

Variable garnet (re)crystallisation during high-temperature polyphase metamorphism

BESIM DRAGOVIC^{1,2}, VICTOR E. GUEVARA^{2,3*}, MARK J. CADDICK²

¹Geosciences, Boise State University, Boise, ID, USA

²Geosciences, Virginia Tech, Blacksburg, VA, USA

³Geosciences, Skidmore College, Saratoga Springs, NY, USA, (*correspondence: vguevara@skidmore.edu)

Unravelling the petrologic histories of polymetamorphic terranes has proven difficult for petrologists. One tool that can be particularly useful in this pursuit is zoned garnet (grt) petrochronology, as the timing of different generations of grt growth can be linked to pressure-temperature (P - T) conditions and paths, ultimately leading to firm constraints on the petrologic and tectonic histories recorded by rocks. However, metamorphic grt growth is dependent on P - T conditions/path, presence/absence of grain boundary fluid, and lithology. The metamorphic history recorded by grt can thus vary from rock to rock within the same terrane.

Here we present results of zoned Sm-Nd grt petrochronology from lithologically distinct Archean granulites from the same outcrop in the northern Wyoming Province, and show that they preserve different records of their shared metamorphic history. These rocks occur as m- to km-scale xenoliths in a ~2.83-2.78 Ga granitoid batholith [1]. Previous work has shown that these rocks record two distinct high-temperature (HT) metamorphic events: one at ~2.78 Ga coeval with batholith emplacement (M_1), and another short-duration (< 1 Ma at peak T) event at ~2.7-2.68 Ga (M_2) [2-3].

Grt from pelitic rocks record both events. ~2.76 Ga cores show strong enrichment in Y+HREE, suggesting they constrain the timing of initial grt growth during M_1 . We interpret ~2.72 Ga rims with elevated Ca, Sm, and Eu concentrations to record the timing of M_2 biotite breakdown melting. In contrast, core and rim dates of euhedral grt from a metagranitoid suggest grt growth only occurred at ~2.79 Ga (M_1). We postulate that lithologic differences and a lack of grain boundary fluids inhibited grt growth in the metagranitoid during the HT M_2 event, which was sufficiently rapid such that its M_1 Sm-Nd grt growth ages were not reset.

[1] Mueller, P.A., Wooden, J.L., Mogk, D.W., Henry, D.J., and Bowes, D.R. (2010), *Precambrian Research*, 183, 77-88.

[2] Dragovic, B., Guevara, V.E., Caddick, M.J., Baxter, E.F., Kylander-Clark, A.R.C. (2016), *Precambrian Research*, 283, 24-49. [3] Guevara, V.E., Caddick, M.J., Dragovic, B. (2017), *Journal of Metamorphic Geology*, 35, 943-965.