SEDIMENTOLOGICAL IMPACTS OF INIMICAL WATERS ON SHALLOW MARINE PLATFORMS: A GEOCHEMICAL PERSPECTIVE

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PROJECT OBJECTIVES

- Isolate geochemical signatures of coral fragments, crustose coralline algae (CCA), and surrounding sediments.
- Quantify geochemical signatures including; $\delta^{13}C_{carb}$, $\delta^{18}O$, $\delta^{13}C_{org}$, $\delta^{15}N_{org}$, total organic carbon (TOC), total nitrogen, concentrations of phosphorus, trace metals, and rare earth elements.
- Assess covariation between $\delta^{13}C_{carb}$ and $\delta^{13}C_{org}$ in reef rimmed settings.
- Discuss the impact of inimical water formation on the sedimentology, geochemistry, and margin development of shallow marine carbonates.

PROJECT RATIONALE

The formation of colder winter waters ('inimical waters' *sensu* Ginsburg & Shinn, 1964; Schlager, 1981) has recently been interpreted to exert an influence on the sedimentology of shallow carbonate environments in the subtropics (Purkis et al., 2019). Sedimentological and geochemical analyses of the surface sediments on Great Bahama Bank (Reijmer et al., 2009; Swart et al., 2009; Oehlert et al., 2012) have characterized sediments produced in a subtropical setting that is influenced by inimical waters in the winter months. In contrast, similar efforts to characterize tropical, reef-rimmed platforms that are not influenced by inimical winter waters have yet to be conducted. In this study, geochemical analyses, including stable isotopes and trace element concentrations, will be conducted and integrated with sedimentological evaluations conducted previously on surface sediments from Fakarava and Rangiroa, two reef rimmed atolls in the Tuamotu Archipelago in French Polynesia. These results will be compared to published studies of Great Bahama Bank and interpreted as two endmembers in a gradient of inimical water formation and platform top sedimentology.

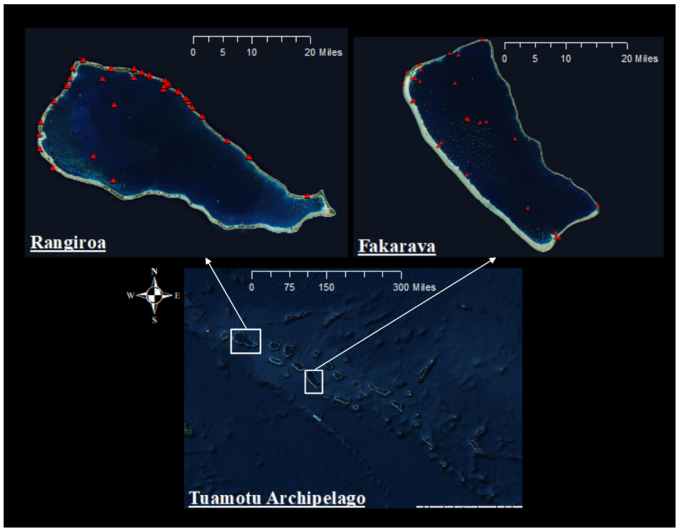

Figure 1: Study sites, Rangiroa and Fakarava, Tuamotu Archipelago. Red triangles denote sediment sampling sites.

APPROACH

To identify the geochemical signatures of sedimentary components of two atolls in the Tuamotu Archipelago, Fakarava and Rangiroa. Surface sediments for both atolls, collected by the Living Oceans Foundation (Fig. 1), will be separated into bulk sediment, coral fragments, and CCA. Each subset will be analyzed for $\delta^{13}C_{carb}$, $\delta^{18}O$, $\delta^{13}C_{org}$, and $\delta^{15}N_{org}$ values, as well as trace and rare earth element concentrations.

SIGNIFICANCE

Inimical waters are created when water masses atop shallow platforms are chilled during winter months in the subtropics, conditions that have been interpreted to promote enhanced mud formation on Great Bahama Bank (Purkis et al., 2019). Previous researchers have noted the negative impact that inimical waters can have on the development of coral reefs (Ginsburg and Shinn, 1964; Schlager 1981, Purkis et al., 2014), using this observation as evidence for limited reef development outside of the modern tropics. Given this duality, it is plausible that inimical waters play an important role in driving the style of sedimentation, and thus style of platform, that develops through geological time. If this observation is applicable to the geological record, it has implications for the distribution and interpretation of geochemical signatures in sediments from deeper, coral-reef rimmed platforms compared to those formed in shallower, open-margin platform settings.

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