Transport and Emplacement of Sulfides in Voisey's Bay Magmatic Ore Deposit, Labrador

A. M. LEITCH[1], D.M. EVANS-LAMSWOOD[2] and R.I WHEELER[2]

[1]*Memorial University of Newfoundland*
[2]*Vale INCO Limited*

The Voisey's Bay igneous intrusion is a 1.34 Ga intrusion of mainly troctolites and olivine gabbros within older gneisses, and is one the oldest members of the predominantly anorthositic Nain Plutonic Suite in Labrador, Canada. The intrusion consists of a sub-vertical conduit several kilometers long and ~30m wide, and two kilometer-scale magma chambers. Mineralization with sulfide ores occurs principally in physical traps, at the base of one magma chamber and where bends and kinks in the conduit led to changes in the magmatic flow regime [1]. Sulfide mineralization occurs as lenses of massive ore, disseminated blobs within the troctolite host or 'net-textured' ore, where sulfide makes up a background matrix containing a network of silicate crystals.

Metal sulfides form as a dense, fluid, immiscible phase from silicate magmas. Small droplets of sulfide may easily be carried by viscous silicate magma whereas large, slippery, heavy slugs would be difficult to transport upward against gravity. We propose that mineralized zones were emplaced as mingled sulfide and silicate magma in an energetic event, possibly due to caldera collapse [2]. This event involved shattering of wall rocks and the intimate mingling of sulfide and silicate liquids to create a foam. Such a foam of would facilitate upward transport of the sulfide liquid. Since foams possess a yield strength, sulfide-silicate foams could 'stick' in local widenings of the sub-vertical conduit, and when they crystallized would form net-textured ores. Foam collapse could result in draining back and collection of massive sulfide in physical traps. Support for these concepts can be found in examination of textures and unit relations in drill core, and in analog experiments mixing oil and water.

Keywords: Sulfides; magmatic ore; fluid dynamics; ore textures.

References

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