Geophysical Research Abstracts,
Vol. 11, EGU2009-11009-2, 2009
EGU General Assembly 2009

Phase relationships between surface- and deep-water records from the Southern Hemisphere, 0.35-1 Ma ago

P. Ferretti (1,2), H. Elderfield (1), S. Crowhurst (1), M. Greaves (1), and I.N. McCave (1)

(1) The Godwin Laboratory for Palaeoclimate Research, Department of Earth Sciences, University of Cambridge, United Kingdom, (2) Department of Stratigraphy, Paleontology and Marine Geosciences, Faculty of Geology, University of Barcelona, Spain (pferretti@ub.edu)

One of the most intriguing aspects of Pleistocene climate is the development of quasi-periodic (ca.100 kyr), high-amplitude glacial variability during the middle Pleistocene. A number of causes have been suggested for this Mid-Pleistocene Transition (MPT), but there is no consensus yet on this matter despite more than two decades of research. Most hypotheses invoke either a response to a long-term cooling, possibly induced by decreasing atmospheric pCO2, or changes in internal ice-sheet dynamics. Marine records from the North Atlantic and tropical-ocean upwelling regions have already provided support for the first hypothesis, documenting decreases of sea-surface temperatures (SSTs) during the MPT; in contrast, no discernible shift in SSTs has been identified in the Western Pacific Warm Pool. Little is known about how deep-water temperatures evolved during this climate transition, how deep-water temperatures correlated with the surface water variability and how temperature change is linked with the records of greenhouse gases and atmospheric temperature from EPICA Dome C.

Here we present records of Mg/Ca and stable isotopes measured in planktonic and benthic foraminifera over the time interval 0.35-1 Ma (Marine Isotope Stages 10-27) from a marine sediment core recovered in the mid-Southern latitudes (ODP Site 1123, Southwest Pacific Ocean). We have analysed three foraminiferal species: Globigerina bulloides, Globorotalia inflata and Uvigerina spp. to represent the upper sea-surface, the thermocline and the deep ocean respectively. The Mg/Ca-based temperature estimates allow us to test the hypothesis of a global cooling associated with the MPT in the Southern Hemisphere and, paired with the foraminiferal d18O record, derive the d18O of the water in which the foraminifer calcified, the latter of which combines a global glacioeustatic signal with local hydrographic effects.

Temperature estimates suggest that the long term average surface- and deep- water temperatures changed relatively little in the South-west Pacific through the interval analysed, with no systematic shift across the MPT. In addition, these results permit preliminary discussion of the magnitude of surface- and deep-water temperature changes during glacial/interglacial transitions and the interglacials themselves. The phase relationship between surface- and deep-water signals has been assessed; in particular, benthic Mg/Ca and planktonic Mg/Ca are almost in phase at eccentricity, tilt and precession, with a slight lead of the planktonics over the benthics. At the 100 kyr period, Mg/Ca leads d18O both in the planktonic and benthic records. Finally, the phasing of variations in the marine record will be considered with respect to other component of the climate system, and a comparison with greenhouse gases and atmospheric temperatures from EPICA Dome C will be attempted, after evaluation of methods for precise synchronization of these records.