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Did the Planet's First Latitudinally-Constrained Glaciation (Mid Ediacaran) Create a Surface to Abyssal Current and Oxidise the Deep Oceans?

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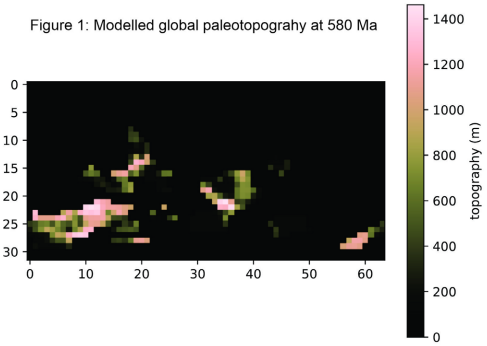

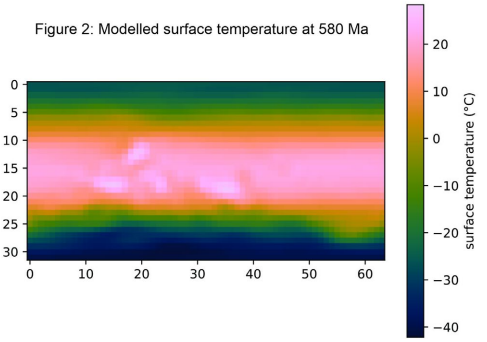

The Shurum/Wonoka anomaly is the largest known carbonate carbon isotope excursion in Earth history. Proposed mechanisms for its origin range from Ediacaran variable photosynthetic carbon isotope fractionation [1], unbalanced oxygenation and remineralising of buried organic carbon [2] or a globally near-synchronous diagenetic overprint[3]. Whatever its origin, it has long been known to be associated with mid-Ediacaran glaciations [4].

Here we explore a hypothesis whether the mid-Ediacaran glaciation (possibly the planet's first latitude-limited glaciation) developed a thermo-haline surface-to-abyssal ocean current that could have delivered oxidants to a deep organic carbon reservoir, leading to the oxygenation of the deep ocean.

The middle Ediacaran was a world with an unusual distribution of oceans and continents—a hemisphere-scale northern ocean and a continent-filled southern hemisphere. Here we have used a full-plate tectonic model [5] and added topography [6] (Fig. 1). We have used this as an input into the intermediate complexity, coupled atmosphere-ocean general circulation model PLASIM-GENIE7 with variable (ranging from pre-industrial up to 8x pre-industrial), but realistic atmospheric pCO2 levels, to forecast global temperatures (Fig. 2), sea ice thickness, salinity, ocean currents and their spatial variations. We evaluate our model by comparing the predicted results to locations the most convincing sites of mid-Ediacaran glaciation on the model, as well as analysing the change in ocean currents as the model progresses (and at different *p*CO2 levels) to investigate whether the hypothesis is valid.

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