Formation of modern dolomites in a Coastal Hypersaline Pool at Alamain, Egypt

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The studied pool is a part of a coastal system comprising a series of carbonate dune ridges and interdunal sabkha- lagoonal enviroments. This system was ascribed by many workers to various marine transgressive episodes of the Pleistocene. However, recently ALEXANDERSSON (1990) gave an age of 2100 years before present to the weekly cemented oolites of the coastal ridge.

The hypersaline pool occupies a small semicircular depression behind the coastal ridge. Seawater probably began to accumulate in this depression since 2000-4000 years ago during the last phase of marine transgression. The elevations of the coastal ridge in the study area vary between 2-7 meters. The occurrence of small stream-like channels on the lee side of the ridge lower sections may indicate that seawater could overtop the ridge during storm surges. Yet, the proposed mechanism of lagoon water replenishment is thought to proceed by seepage through the porous matrix of the ridge to replace the amount of evaporated water.

The water depth ranges from few centimeters at the peripheries to about 1.5 meters in the central part of the lagoon. The salinity of water as measured in the late spring was 78 per thousand.

This work is based on the study of 5 representative sediment cores varying in length from 70 to 180 cm. The bulk mineralogical composition was studied principally by X-ray diffraction with the help of DTA when necessary. The organic carbon and carbonate contents were also determined.

On the average the sediment matrix comprise 38% quartz, 8% feldspars , 16% calcite , 15% aragonite, 15% dolomite , 3% Mg-calcite, and occassional occurences of colestine, glauberite, anhydrite , bassanite, thenardite , huntite, nahcolite and strontianite.

The precipitation of calcite and aragonite throughout the whole sequence indicates that the solution has always been Ca-rich and has been subjected to moderate degrees of evaporation, yet never been desiccated. The promotion of calcite and aragonite deposition raises the Mg level in solution and hence the Mg/Ca ratio. This combined with the low sulphate level and high alkalinity-pH conditions resulting from active sulfate reduction (BAKER and KASTERN, 1981) favors dolomite deposition. The preservation of organic matter even at the deepest core intervals suggests the predominance of low redox environments at the sediment solution boundary throughout the whole depositional history.

The dolomite diffraction pattern always showed a sharp 104 reflection with at least 4 other reflections. Some samples gave reflections of typical dolomite (d_{104} = 2.886 A°), but in many cases the 104 peak is slightly displaced to higher 20 angels. Evidence from DTA analysis proved that the shift in the peak position was due to substitution of iron for Mg. In fact the presence sometimes of a faint split peak may suggest a physical mixture of Fe-dolomite and normal dolomite.

The variability in the quantity and, perhaps, the type of dolomite with depth intervals in cores may reflect episodic fluctuations in the physico-chemical properties of the precipitating solution, rather than diagenetic reactions. However, the mineral suite indicates that such fluctuations were slight and limited in exent as proved from the rare and occasional occurences of accessory minerals and the continuous deposition of the principal mineral association.

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Zooplankton of the meromictic coastal Lagoon of Cullera (Spain)

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The lagoon at Cullera, on the Spanish mediterranean coast (RODRIGO *et al.*, 1992), had, in 1980-81, a permanent sea water wedge, that caused a strong stratification of the water, with a steep gradient of salinity and the presence of an anoxic water layer (fig. 1). The result was a vertical and horizontal heterogeneity of physicochemical parameters and zooplankton (MIRACLE and VICENTE, 1983; MIRACLE *et al.*, 1988).
Samples were taken bimonthly during the period of august 1980 to october 1981, from the vertical profile and from three different sampling points, at the mouth (1), the center (2) and source of the lagoon (3) (fig. 1).

Freshwater zooplankton dominated in the lagoon, and only in autumn-winter the presence of some marine/brackish water species was observed. Generally, copepods and rotifers were more abundant in samples from point 3, less influenced by sea water intrusion, and cladocerans were more abundant in samples from point 2.
Table 1 shows the more abundant species of zooplankton. In addition to these species, another 9 species of copepodes, 5 species of cladocerans, 20 species of rotiferes, nauplii of cirripeda, ostracodes, nematodes and protozoans (Rhizopodea) were found. The presence of marine copepodes (*Acartia clausi, Acartia grani, Oithona nana*) and parasites of fish (*Ergasillus sieboldi*) were noticed.

Zooplankton was dominated by the permanent copepods *Calanipeda aquae-dulcis, Acanthocyclops robustus* and *Metacyclops minutus* (in spring), the cladoceran *Moina micrura* (in summer) and rotifers of the genus *Brachionus, Hexarthra, Notholca, Synchaeta* and *Polyarthra*. The larvae of the polichaete *Mercierella enigmatica* and ciliates of the genus *Euplotes*, were also abundant during spring and autumn (table 1).
Some of these species, i. e., *Hexarthra fennica, Notholca salina, Synchaeta tremula* and *Synchaeta grimpei*, are located in the oxic-anoxic boundary where they show high population densities.

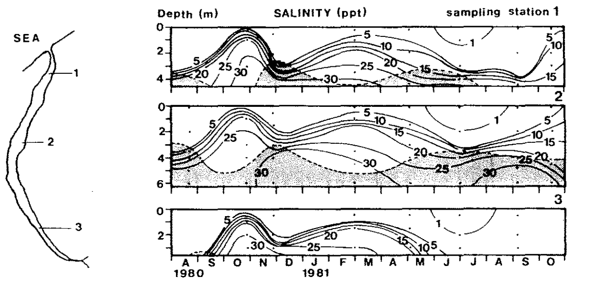

Fig. 1.- Salinity isopleths in Cullera lagoon at 3 sampling stations located as shown in the outline on the left. The anoxic water layer is shaded.

Table 1.- Most abundant zooplankton species of Cullera lagoon (occurrence > 10 % of samples), with indication of their maximum density, as well as the seasons (Sp, spring, Sm summer, A, autumn, W, winter,) and the sampling stations (1, 2, 3) where this maximum was reached. Also values of temperature, conductivity and pH corresponding to each species maximum density are indicated.

Especies	Seasons of maximum	Sampling $station_{max}$	$Density_{max}$ (ind l^{-1})	T^{M} (°C)	Conduct. (mS cm^{-2})	pH
Copepodes						
Calanipeda aquae-dulcis	Sm, A	2	314.0	19.0-23.0	6.3-47.0	7.0-7.8
Acanthocyclops robustus	Sm	3	380.7	22.5-25.5	1.1-4.5	7.4-7.9
Metacyclops minutus	Sp	3	22.7	16.9-22.2	1.7-30.7	7.5-8.2
Ergasillus sieboldi	A	2	1.4	23.0	26.0	5.0-8.7*
Cladocerans						
Moina micrura	Sm	2	72.9	26.0-30.0	2.0-8.8	7.7-8.6
Rotifers						
Brachionus plicatilis	A	3	1043.0	19.0-22.0	6.3-47.6	7.0-7.8
Brachionus calyciflorus	Sm	2	764.7	30.0	2.0	8.6
Brachionus angularis	Sm	2	145.7	25.0	1.6-40.5	6.9-8.6*
Brachionus urceolaris	A	2	17.5	22.5	6.6-26.5	4.8-8.7*
B. quadridentatus	Sp	2	5.2	20.0	2.0	6.0
Brachionus leydigi	W	2	0.2	14.0-14.5*	3.1-12.5*	7.6-8.6*
Keratella tropica	Sm	2	7.6	30.0	2.0	8.6
Keratella cochlearis	Sp	3	1.6	16.9-22.2	1.7-30.7	7.5-8.2
Keratella quadrata	Sm, A	3	0.7	8.0-26.0*	1.1-49.0*	6.9-8.6*
Notholca salina	A	3	47.3	9.0-18.0	1.3-45.6	7.1-8.4
Notholca marina	A	1	4.7	8.0-16.0	2.2-45.2	7.9-8.5
Euclanis dilatata	Sp,Sm	3	3.5	16.9-22.2	1.7-30.7	7.5-8.2
Mitilina ventralis	Sm	3	0.7	22.5-25.5	1.1-43.0*	7.4-7.9
Lophocharis salpina	A	3	9.0	9.0-18.0	1.3-45.6	7.1-8.4
Trichotria tetractis	Sm	2	1.0	25.5-26.0	1.2-4.0	7.4-7.8
Colurella adriatica	A	3	0.7	9.0-10.5	1.4-49.0*	8.4
Lepadella ovalis	Sm, A	3	2.2	26.0	1.1-47.8*	7.8-7.9
Lepadella rhomboides	Sm	3	1.2	16.0-26.0*	1.1-47.3*	7.8-7.9
Lecane luna	Sm	2	0.7	23.0-25.8	1.1-49.6*	4.7-8.7*
Lecane ungulata	A	3	5.5	9.0-18.0	1.3-45.6	7.1-8.4
Lecane hastata	Sm	3	1.5	22.5-25.5	1.1-4.5	7.4-7.9
Lecane bulla	Sm	2	1.5	22.5-25.5	1.1-4.5	7.4-7.9
Lecane closterocerca	Sm, A	3	2.0	9.0-10.5	1.3-11.0	8.4
Lecane hamata	Sm	3	1.7	26.0	1.1-1.2	7.8-7.9
Trichocerca elongata	Sm	3	3.0	26.0	1.1-1.2	7.8-7.9
Asplanchna brightwelli	Sm	2	19.2	30.0	2.0	8.6
Synchaeta tremula	A	2	872.3	20.0-23.0	12.1-29.4	5.0-8.7*
Synchaeta oblonga	Sp	1	188.7	18.0	21.6	7.6
Synchaeta pectinata	Sp	3	5.3	16.9	30.7	7.5
Synchaeta grimpei	W	2	235.2	13.0-14.0	41.9-52.0	7.3
Polyarthra vulgaris	Sm	2	167.3	23.0-25.8	1.3-40.5	5.0-8.7*
Hexarthra oxyuris-fennica	Sm, A	2	689.0	20.0-23.0	12.1-42.4	6.9-8.6*
Polichaeta larvae						
Mercierella enigmatica	Sp, A	2	268.2	22.5-23.0	26.0-29.4	7.5
Ciliophora	A	3	1656.0	7.9-26.2*	1.1-52.7*	4.7-8.7*

* Range corresponding to the presence of the species, because the species had not a marked maximum or the parameter was not measured at the species maximum.

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