Marine redox variability in the nonglacial Cryogenian

BRENNAN O'CONNELL[1] MALCOLM W. WALLACE[2]
ASHLEIGH VS HOOD[3]

[1]University of Melbourne, Parkville, VIC, 3010 Australia
oconnellb@student.unimelb.edu.au
[2] University of Melbourne, Parkville, VIC, 3010 Australia
mww@unimelb.edu
[3] University of Melbourne, Parkville, VIC, 3010
ashleigh.hood@unimelb.edu.au

The Cryogenian period of the Neoproterozoic Era is characterized by massive perturbations to the carbon cycle and some of the most dramatic environmental change in Earth history. The nonglacial Cryogenian sediments of the Adelaide Fold Belt, South Australia, offer insight into shallow and deep marine chemical conditions during the interlude between the 'snowball Earth' Sturtian and Marinoan glaciations. A thick accumulation of nonglacial Cryogenian strata record a range of depositional environments, and provide an opportunity to determine paleo-oceanographic conditions both spatially and temporally. Laterally-equivalent units to the peritidal Angepena Formation include platform and reef margin facies of the Balcanoona Formation and the deep basinal shales and carbonates of the Tapley Hill Formation. Younger Cryogenian nonglacial strata include the iron-rich tidal sediments of the Yaltipena Formation, which overlies the carbonate ramp facies of the Trezona Formation. The Trezona Formation overlies the deep basinal Enorama Shale. Under a newly established sedimentologic framework, we use facies specific and carbonate component specific REE+Y and elemental geochemistry to derive an environmental redox-scape for these marine nonglacial sediments developed between two global ice ages. Carbonate marine cements from these nonglacial shallow marine environments are characterized by well-preserved, non-, bright-, and dull-cathodoluminescent zoning, and strong negative to slightly positive cerium anomalies, suggestive of oxic conditions in shallow waters overlying deeper anoxic, iron-rich waters. Based on carbonate geochemical data, it appears that the nonglacial Cryogenian is characterized by large redox disequilibrium in coastal and shallow marine environments before the widespread ventilation of Earth's oceans during the Ediacaran. Overall, we suggest a coupled sedimentological and geochemical approach is necessary to derive a more nuanced and environment-specific understanding of marine redox evolution during this dynamic Neoproterozoic interval.

This abstract is too long to be accepted for publication. Please revise it so that it fits into the column on one page.