

In search of the deglacial carbonate preservation maximum: Why is it missing?

FIGEN MEKIK¹, ROBERT ANDERSON² AND
ANDY RIDGWELL³

¹Grand Valley State University (mekikf@gvsu.edu)

²Lamont Doherty Earth Observatory
(boba@ldeo.columbia.edu)

³University of Bristol (andy@seao2.org)

One hypothesis for lower atmospheric CO₂ levels during glacial periods invokes increased ocean stratification with a corresponding shift of dissolved inorganic carbon and nutrients from intermediate depths to deep waters. Under this scenario, both increased efficiency of the ocean's biological pump and carbonate compensation contributed significantly to CO₂ drawdown. If the rapid deglacial rise in atmospheric CO₂ (~17 – 14 ka) were caused by a breakdown of this stratification and increased ventilation of deep water masses, then one consequence would be increased CaCO₃ preservation in deep sea sediments.

We present down core records of carbonate preservation for the last 21,000 years from 16 cores in the tropical and subtropical Pacific and Atlantic Oceans. Our preservation records are based on a multi proxy approach involving a new calcite dissolution proxy (the *Globorotalia menardii* Fragmentation Index), size normalized foraminifer shell weights and ²³⁰Th-normalized carbonate accumulation rates. We find that in most of our cores the expected deglacial carbonate preservation maximum is missing. The reasons for this vary with location: (1) in the eastern equatorial Pacific down core variations in the ratio of organic carbon to calcite flux strongly obliterate the deglacial preservation maximum because the deglacial was a time of high productivity in this region, (2) in the western equatorial Pacific most cores have very low sedimentation rates and the deglacial preservation maximum is likely obscured due to bioturbation, and (3) in the equatorial Atlantic the dominance of bottom waters by Antarctic Bottom Water (which is corrosive to calcite) lead to a deglacial dissolution maximum in our cores.

Coastal ocean Iron time series

JEFFREY MENDEZ¹ AND JESS ADKINS²

¹California Institute of Technology, Department of
Environmental Science and Engineering, Pasadena, CA
91104 (jeffreym@caltech.edu)

²California Institute of Technology, Department of Geological
and Planetary Sciences, Pasadena, CA 91104
(jess@gps.caltech.edu)

Iron (Fe) is an essential micronutrient in the ocean. The depletion of Fe has been linked to limitations in biological production [1] which has implications to the global carbon cycle. Major sources of Fe are atmospheric deposition [2] and the flux of Fe from sediments [3]. In order to understand the temporal changes in Fe within the coastal environment we participated in a coastal ocean time series, at the UCLA Santa Monica Bay Observatory site, where we measured dissolved Fe concentrations.

We observed seasonal changes in both the Fe concentration and pattern of the Fe depth profile. In addition, there were several types of high Fe peaks which were consistently observed in the time series. All of these peaks followed temperature changes in depth. One of these types of peaks was located just below the thermocline, and correlated with lithogenic silicates. We hypothesize that this high Fe peak originates from the continental slope, and is derived from sedimentary Fe.

High Fe concentrations were also observed at depth, just above the sediment/water interface. This elevated Fe concentration followed an exponential trend, decreasing in concentration with increased height above the ocean floor. In addition, the rate of change in Fe concentration with height has a seasonal signal. Summer bottom water Fe concentrations have a greater rate of decrease with increasing altitude as compared to both winter and spring bottom water concentrations. We hypothesize that this trend is the result of Fe adsorption onto biologically derived particles, such as biogenic silicates, which were observed to be higher after the spring blooms and summer. Future work will include modelling the flux of Fe from the sediment over time.

[1] Martin *et al.* (1989) VERTEX: phytoplankton/iron studies in the Gulf of Alaska. *Deep-Sea Research* **36**(5), 649-680.
[2] Duce & Tindale (1991) Atmospheric transport of iron and its deposition in the ocean. *Limnology and Oceanography* **36**(8), 1715-1726. [3] Johnson *et al.* (1999) Continental-shelf sediment as a primary source of iron for coastal phytoplankton. *Nature*. **398**, 697-700.