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Carbonate and evaporite precipitation reflected in the hydrochemistry of inter- to supratidal waters of a modern arid coast (Arabian Gulf, Abu Dhabi)

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The Abu Dhabi sabkha and shallow marine carbonates provide examples of carbonate and evaporite deposition under extreme environmental conditions of an arid coastline. At the surface, intertidal, frequently cemented skeletal carbonates grade landwards into gypsum, then halite and anhydrite. The chemical and isotopic composition of marine waters and shallow groundwater was determined along a 4 km long transect from the intertidal to the supratidal zones.

The oxygen and hydrogen isotopic composition of marine and subsurface water shows that the precipitation of the evaporites is controlled by occasional flood recharge and evaporative pumping of marine waters. Continental groundwater is found at shallow depth only further inland, beyond the limit of modern anhydrite precipitation.

During the summer months, the salinity of subtidal waters is generally higher than 50 per mil at temperatures above 37˚C. During low tide, the salinity of seawater trapped in large tidal pools that contain live gastropods rises to 90 per mil with seawater δ^{18}O values up to +7 per mil SMOW. The Mg/Ca ratio of seawater increases during restriction at low tide. This indicates carbonate precipitation as evidenced by cementation of the bottom and sides of the tidal pools. In the upper intertidal zone, $i.e.$ in the zone of gypsum precipitation, the molar Mg/Ca ratio of marine subsurface waters increases substantially, overall the highest value is found in the uppermost intertidal zone of anhydrite formation with values up to 200. Salinity of these waters is at the level of halite saturation. Continental groundwater in the shallow subsurface of the supratidal zone can be distinguished by different δ^{18}O and δD values, lower salinity, and much lower Mg/Ca ratios from the evaporated seawater.