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Controls on Ba/Ca in shallow-water corals: new insights from coral stable Ba isotopes

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The ratio of barium (Ba) to calcium (Ca) in coral skeletons (Ba/Ca) has been widely as a proxy for dissolved Ba concentrations in seawater. However, due to large inconsistencies in the partition coefficient of D_{Ba} ($Ba/Ca_{coral}/Ba/Ca_{seawater}$), its reliability as a quantitative proxy is under debate. In this study, we present a monthly resolved Ba/Ca, Li/Ca, Sr/Ca, U/Ca and $\delta^{138}Ba$ record of a *Porites sp.* coral from the Xisha Islands of the South China Sea. Our results show that coral Ba/Ca exhibits a clear seasonality in phase with Li/Ca, Sr/Ca and U/Ca, which are inversely correlated with sea surface temperature. The temporal changes in seawater Ba contents are likely not the main driver for the Ba/Ca fluctuations in this study, as demonstrated by the paired coral Ba isotope composition measurements ($\delta^{138}Ba$), which show invariant values (0.39 ± 0.05, 2SD) over a four-year record. The strong correlation between Ba/Ca and other temperature sensitive tracers (e.g., Sr/Ca) thus suggests that coral Ba/Ca signals are driven by both sea surface temperature and dissolved Ba concentrations. This highlights the importance of removing the temperature signal in coral Ba/Ca records to reconstruct the evolution of Ba concentrations in surface seawater. In addition, coral stable Ba isotope signatures provide new insights into interpretations of Ba/Ca records and show great potential to complement and ground truth the coral Ba/Ca proxy.