession (*see* Fig. 2).

CONCLUSIONS

The Columbia River Fault Zone has been interpreted as a crustal detachment with tens of kilometres of east-side-down displacement, and as the eastern bounding structure of a metamorphic core complex comprising the Monashee Mountains exhumed during the Eocene. Mapping completed during the 2002 field season along both sides of Upper Arrow Lake demonstrates east-west continuity of Paleozoic rock units across the trace of the Columbia River Fault Zone. The distribution of these rock units limits displacement to about 1 km or less. An initial conclusion is that, if the Columbia River Fault Zone is a crustal detachment, displacement across it dies out south of the town of Nakusp.

ACKNOWLEDGMENTS

Support for field work was provided by NSERC and the Ancient Pacific Margin NATMAP Project. Critical reading and comments by Murray Journeay helped improve the manuscript. We also thank Michael Clarke, who assisted in the field.

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Geological Survey of Canada Project 990002