

# Holocene carbonate-evaporite-clastic deposits on an Arabian desert coast: Analog for Cretaceous oilfields, but what about the proxies?

P. HOMEWOOD<sup>1\*</sup>, M. METTRAUX<sup>2</sup>, S. DIRNER<sup>3,4</sup>, J. MATTNER<sup>4</sup>

<sup>1</sup> 99b rue d'Ossau, 64290 Gan France (\*correspondence: pwhomewood@yahoo.fr)

<sup>2</sup> GeoSolutions, 99b rue d'Ossau, GeoSolutions, 64290 Gan France (moho1959@yahoo.fr)

<sup>3</sup> University Tuebingen (s.dirner@googlemail.com)

<sup>4</sup> GeoTech, Manama Bahrain (geotech@batelco.com.bh)

The Bar Al Hikman mixed carbonate-clastic-evaporite system, in eastern Oman, comprises shallow marine carbonates that form both coral-carpet reefal bodies, and abundant carbonate grainy material, reworked into littoral deposits by summer monsoon storms, and under a 2m-range microtidal regime [1]. On land, the system comprises halite-dominated evaporites in extensive coastal sabkhas as well as gypsum-dominated counterparts that may possibly be nourished from continental aquifers. These sabkhas develop in a mixed grainy siliciclastic / carbonate and clayey Holocene host sediment [2]. The Bar Al Hikman system has developed over a complex subcrop pattern with variable topography that is the major structural contact zone between the obducted Masirah Ophiolite to the East, and the Arabian plate to the West. Apart from times of extreme sea-level highstand during the Pleistocene and Holocene, the area has been dominated by clastic systems over the last million years, under variable, arid to humid conditions [3].

The Holocene sediments record a regression, forced by sea-level-fall from the 6000 year BP maximum, perhaps together with some differential uplift of the Bar Al Hikman peninsula. The deposits are shown to have been laid down as a complex mosaic of open and barred littoral environments. The present-day littoral and lagoonal deposits are a recent frontage to successive stages of accretion of sandy tidal flats, beach ridges, storm spits and lagoonal sediments. Radio-isotope dating documents the rates of shoreline advance southwards. Remnant geobodies, constructed by carbonate factory debris, thus cover a zone several kilometers wide along the southern coastline. The Holocene carbonate sediment record started with a broad, 900km<sup>2</sup> sandy tidal flat and beach system, which was located in embayments framed by sub-cropping Tertiary carbonates, during the six-thousand-year-old sea-level highstand. The embayments were the site of a well established molluscan, bivalve and gastropod dominated, carbonate factory. The present-day patchy distribution of faunal associations at the acre to km<sup>2</sup> scale appears to be the result of both palaeobiocoenosis and the juxtaposition through deflation of outcrops of thin successive layers of embayment sand-flat to lagoonal sediments and fauna. Close to the southern coastline, thin near-shore coral build-ups, in particular unique *Montipora* reef carpets such as those of today, have provided large quantities of coarse rubble grading to fine-grained fragments, to feed the depositional system. On land, the sabkhas have developed in Holocene host sediments that are made up of mixed shallow marine carbonates and siliciclastics. The evolution and stages of accretion of this embayment to littoral carbonate depositional system, and the dominant processes are documented by: time-series observations of littoral features over 9 years including the effects of both Cyclone and Tsunami events on the environment; geomorphological analysis on low to high-resolution satellite images; ground-truthing of geomorphic features; radio-isotope dating (U series and C<sup>14</sup>); and sedimentary petrography on representative samples. Whereas the interpretation of this 6000-year evolution relies on climate proxy studies [3] to establish the continuity of the arid climate and Monsoon control, and on recent weather records to extrapolate wave regimes that built and accreted successive shorelines, the case is used in turn as an analog for interpretation of subsurface seismic and borehole data, reservoir static modeling and prediction of fluid flow pathways [1]. Analogues provide a rule-base for physical attributes of a system, but they are less numerically constrained than proxies.

[1] P.Homewood et al. (2007) *First Break* **25**, 27-33.

[2] M.Mettraux et al. (in press) *IAS sp. Publ.* **42**.

[3] D.Fleitmann & A.Matter (2009) *C.R. Geoscience* doi:10.1016/j.crte.2009.01.006