A Hydrothermal Origin for "Crinkle Chert" of the Big Salmon Complex

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A key focus of fieldwork in the Big Salmon Complex in 2000 was further investigation of a manganiferous metachert marker horizon referred to as the "crinkle chert" (Mihalynuk *et al.*, 1998). The crinkle chert forms a regional sedimentary layer that extends over 80 kilometres in northern British Columbia (Figure 1), and it is similar to a unit known from the Little Salmon area (Colpron and Reinecke, 2000), 250 km to the north. However, at this latter locality, the oldest age of the manganiferous chert is constrained as Late Mississippian, the oldest age limit of fossils in underlying strata (ibid.); whereas the Big Salmon Complex crinkle chert is older than Middle Mississippian based on dikes that cut overlying strata (Mihalynuk *et al*., 2000).

The crinkle chert could be interpreted as a pure meta-siltstone, however microscopic analyses fail to reveal clear evidence of clastic sedimentary textures from anywhere except near the upper contact where it is locally overlain by impure quartzite. An alternate explanation is that it is a metamorphosed radiolarian chert, as such cherts can contain elevated Mn, and to a lesser extent Ba. Greenschist metamorphism and the highly strained nature of these rocks precludes the recognition of radiolarian microfossils, if present, which would unequivocally establish a biogenic origin for the crinkle chert.

Field investigations in 2000 revealed stratiform magnetite layers up to a decimetre thick within, and near the top of the crinkle chert unit (Figure 1). These layers are difficult to explain other than by a hydrothermal origin, as originally suggested by Nelson (1997), based on the presence of trace to minor barium, copper and manganese. Our evaluation of five existing geochemical analyses of the crinkle chert (Cook and Pass, 2000) indicates a hydrothermal, not hydrogenous origin (e.g., Figure 2). The recognition of seafloor hydrothermal origin for the crinkle chert unit points to the possible presence of undiscovered volcanogenic massive sulphide (VMS) mineralization in the area. Explorationists can consider the crin-

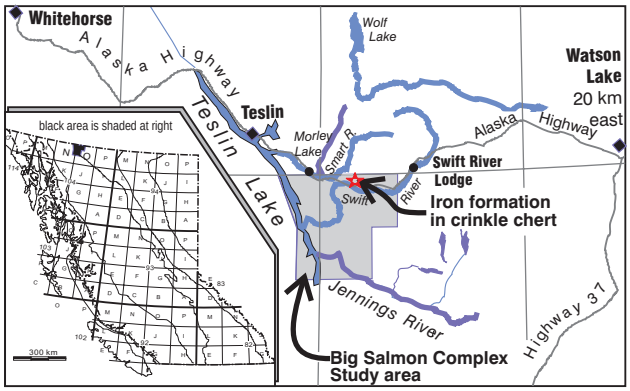

Figure 1. Location of the Big Salmon Project area. The star denotes the locality where iron formation has been observed within the crinkle chert unit. For the regional distribution of the crinkle chert unit in northern British Columbia *see* Mihalynuk *et al.* (2000).

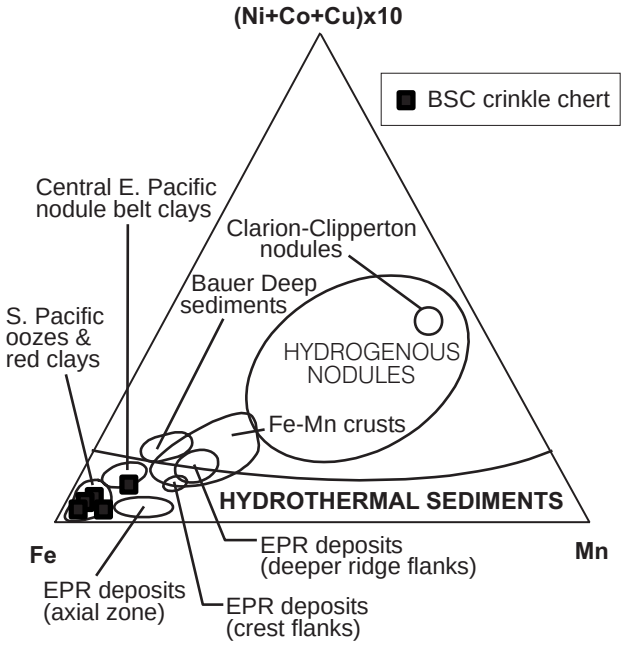

Figure 2. (Ni+Co+Cu)*10-Fe-Mn ternary plot for Big Salmon Complex crinkle chert (Cook and Pass, 2000). Also shown are the general fields for hydrothermal sediments and hydrogenous nodules (Bonatti et al., 1972), Fe-Mn crusts (Toth, 1980), for Bauer Deep sediments (Sayles and Bischoff, 1973), East Pacific Rise deposits (axial zone, crest flanks, and deeper ridge flanks) (Germain-Fournier, 1986), South Pacific biogenous oozes and red clays, siliceous clays from the Central East Pacific nodule belt, and Clarion-Clipperton zone associated Mn nodules (Karpoff *et al*., 1988).

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kle chert as a time-stratigraphic marker for hydrothermal activity.

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