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EFFECT OF GARNET *A–X* SOLUTION MODELS ON THE THERMODYNAMIC MODELING OF HIGH-GRADE METABASITES USING THE TSO MORARI UHP ECLOGITE OF NW INDIA

PAN, Ruiguang[1], MACRIS, Catherine A.[1] and MENOLD, Carrie[2], (1)Department of Earth Sciences, Indiana University – Purdue University Indianapolis, 723 W Michigan Street, SL118, Indianapolis, IN 46202, (2)Geological Sciences, Albion College, 611 East Porter St, Albion, MI 49224

Garnet is a key mineral in the thermodynamic modeling of high-grade metabasites as they record evidence of the metamorphic history (e.g., pressure, temperature, and composition) during porphyroblastic growth of garnet crystals. The availability of different versions of garnet activity-composition (*a-X*) solution models may lead to different results in the calculation of the metamorphic pressure-temperature (*P-T*) paths of metabasites. To test this hypothesis, we use the Theriak-Domino program, thermodynamic dataset (ds 62), and main mineral *a-X* solution models from Green *et al.* (2016) to evaluate the effect of the update of garnet *a-X* solution models from White *et al.* (2007) (W07) to White *et al.* (2014) (W14). In this study, eclogite from the Tso Morari UHP terrane, NW India, is used as a representative metabasite to compare the *P-T* predictions generated from using the two sets of garnet *a-X* relations (W07 vs. W14), while accounting for the effect of garnet fractionation during growth of porphyroblastic grains. The modeling protocol using W14 yields a peak metamorphic *P-T* of 34 ± 1.5 kbar at 551 ± 12 °C, while W07 yields a *P-T* of 28.5 ± 1.5 kbar at 563 ± 13 °C. Results indicate that the two modeling protocol choices result in consistent mineral evolution and temperature changes; however, the pressure generated using W14 is ~5.5 kbar higher than that predicted using W07. The difference in peak pressure results for the two modeling protocols are beyond the suggested uncertainty using mineral isopleth thermobarometry in pseudosections: ± 50 °C and ± 1 kbar at 2σ (Powell and Holland 2008). The model using W07 is more consistent with the peak pressure result calculated with the highest phengite Si (Si p.f.u. = 3.54) barometer (~ 26 kbar at ~ 570 °C) and results of multiple thermobarometers (~520–700 °C and ~20–26 kbar by garnet-omphacite, garnet-phengite, and garnet-omphacite-phengite). This study illustrates the importance of careful consideration of which garnet *a-X* relations one chooses for modeling high-grade metabasites, as well as the need of comparison with non-thermodynamic techniques (e.g., thermobarometry).

References:

Green *et al. J Metamorph Geol* **34**, 845–869 (2016)

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Abstract ID#:
359328

Password:
455407

Meeting:
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Session Type:
Topical Sessions

Primary Selection:
T96. Mineralogy, Petrology, and Geochemistry: New Approaches to Harnessing the Multidimensionality of Complex Systems

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Abstract Title:
EFFECT OF GARNET *A–X* SOLUTION MODELS ON THE THERMODYNAMIC MODELING OF HIGH-GRADE METABASITES USING THE TSO MORARI UHP ECLOGITE OF NW INDIA

Preferred Presentation Format:
Either Oral or Poster

Discipline Categories:
Petrology, Metamorphic Geochemistry

Abstract Submission Fee:
Paid (gsa-2020AM-7721-1443-7911-3019)

Presenting Author

Ruiguang PAN
Email: panr@iupui.edu
Alternate Email: ruiguang.pan@gmail.com

Indiana University – Purdue University Indianapolis
Department of Earth Sciences
723 W Michigan Street
SL118
Indianapolis IN 46202
USA

Student? Y

Catherine A. Macris
Email: camacris@iupui.edu
Alternate Email: macris.catherine@gmail.com

Indiana University – Purdue University Indianapolis
Department of Earth Sciences

723 W Michigan Street
SL118
Indianapolis IN 46202
USA

Student? N

Carrie Menold
Email: Cmenold@albion.edu

Albion College
Geological Sciences
611 East Porter St
Albion MI 49224

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