Nutrient and pH dynamics of intermediate depth Southern Ocean waters during the last Glacial and Interglacial period

ANAGNOSTOU, E.[1], STEWART, J.[1]*, SHERRELL, R. M.[2], ADKINS, J. F.[3], HINES, S. K.[3] AND FOSTER, G. L.[1]

[1]University of Southampton, Southampton, SO14 3ZH, UK; *correspondence: jseaga1415@gmail.com
[2]Rutgers University, New Brunswick, NJ 08901, USA
[3]Caltech, Pasadena, CA 91125, USA

The high latitude surface ocean has been considered a key player in Glacial/Interglacial (G/IG) atmospheric CO_2 change because nutrient and CO_2 rich waters, stored in the deep ocean, mix along isopycnals to the surface and then sink to the subsurface before nutrients are fully utilized by phytoplankton. During glacials it is suggested that polar surface waters were nutrient depleted (e.g. [1]) either because of a more efficient biological pump driving CO_2 drawdown, or because of salinity stratification or reduction in wind-driven upwelling of nutrient-rich deep waters [2]. To date there is ambiguity as to changes in nutrient distributions in polar oceans over G/IG transitions. Here we use the P/Ca proxy in U-series dated deep-sea corals *Desmophyllum dianthus* [3] to reconstruct seawater phosphate concentrations (PO4) during the last G/IG in the Southern Ocean, south of Tasmania. We observe glacial depletion of ~ 50% relative to modern PO4 at ~1000-2000m depth. During the deglaciation, PO4 progressively increased towards higher than modern values at Heinrich Stadial 1, while being more dynamic during the Antarctic Cold Reversal and fully recovering in the modern. Our results provide quantitative constraints on glacial nutrient drawdown and subsequent recovery, with implications for the mechanisms of atmospheric CO_2 variation. Results will be discussed in the context of seawater carbonate system reconstructions based on the same corals, using the boron isotope and U/Ca proxies.

[1] Sarmiento & Orr (1991), *L&O* **36**, 1928-1950. [2] Sigman & Boyle (2000), *Nature* **407**, 859-869. [3] Anagnostou *et al.* (2011), *GCA* **75**, 2529–2543.