

P-T path of metamorphism for a garnet-zone schist in the western Cape Breton Highlands, Nova Scotia, Canada*

TRAVIS MCCARRON¹, CHRIS MCFARLANE¹, AND FRED GAIDIES²

1. *Department of Earth Sciences, University of New Brunswick, Fredericton, New Brunswick E3B 5A3, Canada*

[<travis.mccarron@unb.ca>](mailto:travis.mccarron@unb.ca)

2. *Department of Earth Sciences, Carleton University 1125 Colonel By Drive, Ottawa, Ontario K1S 5B6, Canada*

The Jumping Brook Metamorphic Suite (JBMS) remains a poorly understood package of Barrovian-style metasedimentary and metavolcanic rocks in the Aspy terrane of the Western Cape Breton Highlands. In an effort to understand the tectonothermal evolution of the JBMS, samples from classic Barrovian zones within the JBMS have been the subject of a study integrating petrography, texture analysis and phase equilibria modelling. High resolution micro-computed X-ray tomography was used to characterize the 3D distribution of garnet porphyroblasts in a Dauphinee brook schist containing the assemblage ilmenite + feldspar + garnet + chloritoid + chlorite + biotite + muscovite + rutile. Textural analysis revealed a unimodal crystal size distribution with a skew of -0.0261. The largest garnet porphyroblast within the scanned volume was located, centrally sectioned and analyzed with the electron microprobe to characterize core-to-rim major element zoning. An initial attempt to reproduce the observed garnet core composition ($X_{\text{alm}} = 0.70$, $X_{\text{sps}} = 0.18$, $X_{\text{grs}} = 0.09$, $X_{\text{pyr}} = 0.03$) with the Theriak-Domino software was unsuccessful, yielding an isopleth intersection approximately 15°C away from the garnet-in curve. Ilmenites, which occur in the matrix and as inclusions in garnet, were analyzed with the electron microprobe and were found to contain 5.5–7.5 wt% MnO. The Mn-rich ilmenite likely formed from hydrothermal alteration of the protolith sediment as a distal part of the exhalative-style system that resulted in mineralization in the JBMS at Faribault brook. By using the MnO composition of ilmenite and an estimation of its modal abundance as determined by Mineral Liberation Analysis, a correction to the whole rock MnO composition was made to account for Mn sequestered into ilmenite prior to garnet growth. Using the adjusted whole rock composition, a robust isopleth intersection for the garnet core was obtained at 524°C and 5988 bars. The Theria_g software was then used to reproduce the observed core-to-rim major element zoning by systematically modifying the input *P-T* path. A reasonable match was obtained for garnet growth along a simple *P-T* path starting at 524°C and 5988 bars and ending at 560°C and 7542 bars. Over the ~35°C interval garnet is predicted to grow in equilibrium with the assemblage feldspar + ilmenite + chloritoid + chlorite + white mica + quartz. The modelling results indicate that metamorphism in the garnet zone occurred along a relatively steep *P-T* path that was likely the result of crustal stacking during a promontory-promontory collision in the Early Devonian.

****Winner of the AGS Sandra Barr Award for best graduate student oral presentation***