2-Pyroxene thermometry on single crystals of the Lewisian Complex, Scotland

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The Archaean Lewisian Complex of northwest Scotland is composed primarily of tonalite-trondhjemite-granodiorite orthogneiss, with comparatively lesser amounts of metamorphosed mafic and ultramafic rocks (Rollinson, 1996; Johnson and White, 2011). Despite a tremendous amount of research into the tectono-thermal evolution of this terrane, peak pressure and temperature (P-T) conditions of the complex remain somewhat unconstrained. Previous P-T estimates span a vast range from 8 to 15 kbar and 800 to 1000 °C (Sills and Rollinson, 1987).

Using the relatively new technique of low keV EPMA (Gopon et al., 2013) this study aims to constrain retrograde and peak metamorphic conditions achieved in granulite facies mafic rocks from the Central Region of the mainland Lewisian at Scouriemore by examining sub-micron exsolution lamellae within pyroxene crystals. Traditional electron microanalysis uses accelerating voltage of 15 or 20 keV, which prohibits analysis of features less than 1-2 microns in size. Comparatively, newer instruments and techniques provide spatial resolution down to ∼0.5 microns but require careful execution of the procedure due to the associated analytical difficulties (Heikinheimo et al., 2016).

Pyroxene grains provide a fertile territory for thermometry due to the maturity of the technique, the extent of experimental research within the discipline (Lindsley and Frost, 1992; Bertrand and Mercier, 1985), and the complex intergrowths that can develop within individual crystals. This complexity can potentially reveal details about exhumation rate, retrograde P-T conditions along discrete steps in the path, and peak P-T conditions. For the Lewisian, the aim is to estimate the peak metamorphic conditions using a regression through two or more points on the retrograde path.

References: