Recent coastal sabkhas marginal to the gulfs of Suez and Elat, Red Sea

by

E. GAVISH

Department of Geography, Tel Aviv University (Israël)

Coastal sabkhas are supratidal sedimentary areas with shallow saline groundwater where evaporites accumulate due to intensive evaporation. In recent years sabkhas have been studied in a number of sub-tropical areas with a concentrated effort on the Persian Gulf [PURSER, 1973]. Despite the extensive information gathered on the water geochemistry and the mineralogy of coastal sabkhas, there is still controversy about the hydrodynamic processes operating in it.

The coasts of Sinaï along the Gulfs of Suez and Elat have conditions resembling those in the Persian Gulf : hot and dry climate, high rate of evaporation and saline shallow groundwater extending from the shore inland. The sabkhas developing along these coasts are, however, limited in extent and number because the coastal topography does not allow extensive, broad, supratidal flats. Nevertheless, they may demonstrate well the early processes of sabkha formation.

Most of the sabkhas marginal to the Sinaï coasts do not have such a high content of evaporites and carbonate minerals as in the Persian Gulf [GAVISH, 1974]. They are mainly composed of transported coarse sand with interstitial accumulation of halite crystals in the upper sediments and gypsum crystals below them. Since in most cases these areas are not flooded by sea water and the evaporite accumulation is above groundwater, it may, at least partially, indicate the process of " evaporative pumping " [HSU & SIEGENTHALER, 1969]. The salinity of the groundwater, as well as the accumulation of evaporites in the sediments above it increase inland with distance from the shore.

A unique round sabkha near Nabq, Gulf of Elat, was studied in great detail. The sabkha is about 1.2 m below sea level and is separated from the sea by a 400 m wide bar (Fig. 1). The only recharge is from the Gulf, with the water seeping all year round at an almost constant rate through a system of subsurface conduits.

The sabkha groundwater is highly hypersaline, causing accumulation of evaporites (Fig. 2), but that salinity drops with depth. In large parts of the sabkha, where groundwater is relatively deep, upward migration of brines due to " evaporative pumping " caused considerable accumulation of halite at the surface. Gypsum is still the major evaporite component in this sabkha, precipitating most intensively in the upper sediments where the groundwater is close to the surface. Since no halite is precipitated in these places, the hypersaline brines must reflux down, as is also indicated by the existence of gypsum only in depths greater than 120 cm (Fig. 2). Activity of sulfate-reducing bacteria around the sabkha rim, where the brines are most saline (over 250 $^{o}/_{oo}$), cause the destruction of gypsum in these sediments.

The hypersaline brines in the sediments also cause the formation of dolomite and Mg-calcite, as well as the diagenesis of aragonite and formation of celestite. Today the sabkha is almost at a hydrological equilibrium with the sea, where the loss by evaporation and reflux is balanced almost constantly by seepage.

References

GAVISH (E.), 1974. — Geochemistry and mineralogy of a recent sabkha along the coast of Sinaï, Gulf of Suez. *Sedimentology (Sous presse)*.

HSU (K.J.) & SIEGENTHALER (C.), 1969. — Preliminary experiments on hydrodynamic movement induced by evaporation and their bearing on the dolomite problem. **12**, 1/2, pp. 11-25.

PURSER (B.H.), (éd.), 1973. — *The Persian Gulf*, Springer Verlag Berlin.

Rapp. Comm. int. Mer Médit., **23**, 3, pp. 129-130, 2 figs (1975).

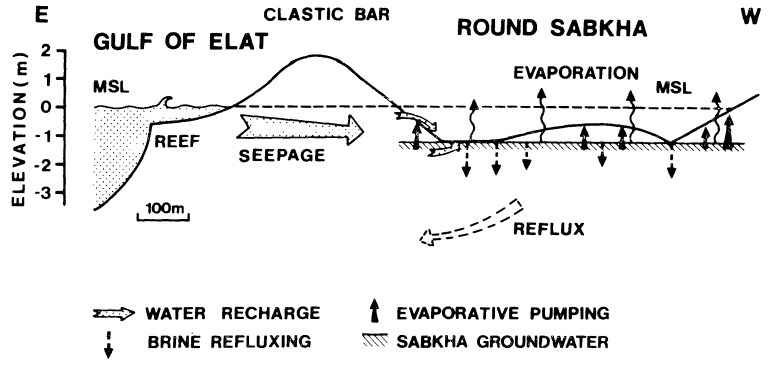

FIG. 1. — A generalized cross-section showing the hydrodynamic mechanism in the sabkha.

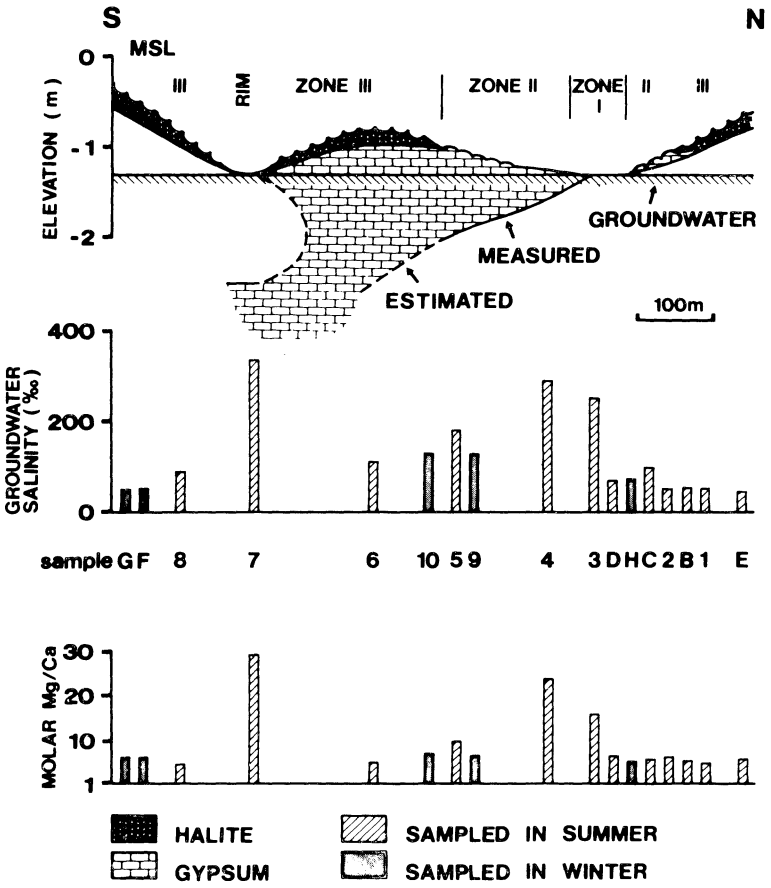

FIG. 2. — A cross-section showing the distribution of the evaporites and groundwater geochemistry in the sabkha.