Extracting primary information through Si isotope analysis on a c. 2.4 Ga microbialite reef

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A c. 2.4 Ga microbialite reef complex within the Turee Creek Group (TCG) in Western Australia was deposited in the aftermath of the Great Oxidation Event (GOE). The diverse reef contains the first appearance of thrombolites, a complex deep water microfossil assemblage, and the oldest shallow water sedimentary phosphorous deposit [1, 2, 3]. Silica is present throughout the reef, as microcrystalline quartz in thrombolites, fine chert preserving the deep water microfossil assemblage, and as euhedral quartz crystals within phosphorous-rich peloids and pebbles [1, 2, 3]. Petrographic examination indicates some relatively early silica phases. Si isotope analysis will be used to evaluate the effect of re-equilibration by Proterozoic sea water and pore fluids on the cherts and quartz grains within this reef, to determine whether primary information (such as sea water temperature, pH, and salinity [4, 5]) can be retained. Here we present a wide range of recorded δ^{30}Si from -2.8 to 4.1 ‰, which is typical of Precambrian cherts [4, 5, 6]. It was recently demonstrated that low temperature re-equilibration of Si isotopes between amorphous and aqueous states readily occurs in water with high ionic strength and that is supersaturated with Si [4]. Since these units were deposited before the advent of silicifers (e.g. diatoms), the ocean would have been supersaturated with silica [4, 5]. Re-equilbration is likely to have occurred, and it is possible that some isotope values reflect the sea water, or diagenesis, rather than the process that first precipitated the silica or the source of silica. By determing how much of an effect re-equilibration has had, we can try to determine what useful, primary information is retained and what the environment was like during the GOE.

[1] Nomchong and Van Kranendonk (2020) *Precambrian Res.* **338**. [2] Barlow and Van Kranendonk (2018) *Geobiology* **16**, 449-475. [3] Soares et al. (2019) *Precambrian Res.* **320**, 193-212. [4] Zheng et al. (2019) *Geochim. Cosmochim. Acta* **253**, 267-289. [5] Stamm et al. (2019) *Geochim. Cosmochim. Acta* **255**, 49-68. [6] Heck et al. (2011) *Geochim. Cosmochim. Acta* **75**, 5879-5891.