Ostracod Trace Element Proxies: More Complexity, Less Certainty

OSCAR BRANSON[1], SIMON REDFERN[1], SERGIO MOLINA[2], AURORA ELMORE[3] ANDHENRY ELDERFIELD[1]

[1]Department of Earth Sciences, University of Cambridge
[2]BESSY II, Helmholtz, Berlin
[3]Department of Geography, Durham University

Ostracods are a prominent source of freshwater [1,2] and marine [3] palaeoproxies. The Mg/Ca and Sr/Ca ratios of their 'calcitic' carapace are used as proxies for salinity and temperature. Recently, a number of uncertainties have been raised regarding several aspects of our understanding of these proxies: the hydrological processes ostracods are used to reconstruct, the biology of the ostracoda [4], and the effect of carbonate ion concentration on trace elements [5,6].

We focus on the biological complexity of ostracods, which has the potential to confound the interpretation of their trace elements. Ostracods are crustaceans, and are thus more biologically complex than the 'workhorse' of the palaeoproxy community: foraminifera. Particularly, the ostracod carapace is a complex, organo-mineral structure [7], which has been shown to contain amorphous calcium carbonate (rather than calcite) in other crustaceans [8]. We address a fundamental aspect of trace element incorporation in ostracods: the internal distribution, and elemental coordination of Mg, Na, S and Fe in the carapace.

We use Photo Emission Electron Microscopy (PEEM) to probe the distribution and coordination of trace elements in a *Krithe* ostracod carapace. This synchrotron X-ray spectroscopy technique allows the nano-scale analysis of specific elements within a structure, by targeting the binding energies of particular electron levels in the atom of interest. Although primarily designed for application in the materials and magentic sciences, we were able to adapt the technique to investigating carbonate biominerals, and demonstrate its potential in the field of palaeoproxy research.

This novel approach reveals a previously unobserved complexity in the incorporation of trace elements in the ostracod carapace, with significant implcations for the interpretation of ostracod palaeoproxies.

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