Sediment hosted strata-bound copper-silver potential of the Creston Formation, Purcell Supergroup, Southeast British Columbia

Russell Hartlaub

Department of Mining and Mineral Exploration
British Columbia Institute of Technology, Burnaby, B.C.
Russell_Hartlaub@bcit.ca

Introduction:

A multi-year field program was commenced in 2007 to examine the metallogenic potential of sedimentary and volcanic rocks from the middle and upper parts of the Purcell Supergroup in southeast B.C. Sediment-hosted Cu deposits are the second most important global source of Cu, lagging only porphyry Cu deposits in total resource. The majority of sediment-hosted Cu deposits are formed within continental rift basins due to fluid mixing within permeable, shallow-water sedimentary.

Major deposits lie within the Kupferschiefer belt of Europe and the Zambian Copperbelt of Africa. In addition, numerous stratabound Cu-Ag occurrences and deposits have been discovered in the quartzite dominated Revett Formation of western Montana. Several of these deposits were examined in 2008.

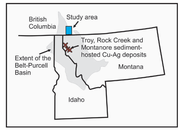
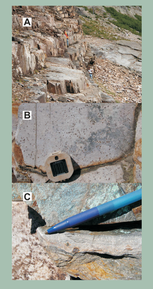


Fig. 1: Regional extent of the Purcell Basin.

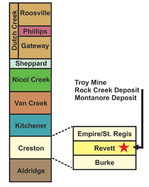


Photos to the right: A) Thick bedded quartzite of the lower Revett Formation. B) Limonite spots replacing chalcopyrite in lower Revett Formation quartzite. C) Detail of limonite spots replacing chalcopyrite and chrysocolla alteration. All three photos were taken at exposures of the Montanore deposit on the north shore of Rock Lake, Montana.

Sediment-hosted copper potential of the middle Creston Formation

The Creston is notable for its alternating units of shallow water siltstone, argillite, quartzite, and silty quartzite. Ripple marks and cross-beds are abundant and consistent with sediment deposition in a relatively shallow, high-energy environment. Flame structures, load casts, scour surfaces, rip-up clasts and desiccation structures occur locally. The magnetic susceptibility readings for the Creston Formation are much higher than the other strata of the Pucell Supergroup.
The Creston Formation has previously been divided into three units based on lithology and environment of deposition (Höy, 1993). These three subdivisions (C1, C2, and C3) are considered to be roughly equivalent to the Burke, Revett, and St. Regis formations in Montana. It is the middle Creston that is considered to have the highest potential for sediment hosted Cu-Co-Ag.

During regional reconnaissance work in 2007 a new Cu occurrence was discovered within the Creston Formation. The disseminated Cu mineralization is hosted in argilite and siltstone. In 2008, additional Cu occurrences were discovered in the same area (See the map below).



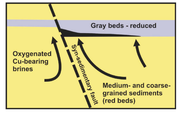
Above: Simplified stratigraphy of the Purcell Supergroup

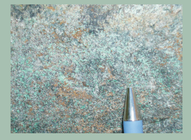
Creston quartzite with ripple marks (left) and with iron and manganeese oxide alteration (right).

Sources of Cu-Ag-Co in the Pucell Basin: Mafic intrusive and extrusive rocks

The majority of sediment-hosted stratabound Cu deposits are formed within continental rift basins due to movement of moderately low pH and oxidized fluids within permeable, shallow-water sedimentary and, more rarely, volcanic rocks. Copper, silver, cobalt, lead, and other metals are leached from minerals within the sedimentary and/or igneous rocks and carried elsewhere and precipitated. There are significant quantities of mafic rocks in the Purcell Basin. These include dykes, sills, and the Nicol Creek Formation, a distinctive flood basalt unit.

The Roo Group of claims (See regional map) contains several copper occurrences. Mineralization is hosted in both coarse clastic rocks of the Sheppard Formation and underlying volcanic rocks of the Nicol Creek Formation. The volcanic rocks are the most likely source of the Cu, but the question arises as to whether Cu was remobilized and concentrated by diagenetic (Volcanic Redbed Cu) or hydrothermal fluids.





Above: A Cu bearing gabbro dyke that cuts the middle Purcell Super-group near Cranbrook. These dykes are Proterozoic and may be roughly the same age as Cu mineralization in the sedimentary rocks.

Below: Quartz veining with chalcopyrite from the Robocop property (Ruby Red Resources).

Key Exploration Strategies

Having identified a reasonable potential for sediment-hosted, stratabound Cu±Ag±Co mineralization on the Canadian side of the Belt-Purcell Basin, it is useful to note some of the key strategies that may be utilized for future exploration in the region. These exploration strategies were gleaned by examining the literature and visiting the sediment-hosted stratabound copper deposits of Montana, as well as by mapping of the Creston Formation in BC.

1.Stream and biogeochemical sampling

Prospecting stream geochemical anomalies led to initial discoveries at many of the stratabound copper deposits in Montana (Hayes, pers. comm. 2008). Although a British Columbia Geological Survey database of regional stream sampling exists, a more detailed study will need to be carried out in selected areas of the Creston Formation. Biogeochemical sampling may also help provide targets in areas of poor exposure.

2.Tracing of prospective strata

Several of the deposits in Montana were discovered by a simple strategy of tracing along prospective stratigraphic horizons after traces of mineralization were discovered (Hayes, pers. comm. 2008). Thick bedded quartzite beds are typical host rocks for the Revett deposits of Montana (Fig. 9a), but the finer grained sedimentary rocks should not be ruled out. The disseminated nature of the mineralization is not always apparent, especially where limonite has partially replaced chalcopyrite.

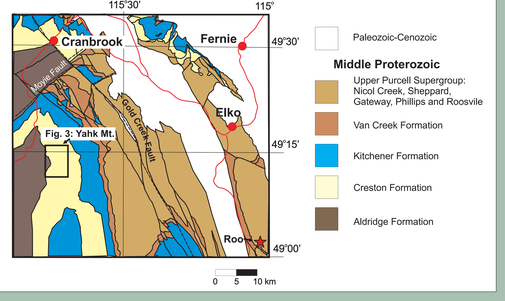
3.Induced polarization studies

Despite the low of concentration of sulphides, stratabound Cu deposits should produce IP anomalies due to the otherwise restricted presence of sulphides and graphite within the Creston Formation.

4.Aeromagnetic mapping

The abundance of magnetite within the Creston Formation indicates that detailed aeromagnetic imagery would be useful for tracing contacts in areas of poor exposure. Both mineralized and non-mineralized Creston Formation rocks may contain magnetite and have similar magnetic susceptibility values.

Fig. 2: Regional Geology (after Höy et al., 1995)



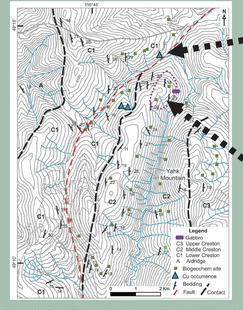
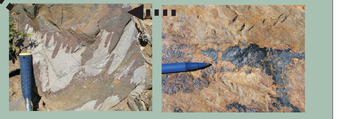


Figure 3: Simplified geological map of the Yahk Mountain area south of Cranbrook (see Fig. 2). Occurrences with copper mineralization, Fe oxidation, and Mn alteration (right) were identified despite the relatively poor bedrock exposure in the area.

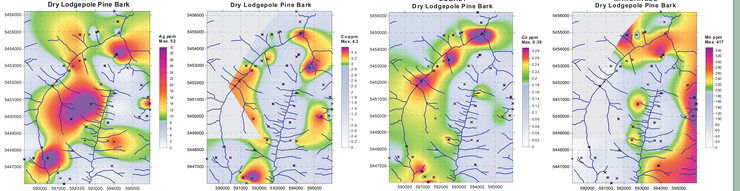
Above: Fine bornite and chalcopyrite disseminated in siltite. Two grab samples returned elevated Cu (0.05% and 0.2% Cu) and Ag (2 and 6 ppm). A sample collected in 2008 from a site approximately 1.5 km southwest returned 0.18 % Cu.



Above left: Red and purple iron-oxide alteration patterns and white bleaching of sandstone from the middle Creston Formation. The alteration is visible evidence for the movement of oxidized (Cu bearing?) diagenetic fluids. Above right: Manganese oxides from Yahk Mountain area.

Biogeochemistry: a test case using lodgepole pine bark

Fifty lodgepole pine bark samples were collected from the Cranbrook area. These samples were processed by Dr. Colin Dunn and analysed for 53 elements. Kriged data plots (below) were created by Dr. Dunn to better examine the element distribution with relationship to geology, known mineral occurrences and drainage patterns. The element patterns appear to be broadly coincident with the mapped geology of the Yahk Mountain area (see figure 3 for a comparison). The Cu and Mn highs locally match mineral occurrences identified during mapping.



(above) Cooper Campbell collecting a bark sample. (Below) Reba scouting for prey while standing on a typical outcrop of silty sandstone from the Creston formation.

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