Biomineralisation of nano-Fe(III) phases in inland waterways

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Discharge of Fe(II)-rich groundwaters to surface-waters results in biomineralisation and the formation of Fe(III)-mineral accumulations in inland waterways. This study describes their micromorphology, pore-water chemistry and environmental occurrence in a Tertiary floodplain setting.

Fe(III) precipitates were pH 6.2-7.2, sub-oxic (Eh 59-453 mV), with dissolved Fe(II) ranging from 0.1 to 81.6 mg L^{-1}. X-ray diffraction indicated a dominance of 2-line ferrihydrite, with lesser amounts of goethite and lepidocrocite. Electron microscopy revealed the nano-crystalline properties of the 2-line ferrihydrite ($Fe_5HO_3{\cdot}4H_2O$), goethite (α-FeOOH) and lepidocrocite (γ-FeOOH). Overall, the results demonstrated distinct variations in Fe(III) mineralogy and micromorphological characteristics. Preliminary groundwater oxidation data found the importance of *Leptothrix ochracea* in promoting the precipitation and stabilisation of these nano-particulate Fe(III) minerals. This biomineralisation resulted in abundant sheath and aggregate microstructures of predominantly 2-line ferrihydrite (Fig 1a), and some lepidocrocite crystals (Fig 1b). The implications to water quality of this biomineralisation process are explored.

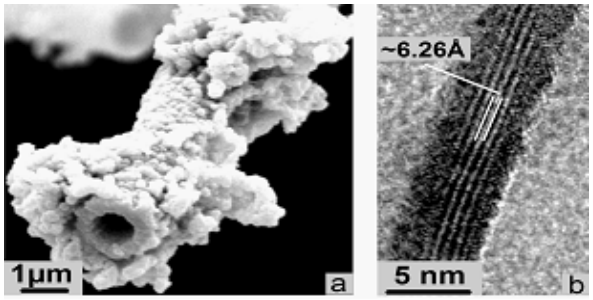

Figure 1 a) *L. ochracea* sheath and nano-particulate ferrihydrite aggregates; b) lepidocrocite nano-crystal ~5 atomic layers thick perpendicular to the (020) lattice plane (d-spacing = ~6.26)

Fluid geochemistry of the Suiyo hydrothermal field at the Izu-Bonin arc submarine volcano

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We revisited the Suiyo hydrothermal field (28º34'N, 140º 30'E, depth=1360m) during NT07-08 dive missions conducted using ROV *Hyper Dolphine* (Japan Agency for Marine Science and Technology). We confirmed that both temeprature (T = 300 degC) and chemistry of the venting hydrothermal fluids have been stable since the first discovery in 1992, which suggests equilibrium of hydrothermal interactions within the aquifer. Rare Earth Element pattern in the hydrothermal fluids showed Light REE enrichment with a positive Eu anomaly.

Shallow drilling using BMS (Benthic Multi-coring System) revealed hydrothermal alteration of pyroclastic rocks of dacite-rhyolite compositions beneath the area of active venting [1]. Enrichment in CO_2 of the venting fluid [2] could be responsible for intense hydrothermal alteration. As hydrothermal clay minerals, montmorillonite, chlorite and mica were identified. Chemical composition of the altered core samples showed uptake of potassium, which may be responsible for high calcium concentration rather than potassium of the hydrothermal fluid.

[1] Marumo K. *et al*. (2008) *Resource Geology*, 58, 220-248.
[2] Toki T. *et al*. (2008) *J. Geophys. Res*., 113, B08S13