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Reworking of Neoarchean TTGs and amphibolites through fluid-fluxed partial melting, Western Shandong Province, North China Craton

Yakymchuk, C.[1], Wan, Y.[2,3] and Lin, S.[1]

[1]Department of Earth & Environmental Sciences, University of Waterloo, 200 University Ave W., Waterloo, Ontario, Canada, N2L 3G1; cyakymchuk@uwaterloo.ca
[2]Institute of Geology, Chinese Academy of Geological Sciences, 26 Baiwanzhuang Road, Beijing 100037, China
[3]Beijing SHRIMP Center, 26 Baiwanzhuang Road, Beijing 100037, China

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The Western Shandong Province represents the most extensive exposure of middle to late Neoarchean (2.7–2.5 Ga) crust in the North China Craton [1]. While extensive geochronological and isotope data exist from *c.* 2.6 Ga TTGs and amphibolites in the Western Shandong Province, field, petrographic and geochemical evidence for partial melting of these rocks has not yet been presented. This information is essential for interpreting existing geochemical and geochronological data from the Western Shandong Province and to understand the Neoarchean crustal evolution of the North China Craton. We present new field and microstructural observations and whole-rock geochemistry to investigate the petrogenesis of these *c.* 2.6 Ga anatectic TTGs and amphibolites.

Metatonalites contain petrologically continuous (similar minerals, modes and microstructures) stromatic and patch leucosomes. Amphibolites contain only patchy leucosome. For both rock types, individual leucosomes are relatively enriched in albite and quartz compared with the melanosome. Some leucosomes contain coarse-grained hornblende with rounded inclusions of biotite and quartz. Orthopyroxene and garnet were not observed in the metatonalites or amphibolites. Together, these observations are inconsistent with fluid-absent hydrate-breakdown melting [2] but support a fluid-fluxed melting reaction where plagioclase, quartz, biotite and fluid were consumed to produce melt and peritectic hornblende [3].

Seven paired *in situ* leucosome–melanosome samples from metatonalite and three paired samples from the amphibolite were selected for geochemistry to determine the crystallization history of leucosome and evaluate if they were derived from fluid-present or fluid-absent anatexis. Leucosomes from both rock types yield smooth rare earth element patterns that are similar to the melanosome. These leucosomes are interpreted to represent approximately primary melt compositions. Leucosomes are relatively enriched in Si, Na and Sr and depleted in K, Ca, Ba and Rb relative to the melanosome. These trends are the opposite of experimental melts produced from fluid-absent hydrate-breakdown melting [4]. However, they are generally consistent with the experimental results of fluid-fluxed melting of Iberian orthogneiss [5].

Our results suggest that fluid-fluxed melting was responsible for reworking of *c.* 2.7 Ga TTGs and amphibolites and generating 2.65–2.60 Ga tonalites and trondhjemites in the Western Shandong Province. This is consistent with extant zircon Hf isotope evolution curves that suggest *c.* 2.7 Ga TTGs and amphibolites were reworked to produce *c.* 2.6 Ga TTGs [1]. The source of the fluids responsible for fluxing melting is unclear.

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