MARINE CARBONATE SEDIMENTATION IN AN ACTIVE RIFT BASIN (RED SEA – GULF OF AQABA)

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PROJECT OBJECTIVES

- Develop a rich geophysical dataset for the northern Red Sea capturing the diversity in styles of syn-rift carbonate deposits.
- Examine this dataset to disentangle the varied controls of carbonate deposition through time in an active rift basin.

PROJECT RATIONALE

Enabled by the 2020 'Deep Blue' research cruise, a comprehensive multibeam dataset is being acquired in late 2020 offshore the Saudi Arabian coastline straddling the coastal shelf to the full depth of the Red Sea spreading axis (Fig. 1). The multibeam bathymetry will be supplemented with sub-bottom lines, ADCP measurement of current systems, and ground-truthed by ROV and submersible dives.

The Red Sea is an active maritime rift system which is unique in the world. Interest in rifts is considerable because they are vital in terms of understanding plate movements and their related seismicity, and because the deep, narrow basins that they yield provide motifs of carbonate deposition that are distinct from more common shelf and open-marine settings (Purkis et al., 2012). Spanning both photic and

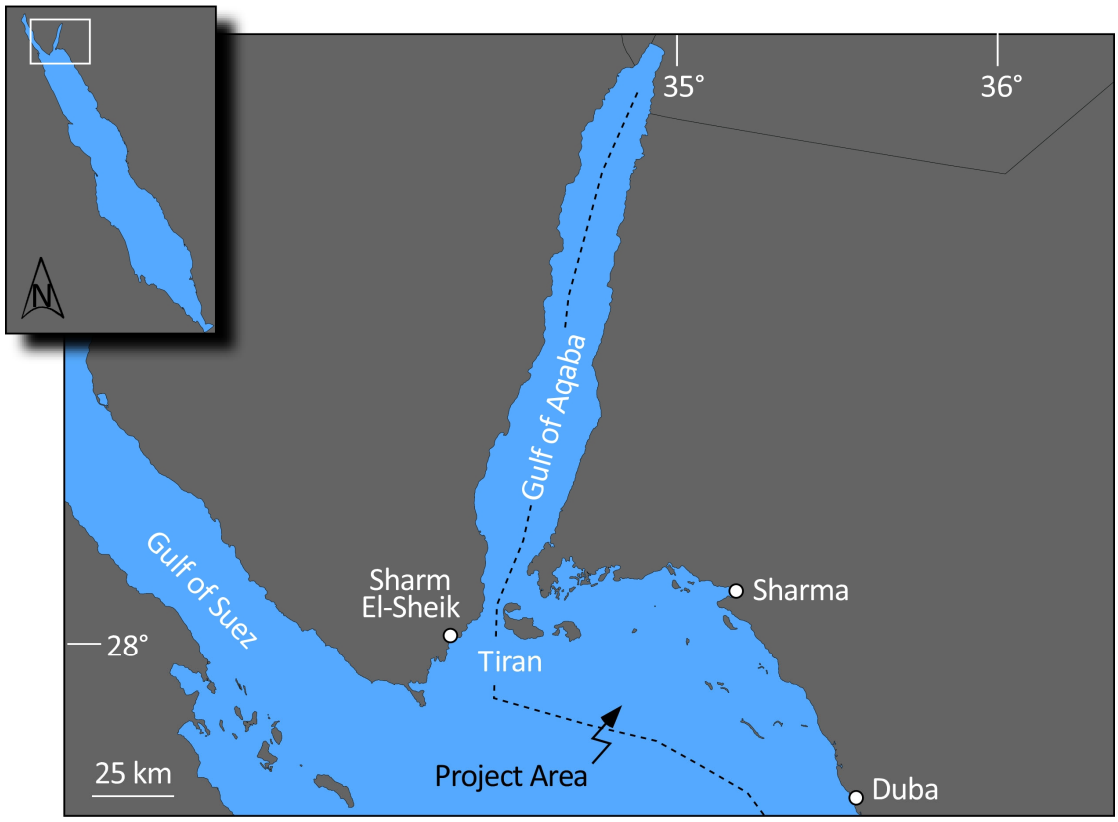

Figure 1: The location of the planned survey of the Northern Red Sea and Gulf of Aqaba.

hemipelagic environments, the deposition of carbonates in the Red Sea is broadly directed by the varied bathymetry delivered by the overall tectonic grain of the rift, and, more locally by pervasive salt tectonics. To the latter, the salt formations likely owe their origin to hydrothermal activity associated with shallow-igneous intrusions along the spreading axis of the basin. Typically associated with fault boundaries, halokinesis in the deep marine presents ductile, glacier-like salt flows which mantle the seabed, much like more conventional gravity flows, plus salt injectites (extrudites) which pierce the seafloor, add to its topography, and disrupt the Pliocene-Quaternary overburden (Mart and Ross, 1987; Mitchell et al., 2010; Augustin et al., 2014). These processes serve to direct the evolution of bathymetry and the subsequent deposition and accumulation of post-salt pelagic and hemipelagic carbonates. The diversity of motifs of carbonate deposition is even more stark in the photic zone. Here, reefal carbonates veneer fault-bounded structural elements of the rift, but also develop atop the pinnacles of salt diapirs. Carbonates deposited on the latter are often abruptly disrupted by collapses of the seafloor created by partial-local removal of mass by salt dissolution and/or suberosion (e.g. Ehrhardt and Hübscher, 2015). Paleo-wind and abundant siliciclastics supplied from the mountains which demark the rift shoulders add further depositional complexity to the syn-rift carbonates. In aggregate, these varied controls acting in the Red Sea deliver arguably the greatest diversity of shore-attached and isolated carbonate platforms witnessed anywhere on the modern Earth. As such, the North Red Sea is an ideal venue to examine syn-rift carbonates and their depositional controls.

APPROACH

A new geophysical dataset will be acquired, ground-truthed, and interrogated to examine the syn-rift carbonates of the northern Red Sea. Emphasis will be placed on disentangling the controls on plan-view morphology and internal stratal patterns of the deposits, with a view to developing a modern analog to Tertiary rift basins in the South China Sea and Mesozoic basins of the South Atlantic.

SIGNIFICANCE

Syn-rift carbonate platform strata can form important petroleum reservoirs within syn-rift basins. They also provide critical records for understanding the tectonic evolution and depositional history of rift systems. This unique dataset from the Red Sea has the potential to provide enhanced understanding in such settings.

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