Iron and phosphorus cycling in the ferruginous Lake La Cruz

J. THOMPSON[1*], R. GUILBAUD[2], N. R. POSTH[3], R. P. COX[3], M. R. MIRACLE[4], E. VICENTE[4], M. D. KROM[5] AND S. W. POULTON[1]

[1]School of Earth and Environment, University of Leeds, Leeds, LS2 9JT, UK (*correspondence: eejt@leeds.ac.uk)
[2]Department of Earth Sciences, University of Cambridge, Cambridge, CB2 3EQ, UK
[3]Nordic Center for Earth Evolution – Institute of Biology,University of Southern Denmark, Odense, Denmark
[4]Department of Microbiology and Ecology, University of Valencia, Burjassot, Spain.
[5]Department of Marine Biology, Haifa University, Israel.

Considering the entirety of Earth's history, the ocean has dominantly been in an anoxic, non-sulphidic state, with the water column containing dissolved Fe (ferruginous). Despite the significance of such conditions, the cycling of nutrients in ferruginous settings remains poorly understood. Phosphorus is thought to be the ultimate limiting nutrient on geological timescales. Therefore it is essential to constrain the behaviour of P under ferruginous conditions in order to evaluate feedback mechanisms associated with P stimulation of primary productivity, organic carbon burial and oxygen production.

The modern Lake La Cruz (Spain) is a meromictic sinkhole and its Fe-rich, sulphide-poor, anoxic hypo-monimolimnion is an ideal system to assess the nature of Fe and P cycling on the ancient Earth. Following the collection of water column, pore water and sediment samples, we have examined the partitioning of Fe and P between key phases, with an aim to constrain how authigenic mineral formation affects P bioavailability. Utilising these data, we will present new insight into the geochemical controls on P cycling under ferruginous conditions, ultimately improving understanding of the associated feedback mechanisms that controlled the chemical nature of the biosphere during these dominant periods of Earth history.