Redox and ecological complexity across the Ediacaran-Cambrian boundary

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There is a pronounced increase in diversity of motile organisms in the late Ediacaran Period (635-540 million years ago, Ma). Whilst it is well recognised that oxygen is a prerequisite to metabolically active ecologies, relative changes in the spatial extent of oxic waters and habitation by terminal Ediacaran forms remain largely unconstrained. We present a new integrated biotic and palaeoredox dataset of iron speciation and carbonate-bound iodine concentrations for one of the most important terminal Ediacaran sedimentary successions, the Nama Group of Namibia (~550-540 Ma).

In the Nama basin, complex soft-bodied benthic macrobiota and ichnotaxa are restricted to wave-dominated shoreface clastics deposited in the mixed, oxic surface layer. Communities of skeletal biota (e.g. *Cloudina*, *Namacalathus* and *Namapoikia*) inhabited shallow shelf to mid-ramp carbonate facies above or intermittently within the zone of manganese reduction where regular ferruginous anoxic incursions during marine transgressions likely proved detrimental.

Combined palaeoredox data robustly agree with the interpretation that Kuibis Subgroup (~550-547 Ma) sediments were deposited in close proximity to an OMZ. The most dramatic feature of the combined data is a gradual transition from unstable and dominantly ferruginous conditions at ~550 Ma to stable oxic conditions immediately prior to the Ediacaran-Cambrian boundary unconformity at ~540 Ma. This transition reflects deepening of the chemocline and is accompanied by a corresponding increase in diversity of the ichnofossil record. We propose that the observed diversification of bioturbating trace makers may directly reflect increasing oxygen stability of the shallow shelf in the final 5 million years of the Ediacaran. This may have facilitated the evolution of recently reported sediment bulldozers, arguably the most metabolically active and disruptive ecology represented in the Ediacaran fossil record.