

Reactivity of chemically synthesized versus biomineralized Fe^{II}-Fe^{III} green rusts with both organic and inorganic pollutants

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Green rusts (GR) are mixed ferrous–ferric hydroxides that have layered structures consisting of alternating positively charged hydroxide layers and hydrated anion layers. These compounds can be obtained by chemical co-precipitation of Fe^{II} and Fe^{III} species or from bioreduction of ferric oxides by iron reducing bacteria. Due to the spatial configuration of structural Fe^{II}, green rusts show high reactivity against both organic and inorganic pollutants. While numerous works were mainly focused on the reactivity of a chemically synthesized GR, no report has appeared on the reactivity of biogenic GR with environmental pollutants. In the case of biogenic GR, the presence of exo-polymeric substances, bacterial cells, etc. could contribute to enhance GR stability. This work is devoted to compare the reactivity of chemically synthesized and biogenic GRs towards two pollutants: Methyl Red (MR) and cationic mercury. Reductive transformation of MR was monitored by spectrophotometric method and cationic mercury by ICP-AES. Results show that both abiotic and biotic carbonated GR can reduce Hg^{II} and MR. The effect of stabilizing agents such as phosphate and silicate on the GR reactivity was also tested.

Studies of surface ocean nitrate utilization in the Subarctic North Pacific using multiple nitrogen isotope recorders in the surface sediment

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In this study, we map and compare spatial patterns of three nitrogen isotope recorders: bulk sedimentary $\delta^{15}\text{N}$, diatom frustule-bound $\delta^{15}\text{N}$ (DB- $\delta^{15}\text{N}$), as well as planktonic foraminifera test-bound $\delta^{15}\text{N}$ (FB- $\delta^{15}\text{N}$) from 37 multicore core-top sediments across the open Subarctic North Pacific (SNP) and the Bering Sea between 60°N and 35°N, which were obtained during the INOPEX cruise in 2009. Both the bulk sedimentary $\delta^{15}\text{N}$ and the DB- $\delta^{15}\text{N}$ vary between 4 and 8‰, with increasing values towards the more nitrate-deplete lower latitudes, generally consistent with changes in the surface ocean nitrate consumption in the SNP. Bulk sedimentary $\delta^{15}\text{N}$ is more variable, which could be due to sedimentary processes altering or contaminating the isotopic signal. Consistent with previous studies [1], the $\delta^{15}\text{N}$ of both recorders are 2–4‰ higher than the expected $\delta^{15}\text{N}$ of the sinking flux, calculated using the World Ocean Atlas 09 summer surface ocean nitrate concentration in a Rayleigh model, assuming the same nitrate source (with the mean deep ocean nitrate concentration and $\delta^{15}\text{N}$), and the fractionation factor during nitrate assimilation as a function of the summer mixed layer depth [2]. The diatom-to-sinking flux offset is constant around 2‰ in the Bering Sea and the southwestern zonal transect, but is greater (around 4‰) in the northwestern and eastern regions. While basin-wide measurements of the $\delta^{15}\text{N}$ of the surface nitrate and the sinking flux will be needed to evaluate the offset, we suspect that the changes in the offset may be due to variations in the nitrate source $\delta^{15}\text{N}$: higher subsurface nitrate $\delta^{15}\text{N}$, originating from the eastern Pacific, has been observed in the northward coastal current off of British Columbia, and may penetrate westward as in the polar half of the North Pacific gyre, while lower nitrate $\delta^{15}\text{N}$ from N fixation in the North Pacific subtropical gyre may influence stations along the southern margin of the gyre. The lack of spatial patterns in the $\delta^{15}\text{N}$ differences between opal size fractions argues against large effects from variations in diatom assemblage; however, the assemblage effect will be directly analyzed once diatom species counts are completed. While we have limited FB- $\delta^{15}\text{N}$ data, the $\delta^{15}\text{N}$ of *N. pachyderma* (mostly sinistral) appears most similar to the DB- $\delta^{15}\text{N}$, within 1‰.

[1] Robinson et al. (2008) *Quaternary Sci. Rev.* **27**, 1076-1090. [2] DiFiore et al. (2010) *Geophys. Res. Lett.* **37**, L17601, doi:10.1029/2010GL044090.