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# Thermal effect of the Late Paleoproterozoic episodic magmatism in the Jining terrane, North China Craton

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The Jining terrane in the eastern segment of the Paleoproterozoic Khondalite Belt, northwestern North China Craton (NCC) is characterized by wide-distribution of high temperature/ultrahigh-temperature (UHT) pelitic granulites/gneisses and extensive magmatic events. Although it has been proven that the UHT metamorphism is related to large scale thermal perturbation in crustal level, the ultimate heat source has kept unclear and the reliable interrelationship between the formation of UHT metamorphism and mantle-derived magmatism has not been established yet.

We report data of two layered complexes emplaced in a duration over 100 Ma, as the candidates of the heat source of UHT metamorphism. The samples include 1923±28 Ma amphibole-gabbro and 1824±2 Ma noritegabbro. The elemental and Hf-O-Sr-Nd isotopic analysis show that the amphibole-gabbro is the crystallization product of assimilating crustal rocks after the 10~20% partial melting of spinel+garnet lherzolite mantle. Based on the published geochronological data of basic intrusive rocks in the Jining terrane, we find that the magmatism at 2.0~1.8 Ga appeares as two episodes of ~1.95 Ga ($M_1$) and ~1.85 Ga ($M_2$). We calculate that the time span of $M_1$-magmatism can reach ~71 Myr through Monte Carlo simulation. The amphibole-gabbro is formed in $M_1$-magmatism, coupled with the peak period of metamorphism and the slow cooling process of UHT pelitic granulites/gneisses. We use “Magma Chamber Simulator (MCS_PhaseEQ_2019AC)” to simulate the genesis of basic intrusive rocks in the Jining terrane. We determine that they have experienced the process of assimilation and fractional crystallization under energy constraints (EC-AFC). The augite, pargasite and zircon record the temperatures during the slow cooling process of magma.

Therefore, the Late Paleoproterozoic mantle-derived magmatism provides a heat source for the UHT metamorphism in the Jining terrane. These basic intrusive rocks are likely to be the product of asthenosphere upwelling after the amalgamation of the Ordos and Yinshan Blocks at ~1.95 Ga.