An expanded molybdenum isotope dataset for Precambrian stromatolitic carbonates

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Here we present molybdenum (Mo) isotopic data from stromatolitic carbonates of different ages to shed new light on early Earth's redox evolution. We examined modern stromatolites from the Bahamas as well as Precambrian stromatolites deposited ca. 1.88 Ga (Gunflint, Canada), 2.52 Ga (Ghaap Group, South Africa), 2.8 Ga (Steep Rock, Canada), and 2.96 Ga (Red Lake, Canada). Modern samples record a molybdenum isotope signature that appears related to the water from which they grew, supporting the idea that the molybdenum isotopic composition of carbonates is a robust proxy for examining paleo-redox conditions of environments where carbonates were precipitated [1]. Ancient stromatolites reveal evidence for oxygen in the environment at 2.8 Ga, while stromatolites from the Ghaap Group (2.52 Ga) and Red Lake (2.96 Ga) appear to have grown under poorly-oxygenated conditions. This data reaffirms suggestions that oxygenic photosynthesis existed at least 0.35 Ga before the rise of atmospheric oxygen [2]. Comparison of our data with the black shale record reveals that black shales may be ill-suited for evaluating the Mo isotopic composition of seawater prior to the presence of appreciable free sulfide ca. 2.6 Ga – and that chemical sediments such as carbonates may be uniquely positioned in this regard.

[1] Romaniello *et al.* (2016) *Chem Geol* **438,** 84–90. [2] Lyons *et al.* (2014) *Nature* **506**, 307–315.