Reconstructing Biogeochemical Processes in the Near Shore Antarctic Sea Ice Environment

D. CARSON AND R. GANESHRAM

The University of Edinburgh, School of Geosciences, Edinburgh, Scotland

Abstract:

The Southern Ocean features prominently in many hypotheses developed to explain the drop in atmospheric CO_2 during Quaternary glaciations. Critical to the testing of these hypotheses is our ability to reconstruct past conditions of Southern Ocean primary productivity, nutrient availability and utilisation based on isotopic and trace element proxies. One aspect of these proxy records not fully investigated is the extent to which they are influenced by materials formed within sea ice, an environment vastly different from that of the open water column. Most proxies are calibrated for open ocean settings, so material produced within sea ice could potentially confound proxy-based reconstructions of water column conditions. Detailed studies on sea ice material are lacking for most isotopic and trace element proxies used in the Southern Ocean.

We report initial results from time-series studies of sediment trap and suspended particulate matter in Ryder Bay (67°S, 68°W). Our sampling spans the winter sea ice cover, transition to open water and the spring bloom over two field seasons (2004/5 and 2005/6). Preliminary results shows variations in productivity (chl-*a*, POC/PON) and the isotopic ($\delta^{13}C$, $\delta^{15}N$ and $\delta^{18}O$) and trace element (Ba, U and Ag) composition of nutrients and organic matter formed in sea ice brine and surface waters. Additionally, through similar analysis of materials collected in sediment traps deployed at this site, the extent to which geochemical signals produced in the sea ice environment influence the sedimentary record was investigated. This proxy data was compared to measured environmental parameters including; temperature, the dissolved CO_2 system, nutrient utilisation and dissolved oxygen to allow quantitative analysis of proxy signatures relative to observed surface water conditions.

References

Sigman, D. M., Boyle, E. A. (2000) Glacial/interglacial variations in atmospheric carbon dioxide. *Nature* 407**,** 859-869.

Stephens, B. B., and Keeling, R. F. (2000) The influence of Antarctic sea ice on glacial-interglacial CO_2 variations. *Nature* 404, 171-174.