Microinclusions in megagarnets: thronhdjemitic melt preserved in garnets at Gore Mountain, Adirondacks (US)

SILVIO FERRERO¹, IRIS WANNHOFF², OSCAR LAURENT³, CHRIS YAKYMCHUK⁴, ROBERT DARLING⁵, BERND WUNDER⁶, ALESSIA BORGHINI¹ AND PATRICK J. O'BRIEN¹

¹Universität Potsdam
²Freie Universität
³CNRS-Géosciences Environnement Toulouse
⁴University of Waterloo
⁵SUNY College at Cortland
⁶GFZ, German Research Centre for Geosciences

Presenting Author: silv.ferrero@gmail.com

The garnet megacrysts (Fig. 1a) of Gore Mountain (Adirondacks, US) are world-renown crystals due to their size, up to 1 m in historical record, which makes them the largest known garnets on the planet. We show here that they are also host to the first primary inclusions of thronhdjemitic melt found in natural mafic rocks (Fig. 1b). The petrological and experimental investigation of the inclusions, coupled with phase equilibrium modelling, shows that this melt is the result of H₂O-fluxed partial melting at T > 900 °C of a lower crustal gabbro.

The compositional similarity between the thronhdjemitic melt inclusions and tonalitic–thronhdjemitic–granodioritic (TTGs) melts makes these inclusions the first direct natural evidence that melting of mafic rocks generates TTG-like melts, and provide us with the possibility to clarify processes responsible for the formation of the early continental crust (Fig. 1c). These TTG embryos represent the thronhdjemitic end-member of the melts whose emplacement at upper crustal levels, after being modified by mixing and crystallization-related processes, leads to the formation of the TTG terranes. Our study also shows how the melt from H₂O-fluxed melting of mafic lower crust has mismatched mineralogical features as well as major and trace element signatures, previously interpreted as evidence of melting at very different pressures. This poses serious limitations to the established use of some chemical features to identify the geodynamic settings (e.g. subduction versus thickened crust) responsible for TTG generation and the growth of early crust.