Deciphering Proterozoic shallow marine redox structure using carbonate REE

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The majority of biological and geochemical recycling in marine environments occurs at relatively shallow depths within the oceans, indicating that the diversification and expansion of early complex life must have been intrinsically linked to ocean surface redox conditions. The rise in atmospheric oxygen in the Neoproterozoic has been broadly linked to the rise in biological diversity and ecological complexity (Cole et al., 2016), and recent work on shallow water redox conditions has indicated an expansion of oxic conditions in the Ediacaran (Wallace et al., 2017). In order to expand on this work, we seek to explore shifts in shallow water redox conditions in the Paleo- and Mesoproterozoic, with the aim of providing a baseline against which shifts in Neoproterozoic redox conditions can be evaluated more robustly.

Using carbonate stratigraphy and sedimentology to constrain depth, we use Rare Earth Element (REE) profiles and trace metal distributions to reconstruct shallow marine redox conditions in the mid-Proterozoic Muskwa basin, the Mesoproterozoic Onelek uplift, the Mesoproterozoic Jixian Group, and the Paleoproterozoic Pethei Group. We then pursue analysis of these data in the context of an intermediate complexity Earth system model with the goal of exploring Ce depth gradients and reconstructing broad shifts in surface ocean redox conditions.

References

Cole et al. 2016. *Geology* 44(7).

Wallace et al. 2017. *Earth & Plan. Sci. Let.* 466.