



## **(Sub)recent cemented intervals in the uppermost sediment column of the Abu Dhabi lagoon: Significance for marine hardground research**

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Early marine carbonate cementation is ubiquitous along the Abu Dhabi coastline, but has not been extensively studied in the detail required to better understand factors controlling the formation of associated cemented intervals which occur in the area. This research uses textural and geochemical analyses to characterize the recently formed (60-600 yrs old) cemented intervals in order to determine the drivers and signatures of their development in various settings including: i) intertidal sabkha, ii) inner lagoon, iii) middle lagoon, and iv) outer lagoon. Field observations show a strikingly diverse range of cemented intervals in a relatively small spatial distribution. The intertidal sabkha, inner, and middle lagoon are dominated by peloidal and bioclastic sediment while the outer lagoon is dominated by oolitic facies. In the intertidal sabkha, friable firmgrounds occur at the seaward edge of well-developed microbial mats, and have a thin microbial cover, no borings or encrustations, and irregular upper and lower surfaces with a considerable amount of open porosity under the upper surface. The formation of the firmgrounds close to the intertidal zone microbial mats may be related to microbial metabolism modifying the pore water chemistry. Hardgrounds primarily occur in the inner and outer lagoon. Slightly shoreward in the restricted inner lagoon, the hardgrounds are characterised by planar upper surfaces, irregular lower surfaces, and little-to-no borings or encrustations. These hardgrounds likely result from lateral development and coalescence of concretionary nodules. In the open inner lagoon, cementation features show significant lateral variability. Hardgrounds containing flat upper surfaces thin and are susceptible to break-up landward, and these clasts are reworked and transported further inland, becoming incipient beachrocks. In the outer lagoon, the lithification of crab(shrimp) burrows forms nodular hardgrounds. These cemented features have a patchy distribution, infrequent borings and encrustations, and sharp boundaries with the surrounding unconsolidated sediment. Carbonate cement fabrics are also fairly diverse in the cemented intervals. Platy and columnar crystals containing small holes on the upper surfaces are commonly observed from the firm- and hardgrounds in the intertidal sabkha and restricted inner lagoon. Acicular cements are ubiquitous in the open inner lagoon and outer lagoon. The large variation in the cemented intervals and cement fabrics observed along the Abu Dhabi coastline is likely associated with differences in sea- and pore-water chemistry, including pH, alkalinity, and Mg/Ca.