

Are bleaching events recorded in coral skeletons? Insights from *Porites* sp. of Lizard Island, Australia

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Environmental perturbations such as heatwaves can lead to coral mass bleaching events and the death of corals affected by bleaching. As a result, these events' increasing number, duration, and earlier annual onset threaten tropical reef ecosystems and emphasise the need to investigate coral bleaching in detail. Studying past hyperthermal events is important to estimate the future capacity of tropical coral reefs to cope with marine heatwave-derived bleaching events. We need a reliable proxy for bleaching events in the coral skeleton to understand the frequency of mass bleaching episodes over geological time.

For a meaningful environmental reconstruction using coral skeletons, understanding the three-dimensional internal structure is as important as the two-dimensional distribution of chemical parameters of the chosen skeletal section.

To address these related issues, we investigate the growth and geochemical signals in the skeleton of massive corals (*Porites* sp.) from Lizard Island (Great Barrier Reef, Australia) in correlation with known bleaching events. The coral skeleton samples, collected in 2022 and 2024, were scanned using micro-Computed Tomography (μ -CT), Laser Ablation-Inductively Coupled Mass Spectrometry (LA-ICPMS), fluorescence imaging, and Confocal Raman Microscopy (CRM).

Using μ -CT, we have reconstructed the three-dimensional internal density structure. We will present growth rates and their lateral uncertainties of the skeletal volumes in relation to the bleaching events. Furthermore, we compare growth models based on skeletal density, geochemical temperature proxy results and skeleton fluorescence and show their reliability in generating accurate age models.

In a subset of samples, we find a disagreement between μ -CT and LA-ICPMS data. In addition, the well-established Sr/Ca thermometer shows a different cyclicity than the Li/Mg signal. The influence of calcification on these temperature proxies will be discussed and a strategy to overcome this disagreement will be presented.

The importance of calcification for a bleaching proxy will be shown by comparing the skeletal growth rate with different

element-to-calcium ratios and the aragonite saturation state of the calcifying fluid (Ω_{Ar}) derived from CRM. Initial results indicate a reduced growth rate after years of coral mass bleaching events and a reduction of Ω_{Ar} .

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