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## Anticlockwise *P-T* Path and Zircon U-Pb Dating of HP Mafic Granulites in Yushugou Granulite-Peridotite Complex, Southern Tianshan Mountains, China

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The Yushugou HP granulite-peridotite complex is located at east of northern margin of southern Tianshan mountains, China, which consists of granulite unit and peridotite unit mainly. Because of the rare association of granulite and peridotite, their origin has been debated for a long time. The main controversial points include the complete ophiolite suite, tectonic mélangé and continental crust-mantle transition zone. In this study, we propose a hanging wall subduction model for the HP granulites based on the petrological study and U-Pb zircon dating. The studied high-pressure mafic granulites can be further grouped into two types: type I is hypersthene-free and type II is hypersthene-bearing granulite. The mineral assemblage is garnet (33%) – diopside (32%) – plagioclase (30%) for type I granulite; and garnet (22%) – diopside (10%) – hypersthene (14%) – plagioclase (45%) for type II granulite. Garnet in both types exhibits core-rim zoning with increasing grossular and decreasing pyrope. Petrographic observations and phase equilibrium modeling with pseudosections calculated using THERMOCALC in the NCFMASHTO system for two representative samples suggest that the granulites have experienced three stages of metamorphism: stage I was recognized by the core of porphyroblastic garnet, and the *P-T* conditions of this

stage are 9.4-10.4 kbar and 860-900 °C for type I and 9.9-10.9 kbar and 875-890 °C for type II granulite respectively; stage II ( $P_{\max}$  stage) was based on the garnet zoning with increasing grossular and decreasing pyrope contents, and the *P-T* conditions of this stage, defined using the garnet rim compositions, are 12.1 kbar and 755 °C for type I and 13.8 kbar and 815 °C for type II granulite; stage III, the amphibolite facies, was characterized by the overprint of hornblende amphibole in granulites. Consequently, the Yushugou HP granulite has recorded an anticlockwise *PT* path characterized by the cooling subduction with the temperature decreasing and pressure increasing simultaneously. The studies of zircon morphology, Th/U ratios and REE patterns show that the protolith's ages of HP granulites are ~430 Ma, reflecting Silurian magmatism, but the metamorphic rims of zircon have three age groups: ~390 Ma, ~340 Ma and ~320 Ma, corresponding to stage I, II and III metamorphic events respectively. We conclude that the HP granulites from Yushugou granulite-peridotite complex should be formed by the cooling subduction of the lower crustal rocks in hanging wall of central Tianshan plate during the northward closing of the paleo-asian ocean.

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