

Spatial heterogeneity of S and C stores in an inland acid sulfate soil

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Sulfate has been concentrated in the Loveday Basin of the lower Murray floodplains, Australia, by evaporation of saline waters. The presence of labile organic carbon and a permanent water cover have resulted in biologically mediated sulfate reduction and the formation of environmentally significant sulfide deposits [1].

Unlike coastal acid-sulfate-soils, the alkalinity produced by sulfate reduction has not been flushed from these sediments and the basin has sufficient carbonate neutralising capacity to buffer acidity produced from sulfide oxidation.

Sulfur (gypsum, pyrite and monosulfides) and carbon (carbonate and organic carbon) are largely concentrated in the upper 40 cm of the basin. However, their distribution and form can vary greatly throughout these surface sediments due to the development of cracks and peds following several wetting and drying cycles.

During dry periods, gypsum and carbonate salts are concentrated within oxidised crack sediments and covering peds as salt efflorescence. Conversely, pyrite framboids are concentrated below the oxidised surface of crack sediments and within the cores of peds. Despite the excess of stored alkalinity at the scale of the wetland, acidic micro-environments characterised by the presence of jarosite occur locally where pyrite and carbonate are separated. Upon rewetting, biological materials rapidly grow and accumulate in sediment cracks, turning the oxidised sediment surface back into a substrate for sulfate reduction.

The dynamic cycling of sulfur and carbon in surface sediments of the Loveday Basin is controlled by physical, chemical and biological processes. Repeated wetting and drying of sediments has resulted in cyclic oxidation and reduction leading to the heterogeneity of the sulfur and carbon stores.

References

[1] Lamontagne S., Hicks W.S., Fitzpatrick R.W., and Rogers S. (2004) *CRC LEME open file report* 167