

The Fe isotopic and mineralogical expression of the transition from Fe-rich to S-rich sediments from the East Anglian Salt Marshes (UK)

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Iron minerals are often deposited in modern marginal marine environments and during burial they can be exposed to a range of microbially mediated redox changes. During this early, anoxic diagenesis, iron minerals can be exposed to hydrogen sulfide, and converted to pyrite. Understanding whether pyrite found in the geological record formed from sulfidization of deposited iron minerals or from precipitation in the water column is critical for proper interpretation of the evolution of iron mineralogy and iron mineral geochemistry over geological time. This is particularly true for the Proterozoic oceans, where there are contrasting interpretations of ferruginous and euxinic oceans based on the distribution of iron mineralogy. Our hypothesis is that the iron isotopic composition of various iron minerals may be a powerful tool for tracking these various diagenetic transformations.

A natural laboratory for analysing early diagenetic transformations of iron minerals is the East Anglian Salt Marshes, United Kingdom, where both ferruginous and sulfidic sediments are present beneath, just few meters apart. The current model for the evolution of the geochemistry of the East Anglian salt marshes is that the sediments were initially iron rich but are variably exposed to sulfide during early burial [1].

Here we present a high-resolution iron-speciation and $\delta^{56}\text{Fe}$ analysis of the different Fe-host phases of both iron-rich and sulfide-rich sediment cores, coupled with a chemical analysis of the porewaters. We have also performed an incubation experiment, where sediment from ferruginous ponds was exposed in the lab to hydrogen sulfide and the iron minerals turned to pyrite. Our results suggest that the iron isotopic composition of the various iron speciation fractions may be a powerful tool to track diagenetic sulfidization in the geological record.

[1] Hutchings, A. M. et al. (2019), *Front. Earth Sci.*, 7, 41.