Benefits of Assessing Elemental and Isotopic Distributions in Marine Biominerals and Precipitates by LA-ICP-MS Imaging

R.W. HUTCHINSON[1], G. FOSTER[2], J.A. MILTON[2], C. STANDISH[2], R.M. SHERRELL[3], S. KO[3], C. PELEJERO[4], R. KOZDON[5], M. RITTNER[6], A. TOMS[1], M.P. FIELD[7].

[1]Elemental Scientific Lasers, Bozeman, MT, USA (rhutchinson@icpms.com)
[2]University of Southampton, National Oceanographic Centre, Southampton, U.K. (gavin.foster@noc.soton.ac.uk)
[3]Rutgers University, Dept. of Marine and Coastal Sciences, New Brunswick, NJ, USA (sherrell@marine.rutgers.edu)
[4]Institut de Ciències del Mar, CSIC, Barcelona, Catalonia. (carles.pelejero@icrea.cat)
[5]Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY. (rkozdon@ldeo.columbia.edu)
[6]TOFWERK, Thun, Switzerland. (m.rittner@tofwerk.com)
[7]Elemental Scientific, Omaha, NE, USA (field@icpms.com)

Previous approaches to spatial analysis of marine biominerals and precipitates such as shells, foraminefera, corals, marine carbonates and Mn-Fe nodules have focused on sequential spot ablations or slow line scan transects in order to maximise counting statistics for determination of accurate distributions of elements and isotopic/elemental ratios. This methodology is typically slow relative to sample area analysed, and results are rarely representative of the entire sample and heavily dependent on the region selected for analysis, typically based on a cursory visual or microscopic inspection.

Modern LA-ICP-MS instrumentation has achieved increases in performance and sensitivity via developments such as fast ablation chambers, the dual concentric injector (DCI), Jet interface and high-sensitivity cones. These improvements allow large-scale images to be constructed in reasonable analytical times and at higher resolution. The information yielded allows the researcher to assess whether any given data point is typical of the entire sample, e.g. an anomalous signal can be attributed to an inclusion or overall sample heterogeneity. Data from an entire region can be assessed as a mean value (e.g. summing of signals from a whole growth band in a marine carbonate) giving rise to improved counting statistics over the previous approach.

Here we give examples of the application of LA-ICP-MS to elemental imaging of deep sea Mn-Fe incrustations (LA-ICP-TOFMS), and to isotopic and elemental composition imaging of tropical and deep-sea corals.