

Magnesium and hafnium isotopic geochemical characteristics of mantle peridotites from Penglai, the North China Craton

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Metasomatic processes are the main causes of heterogeneities in the upper mantle, whose different sources and properties of metasomatic fluid/melt have been enormously studied in the mantle evolution. Recently, research suggests that Mg and Hf isotopes are effective to identify the carbonate or silicate melt and provide insight into evolution of mantle lithosphere. To clarify the nature and origins of metasomatic fluid/melt from mantle peridotites in Penglai, the North China Craton, this study introduced the Mg-Hf isotopic analysis of the whole rock.

The $\delta^{26}\text{Mg}$ of Cpx-rich lherzolites is $-0.25\pm0.08\text{\textperthousand}$, slightly lighter than lherzolites ($-0.21\pm0.06\text{\textperthousand}$), and both of them are within normal mantle value range ($-0.25\pm0.07\text{\textperthousand}$). The $\delta^{26}\text{Mg}$ values of their host basalts are $-0.43\sim-0.36\text{\textperthousand}$, which are similar to the average value of <110 Ma basalts in eastern China and significantly lower than the average of the mantle. The Hf concentrations (0.25~0.56ppm) and ϵHf values (11.4~15.8) of Cpx-rich lherzolites show obviously limited range than those of lherzolites (0.05~0.66ppm, 6.0~32.5). In addition, the Cpx-rich lherzolites exhibit enrichment in Al, Ca, Ti, Si and have both high ratio of $\text{CaO}/\text{Al}_2\text{O}_3$ and $\sum\text{REE}$, relatively enrichment of LREE, and their characteristics of metasomatism are more remarkable.

Combined with the relationship between Ti/Eu and La/Yb, Mg-Hf isotopic analysis indicates that the mantle peridotites from Penglai were mainly suffered by carbonate silicate melt metasomatism, which have the distinct light Mg isotopes and enrichment in Hf isotopes. The origin of the melt is related to the subduction of the Pacific Plate since Mesozoic. The carbonate recirculates into the mantle to form carbonated peridotite, and then has partial melting, blending with asthenosphere to form metasomatism melt.

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