The Geology and Geochemistry of the Ashley and Floodplain Troctolite Intrusions, Voisey's Bay, Labrador, Canada

Luke Maddigan, Derek Wilton, and Greg Dunning
Department of Earth Sciences, Memorial University, St. John's NL, Canada

Abstract

The Ashley and Floodplain intrusions are located within Vale Inco Newfoundland & Labrador Limited's Voisey's Bay project area. The Ashley Intrusion consists of troctolite to olivine gabbro phases which are petrologically similar to the Voisey's Bay intrusion, host intrusion to the Voisey's Bay magmatic Ni-Cu sulphide deposits, approximately 5 km to the northeast. The Ashley and Voisey's Bay intrusions are separated by a poorly exposed region of thick overburden. A separate, 950-m-thick (cumulate) sequence of troctolite, the so-called Floodplain Intrusion, has been intersected in drill core between the western part of the Voisey's Bay intrusion (the Reid Brook Zone) and the Ashley outcrops. Both the Ashley and Floodplain intrusions have been dated by U/Pb isotope dissolution-thermal ionization mass spectrometry (using chemical abrasion). The Ashley intrusion has been dated to 1335 ± 2 Ma based on a weighted mean $^{207}Pb/^{206}Pb$ age (baddeleyite + zircon) which overlaps with the published age of 1333 ± 1 Ma for the Voisey's Bay intrusion. Voisey's Bay troctolite generally has Ce/Yb ratios of 22 to 27 and Ashley troctolite has Ce/Yb ratios that range from 20 to 25. The overlapping U-Pb ages and trace element chemistry suggest that the Ashley intrusion constitutes a western extension of the Voisey's Bay intrusion. The Floodplain intrusion appears to consist of two different intrusions: (1) an upper intrusion that has a weighed mean $^{206}Pb/^{238}U$ igneous zircon age of 1325 ± 3.5 Ma and which is geochemically similar to the Voisey's Bay intrusion, but which also exhibits evidence of contact metamorphism in polycrystalline metamorphic zircon with baddeleyite cores, and (2) a lower intrusion that is geochemically similar to the Mushuau Intrusion, a younger, unmineralized troctolite to olivine gabbro intrusion also present in the Voisey's Bay main project block. The lower intrusion exhibits no evidence of contact metamorphism as only typical igneous zircon is present.