The head and tail of the Voisey's Bay feeder dyke

Chusi Li and Edward M. Ripley
Department of Geological Sciences, Indiana University, Bloomington, Indiana, 47405, USA.

Since the discovery of the very unique Voisey's Bay Ni-Cu sulphide deposit 10 years ago, much about ore genesis associated with troctolitic magmatism in Labrador has been learned owing to close collaboration between research and exploration personnel. There are, however, many questions that still remain to be answered. These include magma flow direction in the feeder dike and magma replenishment in the Eastern Deeps chamber. In the previous model it was thought that the magma flowed eastward from the Reid Brock zone through the Discovery Hill zone to the Eastern Deeps chamber. It now appears that such an interpretation is not consistent with the spatial variations of metal contents of the sulphide ores in the different parts of the deposit. In the feeder dike the concentrations of Ni, Cu, Pt and Pd in the sulphide ores (recalculated to 100% sulphides) decrease westward from the

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Ovoid ore body through the Discovery Hill zone to the Reid Brock zone, which is consistent with magma flowage westward instead of eastward. Nickel, Cu and PGE all have high partition coefficients between sulphide liquid and coexisting magma. Consequently, the sulphide liquid that reacts with the magma earlier will become more enriched in these elements than the sulphide liquid that reacts with the magma later because the magma becomes depleted in these elements with time. In the Eastern Deeps chamber the contents of Ni, Cu, Pt and Pd increase upward in the mineralized units, suggesting continuous replenishment of chalcophile element undepleted magma to the chamber. Olivine from the feeder dike is much more evolved than olivine from the Eastern Deeps chamber (Fo_{40}–Fo_{55} versus Fo_{55}–Fo_{75}), suggesting that the parental magma of the Eastern Deeps is more primitive than that of the feeder dike. Thus, it is unlikely that the feeder dike is the feeder of the Eastern Deeps chamber.