Secular Fe isotope variations in the NW and Central Pacific Ocean

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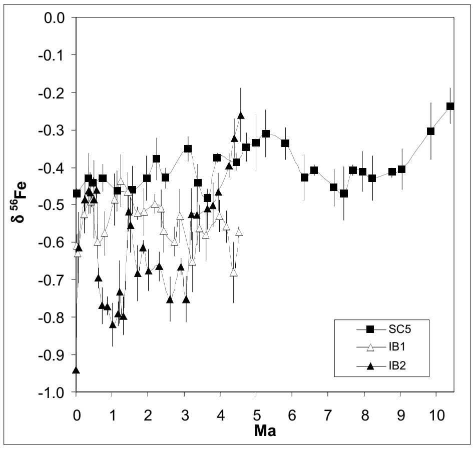
The source of dissolved iron in the ocean is a matter of debate. Zhu *et al*. (2000) proposed that temporal changes in Fe isotope composition recorded in a northern Atlantic Ocean Fe-Mn crust were produced by changes in the Fe isotope composition of terrigenous sediments. However, recent studies suggest that the isotopic composition of Fe delivered to the oceans in the form of aerosol particles and the suspended load of rivers is homogeneous (Beard *et al*., 2002; Beard *et al.*, in press), making Zhu *et al*.'s hypothesis less plausible. However, relative changes in Fe fluxes from hydrothermal vs. terrigenous (aeolian) inputs to the Fe ocean budget may produce Fe isotopic variations in seawater (Beard *et al*., in press) because the hydrothermal component has a ^{56}Fe/^{54}Fe less than that of the aeolian component.

Here, to further constrain possible controls on temporal changes in the Fe isotope composition of seawater we report high-resolution Fe isotope profiles in Fe-Mn crusts from the Pacific Ocean (Izu-Bonin Back-arc Basin: IB1 and IB2, and Central Pacific: SC5). The two IB crusts were situated behind the back-arc rifting sites where present and past hydrothermal activities have been reported (Ishizuka *et al.*, 2002). The IB crusts exhibit lower δ^{56}Fe values compared to crust SC5, from the middle of the Pacific Plate where no adjacent hydrothermal activities have been reported. These differences in Fe isotope compositions may reflect significant advection of hydrothermal Fe with a low δ^{56}Fe value to IB crusts (Beard *et al*., in press). Differences in temproal Fe isotope trends in the IB crusts may be a result of local redox changes where one crust grew at 1860m and the other at 2600 meters or local changes in Fe fluxes with different Fe isotope compositions.



Secular variations in δ^{34}S and δ^{13}C values of late Neoproterozoic carbonates from southern China

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Carbonate rocks of Sinian age, deposited on the Yangtze Platform, southern China, were studied in order to document secular variations in δ^{34}S and δ^{13}C of late Neoproterozoic seawater. The Sinian, equivalent to Neoproterozoic III, has been confined between ca. 600 and 544 Ma according to the ages of Barfod et al. (2002) and Jenkins et al. (2002). Stratigraphic units include in ascending order the Doushantuo and Dengying formations.

Previous secular $\delta^{34}S_{sulfate}$ trends for the Neoproterozoic have been carried out by means of relatively rare evaporitic gypsum and barite deposits that provide only a low-resolution δ^{34}S evolution of seawater sulfate. However, δ^{34}S analysis of trace sulfate in marine carbonates, which are abundant in the late Neoproterozoic sedimentary rocks on the Yangtze Plateform, southern China, can provide a continuous record of seawater sulfate evolution assuming that primary sulfate remains associated with carbonate minerals. Contemporary δ^{13}C values of seawater carbonate can been obtained from the same carbonate samples.

In our study, δ^{34}S and δ^{13}C values were measured from the same carbonate sample. Both parameters display distinct stratigraphic variations. For the basal Doushantuo Formation, $\delta^{34}S_{sulfate}$ changes from +30.0‰ to +47.3‰ whereas $\delta^{13}C_{carbonate}$ shows a change from –3.0‰ in glacial sediments and cap carbonates to +4.6‰ in subsequent carbonates. Thereafter, values decline with significant oscillations. Large negative excursions for S and C isotopes characterize the boundary between the Doushantuo and Dengying formations. The overlying unit displays stable or slightly decreasing isotope ratios. Average $\delta^{34}S_{sulfate}$ and $\delta^{13}C_{carbonate}$ values change from +34.5‰ and +3.3‰ for the lower, respectively, to +28.4‰ and +2.1‰ in the higher Dengying Formation. Additional negative excursions of δ^{34}S and δ^{13}C exist at the Precambrian-Cambrian boundary. Stronger oscillations in $\delta^{34}S_{sulfate}$ and $\delta^{13}C_{carbonate}$ were recorded for the Doushantuo Fm. suggesting still variable environmental conditions shortly after the global glaciation. A somewhat stabilized oceanic environment is reflected by stable isotopic signatures for the Dengying Formation.

References:

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