Preliminary geochemical data from Earth's oldest carbonate platform (2.94 Ga Red Lake greenstone belt, Canada)

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One of the major consequences of photosynthesis is locally increased carbonate alkalinity, which stimulates the precipitation of carbonate minerals in aqueous environments. On the modern Earth, reef–type ecosystems occupy the most productive end of the oxygen– and carbonate–producing spectrum. However, prior to about 700 million years ago, photosynthetic bacteria fulfilled this role, building reef–like microbialite (e.g., stromatolite) structures, and eventually whole carbonate platforms, out of the carbonate minerals they help precipitate as a consequence of their alkalinizing effect. Rather shockingly, the most ancient examples of these systems, dating back to ca. 3.0 Ga, remain little explored.

Here we report preliminary major element, trace element, $\delta^{13}C_{carb}$, $\delta^{18}O_{carb}$, $\delta^{13}C_{org}$, and Mo isotope data for carbonates from outcrop and drill core of the 2,940 +/- 2 Ma to 2,925+/- 3 Ma Ball assemblage, Red Lake Greenstone belt, N. Ontario, Canada [1]. This deposit contains over 400m of metasedimentary rocks that include over 200m of stromatolitic calcite and dolostone carbonates, making it the earliest known significant accumulation of carbonate on the planet. Carbon isotope variation is relatively limited, a feature that we attribute to higher prevalent pCO_2 at the time, while trace element and Mo isotope data appear to suggest the transient presence of oxygen, which echoes previous claims for the presence of oxygenic photosynthesis as far back as 2.9 – 3.2 Ga [e.g. 2, 3].

[1] Corfu and Wallace (1986) *Can J Earth Sci* **23,** 27–42.

[2] Planavsky *et al.* (2011) *Nature Geosci* 7, 283–286.

[3] Satkoski *et al.* (2015) *EPSL* **430**, 43–53.