

Geochemical dispersion in a neutralized mine drainage environment, Walton, Nova Scotia

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Magnet Cove Mine located near Walton in Hants County, Nova Scotia, was active between 1940 and 1978 when it produced about 4 Mt barite and 0.3 Mt of Cu-Pb-Zn-Ag sulphide ore. Investigation of the mine site and adjacent Rainy Cove Brook, supported by air-photo evidence from 1945 to 1991, shows that the primary dispersion mechanism of heavy metals from Magnet Cove Mine site into the downstream envi-

ronment is (and has been) by physical erosion and transport of tailings. Sediment samples (n = 69) collected from the tailings ponds and from upstream and downstream drainage were analyzed by AAS for Fe, Mn, Ba, Zn, Cu and Pb. Results show that the downstream sediments are very similar to the tailings in their metal contents, and anomalously enriched over upstream sediments on average by the following fac-

tors: Mn 5x, Ba 4x, Zn 1.3x, Pb 2.7x, and Cu 6x. ICP-NA analysis of selected tailings samples shows that there is close correlation of the heavy metals: Ag, As, Sb, Co, Ni, V, Cr, Th and U with the metals Fe, Mn, Ba, Zn, Cu and Pb.

The secondary process for the release of contaminants into the downstream environment is through solution and precipitation. Selected water samples collected from mine site, upstream, and downstream locations were analyzed by ICP-MS and other methods. The open pit water, which overflows into Rainy Cove Brook, shows strong enrichment in sulphate, chloride, Ca, Mg, Na, K and Mn (but not Ba), and also in Se, As, Co, Ni, Cr, V and U. Mixing of the more alkaline open pit water (pH 7.9) with the more-or-less acidic waters from on-

site leachates (pH 3.9 - 6.9), and from upstream tributaries of Rainy Cove Brook (pH 5.7 - 6.7) results in (i) neutralization of pH, (ii) dilution of heavy metal concentrations by an order of magnitude, and (iii) flocculation of Fe-Mn oxyhydroxides (which probably further reduce, by adsorption, the concentrations of heavy metals in the water). As a result, the downstream water (pH 7.2 - 7.6) is only slightly enriched, over upstream water, in As, Mo, Th and U, but moderately enriched in sulphate, chloride, and Na.

Other processes which are contributing to the amelioration of the affected area include the post-mining natural stabilization of the flood plain at the lower end of Rainy Cove Brook and its gradual conversion to a wet-land environment.