

Component and structure of manganese dominant mineral of Co-rich crusts from West Pacific

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West Pacific is one of the most enriched regions of Co-rich crust. This study selected a multilayered-structure crust, and sampled from an enrichment belt of the main manganese mineral. The component of the manganese-dominant mineral is MnO₂ with water and a lot of other element (Fe, Ca, Na, Mg, etc.), its formula can be writing as MnO₂ • XH₂O (with Fe, Ca, Na, Mg, and other elements). As it is completely different from vernadite, but its structure and stability similar with δ-MnO₂; for close intergrowth with iron hydroxide, XRD values are larger with the 0.24~0.245 nm and the 0.14~0.143 nm than vernadite. The name is proposed for the marine δ-MnO₂. Marine δ-MnO₂ has layer-structure even with tunnel structure, and has good structural stability. When heated to 400 °C, its crystal structure remains basically unchanged. Marine δ-MnO₂ changes into Mn₂O₃ (γ-Mn₂O₃) around 550 °C, then changes into Mn₃O₄ around 804 °C. The temperature of 804 °C is lower 146 °C than the temperature of 950 °C reported by a literature, the structural stability may be related to the metal ions contained. The manganese-dominant mineral of Cobalt-rich crusts in this area is δ-MnO₂, for the three main manganese minerals of todorokite, birnessite and δ-MnO₂ in deep seas, δ-MnO₂ is the most thorough oxidized mineral, the O/Mn are 1.74~1.87, 1.87~2.00, 1.99. This shows that the crusts underwent the strong oxidative environments and agrees with the enrichment characteristic of the REE.

Identification of marine manganese minerals should use many means, and the peak of XRD should be determined according to the standard of marine manganese minerals. Considering different stabilities and structures between marine manganese minerals and the terrestrial counterparts, we should use a new naming system for marine manganese minerals: marine 1 nm mineral, marine 0.7 nm manganese mineral marine δ-MnO₂.

[1] F. Jean, C. Cachet, L. T. Yu. (1997) Structural changes induced by chemical reduction of various MnO₂ species, *Journal of Applied Electrochemistry*, **27**: 635-642

Fe isotope evidence for mantle metasomatism in the lithospheric mantle of the Eastern China

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To further constrain the iron isotopic composition of the terrestrial mantle and investigate the behavior of iron isotope during mantle processes, we have determined the Fe isotopic composition of Cenozoic alkali basalts and peridotite xenoliths entrained in Mesozoic and Cenozoic basalts from eastern China by high-resolution MC-ICP-MS.

Results from alkali basalts show a limited Fe isotopic variation, with δ⁵⁷Fe ranging from 0.169‰ to 0.241‰. By contrast, both the mantle peridotites and their mineral separates from the North China Craton exhibit an extremely large Fe isotopic variation with δ⁵⁷Fe ranging from -1.002‰ to 0.258‰. This may reflect heterogeneous Fe isotopic compositions of the lithospheric mantle beneath the North China Craton. An average δ⁵⁷Fe (-0.028‰) calculated from all the mantle xenoliths in this study is obviously lower than the average value (0.198‰) of δ⁵⁷Fe for the Cenozoic alkaline basalts, similar to the previous observation that the basalts generally have heavier Fe isotopes than the mantle peridotites. In individual minerals, δ⁵⁷Fe of the olivines (-0.968 to 0.154‰) are systematically lighter than those of the coexisting pyroxenes (-0.718 to 0.169‰ for orthopyroxene and -0.642 to 0.304‰ for clinopyroxene, respectively). The phlogopite of apparently metasomatic origin has the heaviest iron isotopic composition amongst the mineral phases with δ⁵⁷Fe of 0.302 to 0.376‰. This Fe isotope disequilibrium between mineral phases and an extremely Fe isotope variation in these peridotites, in particularly for the wehrlites, were probably produced by the multistage melt-peridotite interactions, consistent with the petrological observation that some of the xenoliths analyzed such as wehrlites were the products of highly mantle metasomatism. Analogous positive correlations between δ⁵⁷Fe and other major and trace element indicators of metasomatism such as CaO and Rb further support the above suggestion.

These characters suggest that mantle metasomatism or melt-rock interaction can significantly modify Fe isotopes and play an important role in producing Fe isotopic heterogeneity of the lithosphere mantle.