

Uncovery of Palaeoarchaean deep mantle heterogeneity

With the support by the National Natural Science Foundation of China, the research team led by Prof. Song ShuGuang (宋述光) and Prof. Wei ChunJing (魏春景) at the School of Earth and Space Sciences, Peking University, uncovered compositional heterogeneity in the early Archaean deep mantle, which was published in *Nature Geoscience* (2019, 12: 672–678).

The thermal and chemical state of early Archaean deep mantle has long been the research focus of Precambrian Geology. Due to the rare occurrences of early Archaean deep mantle-sourced magmas, it is not clear whether compositional heterogeneity existed in the early Archaean deep mantle.

This research focused on the newly discovered ferropicrites and associated ultramafic cumulates in Eastern Hebei, the North China Craton. *In situ* zircon U-Pb geochronological study on the ultramafic cumulates shows that ferropicrites were formed in the Palaeoarchaean (3.45 Ga). Detailed geochemical study suggests that ferropicrites have trace element patterns similar to present-day ocean island basalts, but are more enriched in iron relative to typical mantle plume-related picrites. The Palaeoarchaean ferropicrites were produced by mantle plume activities from deep mantle. Their deep mantle source was enriched in iron and incompatible elements, suggesting that deep mantle heterogeneity was present in the Palaeoarchaean with a partial enrichment of iron and incompatible elements.

The importance of this research not only lies in that it reports the third case of confirmed oldest mantle plume activities with the other two cases of 3.5–3.46 Ga komatiites in Barberton, South Africa and East Pilbara, Australia, but also proves that deep mantle compositional heterogeneity existed in the Palaeoarchaean, most probably introduced by recycled crustal material.

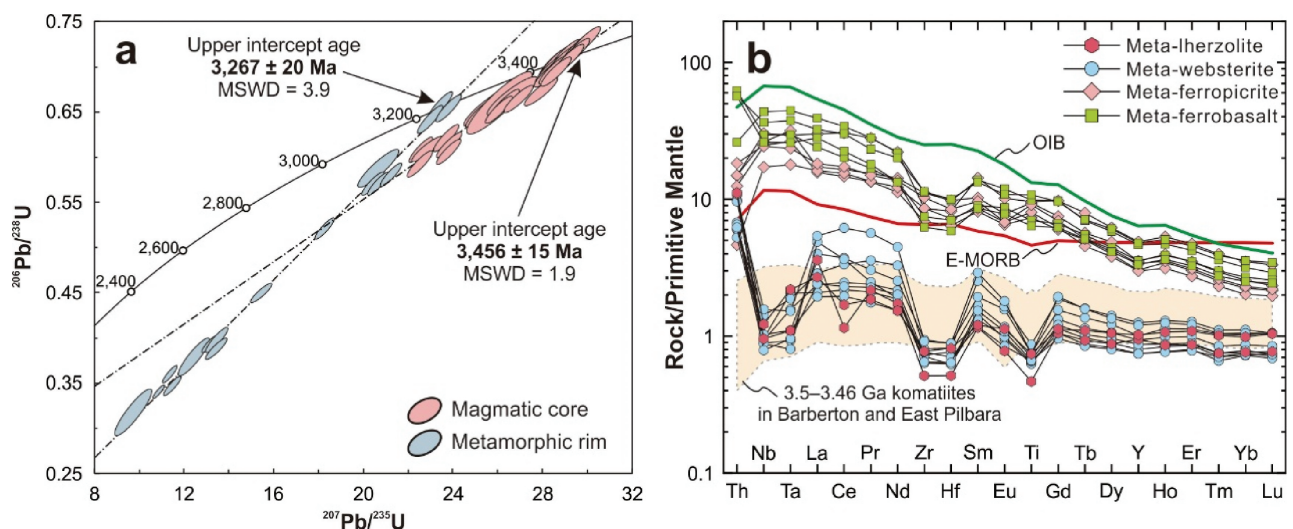


Figure (a) Zircon U-Pb concordia diagram for Palaeoarchaean ultramafic cumulates in Eastern Hebei; (b) trace element patterns of Palaeoarchaean ferropicrites and ultramafic cumulates in Eastern Hebei.