SLOPE DIAGENESIS IN A WARM OCEAN

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PROJECT OBJECTIVE

- Analyze slope carbonates from the Gulf of Aqaba, with the goal of revealing what organic and inorganic mechanisms are at play to stabilize and bind sediments in this location.
- Determine the role of microbial cements on the stability of the slope.

PROJECT RATIONALE

The Gulf of Aqaba is located along the African and Arabian margins and is unique because it is a part of the youngest actively rifting marine basin on Earth. Previous research conducted in this area has revealed the presence of several biologically complex brine pool ecosystems, as well as large evaporite deposits that are Miocene in age (Purkis et al., 2002). Another unique feature of the Gulf of Aqaba is that unlike most modern ocean basins, temperatures do not significantly decrease with depth. The temperatures in the Gulf of Aqaba are above 21°Celsius, even at depths of 1700 meters. Interestingly, the oceans of the Cretaceous did not experience thermohaline circulation, leading them to be relatively warm at extremely deep portions of the ocean. As such, there is potential for the slopes of the Gulf of Aqaba to be a proxy for what slopes were constructed of in the Cretaceous.

SAMPLE SET

We plan to analyze a total of 30 samples that were collected by the ROV Neptune, deployed on research cruises in 2020 and 2022, in the Gulf of Aqaba and surrounding areas. The samples were collected from different depths from 0 to 700 meters. The samples vary extensively with depth; at shallower depth they are encrusted by a diversity of brightly colored fauna, while deeper samples have a darkened exterior due to manganese and iron staining. In addition, there are textural differences. Samples from deeper areas along the transects are better sorted and finer grained than those along shallower portions of the transect. Porosity and texture vary significantly within samples collected at

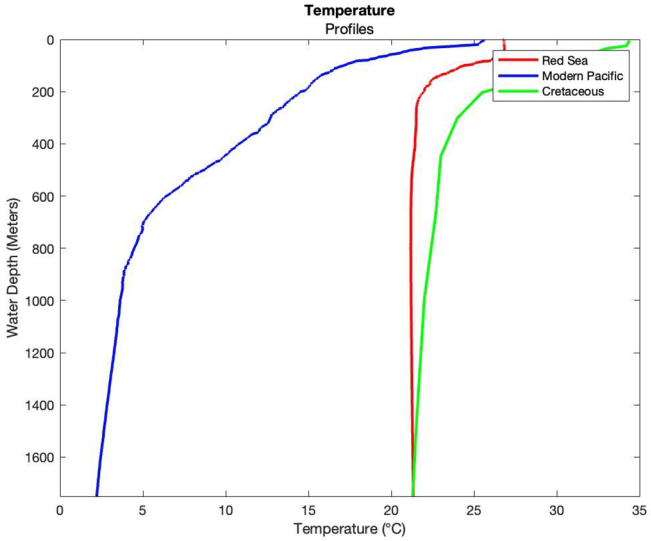

Figure 1: Temperature profile of the Red Sea, Modern Pacific and the Cretaceous. The Red Sea profile is unusual as it remains of warm temperature to great depth. As such it is similar to what is believed the Cretaceous ocean profile.

different depths, with some samples showing more evidence of biological activity and cementation.

Approach and Methodology

The slope samples of the Gulf of Aqaba will be studied regarding their composition and how sediments are bound and cemented. Visual inspection and description of the samples will be followed by the analysis of thin sections under a petrographic microscope to determine the grain composition and diagenetic alterations. Several samples display abundant microbially induced cementation. Characterization of microbes associated to the evolution of cements will be carried out using SEM analysis (Diaz and Eberli, 2022).

Figure 2: Hand sample of the slope from the Gulf of Aqaba with abundant microbially induced cementation.

Significance

The temperature profile of the Gulf of Aqaba, and the red sea in general, potentially provides an analog of the oceans of the Cretaceous period, when global climate was significantly warmer than it is in modern times. Consequently, the results of this study likely provide new insights into the formation and diagenesis in deep and warm waters that might potentially be different from diagenetic processes in the modern oceans.

References

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