Pore water redox variability and environmental change recorded by the 1.4 Ga Velkerri Formation, Northern Territories, Australia

B. R. JOHNSON[1*], G. COX[2], A. JARRETT[3], N. J. TOSCA[1]

[1]Dept. of Earth Sciences, University of Oxford, Oxford, UK
[2]Dept. of Applied Geology, Curtin University, WA, Australia
[3]Geoscience Australia, Canberra, Australia
*brooke.johnson@hertford.ox.ac.uk

Models of Mesoproterozoic marine environments are based on studies of few surviving unaltered sedimentary successions. Previous studies have documented considerable variation in sedimentary redox conditions, which appears to be a common feature of Mesoproterozoic successions [1, 2].

We conducted a high-resolution study of the Middle Mesoproterozoic Velkeri Formation of the Roper Group, McArthur Basin, Northern Territories, Australia, using optical petrography, X-ray diffraction, SEM/EDS element mapping, and LA-ICP-MS. Changes in the sedimentology and the abundance of authigenic and early diagenetic minerals and mineral redox proxies were mapped across the Velkerri taken from cores across the McArthur Basin. Abundant chamosite/berthierine cements and grains, early diagenetic phosphatic spheres (often containing glauconite rims and filled with organic matter) and glauconite cements and grains track lithological changes associated with the enrichment of organic matter. In addition, Fe-sulfides commonly include the FeS_2 dimorph marcasite in addition to pyrite, which indicates re-oxidation of sulfidic pore waters and a lowering of pH during growth [3]. Early diagenetic siderite growth pre-dates and post-dates sulfide formation.

Together, these observations indicate that redox conditions in pore and bottom waters (and probably at the sediment-water interface) oscillated between sub-oxic and ferruginous, which sometimes favoured the preservation of sedimentary phosphate. Sediments in the more distal parts of the basin retained a more marine character while proximal sections show evidence for evaporites and salinity fluctuations. These environmental changes reflect intermittent marine and evaporative influences, and were probably controlled by local tectonics which contributed to basin restriction and nutrient loading during erosion of local orogens [2]. Understanding the Mesoproterozoic sedimentary record thus requires recognizing biases introduced by preferential preservation in epicratonic basins.

[1] Sperling, E. et al. (2014) *Geobiology*, 12, p. 373-86 [2] Cox, G., et al. (2016) *Chem. Geo*, 440, p. 101-14. [3] Schieber, J. (2011) *J. Sed. Res.*, 81(7), p. 447-58.