

Trace elements in mollusc shells and benthic foraminifera

HANNA L. BROOKS¹, ALICIA M. CRUZ-URIBE¹, JOSHUA S. STONE¹

¹School of Earth and Climate Sciences, University of Maine, Orono, ME

hanna.brooks@maine.edu

Throughout the course of an organism's life, the chemical signatures of environment, food consumption, and weather are recorded into their carbonate structures; these signatures can be directly linked to a time-resolved lifespan. Here we present trace element data from benthic foraminifera and tropical molluscs determined using an ESI NWR193^{UC} excimer laser coupled with an Agilent 8900 triple quadrupole mass spectrometer in the MicroAnalytical Geochemistry and Isotope Characterization (MAGIC) Laboratory at the University of Maine. Benthic foraminifera are protists that live on the sea floor and produce calcite shells, progressively adding chambers. Changes in Mg/Ca in foraminifera are used as a proxy for ocean temperature. Laser ablation ICP-MS data for 18 trace elements were collected in individual growth chambers in foraminifera of the genus *Uvigerina* from the Bay of Plenty. Line scans were performed within thin (~10 µm) chamber walls using a spot size of 8 µm, beam energy density of 3 J/cm², repetition rate of 12 Hz, and scan speeds of 2-3 µm/s. Concentrations were determined relative to the NIST610 glass. Ratios of Mg/Ca and other trace elements record the same range of values as those determined via bulk wet chemistry analysis of ~10 foraminifera for a given population, which suggests that LA-ICP-MS may be a viable alternative to wet chemistry.

Trace element data were collected across shells of the warm-tropical mollusc species *Chione subrugosa* from the Ostra Base Camp area, Peru (78°37'22"W, 8°54'46"S). Previous studies of the area have suggested that a large climate transition occurred, transforming a warm water tropical bay into a desert surrounded by a coastal stand with cool waters. This area was occupied by humans at 6250-5450 radiocarbon years BP. This study examines *Chione subrugosa*, which were found in the living position at the fossilized Ostra Beach and are thought to have been the final living warm-tropical molluscs in the bay. Studies of modern molluscs have revealed that molluscs record massive climatic changes, such as El Niño, in their chemistry. Laser ablation provides a unique opportunity to examine chemical changes directly related to the changing coastal environment. Line scans transverse growth bands along the length of the shell, providing a high resolution record of daily variation in trace element chemistry over the lifespan of the mollusc. Eleven elements were analysed with a beam energy density of 2.4 J/cm², repetition rate of 15 Hz, spot size of 5 x 25 µm, and a scan speed of 5 µm/s. Preliminary data suggest the preservation of yearly oscillations in trace elements, with high concentrations of La, Ce, U, and Pb during early shell growth. Continued study will examine catastrophic mollusc life events in an effort to link these with environmental climate changes over daily timescales.