



**GEOLOGY OF THE PURCELL SUPERGROUP
BETWEEN WILDHORSE RIVER AND SAND CREEK
(82G/6, 11)**

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INTRODUCTION

This study of the stratigraphy, sedimentation, and deformation of the rocks of the Middle Proterozoic Purcell Supergroup was initiated in 1977 with the mapping of an area of approximately 120 square kilometres north of the Bull River. Mapping, at a scale of 1:25 000, was completed in 1978 and some stratigraphic sections were studied in detail. The area has been mapped on a reconnaissance basis by Leech (1958, 1960) and Thompson (1962a). The area immediately to the north is presently being studied by T. Höy of the British Columbia Ministry of Mines and Petroleum Resources.

The Bull Canyon fault, a southwest-dipping fault on the southern flank of the Steeples that abruptly steepens to a vertical, northeast-trending fault east of the Bull River (Fig. 30), was recognized by Thompson (1962a, b) and Leech (1962, unpublished field maps). Data collected in this study suggest the Bull Canyon fault is a thrust fault which separates two distinct stratigraphic sequences of Purcell rocks. The main features of the geology in the area to the north of this fault have been described (McMechan, 1977) and will not be repeated here. An account of the stratigraphic, sedimentologic, and structural relations within the entire map-area, and their regional implications, will be presented as a British Columbia Ministry of Mines and Petroleum Resources 1:50 000 preliminary geological map with accompanying notes. A discussion of the results of the 1978 field study, in terms of stratigraphy, structure, and economic geology follows.

STRATIGRAPHY

The oldest rocks exposed in the area to the south of the Bull Canyon fault belong to the Aldridge Formation. They comprise three distinct map units. The lowest (unit A1) includes at least 850 metres of slabby to flaggy, very rusty weathering, homogeneous, medium grey argillaceous siltite interlayered with very thin parallel-laminated, light to medium grey, graded siltite couplets or with very thin parallel laminae of dark grey siltite. Rare thin-bedded quartzites occur in this siltite sequence. The base of unit A1 is not exposed within the map-area.

The middle unit (unit A2) comprises approximately 650 metres of thin to thick-bedded, fine-grained, light grey argillaceous quartzite interbedded with rusty weathering, crossbedded or laminated, light and medium grey, graded siltite and dark grey argillite. Quartzite beds grade to dark grey siltite in the top few centimetres. They commonly contain rip-up clasts of black argillite and frequently have flute or asymmetric load casts along the base. Thus, they resemble the A unit of the Bouma sequence. Convolute layering, in beds up to 10 metres thick, occurs locally in the Bull River area.

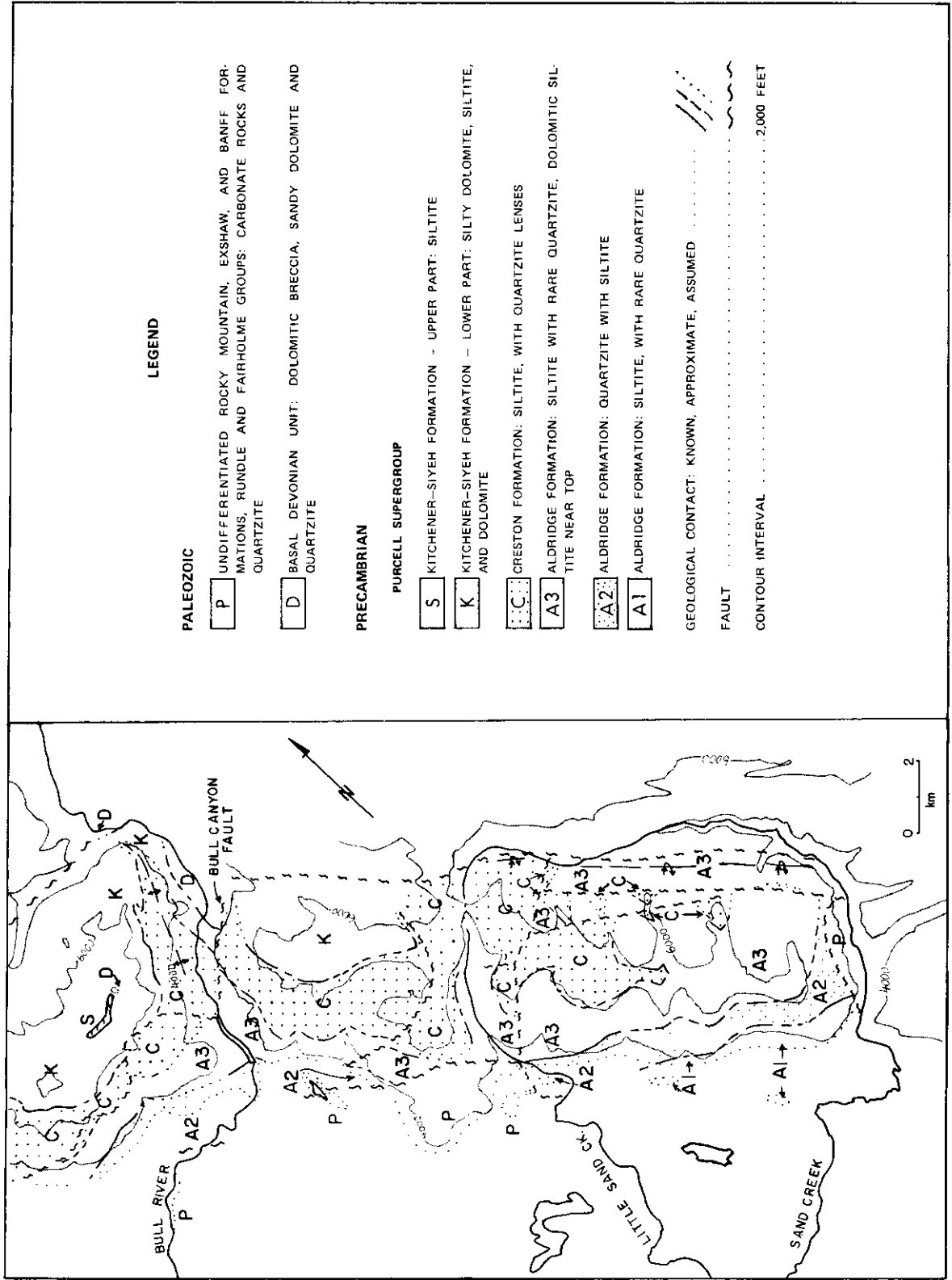


Figure 30. Generalized geological map of the Purcell Supergroup exposed between Bull River and Sand Creek.

The upper unit (unit 3A) consists mainly of rusty weathering, pyritic, thin parallel-laminated, graded grey siltite, dark argillaceous siltite with sparse laminae of light grey siltite, and slabby to blocky, faintly colour laminated, dark and medium grey, fine siltite. Thin irregular 'mudcracks' and small-scale scour-and-fill structures occur locally in siltites of the transitional contact zone between the Aldridge and Creston Formations (see discussion following) but are generally lacking elsewhere. Thin to thick-bedded quartzites form a subunit of A3 that is traceable across the map-area and also occur as isolated lenses in the vicinity of Bull River. The quartzites commonly exhibit convolute bedding, dolomite-cemented layers, and ripple crosslamination. In the Sand Creek area, the traceable quartzite unit is at least 5 metres thick and occurs approximately 375 metres above the base of unit A3.

Rocks of the Aldridge Formation grade into those of the Creston Formation over a few hundred metres of section. Two sequences of interlaminated dolomitic siltite and green non-dolomitic siltite containing abundant ripple and channel crosslaminations, mudcracks, rip-up debris beds, and disrupted bedding, the latter apparently formed by dewatering, are found in the transition zone throughout map-area south of Bull Canyon fault. The dolomitic intervals are interlayered on the centimetre and metre scale with thin parallel-laminated, dark and light grey siltite. They appear to be conformable with the underlying and overlying strata. Siltite with discontinuous, medium to fine-grained, graded laminae, abundant mudcracks, and scour-and-fill structures (features characteristic of the Lower Creston Formation) normally occur below the dolomitic interval, whereas siltite with characteristics of the Upper Aldridge Formation (unit A3) occur above it. The Aldridge/Creston contact has been designated at the top of the thick sequence of siltite, characterized by continuous parallel laminations and a general lack of 'mudcracks,' that lies immediately above the dolomitic horizons. Unit A3 is approximately 700 metres thick in the Sand Creek area. The dolomite intervals are interpreted as upper intertidal flat deposits. The upper part of unit A3 therefore represents a shallowing upward sequence from 'turbidite fan' (quartzite subunit) to subtidal and intertidal environments, followed by a return to subtidal conditions.

South of the Bull Canyon fault, the Creston Formation is between 920 and 990 metres thick. Three main subdivisions of the formation were recognized. The lower part of the Creston Formation consists of thin, planar-bedded, limonite-spotted, green-grey, coarse-grained siltite, separated by very thin 'mudcracked' black argillite partings, and interlayered with continuous to discontinuously laminated, light and dark grey, graded 'mudcracked' siltite. Rippled surfaces, load casts, and rip-up debris beds are locally associated with the coarse siltite. Rare, very thin white quartzite lenses occur near the top of the lower part of the Creston Formation.

The middle unit of the Creston Formation consists primarily of discontinuously laminated, medium to fine-grained, dark to light green, graded siltite. Scour-and-fill structures, mudcracks, and rip-up debris layers are locally abundant. Thin-bedded, coarse-grained, green siltite and rare lenses of white quartzite are interbedded in this sequence. A dolomitic siltite horizon with sedimentary structures, similar to the non-dolomitic green siltite, occurs in the middle unit of the Creston Formation, in the vicinity of Little Sand Creek. An interval of faintly laminated, fine-grained, purple and green siltite usually occurs near the top of the middle unit.

Medium to very coarse-grained, white quartzites are abundant in the upper unit of the Creston Formation. They are characteristically very thin to thin bedded and well sorted. Crossbedding, siltite rip-up clasts,

mudcrack in-filling, and dolomite cementation are common features. The quartzites form tabular lenses interbedded in siltites similar to those of the middle unit of the Creston Formation. Near the top of the formation some of the siltites are dolomitic. Mudcracks and ripple marks are common throughout the upper unit and interference ripple patterns are particularly abundant in the Little Sand Creek area.

Strata of the Kitchener–Siyeh Formation transitionally overlie those of the Creston Formation. The change from non-dolomitic siltite (with interbedded thick quartzite lenses) to interlaminated dolomitic and non-dolomitic siltite occurs over a few tens of metres of section. The top of the Creston Formation has been placed at the top of the last sequence of non-dolomitic siltite with thickness in excess of 5 metres. At least 800 metres of the lower or dolomitic part of the Kitchener–Siyeh Formation is exposed in the Iron Mountain area. A total thickness cannot be estimated because of faulting. Comparison with the Kitchener–Siyeh Formation exposed immediately to the southeast across the Upper Sand Creek fault suggests the upper or non-dolomitic part of the formation may have been removed by sub-Devonian erosion.

Brown-weathering, discontinuously interlaminated, light grey dolomitic and green non-dolomitic siltite, interbedded with rare dolomitic sandstone, comprise the basal 250 metres of the Kitchener–Siyeh Formation in the Iron Mountain area. Climbing ripples, ripple crosslamination, cut-and-fill structure, and rare mudcracks occur in this unit. The remaining exposed strata consist of orange-brown weathering, thin-bedded silty dolomite that contains irregular black argillite partings or molar-tooth structures. These strata are interbedded with very thin-bedded, medium to fine-grained, light to dark grey, graded siltite and occasional stromatolite, oolite, or dolomitic rip-up debris beds. Load casts and flame structures are common in the siltite intervals.

Strata of the formations described above have been faulted against siltite, dolomitic siltite, and dolomite of the Gateway and Kitchener–Siyeh Formations on the east, against Paleozoic carbonate rocks and quartzite on the south, and Paleozoic carbonate rocks on the west. Details of the distribution of these units and lithologic descriptions are given by Leech (1958).

Intrusive rocks are rare in the region south of the Bull Canyon fault. One laterally persistent sill occurs near the top of the Creston Formation and two parallel northwest-trending dykes of variable width intrude Aldridge sediments in the immediate vicinity of Bull River.

STRUCTURE

The area south of the Bull Canyon fault is dominated by a large open recumbent anticline that forms the Lizard segment of the Hosmer nappe. The upright limb and hinge zone of this anticline underlie the study area. Bedding in the upright limb is generally east dipping while that in the overturned limb is west dipping. Strata of the upright limb have overridden those of the overturned limb on a steep, northwest-trending thrust fault that cuts through the overturned limb of the structure (Leech, 1958). Near the Rocky Mountain Trench the upright limb of the anticline is offset by a major west-dipping normal fault, the Murray Lake fault, which puts Devonian and Mississippian rocks against rocks low in the Precambrian sequence (Aldridge and Creston Formations). Two northwest-trending, steep west-dipping normal faults

occur in the southeast portion of the study area. Their trends, and that of the Murray Lake fault, are affected by a southeast-dipping, northeast-trending fault located south of Little Sand Creek. A north-dipping fault with variable stratigraphic displacement is inferred in the area immediately north of Sand Creek. A penetrative cleavage has developed in argillaceous rocks in all the formations but is best developed in the Aldridge Formation.

ECONOMIC GEOLOGY

One important copper-silver-gold deposit and numerous smaller copper or lead-silver showings occur within the map-area south of the Bull Canyon fault. Smaller showings usually occur as chalcopyrite, pyrite or pyrrhotite, or galena associated with quartz or siderite-quartz veins.

The Bull River deposit consists of several siderite-quartz veins that contain chalcopyrite as massive pods, blebs, and fracture fillings. The mineralized veins occur in argillites, siltites, and quartzites of the Aldridge Formation (unit A2), and at or near diorite dyke contacts. Chalcopyrite also occurs in fractures in the host sediments. Total production at the Bull River mine during its operating life from 1972–1974 was 471 906 tonnes of ore grading: copper, 1.54 per cent; silver, 13.37 grams per tonne; gold, 0.274 grams per tonne.

ACKNOWLEDGMENTS

I would like to thank Tory Fenton, Peter Fry, and Wendy Comfort for their able assistance in the field. Discussion with Dr. G. B. Leech of the Geological Survey of Canada concerning the geology of Purcell strata exposed in the southernmost portion of, and immediately east of, the map-area, is greatly appreciated.

This project has been funded by the British Columbia Ministry of Mines and Petroleum Resources and the Natural Sciences and Engineering Research Council of Canada.

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