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# Environmental controls and growth effects on trace element composition of coral aragonite: Application of paleothermometry proxies in Fijian massive *Porites* spp.

**ANA SAMPERIZ**[1], SINDIA SOSDIAN[2], ELEANOR H JOHN[2], ERICA HENDY[3], KENNETH G JOHNSON[4] AND STACY JUPITER[5]

[1]Cardiff University, School of Earth and Environmental Sciences
[2]Cardiff University
[3]University of Bristol
[4]Natural History Museum
[5]Wildlife Conservation Society Fiji

Presenting Author: samperizvizcainoa@cardiff.ac.uk

Paleotemperature proxies such as measurements of the ratio of certain trace elements to Ca (El/Ca) in the coral skeleton offer an opportunity to resolve seawater surface temperature (SST) at sub-seasonal resolution; however, differences in mean composition and temperature sensitivity have been found in different regions and environments, attributed to “vital effects”. These “vital effects” can be originated by coral physiological processes during biomineralization affecting the trace element partioning beyond the environmental signal. Therefore, the robustness and applicability of the El/Ca proxies for reconstructing SST depends on resolving the source of “vital effects”.

In this study, we successfully use a multi-proxy approach to explore the links behind skeletogenesis and environmental controls on El/Ca incorporation into coral aragonite. We investigate the variability of coral Sr/Ca, Mg/Ca, Li/Ca and U/Ca and their correlation with skeletal density, seawater temperature and turbidity. Furthermore we explore their robustness as SST-proxy in the South-West Pacific. Six massive *Porites* spp. coral cores were collected at four different inshore reefs in Viti Levu (Fiji) in 2017. We generated monthly resolved El/Ca timeseries covering a period from 2001 to 2017 using Laser Ablation (LA) – ICPMS. Geochemical data was coupled to skeletal density data obtained through Computed Tomography (CT). Sr/Ca, Mg/Ca, Li/Mg and U/Ca across all sites were correlated with density, and following a co-variability expected under Rayleigh fractionation. Sensitivity to SST variability differed across El/Ca proxies, although Sr/Ca was consistently the most sensitive proxy for SST. Results showed that SST proxies in Fiji are influenced by an interplay between SST, $Ca^{2+}$ pumping and Rayleigh fractionation, and skeletal density. Furthermore, we show how differences in skeletogenesis and aragonite precipitation across reefs is associated with local environmental conditions (i.e., seawater turbidity), and as such this variable is impacting El/Ca in this region complicating the acquisition of SST records.