

Intra-test heterogeneity in trace element composition of *Amphistegina lessonii* as proxy of ambient seawater temperature and tidal height

SONAL KHANOLKAR¹, RALF SCHIEBEL¹, ASMITA SINGH², PRATUL KUMAR SARASWATI², KLAUS PETER JOCHUM¹, ULRIKE WEIS¹, BRIGITTE STOLL¹ AND GERALD H. HAUG^{1,3}

¹Max Planck Institute for Chemistry

²Indian Institute of Technology Bombay

³ETH Zurich

Presenting Author: sonal.khanolkar@mpic.de

Amphistegina is a larger benthic foraminifer (LBF) commonly found within the modern coral reefs, and a major contributor to the CaCO₃ budget of shallow marine environments. As the family Amphisteginidae occurs through the Cenozoic, the potential as an archive for paleoclimate reconstruction is explored. We analyzed adult microspheric specimens of *Amphistegina lessonii* collected in September 2003, November 2003, January 2004, and March 2004, from ~2 meters water depth in the coral reefs of Akajima, Okinawa, Japan. The intra-test variability in trace elements of *A. lessonii* was investigated using femtosecond-laser ablation-inductively coupled plasma-mass spectrometry (fs-LA-ICP-MS) of the nine specimens from the outermost to innermost chamber. Tests of *A. lessonii* were analyzed for Mg/Ca, Na/Ca, and Sr/Ca along the septa to observe Test Size-Lifespan relationships. The lifespan of a specimen of *A. lessonii* of 1200 µm in diameter is estimated at ~3 months and ~2 months for specimens 900 µm in size. Over the estimated lifespans, Mg/Ca of individual specimens of *A. lessonii* is highly variable and displays co-variation with temperature and tidal height. High tides may increase sediment re-suspension and light attenuation thus leading to high Mg/Ca values within the calcareous shell of *A. lessonii*, analogous to similar mechanisms described for the symbiont-bearing planktic foraminifers. Na/Ca and Sr/Ca show no correlation or covariation with tidal height or temperature. A significant correlation between Mg/Ca and sea surface temperature can be described by the equation $\text{Mg/Ca (mmol/mol)} = 25.904 e^{0.0172T} \pm 1.31$ ($R^2 = 0.78$, $p < 0.05$) (Khanolkar et al., 2021). Future projects may apply and further develop this approach for the reconstruction of the tropical shallow marine paleoenvironments.

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