Geophysical Research Abstracts
Vol. 16, EGU2014-12590, 2014
EGU General Assembly 2014

Nanostructural detail in the multi-proxy geochemical signatures of foraminifera revealed by synchrotron X-rays

Simon Redfern (1), Oscar Branson (1), Elizabeth Read (1), Sambuddha Misra (1), Henry Elderfield (1), and Tolek Tyliszczak (2)

(1) Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge, CB2 3EQ, UK (satr@cam.ac.uk), (2) Advanced Light Source, Lawrence Berkeley National Laboratory, Berkeley, 94720, CA, USA

The spatial distribution and chemical (bonding) environment of key geochemical markers in foraminiferal calcite has been measured at the nanometre length scale using synchrotron X-ray microscopy methods, combined with X-ray spectroscopy. These techniques reveal the short-time-scale growth banding in the trace concentrations of key proxies including boron, magnesium and sodium. The results validate the use of Mg and B to reconstruct past temperature and simultaneous CO_2 changes and point to their simultaneous use together with the application of Na. Furthermore, they reveal the nature of ion transport during biomineralisation which explains the mechanisms of incorporation of these key proxies. Our data allow the development of a new model of trace element incorporation in foraminifera which explains the behaviour of all major proxy elements in terms of the physiology of calcification. Our further studies have also revealed the role of diagenetic overgrowth in modifying the geochemical signatures of foraminiferal shells. The results explain why foraminiferal multi-palaeoproxies work.