A Geological Description of Belghelam Island, North-East Abu Dhabi, UAE

by Graham Evans and Anthony Kirkham

Fig 1. General location map for Belghelam. (Courtesy: Google Earth)

Fig 2. Detailed map of Belghelam. (Courtesy: Google Earth)

The island of Belghelam, north-east of Abu Dhabi Island, is approximately five kilometres long and one kilometre wide with a WNW-ESE orientation (***Figs. 1 & 2***). The island has a core of Pleistocene rocks and is fringed by Quaternary sediments.

The core of the island is formed of Pleistocene carbonate aeolianites (wind-blown carbonate sands locally known as 'miliolite') displaying large scale, high-angled cross-bedding (***Figs. 3 and 4***). This forms a series of low ridges orientated parallel to the main trend of the island. The highest occur along its western and northern flanks and forms the substrate on which the main residence of H.H. Sheikh Surour bin Mohammed Al Nahyan is built. A wave-cut platform along the northern shoreline, generally about 20m wide, is cut into these aeolianites and this widens to well over 100m at the western seawards-facing extremity of the island (***Fig. 5***). The seaward edge of the wave-cut platform displays a resistant raised rim due to a thin crust of calcium carbonate precipitated from evaporation of water which splashes over it at most high tides (***Fig. 6***). The wave-cut platform is thought to have developed about 4000-5000 years ago at about the climax of the Flandrian transgression when sea level was approximately one metre higher than it is today.

The cross-bedded sets of the aeolianite originated in a barchanoid dune field formed by an earlier (palaeo) Shamal that blew from a general north-westerly direction. However, as a result of increased wind strength during climatic variations in the Pleistocene glacial periods, the barchans were remodelled to long, linear, *seif* dunes. In fact, it seems likely that the entire island represents the westernmost erosional relict of a palaeo-*seif* dune that formed a peninsula extending seawards from the immediately adjacent mainland shoreline. This same pattern of *seifs* can be traced for about 100kms towards the Hajar Mountains across the UAE (***Fig. 7***). The sands of the *seifs* become more quartzose in composition and redder in colour as the carbonate constituents decreases to leeward along the palaeowind direction.

The remnants of similar fossil *seif* dunes, remodelled from barchans, have been described from the Al Dabb'iya Peninsula but there they are capped by Pleistocene marine sediments which accumulated when sea level was about 7-8m higher than that of today (about 125 Ka). It is likely that similar sediments once partially covered the Belghelam aeolianites but have since been removed by deflation.

Lithified fossil mangrove trunks and rhizoliths (fossilised roots) are abundantly exposed along the outer parts of the wave-cut platform all along the northern coast (***Fig. 8***). These former mangrove stands appear to have developed in the intertidal zone, just as they are today in the area, around the time of the Flandrian transgressive climax (ca 4 Ka). Any Holocene sediment that once covered the rhizoliths has been largely removed by wind and wave erosion, except for one or two remnants. Burrows of *Ophiomorpha* also occur on the wave-cut platform and can be recognised by their sub-vertical orientations and their sediment linings created by the burrowing organisms (possibly crabs). A small patch of a coquina of disarticulated oyster shells can be seen plastered against part of the wave cut platform near the western extremity of the island and gave a carbon dating of ca 650 years BP ***(Fig. 9***). However, the cutting of the platform is thought to have occurred earlier at ca 4 Ka.

Much of the southern half of the island is formed by a carbonate platform with an elevation of about two metres above mean sea level. The underlying bedrock is in places either deflated aeolianites or, along the extreme south coast, Pleistocene marine carbonates which unconformably overlie the truncated aeolianite.

The platform is covered by a thin, mobile sand veneer fashioned into highly deflated *nebkha* (coppice dunes). The halophytic plants that stabilised these were dead in 2004, when fieldwork was undertaken, probably due to lack of significant rainfall during recent years. All that remained were the woody stems of the dead halophytes which are no longer able to baffle the wind-blown sands and so the *nebkha* was slowly being deflated to leave behind a lag of marine mollusc shells including abundant cerithid gastropods. These suggest that the platform was flooded during the Holocene and probably is still occasionally flooded by marine waters during severe Shamal storms. Living halophytes occured in 2004 only along the back of the present intertidal zone, especially along the southern shore, where it appears moisture is more readily available for sustained growth (***Fig. 10***).

At two localities (GPS N24.56061 E 54.56568) along the southern edge of the two metre platform Holocene(?) beachrocks displaying fenestral pores and containing mollusc shells are exposed (***Fig. 11***). Broken slabs of the beachrock show up to three caliche crusts. Along the same southern shoreline, small gullies cut a scarp in which the aeolianite and overlying Holocene(?) marine carbonate are exposed suggesting there is, or has been, periods of substantial run-off during or after heavy rains (***Fig. 12***).

Whereas most of the northern shoreline is rocky, the eroded edges of the platform along the south coast and parts of the northeast are flanked by a narrow beach of skeletal pelletal sands and by a belt of low modern dunes (1-2m high). In the northwest a thick stand of mangroves has also developed. Generally the entire island is flanked by broad intertidal flats of carbonate sand which are exposed at low water (***Fig. 13***).

Offshore to the south-west of the main island is a small islet composed of aeolianite but with a capping of marine limestone (***Fig. 2***). A narrow wavecut platform similar to that of the main island surrounds the feature.

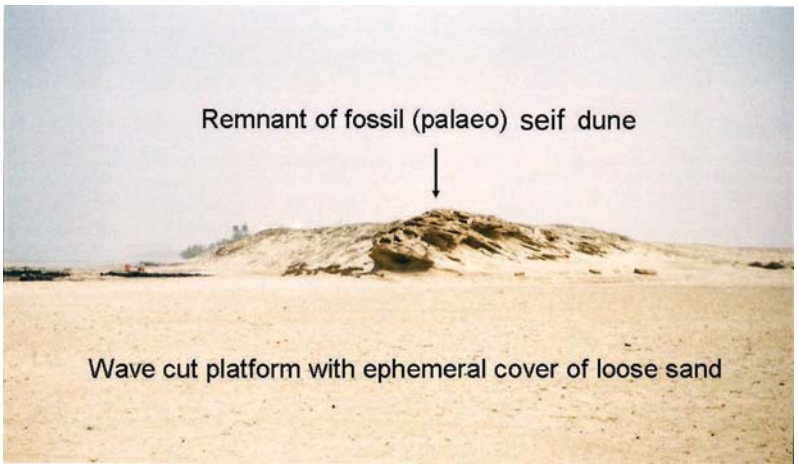

Fig 3. Remnant of a palaeo-seif dune trending WNW-ESE along the northern coast. Current dune height is approximately 15m on average. A wave cut platform is seen to the left of the dune. View to the east from the western extremity of Belghelam.

Fig 4. Exposure of cross-stratified aeolianite at the paleo-seif shown in *Figure 3*.

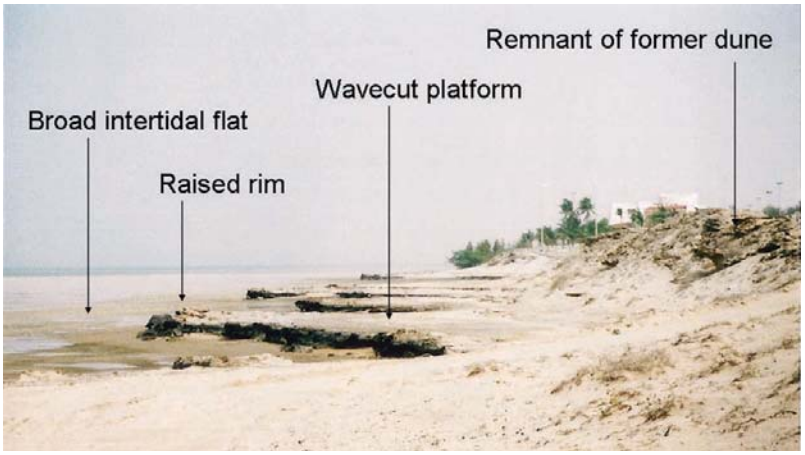

Fig 5. The wave cut platform along the northern coast of Belghelam. Palaeo-seif dune to the right. View to the east.

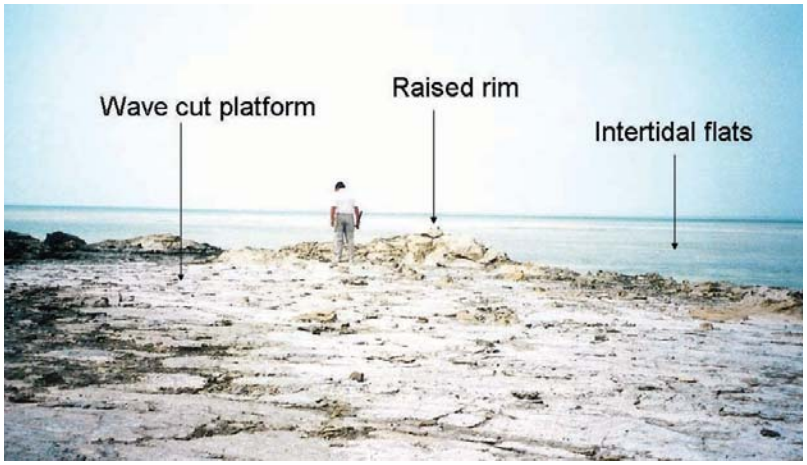

Fig 6. Wavecut platform with raised rim along its western seaward edge. The platform is about a metre above present day mean sea level and cut into aeolianite. Northern coast of Belghelam.

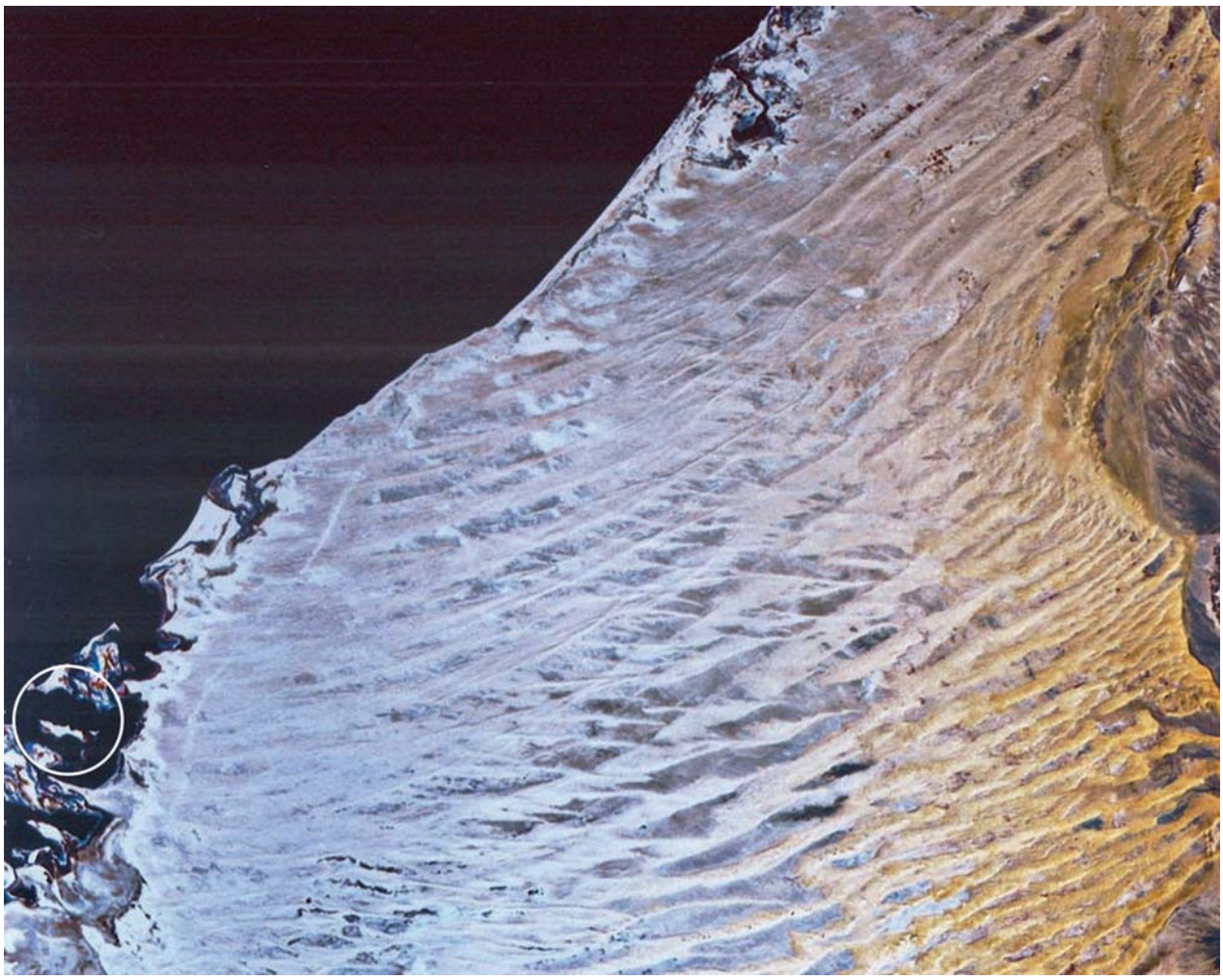

Fig 7. Satellite image of the mainland between Abu Dhabi and Jebel Ali. Alluvial fans outwashing from the Hajar Mountains are to the right. Most of the area is traversed by sweeping palaeo-seif dunes which formed during the Pleistocene. They are now largely cemented and form promontories or peninsulas that extend into the lagoon (lower left). Belghelam (circled) is as an offshore remnant of one of these palaeo-seifs. Courtesy of *GeoArabia*.

Fig 8. Mangrove rhizoliths exposed on the wave-cut platform.

Fig 9. An oyster coquina plastered against the wave-cut platform, northwest end of Belghelam, The oysters have been dated as about approximately 650 years of age.

Fig 10. Southwest coast of Belghelam with a narrow cordon of halophytes along the back of the beach. The low scarp is poorly developed here. Inland, the platform is sparsely covered by dead halophytes.

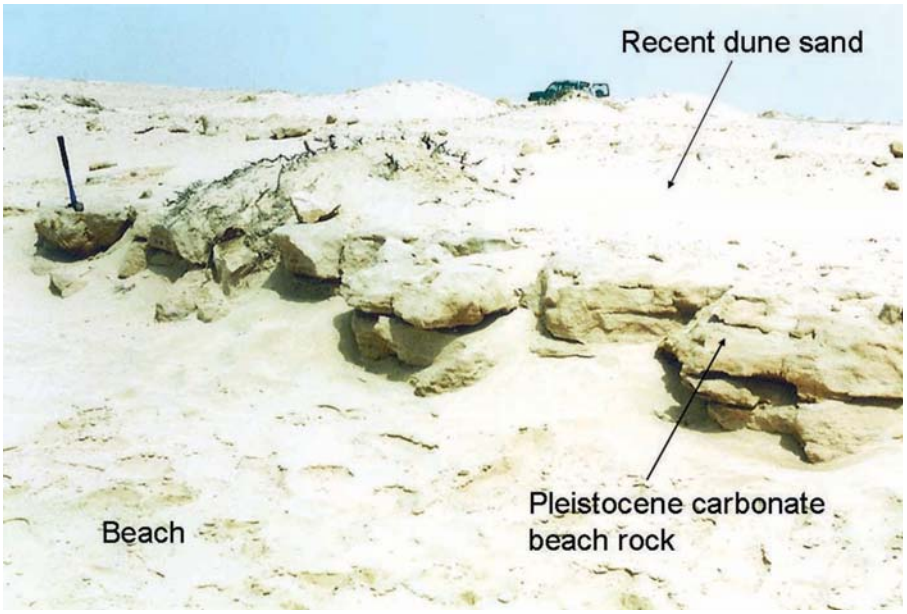

Fig 11. Holocene(?) beachrock scarp along the southern coast of the island. Hammer (left) for scale.

Fig 12. An erosional gully transecting the low beachrock scarp, southern coast of Belghelam.

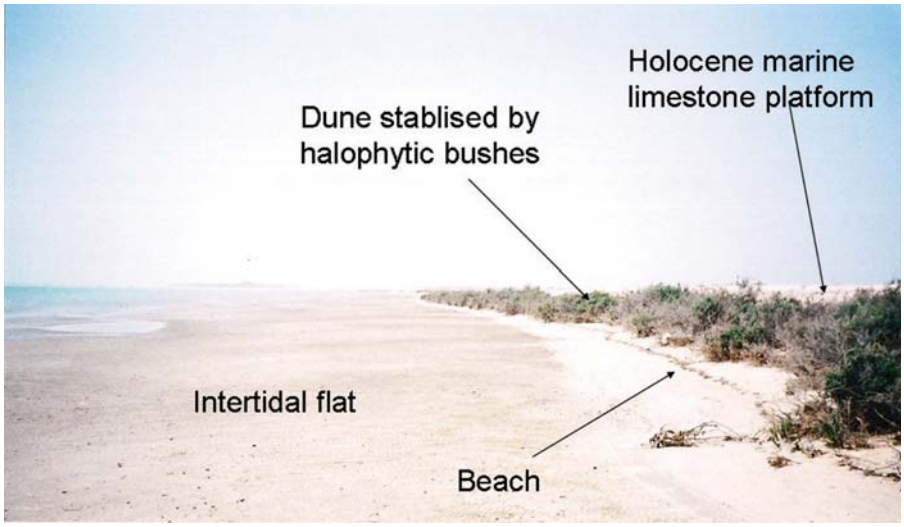

Fig 13. Sandy beach with halophytic plants stabilising aeolian dunes along the back of the beach. The low Holocene(?) platform is visible behind. Southern coast of Belghelam.

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* Further details of the whole coastline of Abu Dhabi can be seen in: The Emirates: A Natural History. *Eds.* P. Hellyer and S. Aspinall, 2005, Trident Press Ltd., London. See especially articles therein by 1) G.Feulner, A Geological Review, p.41-63, 2) G.Evans and A.Kirkham, The Quaternary Deposits, p.65-78. These articles have a reasonably complete general bibliography of the Quaternary and sedimentology of the coast of Abu Dhabi.