EXPLORING SIGNATURES OF DIAGENESIS USING ROLLING WINDOW REGRESSION

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PROJECT OBJECTIVES

- Analyze trace metals and REE concentrations in Clino, San Salvador, and Enewetak cores.
- Examine zones of diagenetic alteration and diagenetic surfaces using Rolling Window Regression Analysis.
- Expand characterization of geochemical signatures unique to specific diagenetic processes in marine carbonates.
- Evaluate impacts of oceanography, sea level, and climate on diagenetic zones.

PROJECT RATIONALE

Recently, Rolling Window Regression (RWR) analysis was demonstrated as a useful tool for characterizing the type of diagenetic alteration a deposit has undergone (Oehlert and Swart, 2019) (Fig. 1). Significant RWR signatures were associated with subaerial exposure surfaces, periods of non-deposition, and the formation of marine hardgrounds (Table 1). However, diagnostic RWR signatures unique to each type of diagenetic process have yet to be characterized.

Therefore, this project has two goals: 1) to determine if these RWR signatures are applicable to other shallow marine settings by applying the RWR analysis to cores from Enewetak atoll in the Pacific Ocean, and 2) to expand the range of geochemical signatures used in RWR to provide additional constraints in an effort to elucidate diagnostic RWR signatures for each diagenetic process.

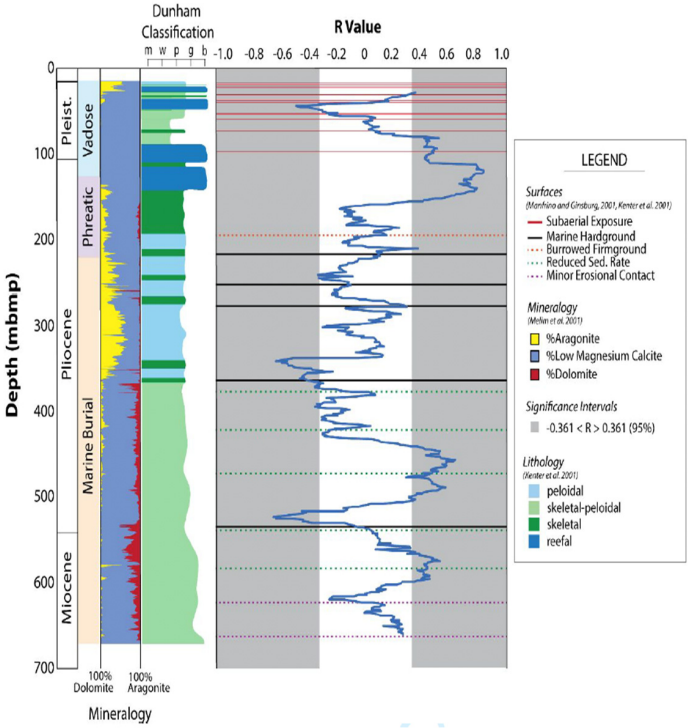

Figure 1: Rolling window regression analysis (30 m window) from the Clino core. From Oehlert and Swart, 2019.

APPROACH

In order to address these goals, we will analyze the stable isotope composition and trace element concentrations of a core from the Enewetak atoll, the trace element concentrations of sediments at Clino and San Salvador, and incorporate published records of stable isotopes (Melim et al., 2001; Dawans and Swart, 1988) to provide high resolution geochemical records for RWR analysis. Then, a systematic evaluation of diagenetic alteration in both the Atlantic Ocean and Pacific Ocean will be conducted to determine if diagnostic RWR signatures can be developed for unique diagenetic processes.

Table 1. Hypothetical relationships between stable carbon and oxygen isotope shifts in marine carbonates from Clino, their RWR correlation coefficients, sedimentological and diagenetic processes and their interpretation in the geological record.

Interpretation	Sedimentology	Diagenesis	RWR correlation	$\delta^{13}C$ shift	$\delta^{18}O$ shift
Marine hardground		Sulphate reduction	Negative	–	+
Marine hardground		Marine cementation	Positive	+	+
Subaerial exposure		FW diagenesis	Positive	–	–
Subaerial exposure		FW diagenesis	Negative	–	+
Aggradation/low stand	Facies change		Positive	–	–
Progradation	Facies change		Positive	+	+

SIGNIFICANCE

RWR analysis of geochemical records from carbonate sediments will be a powerful tool in understanding diagenesis in marine carbonates if diagnostic RWR signatures can be developed for each diagenetic process (*ie* short-term subaerial exposure vs long-term subaerial exposure).

REFERENCES

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