

## Melting Reactions of Gneissic Inclusions with Enclosing Magma at Voisey's Bay, Labrador, Canada: Implications with Respect to Ore Genesis

CHUSI LI,

*Department of Earth Sciences, University of Pretoria, Pretoria 0002, South Africa*

AND ANTHONY J. NALDRETT

*Department of Geology, University of Toronto, Toronto, Canada ON M5S 3B1*

### Abstract

The Voisey's Bay Ni-Cu-Co sulfide deposit is associated with a 1.333 Ga troctolitic-gabbroic intrusion, which transects the 1.85 Ga collisional boundary between Tasiuyak paragneiss of the Proterozoic-aged Churchill province to the west and orthogneiss of the Archean-aged Nain province to the east. The intrusion comprises an upper chamber to the east (the Eastern Deeps subchamber), a lower chamber to the west (the Reid Brook subchamber), and a conduit connecting them. Sulfide mineralization is closely associated with a breccia which occurs close to the basal contact of the Eastern Deeps subchamber and within the conduit. The breccia is composed of abundant Tasiuyak paragneiss inclusions with a troctolitic-gabbroic matrix. The gneiss inclusions have reacted extensively with the enclosing magma. In general, the degree of reaction increases from the Reid Brook subchamber through the conduit to the Eastern Deeps subchamber. In the course of this reaction, garnet has been oxidized to form hercynite and magnetite with the release of SiO<sub>2</sub> to the magma; cordierite has been dehydrated to form hercynite with the release of SiO<sub>2</sub>; hypersthene and K feldspar have reacted together to produce hercynite with the release of SiO<sub>2</sub> and K<sub>2</sub>O; plagioclase has broken down to produce corundum, losing SiO<sub>2</sub> and Na<sub>2</sub>O to the magma and itself becoming enriched in anorthite; and the corundum has subsequently reacted with FeO and MgO from magma to form hercynite. The color of the hercynite changes progressively from beige in the Reid Brook subchamber, through green within the conduit, to black in the Eastern Deeps subchamber; this color change reflects an increase in FeAl<sub>2</sub>O<sub>4</sub> at the expense of the MgAl<sub>2</sub>O<sub>4</sub> in the hercynite. The inclusions in the Eastern Deeps subchamber characteristically show a series of reaction rims ranging from labradorite through biotite to hypersthene. It is seen that reaction with the gneiss inclusions results in the addition of SiO<sub>2</sub>, K<sub>2</sub>O, and Na<sub>2</sub>O to the magma. This felsification of magma has resulted in a decrease in its ability to dissolve sulfide and therefore has promoted sulfide immiscibility.