Paleoceanographic utility and calcification mechanisms of Stylasterid corals

IVO G. STRAWSON[1], ANA SAMPERIZ[1,2], JOSEPH A. STEWART[1], LAURA F. ROBINSON[1], MELANIE J. LENG[3], RUSSELL D. DAY[4,5]

[1] School of Earth Sci., Univ. of Bristol, Bristol, BS8 1RJ
ivo.strawson@bristol.ac.uk

[2] School of Earth & Ocean Sci., Cardiff University, CF10 3AT

[3] National Environmental Isotope Facility, Bristish Geological Survey, Nottingham, NG12 5GG

[4] NIST, Charleston, SC 29412

[5] MANTA, Charleston, SC 29412

The geochemistry of deep-sea corals (DSCs) provides unique paleoceanographic insight into the carbon content and temperature of sub-surface waters. However, before robust proxy information can be attained species-specific "vital effects" must be quantified using modern environmental parameters. Stylasterids are a diverse and cosmopolitan family of DSC that accrete their carbonate skeleton using either calcite or aragonite. Despite their wide spatial and bathymetric distribution, the calcification mechanisms and potential of stylasterids as paleoceanographic archives remains largely unexplored.

Here, we assess the proxy potential of stylasterids as recorders of seawater temperature and pH, using a global distribution of wild specimens (both aragonitic and calcitic genera) from a range of hydrographic conditions (spanning 17°C and 0.3 pH units). We present new trace metal, $\delta^{11}B$, $\delta^{18}O$ and $\delta^{13}C$ data to test the applicability of temperature (Sr/Ca, Li/Mg and $\delta^{18}O$) and pH ($\delta^{11}B$) proxies. We further use these data to infer aspects of stylasterid biocalcification mechanisms and to assess vulnerability of this group to ocean acidification. Our results support the use of Li/Mg and $\delta^{18}O$ as robust proxies for temperature in aragonitic specimens. Importantly, $\delta^{18}O$ results show significantly less internal variation than for DSC scleractinia, while Li/Mg ratios are comparable to previous studies on aragonite corals. Boron isotope data suggest that stylasterids are unable to strongly modify pH at the site of calcification (*c.f.* pH-upregulation in scleractinia) leaving these organisms potentially at high risk from future ocean acidification.