Geology of a transect across the Nain Plutonic Suite in the vicinity of Voisey's Bay

John S. Myers
Department of Earth Sciences, Memorial University of Newfoundland, St. John's, NL, A1B 3X5

A five year research project at Memorial University, supported by VBN/INCO and NSERC, is studying the geology of a transect across the Nain Plutonic Suite to better understand the geological setting of the Voisey's Bay Ni-Cu-Co deposit. This study is based on new geological mapping at a scale of 1:20 000, completed between 1999–2003. The gneisses that host the mineral deposit were mapped at 1:10 000 by Alana Rawlings as the foundation of her MSc thesis completed in 2001. Other theses are at writing stages: PhD theses by Ron Voordouw and Donald Wright, MSc theses by Owen Gaskill and Tanya Tettelaar, and BSc (Hons) theses by Cory Furlong and Clare Goddard. The talk outlines the regional geology determined by this collective study in a transect ~80 km long and ~40 km wide.

The Nain Plutonic Suite forms a batholith comprising numerous plutons, dykes and sheets of anorthosite, leuconorite, leucotroctolite, troctolite, ferrodiorite, monzonite and granite. The batholith is ~70 km wide and over 200 km long and was emplaced from ~1360 to 1290 Ma along a ~1860 Ma suture between two Archean continents. The host rocks in the studied transect include Archean and Paleoproterozoic tonalitic and metasedimentary gneisses, and ultramafic, gabbroic and anorthositic gneisses of (?)Paleoproterozoic age. All these rocks were intruded by basaltic dykes and then, except for Archean gneisses to the east of the Nain Plutonic Suite, were strongly deformed and recrystallized to granulite grade at ~1860 Ma during the Torngat orogeny.

Within the Nain Plutonic Suite, pluton and dyke emplacement was associated with intermittent extension and transcurrent movements on east-west and NNW–SSE faults. During successive emplacement, older structures tended to be reactivated by younger intrusions. The same kinds of magmas were intruded intermittently throughout the development of the batholith. In many cases, intrusion was accompanied by fragmentation of the adjacent wall and roof rocks, and probably involved cauldron subsidence. Anorthosite and granite form large tabular plutons whereas composite ferrodiorite/monzonite intrusions mostly form arcuate dykes, small circular plutons, or narrow remnants in the margins of large anorthosite plutons. Relatively small amounts of troctolite mainly form sheet-like bodies. There is an overall longitudinal asymmetry to the batholith with rapakivi granite predominant in the west and anorthosite in the east. The anorthosite is further spatially divided into older, partly deformed and recrystallized anorthosite and leuconorite in the west and north, and younger, undeformed and unrecrystallized anorthosite and leucotroctolite in the east and south.