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# Refertilization of lithospheric mantle beneath the Yangtze craton in south-east China: evidence from noble gases geochemistry

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**Abstract**

The Yangtze craton (YC), in eastern China, is one of the oldest cratons in the world and is characterized by a complex tectonic and geodynamic evolution. This evolution regards most of the eastern China craton, which since Mesozoic time has undergone significant thinning (>200 km) of Archean lithosphere. This thinning favored the refertilization of the old refractory subcontinental lithospheric mantle (SCLM) by the upwelling of younger fertile asthenosphere. Whether this feature is localized only beneath certain areas of eastern China or is a more widespread characteristic of the mantle, including the YC, is a matter of debate.

In order to constrain the history of the YC SCLM, we have measured the He- and Ar-isotopic compositions of fluid inclusions hosted in mantle xenoliths in the Lianshan area, which is part of the poorly investigated YC in south-east China. We also report new mineral chemistry and trace element compositions of clinopyroxenes from the same suite of samples, for comparison with noble gases. Two distinct types of xenoliths can be identified: Type 1, characterized by mantle-like He-isotopic ($^3He/^4He$) ratios (up to 9.1 Ra), represents fragments of a fertile lithospheric mantle; Type 2, showing $^3He/^4He$ values in the SCLM range ($^3He/^4He$<7 Ra), represents shallow relicts of a refractory mantle. The patterns of rare-earth elements as well as the Y and Yb concentrations in the clinopyroxenes normalized to primitive mantle ($Y_N$ and $Yb_N$, respectively) indicate that fractional partial melting might have affected the local mantle by <3% in Type 1 and up to 20% in Type 2 xenoliths from Lianshan, respectively. The range of $^4He/^{40}Ar^*$ ($^{40}Ar^*$ is corrected for atmospheric contamination) ranges from $4.9\times10^{-4}$ to $3.6\times10^{-1}$, which is below the typical production ratio of the mantle ($^4He/^{40}Ar^*$=1–5); this range is however compatible with this fractional partial melting. The variable $^3He/^4He$ and $^4He/^{40}Ar^*$ values in Lianshan xenoliths suggest that the local mantle source