Subarctic Pacific evidence for a glacial deepening of the oceanic respired carbon pool

S.L. JACCARD[1*], E.D. GALBRAITH [2], D.M. SIGMAN[2], G.H. HAUG[1]

[1] D-ERDW, ETH, Zurich, Switzerland (*correspondence: samuel.jaccard@edrw.ethz.ch)
[2] Department of Geosciences, Princeton University, Princeton, USA

Measurements of benthic foraminiferal Cd/Ca have indicated that the glacial-interglacial change in deep North Pacific phosphate concentration was minimal, which has been taken by some workers as a sign that the biological pump did not store more carbon in the deep glacial ocean. Here we present sedimentary redox-sensitive trace metal (Mn, Mo, U) records from ODP Site 882 (NW subarctic Pacific, water depth 3,244 m) to make inferences about changes in deep North Pacific oxygenation – and thus respired carbon storage - across glacial Terminations I & II. These observations are complemented with biogenic barium and opal measurements as indicators for past organic carbon export to separate the influences of deep-water oxygen concentration and sedimentary organic carbon respiration on the redox state of the sediment. Our results suggest that the deep subarctic Pacific water mass was depleted in oxygen during glacial maxima, though it was not anoxic. We reconcile our results with the existing benthic foraminiferal Cd/Ca by invoking a decrease in the fraction of the deep ocean nutrient inventory that was preformed, rather than remineralized. This change would have corresponded to an increase in the deep Pacific storage of respired carbon, which would have lowered atmospheric CO_2 by sequestering CO_2 away from the atmosphere and by increasing ocean alkalinity through a transient dissolution event in the deep sea. Preliminary calculations show that the magnitude of change in preformed nutrients suggested by the North Pacific data would have accounted for a substantial portion of the observed decrease in glacial atmospheric pCO_2.