Linking Neoproterozoic oxygenation to the Marinoan glaciation and radiation of eukaryotes

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Significant debate surrounds Neoproterozoic oxygenation including its timing, its relationship to snowball glaciations and the emergence of large complex metazoans. Here we report high-resolution element and isotope geochemistry on drill core intersecting Cryogenian and Ediacaran strata in South Australia. Redox-sensitive element abundances supported by carbon and nitrogen isotopes indicate that while some increase in oceanic oxygen levels is apparent in the aftermath of the Sturtian glaciation, persistent growth in oceanic oxygen concentration occurs in the immediate aftermath to the Marinoan glaciation. This work supports recent models arguing for a direct link between snowball glaciations and step changes in atmospheric pO_2. However, we suggest that the necessary prerequisites for Neoproterozoic oxygenation are both extreme glaciation, and a coupling to the previously reported rise of eukaryotes to ecological dominance in marine environments. The confluence of glaciation and ecological change are likely factors that tie significant increases in oxygenation to the later Marinoan glaciation.