Nagurney et al. Supplemental Material Part I

Part I: Choice of Samples for Samples Not Described in Main Text

Examples with Minimal Overstepping

Sample W122 is from the Danba Structural Culmination in eastern Tibet, where a complete Barrovian sequence is exposed (Weller et al. 2013). Sample W122 was chosen because combined petrographic, geochronologic, and thermobarometric analysis reveal that metamorphism was continuous and the crystallization of garnet occurred simultaneously with the main stage of compression in this area (Weller et al. 2013), which suggests a simple prograde metamorphic *P-T* history.

Sample DM_06_128 is from the Kootenay Arc, British Columbia (Moynihan and Pattison 2013). This sample was chosen for this study as previous work has shown that the garnet core isopleths intersect at 10ºC greater than garnet-in, which suggests minimal overstepping of the garnet-in reaction (Moynihan and Pattison 2013).

Examples with Apparent Overstepping

Sample 12TM16 is from the Flinton Group, southeastern Ontario and was chosen for this study as an example in which garnet nucleation was moderately overstepped (32ºC and 1.1 kbar) (McCarron et al. 2014).

Sample ED34, from the Menderes Massif, southwest Turkey, has previously been reported as containing garnet which grew following moderate (25ºC and 0.8 kbar) overstepping of initial garnet-forming reactions (Etzel et al. 2019).

Sample D13-75 is from the Himalayan metamorphic core (Central Himalaya) in western Nepal (Iaccarino et al. 2017). Garnet-in reactions were moderately (30ºC and 0.7 kbar) overstepped in this sample (Iaccarino et al. 2017).

Sample TH203B is from the Albion Mountains, Idaho, and demonstrates overstepping of garnet growth reactions by 50ºC and 0.7 kbar in this sample (Kelly et al. 2015). This is thus an ideal example to study the effects of larger oversteps of the garnet-in reaction. Sample SSFM307-7G is from the Funeral Mountains, eastern California (Craddock Affinati et al. 2020). Pseudosection modelling reveals that garnet nucleation in this sample was overstepped by greater than 50ºC and 2 kbar (Craddock Affinati et al. 2020), so this sample is an ideal example of significant temperature overstepping.

References:

Craddock Affinati, S., Hoisch, T.D., Wells, M.L., and Vervoort, J.D. (2020) Pressure-temperature-time paths from the Funeral Mountains, California, reveal Jurassic retroarc underthrusting during early Sevier orogenesis. GSA Bulletin, 132, 1–19.

Etzel, T.M., Catlos, E.J., Ataktürk, K., Lovera, O.M., Kelly, E.D., Çemen, I., and Diniz, E. (2019) Implications for thrust-related shortening punctuated by extension from P-T paths and geochronology of garnet-bearing schists, southern (Çine) Menderes Massif, SW Turkey. Tectonics, 38, 1974–1998.

Iaccarino, S., Montomoli, C., Carosi, R., Massonne, H.J., and Visonà, D. (2017) Geology and tectono-metamorphic evolution of the Himalayan metamorphic core: Insights from the Mugu Karnali transect, Western Nepal (Central Himalaya). Journal of Metamorphic Geology, 35, 301–325.

Kelly, E.D., Hoisch, T.D., Wells, M.L., Vervoort, J.D., and Beyene, M.A. (2015) An Early Cretaceous garnet pressure–temperature path recording synconvergent burial and exhumation from the hinterland of the Sevier orogenic belt, Albion Mountains, Idaho. Contributions to Mineralogy and Petrology, 170, 1–22.

McCarron, T., Gaidies, F., McFarlane, C.R.M., Easton, R.M., and Jones, P. (2014) Coupling thermodynamic modeling and high-resolution in situ LA-ICP-MS monazite geochronology: evidence for Barrovian metamorphism late in the Grenvillian history of southeastern Ontario. Mineralogy and Petrology, 108, 741–758.

Moynihan, D.P., and Pattison, D.R.M. (2013) An automated method for the calculation of P-T paths from garnet zoning, with application to metapelitic schist from the Kootenay Arc, British Columbia, Canada. Journal of Metamorphic Geology, 31, 525–548.

Weller, O.M., St-Onge, M.R., Waters, D.J., Rayner, N., Searle, M.P., Chung, S.L., Palin, R.M., Lee, Y.H., and Xu, X. (2013) Quantifying Barrovian metamorphism in the Danba Structural Culmination of eastern Tibet. Journal of Metamorphic Geology, 31, 909–935.