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Investigating the chronic effects of ocean acidification on *Porites sp.* coral calcifying fluid Ω_{Ar} through Raman spectroscopy

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Characterizing the aragonite saturation state (Ω_{Ar}) of coral calcifying fluid represents an essential step in deciphering if, and to what extent, coral calcification responds to ocean acidification. Although quantifying calcifying fluid Ω_{Ar} is critical for understanding and documenting the physicochemical constraints on coral calcification, doing so has proved challenging due to the fluid's small size and isolation beneath living tissue. Raman spectroscopy is a unique technique for testing the sensitivity of coral calcifying fluid Ω_{Ar} to ocean acidification due to its high sensitivity to the Ω_{Ar} at which aragonite crystals were formed. The v_1 peak found in the Raman spectrum of $CaCO_3$ represents the vibrations between the C and O of carbonate, and the width of this peak indicates the level of disorder in the crystals. Since crystals formed at higher Ω_{Ar} invariably have greater disorder, Raman spectral analysis can be used as a proxy of Ω_{Ar} at which crystals formed. To date, no study has explicitly tested if ocean acidification—via its effects on coral calcifying fluid Ω_{Ar}—has reduced the calcification rates of corals living in the wild. This project will leverage novel Raman spectroscopy techniques to test—for the first time—if coral calcifying fluid Ω_{Ar} has declined in corals across the tropics over the past century. Raman measurements will be conducted at micron-scale resolution, representing ~daily growth, down the length of three *Porites sp.* cores taken from the Coral Sea, the Red Sea and the South China Sea dating back to the early 19th century. Results of this long-term observation of calcifying fluid Ω_{Ar} will validate previous estimates from numerical models and laboratory studies. Such results will bridge a gap between field and lab studies, revealing whether the implications of ocean acidification on calcifying fluid Ω_{Ar} represent what has manifested *in-situ.*