

Documenting a modern day transgressive surface in a carbonate ramp setting

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The low-angle carbonate ramp geometry of the Abu Dhabi coastline provides an ideal site for studying the effects of marine transgression in a setting analogous to Mesozoic epeiric seas. Supratidal sabkha evaporite precipitation passes offshore, through a broad and complex carbonate-evaporite intertidal environment, into a subtidal carbonate depositional setting. The coast of the mainland is locally isolated from open-marine conditions by a number of peninsulas and islands associated with the east-west trending Great Pearl Bank.

This study combined 12 years of fieldwork observations with historical satellite imagery in order to establish multiple lines of evidence for active retrogradation over a 15 km length of coastline in the Abu Dhabi sabkha. Surveyed transects of the sabkha yield an average slope angle of 0.02° . Employing a current estimate of global sea level rise of 3.3 mm/yr, we calculate an expected present-day marine transgression of 7.9 m/yr.

The landward and seaward boundaries of the microbial mat facies belt are strongly controlled by the location of the intertidal zone. The seaward limit of the Recent microbial mat belt in the Abu Dhabi Sabkha is currently being buried beneath retrograding lower-intertidal sediments whilst the landward side is simultaneously backstepping over previously-supratidal gypsum-dominated facies. The landward migration of spits and beach ridges was monitored at several locations with rates of retrogradation of up to 28 m per year being recorded locally.

The study also identified numerous erosive features that are consistent with an increase in energy regimes. There has been a significant increase in denudation of the microbial mat, causing underlying sediment to be increasingly susceptible to erosion. In the lowermost intertidal zone, erosion of the hardground and other facies is observed. Clasts from the hardground are transported landward onto the surface of the sabkha where they are incorporated within other facies.

This study provides definitive evidence that the current sedimentary regime of the Abu Dhabi coastline has entered a retrogradational phase associated with marine transgression. From a sequence stratigraphic perspective, the current system would be identified as a flooding (transgressive) surface.