

New insights on Fe-S minerals and clay matrices in anoxic coastal sediments

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Iron monosulfides (FeS) including mackinawite, pyrrhotite and greigite, form rapidly in anoxic sediments, and then typically transform to pyrite under normal depositional conditions. The reaction mechanisms involved in this transformation are a rich source of scientific debate and active research. At least 2 mechanisms have been identified, with the mineralisation pathways dictated by environmental factors and physical sedimentary processes. Here, we explore the potential relationships between iron sulfides and clay mineral fractions in contrasting reducing depositional environments: a eutrophic contemporary estuarine benthic sediment, and a Holocene coastal floodplain sediment.

Sediments were collected from the two contrasting sites: i) Peel Harvey Estuary (West coast of Australia) and; ii) Tucken Swamp (coastal floodplain on the east coast of Australia). Fe and S speciation, and mineralogy were determined as key parameters to understand biogeochemical cycling of iron.

Surprisingly, the total Fe and S pools were higher in inland swamp than in the estuary. Labile Fe (1M HCl extractable Fe) was most abundant in both sediments which demonstrates the iron monosulfides accumulates in eutrophic hypersulfidic sediments. XAS Fe K-edge results confirm the dominance of mackinawite. X-ray diffraction revealed a striking similarity in the clay minerals at the two starkly different sites, with mostly kaolinite and smectite in equal measure. Implications of this universal nature of the clay mineral composition and its dissociation with Fe-S mineral fractions to depositional sedimentary processes is discussed.

[1] Bush et al. (2004), *Soil Research*. **42**, 603-607. [2] Rickard and Luther. (2007), *Chemical Reviews* **107**, 514-562.