Controls on VMS mineralization, Bathurst Mining Camp, New Brunswick

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The Middle Ordovician VMS deposits of the Bathurst Mining Camp occur in three groups, namely: Tetagouche, California Lake and Sheephouse Brook groups. Although there are many subtle differences between deposits they can be divided into three categories based on their host rocks, specifically: 1) autochthonous volcanic sediment-hosted massive sulphides, 2) autochthonous volcanic-hosted massive sulphides, and 3) allochthonous sediment-hosted massive sulphide deposits.

The first category includes the majority of the larger massive sulphide bodies: e.g., Brunswick No. 12 (geologic resource 229 MT @ 7.66 wt. % Zn, 3.01 wt. % Pb, 0.46 % Cu and 91 g/t Ag) in the Tetagouche Group and the Caribou deposit (≈70 Mt) in the California Lake Group. All deposits of this group have siliciclastic (locally graphitic) or tuffaceous sedimentary rocks in the immediate footwalls, most display evidence of footwall hydrothermal alteration and metal zoning within the massive sulphide lens, and many have a recognizable vent-complex and stringer sulphide feeder-zone. Most of these deposits are associated with the Nepisiguit Falls Formation (lower part of the Tetagouche Group), which is dominated by quartz-feldspar phyric tuff-lavas or crystal tuffs, and volcaniclastic and epiclastic equivalents.

In the eastern part of the Bathurst Camp, Brunswick-type horizon deposits are associated with a laterally extensive, sulphide-capping Fe-rich chemical exhalite (iron-formation) that has been traced for several km's along strike. In contrast, deposits occurring at this stratigraphic level in the western part of the camp lack, or have very poorly developed iron formations. Iron-formation is less well-developed in the upper part of the Tetagouche Group and is not known to occur in the Sheephouse Brook or California Lake groups.

A second type of deposit consists of felsic volcanic-hosted sulphide bodies such as the Armstrong B and Stratmat deposits hosted by feldspar-phyric rocks of the California Lake and Tetagouche groups, respectively. These bodies have felsic rocks in both footwall and hanging wall, are of small (< 3 Mt) size, and commonly do not have well-developed metal zoning or a recognizable vent complex.

A third type of deposit (of which the Canoe Landing Lake deposit is the only example) consists of resedimented sulphides hosted by sedimentary rocks. This deposit is unique in that footwall hydrothermal alteration, metal-zoning, and stringer-sulphide feeder veins are absent.

Regardless of host rocks, several factors appear to influence the formation and preservation of VMS deposits. Of primary importance is the development of metal-bearing, hydrothermal fluid. This is enhanced by permeable footwall rocks, high geothermal gradient, and contribution to the metal budget by a degassing magma. These fluids may vent in narrowly focused zones or spread out over large areas. Topography, i.e. basin development, is particularly important in terms of concentrating the metal sulphides as is sufficient time to form large deposits. Finally, the local chemistry of the water column is important in terms of preserving the sulphide bodies from oxidation prior to burial by later volcano-sedimentary units.