Novel application of organic and inorganic geochemical proxies for exploring ocean-continent linkages over the last 1400 years from Gulf of Mexico sediment

J. RICHEY[1], D. HOLLANDER[1]*, T. EGLINTON[2] AND B. FLOWER[1]

[1]University of South Florida, College of Marine Science, St. Petersburg, FL 33710
(*correspondence: davidh@marine.usf.edu)
[2]Woods Hole Oceanographic Institution, Woods Hole, MA

We use a multi-proxy approach to explore the linkages between moisture balance in the Gulf of Mexico (GOM) and North American (NA) continental hydrology during the Late Holocene. The Pigmy Basin in the northern GOM is ideally situated to capture decadal-scale variability of both terrigenous inputs via the Mississippi River (MR), and sea surface variability in the GOM. This study focuses on the sedimentary record spanning the Little Ice Age (LIA) and Medieval Warm Period (MWP) (i.e. the last 1400 years) and utilizes both organic and inorganic geochemical analyses to define intervals of varying continental inputs and to assess changes in the moisture balance (E-P) in the GOM. Results indicate multi-decadal episodes of increased terrestrial inputs interpreted as increased MR discharge (wet intervals) that coincide with intervals of increased $\delta^{18}O$ seawater, interpreted as increased salinity. Episodes of decreased continental inputs (i.e. dry intervals) are associated with lower salinity in the GOM. Variations in atmospheric circulation, position and intensity of the Bermuda high, can provide a coherent mechanism that can control evaporative processes over the GOM and the amount of moisture transport to and precipitation over the NA continent. Through the development of a molecular ^{14}C chronology and dD record of terrestrial biomarkers, fundamental questions regarding the role of climate change on: 1) the age and export rate of continentally derived organic carbon to oceans and 2) the time-dependent regional patterns of precipitations in the MR basin on the NA continent will be discussed.

Carbonate burial, circulation and CO_2 release at terminations

R.E.M. RICKABY[1] AND H. ELDERFIELD[2]

[1]Department of Earth Sciences, Oxford University, Parks Road, Oxford, OX1 3PR, UK (rosr@earth.ox.ac.uk)
[2]Department of Earth Sciences, Cambridge University, Downing Street, Cambridge, CB2 3EQ, UK (he101@cam.ac.uk)

Whether the concentration of carbon dioxide (pCO_2) acts as a passenger or driver of glacial terminations remains unclear. Despite nearly three decades of research, an unchallenged explanation for the rise of 90 ppmv in atmospheric carbon dioxide (pCO_2) associated with each termination of the late Pleistocene remains elusive. Here we investigate changes in ocean ventilation (via benthic $\delta^{13}C$ in a high latitude North Atlantic core) and ocean alkalinity (via trace metals in benthic foraminifera from the Weddell Sea) to outline the evolving ocean carbon cycle during the deglacial release of CO_2.

We document three deglacial $\delta^{13}C$ minima in the intermediate depth North Atlantic, which builds the picture of a near-ubiquitous deglacial intermediate depth $\delta^{13}C$ minima, synchronous with the deglacial minimum in $\delta^{13}C$ of atmospheric CO_2, and pulses of CO_2 output to the atmosphere. Globally, intermediate depth $\delta^{13}C$ signatures converge to the same value at the start of the deglaciation. These observations appear characteristic of ventilation and flushing of a CO_2-laden isolated reservoir at depth. In addition to this flushing, alkalinity changes may contribute a major fraction of the deglacial pCO_2 rise. Our trace metal records from the Weddell Sea indicate a lower CO_3^{2-} during the deglacial terminations and peak interglacial warmth, relative to the coldest glacial periods. An increase in whole ocean alkalinity during the glacial period, is almost inevitable due to the near elimination of available shelf area for the burial of alkalinity by coral reefs. This increase can be reconciled with reconstructions of the depth of the glacial lysocline, if carbonate burial rates also increased *above* the lysocline as a result of enhanced pelagic calcification by foraminifera and coccolithophores. Should the pelagic burial rate of alkalinity in the more alkaline deepwaters of the glacial ocean outstrip the rate of weathering supply of alkalinity to the ocean towards the end of glacial maxima, the consequent whole ocean decrease in CO_3^{2-} could provide an orbital-independent mechanism to trigger the deglacial rise in pCO_2. The extreme interglacial periods with elevated pCO_2 may be exceptional events resulting from the rebounding deglacial imbalance in the carbonate system.