Origin and Tectonic Implications of the Megacrystic Gore Mountain Garnet Granulites

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The megacrystic Gore Mountain Garnet Granulite (GMGG) of the Barton Garnet Mine (Gore Mountain, NY, USA) in the central Adirondack Highlands contains the largest megacrystic garnets in the world (up to 1m diameter). Here we present new thermometry (840±50˚C) and cooling rate predictions (1.5 ˚C/Myr) based on hornblende-plagioclase thermometry and Fe-Mg diffusion profiles in the garnets respectively, showing that previous Fe-Mg based thermometry from these rocks and the surrounding region are incorrect. Previous studies have proposed that the ca. 1050 Ma GMGG were caused by an influx of fluids into a ca. 1155 Ma olivine metagabbro. Using Perple_X, a Gibbs free energy minimization program, we quantify this by showing that hydration reactions at expected P-T conditions strongly increase the stability of garnet, heavily favouring garnet growth over nucleation, by reducing the stability of anhydrous mafic phases through the introduction of amphibole. With continuing hydration, garnet is eventually resorbed to stabilize more amphibole. These results explain microscopic and macroscopic textures in the rock as well as peculiarities found in the garnet Mg number and major element profiles. Furthermore, we show that with some hydration, density increases due to increased stability of garnet. Finally, we discuss the geologic and geophysical implications of fluid influxes to the lower crust.