Pyrite formation in the water column and sediments in an alkaline, saline, meteorite crater Lake Tswaing, South Africa

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In normal-marine sediments, i.e., those deposited under an oxic water column, pyrite is formed exclusively within the sediment (diagenetic pyrite). In contrast, in euxinic environments, pyrite can form in the water column (syngenetic pyrite), as well as below the sediment-water interface.

The concentrations of organic carbon, partitioning of iron and sulfur, stable isotopic ratios of major sulfur species, and pyrite morphologies in the water column and sediments of oxic and euxinic portions of a sulfate-rich, meromictic lake (Tswaing Lake near Pretoria in the Gauteng Province of South Africa) were analysed in order to examine the effects of euxinic conditions on pyrite formation and sedimentary Fe-S-C relations.

The variability is related to the extent that iron is scavenged in the sulfidic water column (Wilkin and Barnes, 1997) and is a function of the reactivity of iron-bearing detritus, the mode of sediment transport, as well as the physical, chemical, and biological conditions in the chemocline. Similar variability in the ratio of syngenetic to diagenetic pyrite should be expected in ancient shales deposited under euxinic water columns, and should be taken into account when using interrelationships in the Fe-S-C system for interpreting paleodepositional environments.

In modern euxinic environments, the proportion of pyrite formed in the water column (i.e., syngenetic pyrite) to that formed in the sediments (i.e., diagenetic pyrite) varies.

In Tswaing Lake, the pyrite burial flux is dominated by growth below the sediment-water interface. This variability is related to the extent that iron is scavenged in the sulfidic water column.

[1] Wilkin, R. T., and Barnes, H. L., 1997, Pyrite formation in an anoxic estuarine basin: American Journal of Science, v. 297, p. 620–650.