Intermittent sub-tidal oceanic euxinia from 1780 Ma

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The evolution of sulfidic conditions in the Palaeoproterozoic ferruginous oceans was not only an inhibitive stage for biological evolution, as euxinic bottom waters would have sequestered bioessential metals into sedimentary pyrite, but it was also vital for base metal deposits. The disappearance of Banded Iron Formations (BIFs) ~1.8 Gyr ago was closely followed by the advent of sedimentary 'exhalative' (SEDEX) Zn-Pb deposits in black shales. Previous assertions that the cessation of BIF deposition reflected deep oceanic oxygenation [1], or widespread anoxic sulfidic (euxinic) conditions [2], have been disputed with evidence for co-existence of ferruginous and euxinic conditions from the Neoarchean to the Neoproterozoic [3]. There is an emerging model of euxinia along continental margins [4] and localised sub-basins, while the deep oceans remained ferruginous [3]. Such euxinic environments were critical for the formation of exhalative deposits, largely known from ~1.64 Ga.

Here we present evidence for intermittent euxinia in shales deposited in a marine shelf environment in the ~1.78 Ga Tawallah Group in the basal McArthur Basin in northern Australia, which also contain evidence for earlier SEDEX mineralization. Additionally, oxidised facies overlying the shales add weight to a stratified redox model for near shore environments in the Palaeoproterozoic ocean [4]. These findings imply shallow euxinia may have been widespread from at least 1.8 Ga.

[1] Holland (2005) *Econ. Geol.* **100**, 1489-1509. [2] Canfield (1998) *Nature* **396**, 450-453. [3] Planavsky *et al.* (2011) *Nature* **477**, 448-452. [4] Poulton *et al.* (2010) *Nature Geo.* **3**, 486-490.