A geochemical redox model for Ediacaran ocean chemistry in Nanhua Basin, South China

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A detailed spatial and temporal record of Ediacaran marine biogeochemistry has been compiled for the Doushantuo Formation (635-551 Myr) in South China at four outcrop sections in the Nanhua Basin, encompassing a shelf-to-basinal paleoenvironmental transect. Our dataset includes iron speciation, trace element contents, TOC and TIC measurements as well as stable isotope chemostratigraphy (^{13}C for carbonate and organic matter, ^{34}S for pyrite and carbonate-associated sulfate). Our findings are consistent with an early Ediacaran occurrence of animals living in oxygenated shallow shelf waters [1] but with ferruginous deep waters [2]. We also observe evidence for euxinic waters at intermediate depths on the continental shelves. We argue for a distinctive redox structure characterized by strong lateral sulfate concentration gradients, with highest dissolved sulfate levels on the inner shelf and a 'sulfide maximum zone' underlying the oxic surface waters. The intensive Neoproterozoic glaciations may have effectively re-set marine sulphate levels to <<1 mM in the early Ediacaran, and this structure would then be driven by continental delivery of sulfate coupled with sulfate reduction in the water column.

[1] Yin *et al*. (2007) *Nature* **446**, 661-633. [2] Canfield *et al*. (2008) *Science* **321**, 949-952.

Iron cycle in the river sediments and eolian dust in East Asia

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Iron has now been widely recognized as an important limiting nutrient for phytoplankton activity, which is of great significance for atmospheric CO_2 sink. The main sources of iron in global ocean are primarily derived from the continents via the fluvial and eolian transport. East Asia continent is characterized by widely-distributed Loess Plateau and large rivers including the Changjiang (Yangtze River) and Huanghe (Yellow River). Both the fluvial and loess-derived eolian particulate matters exert a remarkable control on the biogeochemical cycle and environment change in the west Pacific marginal seas.

In this study, iron speciation and isotope in the Changjiang and Huanghe suspended sediments and eolian dust were investigated, and fluxes of terrigenous iron into the marginal seas were estimated. Both the highly and poorly reactive fractions of iron are more concentrated in the Changjiang sediments than in the Huanghe sediments and eolian dust, primarily reflecting different controls of chemical weathering intensity, source rock geology and anthropogenic impact. Distinct and large spatial variations of reactive iron fractions occur in the Changjiang sediments, overall showing higher proportions towards the downstream. The iron speciation and isotopes in the Huanghe sediments and eolian dust are very similar, due to their similar sediment provenances. The flux of highly reactive iron of the Changjiang is comparable with those of the Huanghe and eolian dust, whereas the fluxes of poorly reactive and unreactive iron fractions are much different between them.

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