Equilibrium iron isotope fractionation between Fe(II) and hydrous ferric oxide

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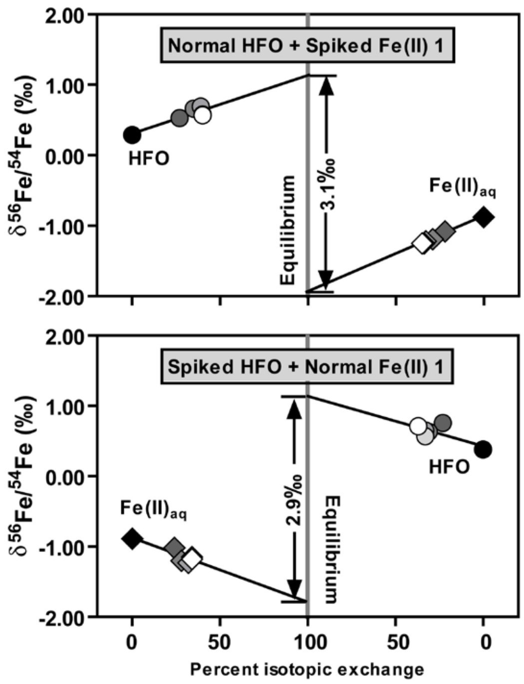
The $^{56}Fe/^{54}Fe$ fractionation between aqueous Fe (II) and hydrous ferric oxide (HFO) was determined using the three isotope method. Experiments were conducted at 25°C at neutral pH in the presence of dissolved Si (2.14 mM), in order to prevent any phase transformation of HFO. XRD and TEM confirmed that the solid remains 2-line ferrihydrite through the course of the experiments (28 days). Four replicate experiments using either ^{57}Fe-enriched aqueous Fe (II) or ^{57}Fe-enriched HFO yielded an average Fe (II)-HFO equilibrium Fe isotope fractionation factor of -3.00 ± 0.20 (2σ) ‰.

Combining previous aqueous Fe (II)-Fe (III) experimental results with the Fe (II)-HFO equilibrium fractionation determined here produced an equilibrium fractionation factor of 0‰ between Fe (III) and HFO. This important finding demonstrates that, under equilibrium conditions, the $\delta^{56}Fe$ value of Fe $(III)_{aq}$ will be directly reflected in the Fe isotope composition of poorly crystalline ferric hydroxides. This in turn confirms earlier inferences that in systems where the ferric hydroxide-Fe $(II)_{aq}$ fractionation is less than 3‰, kinetic isotope effects upon precipitation is the likely explanation. Counterintuitive to the reactive nature of HFO, only ~40% of isotope exchange occurred (Figure) after 28 days, presumably due to adsorption of Si to HFO surfaces.



Organic geochemistry of Triassic mudstones in the central Junggar Basin, northwest China

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The central Junggar Basin is a key petroleum exploration target of the basin, which is an important petrleum base and reseach highlights in northwest China. In previous studies, Permian mudstones are generally accepted as the effective source rock sequences. In this preliminary study, we reported the organic geochemistry of Triassic mudstones and discussed its geological implications.

It is showed that the mudstones have a high abundance of organic matter, with TOC content more than 1%. The organic matter has a relatively high carbon isotopic value (25.70-28.13), indicating a type-II to –III kerogen type. Analyses on organic maturation show that the mudstones in the Mosuo are mature and highly mature, while the mudstones in the Madong area have not reached the oil generation threshold. Thus, it may be indicated that the Madong area has been a paleo-uplift since the Late Triassic. The analyses of biomarkers indicate that most hydrocarbons are generated from a brackish water or fresh water deposition environment whose redox changes from weak reduction to weak oxidation.

In summary, the Triassic mudstones in the central Junggar Basin have high organic matter contents, are mature to highly mature in the sag areas; thus, the mudstones are good gas-prone source rocks due to its humic organic-matter type. This set of mudstones should be laid enough emphasis in shaping the future petroleum exploration strategy.