Geochemical constraints on the depositional and diagenetic history of a unique 2.4 Ga microbialite reef

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A Unique Microbialite Reef

Recent studies of a microbialite reef complex from the c. 2.4 Ga Turee Creek Group, Western Australia, have revealed occurrences of the oldest known thrombolites, unique stromatolite morphologies, shallow-water phosphorite deposits and diverse microfossil assemblages [1, 2, 3, 4]. The environmental and diagenetic context of these occurences, however, had not previously been examined in detail. Here we present results from a range of geochemical analyses including carbonate C, O and Sr stable isotopes, REE and bulk XRF analysis, as well as petrographic examinations, that we use in concert to construct the most detailed and complete depositional and diagenetic timeline for the reef complex yet.

Results/Discussion

Field observations, REE and bulk XRF data paint a picture of an open marine carbonate plaform, starved of terrigenous material, and the subject of multiple stages of sea level rise, fall and subaerial exposure.

The $\delta^{13}C$ and $\delta^{18}O$ values of invididually microsampled carbonate domains, reveal primary information that allows us to constrain the source of different carbonate phases, including those from microbialites and early and late cements, across the stratigraphy of the reef complex.

In situ and bulk Sr-isotope analysis of the best petrographically and geochemcially preserved carbonate phases allow us to define a $^{87}Sr/^{86}Sr$ value of 0.70468 as the most representative seawater value from the reef complex, adding to the seawater Sr-isotope curve for a time period that is relatively data poor.

Our new complete depositional and diagenetic history for the reef complex provides necessary context for interpreting the special features that make this reef unique.

[1] Nomchong and Van Kranendonk (2020) *Precamb. Res.*, **338**. [2] Barlow et al. (2016) *Geobiology*, **14**, 317-343. [3] Soares et al. (2019) *Precamb. Res.*, **320**, 193-212. [4] Barlow and Van Kranendonk (2018) *Geobiology*, **16**, 448-475.