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Multiple partial melts trapped in garnets from the Adirondacks lower crust: clues for TTG formation

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The Adirondack Mountains, New York State, USA belongs to the Canadian Grenville Province (Darling and Peck, 2016). The rocks exposed in the Adirondacks are interpreted to be the lower plate of a thrust-system at crustal levels during the Ottawan Orogeny (1090-1050 Ma) of the Grenvillian orogenic cycle. Garnet is abundant throughout the Adirondacks, with the greatest occurrence of megacrystic garnets within central Highlands. In the Gore Mountain area, the Hooper Mine is located 5 kilometers northwest of the Barton Mine and consists of partially melted mafic granulite. The mineral assemblage consists of medium grain size plagioclase, green hornblende and garnet in proportion 60:20:20. We separated the garnets of the Hooper Mine in two categories according to their size, chemical zoning and habitus: (1) Large, euhedral garnet porphyroblasts of diameter > 5 cm (LG), and (2) and small, xenoblastic grains (SG). Both types of garnets contain quartz, rutile and melt inclusions, similar to those observed in Barton Mine (Ferrero et al., 2021). In LG, chemical zoning is weak and inclusions are scattered randomly within the mineral. In SG, zoning coincides with the presence of quartz and melt inclusions in domain of low Ca and Y. Ti-in-quartz and Ti-in-amphibole thermometers in SG give equilibrium temperatures of 800-900 °C at 10 kbar.

Major and trace element analyses on rehomogenised melt inclusions in both types of garnet indicate two types of melts are present in the migmatite – granitic melt in SG and trondhjemitic melt in LG. Stable isotope ratios of oxygen and hydrogen in hornblende (δ^2H: -62 to -73 $^0/_{00}$ and δ^{18}O: 4.7 to 6.7 $^0/_{00}$) indicate that partial melting occurs in a closed isotopic system and records the primary magmatic δ^2H signature of the protolith. The range of melt chemistries, combined with the information previously collected in the Barton Mine defines a trend characteristic of primitive TTG melts or TTG embryos. These melts, combined with different proportion of peritectic phases (i.e. garnet, plagioclase and quartz), reproduces the full TTG chemistry range (Moyen, 2011). Therefore, the Mesoproterozoic mafic lower crust might be a perfect laboratory to test early granitoids genesis processes and better understand the link between melt inclusions, plate

tectonics and the formation of the continental crust (Nicoli & Ferrero, 2021).

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