Sulfide Mineralogy and Cobalt Deportment at the Viscaria Cu-Fe Deposit, Kiruna District, Northern Sweden

Koray Tasbicen[1], Marcello Imaña[2], William X. Chávez, Jr.[1]
1. New Mexico Tech, Socorro, NM, USA, 2. Copperstone Resources AB, Kiruna, Sweden

The Viscaria Cu-Fe deposit is hosted within 2.2 Ga Paleoproterozoic-age rocks of the Norbotten region, Sweden; these rocks also host world-class IOA deposits as well as Cu + Fe ± Zn and Cu ± Fe ± Au occurrences. Copper mineralization at Viscaria comprises three stacked, subvertical ore lenses of semi-massive to massive magnetite + chalcopyrite + carbonate, with disseminations and veinlets of pyrite + low-Fe sphalerite or pyrrhotite + high-Fe sphalerite. Locally, anomalous Co and Ni values correlate positively with copper.

Trace element characterization of sulfide shows that cobalt enrichment occurs with paragenetically early pyrite-magnetite and early pyrrhotite and sphalerite; in these assemblages, chalcopyrite is not favoured. Varying abundances of sulfides within different ore lenses and variations of carbonaceous content in host rocks impact cobalt concentration in sulfides. In the stratigraphically uppermost A Zone, cobalt is partitioned between pyrite, pyrrhotite, and sphalerite, with average Co concentrations of 846, 596, and 635 ppm, respectively. Cobalt favours pyrrhotite and sphalerite in the B Zone, with average Co concentrations of 1,370 and 749 ppm. Pyrite is the primary host for cobalt in the stratigraphically lowest D Zone, with an average concentration of 2,423 ppm. Co/Ni ratios of pyrite at Viscaria within the D Zone display the most significant values, from 10 to 100, while ratios for the A and B Zones vary from 0.1 to 1. High Co/Ni ratios of the D Zone might be attributed to greater-temperature fluids that we suspect originated from a mafic intrusion source. Mineral assemblages of the D Zone suggest more oxidizing conditions than A and B Zones, with Co/Ni ratios similar to iron-oxide and copper-bearing manto/vein/skarn systems, including those not occurring within carbonaceous stratigraphic sequences worldwide. Mineralization and alteration assemblages and textural features at Viscaria suggest a similar epigenetic origin for A, B, and D Zone ores.