

The use of time of flight ICP-MS and very fast washout, high repetition rate laser ablation to image marine bio-carbonates. Insights into the growth processes and environmental contamination.

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The advent of time of flight ICP-MS where the ion beam from a laser ablation plume is sampled significantly faster than the ablation rate of the laser has dramatically improved the precision of measurements as the ion signals are available without aliasing effects between elements. As sample cells of laser ablation systems have developed, the single shot signal times have reduced to only a couple of milliseconds and even sub-millisecond for some minerals and ablation conditions. To fully utilise this performance and obtain the highest resolution images, it is necessary to collect data (store ICP-MS spectra to disk) faster than the single shot washout time and ideally faster than the laser repetition rate.

A Teledyne Cetac Iridia laser ablation system was used with 3-5mm spots, ablating at 200-1000Hz. NIST glass calibration standards along with mounted and polished samples were imaged using parallel lines with a spot spacings of 0.1-2.5mm so multiple laser shots could be combined to form one pixel with improved signal to background. The laser patterns were generated as free drawn irregular shapes around the minerals which saved 20 to 40% of the time that would have been taken for a rectangular block of ablation lines. The patterns included calibrations and bio-carbonates defined in one list and the running of the lines were then completely automated from the ICP-MS software.

A Nu Instruments Vitesse ICP-TOF-MS was used and this work will demonstrate a unique ability to store spectra to disk faster than the laser ablation rate, providing the ability to characterise each laser shot. The data integration and exact positioning of each pixel via hardware signals and software control of the laser patterns will be discussed along with the ability of the Vitesse's Nu Quant data reduction software to process the mass spectra in real time, displaying a live fully calibrated image to track the ablation whilst at the same time exporting data line by line for further reduction in the other 3rd party software packages software.

A range of marine bio-carbonates will be shown including tropical and cold-water corals, foraminifera and otoliths.

