Fe isotope variations in North Pacific deep water over last 80Ma

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Fe-Mn crust has proved to provide excellent records of isotope composition of dissolved Fe in deep seawater. Investigating the variability of Fe isotope composition of Fe-Mn crusts is an important approach to trace Fe cycling in marine environments.

A crust named CLD01 (160°44'24''E, 21°45'N, water depth = 2210 m) from the central North Pacific has been selected for Fe isotope study. This crust has been subjected to detailed investigation in terms of radiogenic isotopes, and its age has been constrained using multiple approaches extending to ca. 80Ma (Ling *et al*., 2005). The sub-samples were obtained by micro-milling, and Fe isotope measurements were performed using a Nu Plasma HR MC-ICPMS at high-resolution mode after chemical purification. The results are expressed in ε units which are deviations in parts per 10^4 from the same isotope ratios of the reference material IRMM-14. The overall variations in $\varepsilon^{57/54}$Fe units are from -8.8 to 0.9, within the range of Fe isotope composition of Fe-Mn crust reported before. In more detail, the Fe isotope compositions of the crust start with -3.6 ε^{57}Fe units at the surface, broadly increase to maxima of 0.9 at ca. 50Ma, then decrease sharply to -8.8 at ca. Ma. Furthermore, the ε^{57}Fe values obtained from the crust are negatively correlated with $^{206/204}$Pb and $^{208/204}$Pb ratios.

These results illustrate for the first time that the evolution of Fe isotope composition in North Pacific seawater back to latest Cretaceous, and confirms that the average Fe isotope composition in seawater is light relative to the bulk silicate Earth. In general, the main Fe sources for open oceans are terrestrial aerosols and MOR hydrothermal plumes. The crust studied is far away from MOR, and there is no evidence of MOR hydrothermal contribution in terms of Pb- and Nd-isotopes. While the exact reason why the overall Fe isotope composition in seawater as recorded in Fe-Mn crusts is lighter than bulk silicate Earth remain to be investigated, it is interesting to note that the Fe isotope compositions of precipitates resulting from Fe(III) hydrolysis are significantly lighter than those of residual solutions. The main turning point in the trend of Fe isotope variation occurs at ca. 50Ma, which is broadly coincident with the switchover of terrestrial inputs from North America to Asia (Ling *et al*., 2005). The strong linkage between Fe- and Pb-isotope compositions strongly suggests that Fe isotope variation in North Pacific deep water is related with global climate change through source inputs.

Reference

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He isotope data evidence of crust contamination for mantle melts resulting to the PGE mineralized layered basic intrusions

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He isotopic composition of magmatic fluids from various PGE mineralized layered basic intrusions have been studied for understanding the role of mantle-crust interaction in formation of large Pt-Cu-Ni deposits. ^{3}He/^{4}He ratio have been obtained for Noril'sk, Talnakh, and Chineisky PGE mineralized layered basic intrusions (Russia), as well as for the Bushveld Complex (South Africa). All our results have been compared with He isotopic data of Hawaiian and Icelandian basalts and others no mineralized small basic intrusions of the Noril'sk Region (Basu *et al*., 1995).

^{3}He/^{4}He ratio is a sensitive indicator of crust substance contamination for mantle melts in processes of magmatic ores formation. ^{3}He/^{4}He value >8-10*10^{-6} corresponds to mantle He, while <1*10^{-6} value is connected with crust source. These ratio values up to 1-8*10^{-6} are typical for mixture of mantle and crust He in fluids.

It is important to note, that only basalts and very small basic intrusions with pure ore mineralization contain mantle He, whereas crust He is predominant in all the large Pt-Cu-Ni deposits from layred basic intrusions. This result correlates well with S and C isotopic data (Riabov *et al*., 2001.

The results obtained give us a possibility to suggest that crust contamination of mantle melts is one of the important factor in formation of large and unique Pt-Cu-Ni deposits for layered basic intrusions.

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