Marine and terrestrial palaeoclimate proxies from the stable isotope analysis of North African molluscs

AMY L. PRENDERGAST[1], RHIANNON E. STEVENS[2], TAMSIN C. O'CONNELL[2], CHRISTOPHER HUNT[3] AND GRAEME BARKER[2]

[1]Department of Archaeology, University of Cambridge, Downing Street, Cambridge
[2]McDonald Institute for Archaeological Research, University of Cambridge, Downing Street, CB2 3ER
[3]Queens University Belfast, School of Geography, Archaeology and Palaeoecology, 42 Fitzwilliam Street, Belfast

Stable isotope analyses from the topshell *Osilinus turbinatus* and the pulmonate snail *Helix melanostoma* from the Haua Fteah, an archaeological site in North Africa have allowed the construction of paired marine and terrestrial climate curves that extend from c.20, 000 years ago to c. 7000 years ago. These analyses have been interpreted with reference to analogue studies on modern marine and terrestrial molluscs from Libya. In marine molluscs, $\delta^{18}O$ records fluctuations in sea surface temperature. In terrestrial molluscs, $\delta^{18}O$ varies according to the water ingested by the animal as the shell grows, which in turn is linked to water and air temperature at the moment of precipitation whilst $\delta^{13}C$ provides a proxy for palaeovegetation patterns and water stress. Intrashell stable isotope series from the Haua Fteah record snapshots of sub-seasonal climatic variations covering rapid and profound climatic fluctuations from MIS 2 to MIS 1. This high-resolution climatic framework coupled with the well-dated record of cultural change in the archaeological record, allows an examination of human-environment interactions during critical periods of late Pleistocene to early Holocene climate change.

Effects of ocean acidification in a supersaturated ocean (Carnian, Late Triassic)

N. PRETO[1], J. DAL CORSO[1] AND G. ROGHI[2]

[1]Dipartimento di Geoscienze, Iniversità degli Studi di Padova, via Gradenigo 6, 35131, Padova, Italy (*correspondence: nereo.preto@unipd.it)
[2]Istituto di Geoscienze e Georisorse, CNR, via Gradenigo 6, 35131, Padova, Italy

Ocean acidification triggered by recent anthropogenic emission of CO_2 is predicted to impact negatively on calcifying organisms. Here we present the response of lower Carnian shallow-water microbial carbonate platforms to an early-Late Triassic (~230 Myrs) episode of increased pCO_2. A negative carbon isotope excursion (CIE) of 2-4‰ was discovered in the lower Carnian (Upper Triassic) of the Dolomites (Southern Alps, Italy) which testifies for a rapid injection of light carbon in the atmosphere-ocean system linked to the eruption of Wrangellia large igneous province. The observed rise of the Carbonate Compensation Depth (CCD) in the deep-water succession and the crisis of shallow water carbonate systems [1] is best explained by an episode of ocean acidification triggered by increasing pCO_2.

Point-counting of calciturbidites and carbonate storm layers interbedded with the shales of the Carnian San Cassiano and Heiligkreuz formations show that carbonate grains with microbial origin are dominant below the CIE, but fall to less than 10% above, where skeletal grains and ooids become dominant. The turnover point coincides exactly with the CIE. It seems that ocean acidification favored metazoans and higher carbonate-secreting organisms over calcifying microbes. Thus, the Carnian case study seems a counter-example of today ocean acidification. However, Carnian seawater where microbes flourished was extremely supersaturated ('Neritan ocean' state [2]), and the effect of CO_2 injection in the system was probably just to drive supersaturation closer to present-day values. The Carnian case study demonstrates, at least at the short time-scale of the Carnian CIE, that the effects of ocean acidification can be strongly non-linear, and dependent on boundary conditions as the local saturation state of seawater with respect to carbonate.

[1] Rigo *et al*. (2007) *Palaeogeogr. Palaeocl. Palaeoecol.* **246**, 188–205. [2] Zeebe & Westbroeck (2003) **4**, *Geochem. Geophys. Geosyst.* **4**, doi: 10.1029/2003GC000538.