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A 50-Year Record of Calcifying Fluid pH in *Porites lobata* from Lanyu, Taiwan: Implications for Seawater pH Reconstruction

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Massive coral *Porites lobata* is considered an excellent geological archive for recording environmental conditions in its aragonitic skeleton. Among the various proxy tools that have been calibrated and applied, boron isotopes ($\delta^{11}B$) and B/Ca ratios in *Porites* corals are thought to reflect the coral's calcifying fluid pH (pH_{CF}). While the extent to which these proxies can reconstruct seawater pH (pH_{SW}) and carbonate chemistry remains uncertain, their potential for such reconstructions continues to be a major focus of research, as reconstructed pH_{CF} remains sensitive to environmental pH changes. Here, we present seasonally resolved records of $\delta^{11}B$ and B/Ca ratios over 1975 – 1986, and 2006 – 2021 from coral collected from Lanyu, Taiwan. Our aim is to provide long-term, high temporal-resolution records to assess coral-based pH_{SW} and carbonate chemistry.

The records reveal clear seasonal variations in both $\delta^{11}B$ and B/Ca ratios. A significant decline in pH_{CF} is also observed, with an accelerated decrease after 2010. The estimated pH decline over the past 50 years in Lanyu is approximately 0.017 pH units per decade, aligning with model estimations. The positive correlation between $\delta^{11}B$ and B/Ca ratios resulted in a consistent value of calcifying fluid carbonate ion concentration ($[CO_3^{2-}]$), and a slight increase in calcifying fluid dissolved inorganic carbon (DIC_{CF}) over these two time periods. By comparing our results with published *Porites lobata* records, discrete water measurements, and satellite-derived sea surface temperature (SST) and pH_{SW}, we find that habitat temperature differences primarily explain the observed pH offsets between pH_{CF} and pH_{SW}. However, these comparisons also suggest that long-term warming has a limited effect on the sensitivity of pH_{CF} to pH_{SW}. Further compilations of pH_{CF} data from different geographic regions will help to constrain pH_{CF} variability in *Porites* corals in response to pH_{SW} changes.