Investigating the viability of coral species *Dipsastraea speciosa* and *Hydnophora microconos* as reliable archives of central tropical Pacific climate change using Sr/Ca and $\delta^{18}O$

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Introduction

- The central tropical Pacific exerts a strong global influence on interannual climate variability through the El Niño-Southern Oscillation (Fig. 1); yet it is unclear how much this region has warmed or freshened due to anthropogenic climate change.
- To extend the climate record in this region, studies use geochemistry from high-resolution records, which predominantly rely on *Porites* corals (Sadler et al. 2014).
- However, *Porites* corals are not always abundant in time and space, making it challenging to create a continuous record of sea surface temperature (SST) and sea surface salinity (SSS) to before the industrial era.

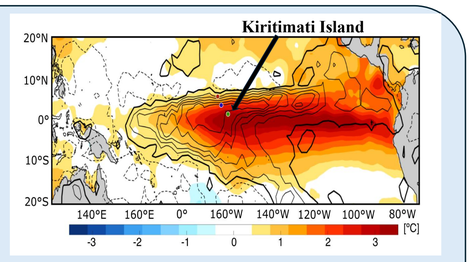


Figure 1. Temperature and precipitation anomalies during the 2015/16 El Niño event (Grothe et al., 2020)

Research Questions and Previous Work

- **Question**: Can *Dipsastraea Speciosa* (DS) and *Hydnophora Microconos* (HM) corals (Fig. 2) record climate through Sr/Ca and $\delta^{18}O$ values, supplementing the *Porites* record?
- **Previous work**: Initial $\delta^{18}O$ timeseries supports the viability of DS and HM corals for paleoclimate (Figure 3) (Grothe, AGU OS 2024)

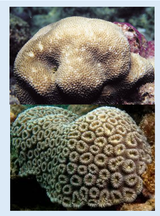


Figure 2: Photographs of living HM (top) and DS (bottom)

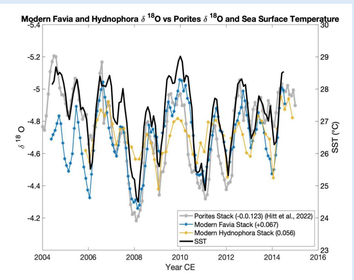


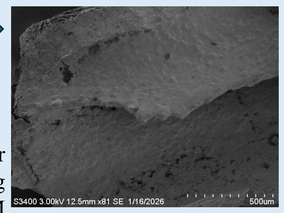
Figure 3: Averaged $\delta^{18}O$ values for *Porites*, *Hydnophora microconos* , and *Dipsastraea* (previously Favia) corals compared to SST data

Methods

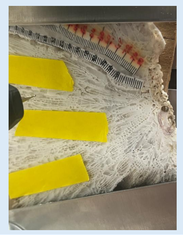
Drill modern corals off the reef

Slab coral to expose growth axes for sampling

Screen corals for diagenesis using SEM



Drill sample along thecal wall for monthly resolution



Analyze samples for Sr/Ca using ICP-OES

Analyze results

Dipsastraea speciosa

- Tested two modern corals, X14-2 and X13-5
- Looked at reproducibility within each coral (Fig. 4a and 4b) and across both corals (Fig. 4c)
- Sr/Ca timeseries are reproducible and track changes in SST while recording the 2009/2010 El Niño event

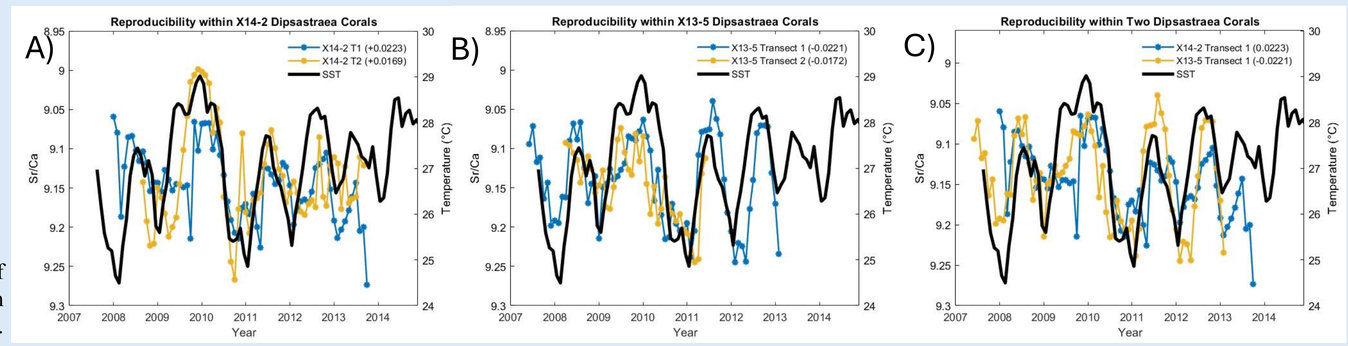


Figure 4: Sr/Ca for Dipsastraea Speciosa corals. A) both transects (T1 and T2) of coral X14-2. B) both transects (T1 and T2) of coral X13-5. C) Transect 1 of both corals X14-2 and X13-5. Offsets of all corals are stated in the figure legend.

Hydnophora microconos

- Tested two modern corals, X15-8-1 and X15-35-1
- Looked at reproducibility within each coral (Fig. 5a and 5b) and across both corals (Fig. 5c)
- Sr/Ca timeseries are reproducible and track changes in SST while recording the 2009/2010 El Niño event

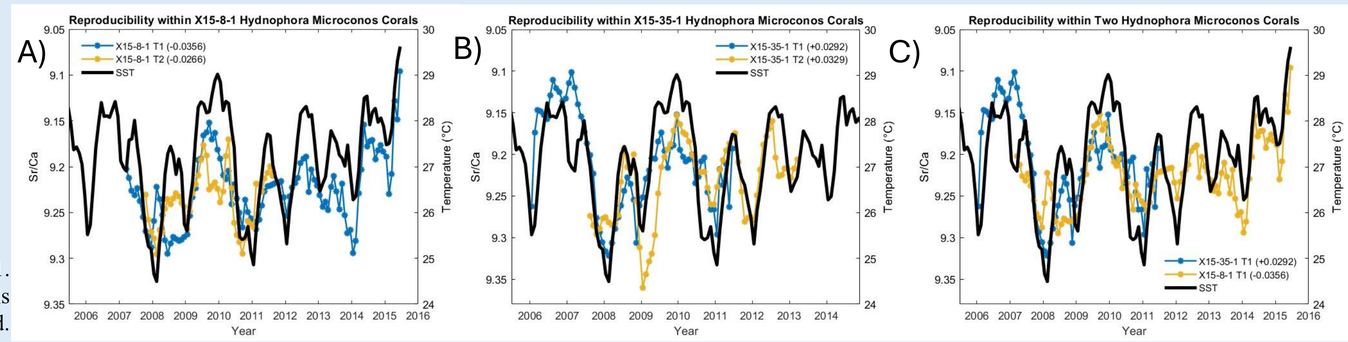


Figure 5: Sr/Ca for HM corals. A) both transects (T1 and T2) of coral X15-8-1. B) both transects (T1 and T2) of coral X15-35-1. C) Transect 1 of both corals X15-35-1 and X15-8-1. Offsets of all corals are stated in figure legend.

Reproducibility Between Coral Species

- Sr/Ca and $\delta^{18}O$ for both species of coral closely match SST data, supporting the reliability of the proxy data
- Averaging both transects of each coral species (Fig. 6) reduces noise in the data, providing more reliable results

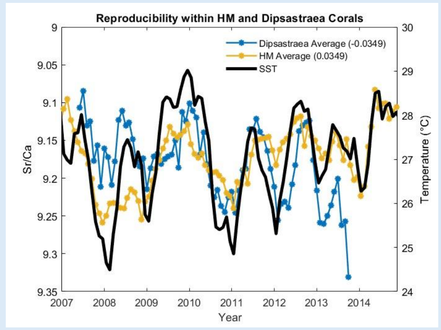


Figure 6: Averaged Sr/Ca data (from the two transects) for DS (X14-2 and X13-5) and HM (X15-8-1 and X15-35-1) compared to SST data.

Paired Sr/Ca and $\delta^{18}O$

- Paired Sr/Ca and $\delta^{18}O$ data collected at the same sampling site (T1) for both DS (Fig. 7a) and HM (Fig. 7b)
- Good reproducibility between isotopes

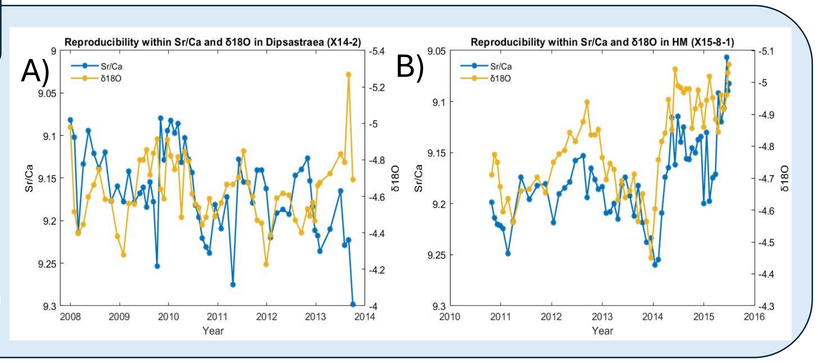


Figure 7: Paired Sr/Ca and $\delta^{18}O$ for A) DS X14-2. B) HM 15-8-1.

Future Questions

- Correlate HM and DS $\delta^{18}O_{sw}$ with SSS instrumental records
- Test emerging SST reconstruction methods, such as Sr-U thermometry
- Apply methods with fossil record, see abstract CC24G – 1096 (Poster 1096) A. Lord

Significance

- Alternative coral species to *Porites* may prove useful in extending the climate record back to before the industrial era and over the last millennium by opening a vast archive of untapped records
- This work will aid in creating a 200-year-long continuous reconstruction of SST and SSS in the central tropical Pacific, allowing us to constrain total warming and freshening in this region from anthropogenic climate change

References

1. Sadler J, Webb GE, Nothdurft LD, Dechnik B. 2014. Geochemistry-based coral palaeoclimate studies and the potential of 'non-traditional' (non-massive *Porites*) corals: Recent developments and future progression. Earth-Science Reviews. 139:291–316 [accessed 2025 Dec 3] https://doi.org/10.1016/j.earscirev.2014.10.002
2. Grothe PR et al. 2020. Enhanced El Niño–Southern Oscillation Variability in Recent Decades. Geophysical Research Letters. 47(7):e2019GL083906 [accessed 2025 Dec 3] https://doi.org/10.1029/2019GL083906