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Sea-Level Controlled Low-Energy Shoreline Progradation and Facies Successions along the Southwestern Coastline of Qatar (Al-Zareq Area, Gulf of Salwa)

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ABSTRACT

Qatar is a north-south oriented peninsula that protrudes into the southern Arabian Gulf. Its western coastline is characterized by low-energy beach systems that form in a narrow embayment (Gulf of Salwa), protected from high wave energy associated with the predominant northwestern Shamal winds by the Bahrain-Qatar high.

Globally, the Holocene transgression started about 18,000 years ago. The Bahrain-Qatar high acted as a barrier between the Gulf of Salwa and the Arabian Gulf, preventing flooding of the Gulf of Salwa until about 9,000 years before present (yr BP). Sea level reached a highstand of 2 to 4 m above present day about 6,000 yr BP. The subsequent regression of sea level caused several kilometers of seaward progradation and the stranding of previous Holocene shorelines.

The present study aims to illustrate facies changes and coastal evolution in the area of Al-Zareq, situated along the southwestern coastline of Qatar. Our investigation entailed general sedimentologic and stratigraphic descriptions, grain size and shape distribution, petrographic thin section and XRD analyses, as well as radiocarbon and OSL age dating. Distinct facies types, formed by the interplay between siliciclastic, carbonate, and evaporite deposition and precipitation, and related to paleobathymetry controlled by pre-flooding Pleistocene dune fields and sea-level variations, are indicative of different depositional environments. Interpreted environments of deposition include open- marine (coarse bioclastic carbonate), protected (fine bioclastic carbonate) and restricted (salina-type evaporite) shallow subtidal lagoons, higher-energy intertidal beaches (gastropods and ooids), as well as low-energy intertidal microbial mat and supratidal coastal sabkha environments. Dense sampling for radiocarbon dating chronologically pinpoints facies changes and coastal dynamics and evolution. Over time, the Pleistocene and Early Holocene terrestrial dune environment transitioned to subtidal marine conditions during the Middle Holocene sea-level highstand. This was followed by Late Holocene beach migration/progradation, causing gradual restriction and closing of lagoons, and the eventual formation of sabkha conditions.

The described sea-level-controlled facies successions observed at Al-Zareq represent low-energy beach environments that can be used for conditioning geological and reservoir models of arid climate reservoirs like the Jurassic Arab and the Permo-Triassic Khuff formations.