Mollusc clumped isotope thermometry using a new approach

PRASANNA NAIDU K.1 and PROSENJIT GHOSH 2

1 (prasanna@ceas.iisc.ernet.in)
2 (pghosh@ceas.iisc.ernet.in)

We present a new approach of calibrating clumped isotope thermometry for mollusc. In our study we sampled growth bands from live mollusc specimens (Villorita cyprinoides var. cochinensis) collected from Cochin back water estuary in India. The growth bands represent seasonal carbonate deposition at different temperatures during a year. Simultaneous collection of water samples and co-existing carbonate allowed calculation of temperature using Epstein thermometry [1]. The temperature estimated using this approach showed seasonal range of 20° C to 42 °C.

The \( \Delta_{47} \) values are derived using the method described in Ghosh et al. 2006 [2] where heated gas equivalent together with carbonate standards (like NBS-19 and MAR J1) are analysed. The approach in producing this calibration curve varies from Henkes et al., 2013 [3] where bulk samples of mollusc species collected from natural marine setup across latitudes along with specimens grown under monitored conditions were analysed for \( \Delta_{47} \) using carbon dioxide equilibrium scale. Our relation obtained as a function of temperature (in kelvin) is

\[
\Delta_{47} = 0.055 \times 10^6 / T^2 + 0.02 \quad (r^2 = 0.8996),
\]

which matches well with the inorganic calcite precipitation curve. We are monitoring the similar specimens at laboratory condition at different temperatures to further evaluate the thermometry equation.


A first look at boron isotope based pCO2 values from the eastern Arabian Sea for the last 22 kyr

S. S. NAIK1*, P.D. NAIDU1, S. N. NAIK1 AND G. L. FOSTER2

1 CSIR-National Institute of Oceanography, Goa, India 403004 (*correspondence: sushant@nio.org)
2 Ocean and Earth Science, National Oceanography Centre Southampton, University of Southampton, SO14 3ZH, UK (Gavin.Foster@noc.soton.ac.uk)

The Arabian Sea is an unique region with semi-annual reversal of surface water circulation between southwest (SW) and northeast (NE) monsoons. The pCO2 in the Arabian Sea is always in excess of that in the atmosphere, and the EAS is found to serve as a significant source of carbon dioxide to the atmosphere [1]. However nothing was known up to today about the past pCO2 variations of the EAS.

We present here for the first time pCO2 values from the eastern Arabian Sea for the last 22 kyr. We have used planktonic foraminifera species Globigerinoides ruber (sensu stricto) from a sediment core AAS9/21, collected at 1807m water depth (14°30.539’N, 72°39.118’E). We have analysed boron isotopes on a MC-ICPMS at the University of Southampton, UK. pH and pCO2 were calculated from the boron isotopic values. Results show that pCO2 varied from ~200 to ~440ppmv during the study period. A comparison with atmospheric CO2 data from Antarctic ice core [2] suggest that the EAS seems to have fluctuated between a source and sink of atmospheric CO2 in the past, with significant excess (w.r.t. the atmosphere) during the deglaciation. Further comparison with western Arabian Sea (WAS) pCO2 values [3] for the similar period reveals that during most of the time the WAS pCO2 values were much higher as a result of intense upwelling which brings CO2-rich sub-surface waters to the surface. The large variations in pCO2 from the EAS are probably be due to a combination of physical processes such as moderate upwelling, influx of freshwaters from rain and rivers, and winter convective mixing processes.