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STUDY OF BRYOZOA IN THE SEDIMENTS OF THE NILE DELTA CONTINENTAL SHELF

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ABSTRACT

The present work deals with the study of seven bryozoan species collected from the Nile Delta continental shelf. The chemical analysis of these shells exhibited that there has been a close relationship between the distribution of some elements (Mg, Sr and B) and water salinity. The low content of Mg, Sr and B in the shells located infront of the Rosetta and Damietta Nile mouths is largely due to the low salinity, and vice versa with respect to those far from the same sectors. The presence of Mn content in the examined species suggests the adsorption of this element from the sea water, while Fe may be largely extracted from the food supply. This study also serves to interpret the diagenetic nature and the history of the studied shells.

INTRODUCTION

The continental shelf of Egypt has attracted considerable interest by many workers during the past decade. Workers have considered its bottom topography (Misdrop and Sestini, 1976 and Coleman et al., 1981) and its foraminiferal assemblages (Mohamed, 1972). Sediment distribution on the continental shelf has been studied by Mohamed (1968), El-Wakeel et al (1974), Misdrop and Sestini (1976) and Summerhayes et al (1978). These studies agree in showing sands nearshore and on the outer shelf of the Delta, while muds on the Rosetta and Damietta cones. Mohamed (1968) and El-Wakeel et al (1974) stated that seaward of the Delta the nearshore sands and all of the muds are terrigenous, while the sands of the outer shelf are calcareous. Gorgy (1966) described the outer shelf sands as coralligenous (i.e., composed mainly of coralline algae); El-Wakeel et al (1974) described them as bryozoan sands. Accroding to Semmerhayes et al. (1978) the sand fraction of the shelf sediments contains a varied mixture of the whole and fragmented remains of many different organisms (mainly mollusks, echinoids, Bryozoa, coralline algae, benthonic Foraminifera, planktonic Foraminifera and pteropods). These organisms appear to have been recent, some of them are reworked and iron-staind. The latters are mostly distributed on the outer shelf which must be relict (older shells).

An earlier investigation of the composition of the bryozoan shells, Vinogradov (1953) pointed out that the bryozoan shells contain $MgCO_3$ more than Cirripedia and Mollusca and less than Echinodermata, Corallinaceae and Alcyonaria. Moreover, Lowenstam (1963) indicated that the bryozoan skeletons are composed of mixture of calcite and aragonite, however, in addition to the various forms of the calcium cabonate some skeletons contain, silica, phosphate, iron oxide and sulphate. In the present study we focus on the study of the bryozoan species present in the sediments near the outer shelf (Fig.1). Herein, we demonstrate the value of counting bryozoan population (entire and fragmented tests) in the sand-size fractions near the outer shelf (Fig. 2). Particular attention is paid to the chemical analysis of the identified bryozoan species (table-1) which may be helpful in understanding the diagenetic nature of these shells.

MATERIALS AND METHODS

A total of 81 grab samples were provided by Woods Hole Oceanographic Institution. These samples were collected during 'Chain' cruise in 1975. covering the Egyptian continental shelf up to 100 fathom depth. Nine additional samples were also obtained from collection of the Coastal Research Institute at Alexandria, Egypt. The sand size fractions (0.062-2.00 mm) were examined petrographically. In each sample, 400 grain were counted using binocular microscope for the major components (light, heavy, mica, glauconite, Foraminifera, Ostracoda, bryozoan shell fragments and plant debris). The counted bryozoan components include both broken and whole shells. The well preserved whole bryozoan shells were found to be enriched only in five stations No. 50, 47, 99, 177 and 158. The bryozoan shells of these stations revealed the presence of seven species. These species were subjected to chemical analysis. The analysis was carried out by means of a Carl Zeiss spectrographic method, described by Abdel Aal and Frihy (1984). The seven bryozoan species are systematically arranged as follows according to the classification of Moore (1968).

Phylum : BRYOZOA Ehrenberg, 1831
Subphylum : CTOPROCTA Nitsche, 1869
Class : GYMNOLAEMATA Allman, 1856
Order : CHEILOSTOMATA Busk, 1852
Suborder : ANASCA Levinsen, 1909
Family : MEMBRANIPORIDAE Busk, 1854

Genus: **Cellarinidra** Canu-B, 1927

Cellarinidra salicornioides Lamouroux (pl. I, Fig. 1).

Family : ARACHNOPUSHDAE Jullien, 1888

Genus : **Exechonella** Canu-B., 1927

Exechonella grandis (Duvergier), (pl. 1, Fig. 2)

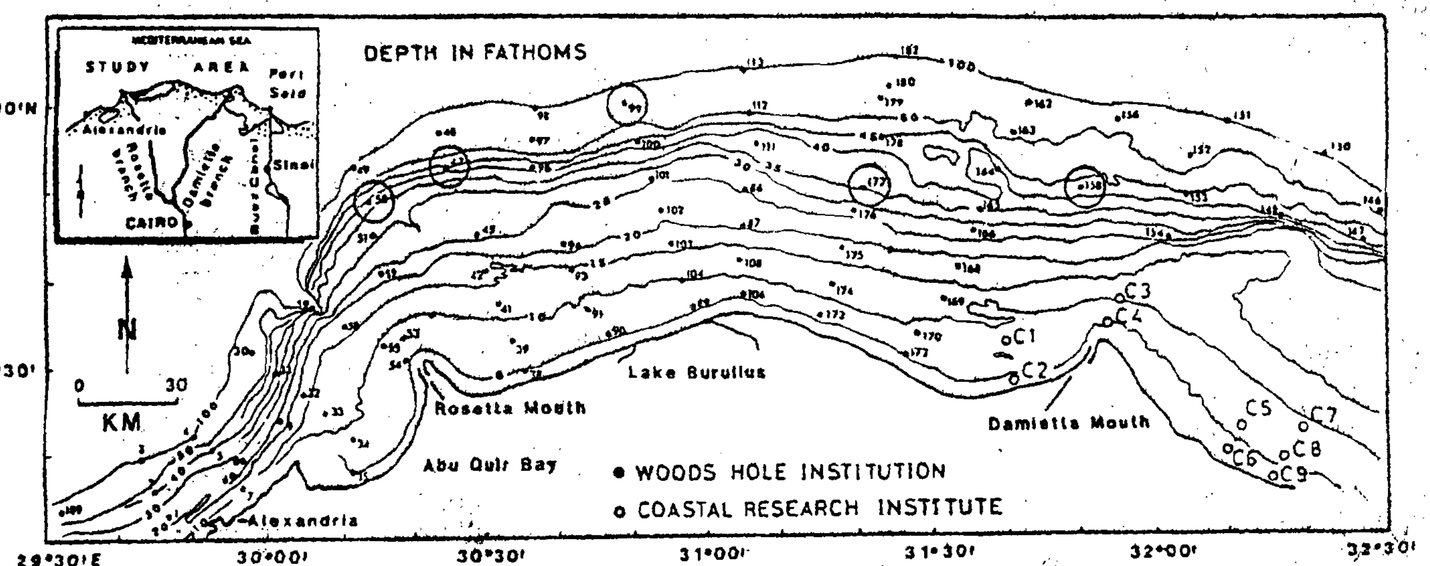

Fig. (1)
Map of the study area showing the location of the bottom samples on the continental shelf of Egypt. Numbers in circles denote samples contain well preserved bryozoan shells.

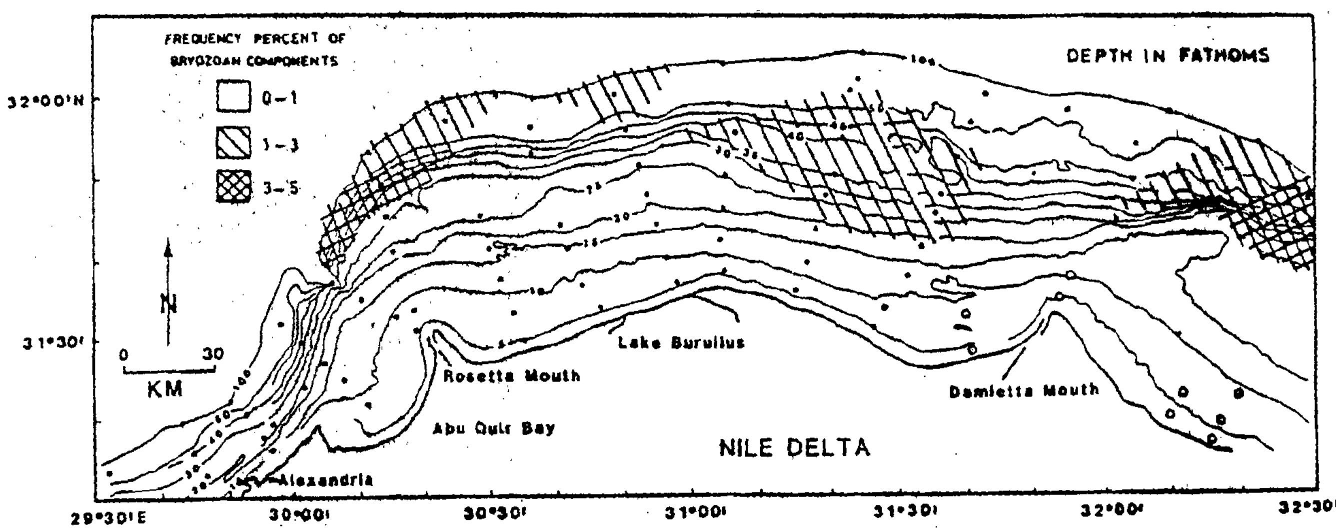

Fig. (2)
Frequency distribution of bryozoan components (whole and broken tests) counted in the bottom samples of the continental shelf.

TABLE 1

Concentration of B, Mg, Si, Al, Fe, Ti, Mn and Sr in the studied bryozoan shells.

Bryozoan Species	Station number	CONCENTRTATION OF ChEMICAL ELEMENTS						
		B	Mg	Si	Al	Fe	Ti	Mn
Cellarinidra salicornioides	47 47	0.0014	0.06	1.20	0.26	0.42	0.015	0.110
Cellarinidra salicornioides	50	0.0024	0.40	2.80	0.41	0.40	0.074	0.070
	158	0.0014	0.50	1.30	0.32	0.52	0.080	0.180
	47	0.0012	0.14	1.27	0.38	0.51	0.050	0.230
Exechonella grandis	50	0.0024	0.70	2.60	0.38	0.62	0.090	0.290
	99	0.0032	2.60	2.20	0.34	0.46	0.078	0.150
	177	0.0042	2.50	0.98	0.41	0.46	0.035	0.110
	177	0.0036	2.60	1.20	0.45	0.62	0.070	0.220
Calpensia nobilis	47	0.0014	0.18	1.50	0.36	0.58	0.060	0.240
	158	0.0016	0.10	1.60	0.45	0.68	0.086	0.340
Caberea boryi	50	0.0024	0.80	1.60	0.38	0.58	0.080	0.200
	158	0.0016	0.60	1.60	0.36	0.60	0.084	0.280
Bryocryptella sp.	50	0.0020	0.80	1.80	0.34	0.56	0.082	0.160
	99	0.0025	2.60	2.20	0.38	0.60	0.074	0.200
Marguetta sp.	99	0.0030	2.40	1.80	0.34	0.60	0.080	0.200
	177	0.0020	1.80	1.20	0.48	0.60	0.072	0.240
	50	0.0020	1.00	0.70	0.32	0.35	0.060	0.082
Diplonotos sp.	99	0.0025	2.70	2.70	0.38	0.60	0.082	0.260
	158	0.0016	0.54	0.70	0.38	0.56	0.035	0.190
	177	0.0060	1.10	0.90	0.45	0.54	0.070	0.400

Family : CALPENSIIDAE Canu-B., 1923
Genus: **Calpensia** Jullien, 1888

Calpensia nobilis (Esper), (pl.1, Fig.3).

Family :SCRUPOCELLARIIDAE Levinsen, 1909

Genus **Caberea** Lamouroux,1816
Caberea boryi (Audouin), (pl. I, Fig. 4)

Suborder : ASCOPHORA Levinsen, 1909.

Family : MUCRONELLIIDAE Levinsen, 1909
Genus: **Bryocryptella** Cossman, 1906
Bryocryptella sp. (pl. I, Fig. 5)

Genus: **Marguetta** Jullien, 1903
Marguetta sp. (pl. I, Fig. 6)

Family :PETEPORIDAE Smitt, 1867
Genus: **Diplonotos** Canu-B., 1930
Diplonotos sp. (pl. I, Fig. 7).

RESULTS AND DISCUSSION

The bryozoan components (whole and broken shells) counted in the coarse fraction are found to be enriched in the samples of the middle and upper shelf, (Fig. 2).

The biogechemical data of the seven bryozoan species shells are shown in table (1) and geographically depicted in Figs. 3 - 6. It is of interest to note that the bryozoan shells picked from stations No.50 and 47 near the Rosetta Nile mouth are some what similar to those of station No. 158 which heads off the Damiatta Nile mouth. These shells have a fairly low concentration of Mg,Sr and B compared with those of other stations, (Fig.3). We believe , however, that this could be attributed to the effect of low salinity which actualy resulted from the Nile water discharged by both Rosetta and Damietta branches. On the basis of salinity changes, it is found that **Cellarinidra solicornoids** could be the most tolerant of low salinity. This species is characterized by displaying low concentration of Mg, Si, Fe, Mn, Ti and Al than in any of the other species, (Fig.6). This species is localized in stations No. 47, 50 and 158 seaward off the Rosetta and Damietta promontories whose water was of low salinity. Such fact directly allowed close correlation between salinity conditions and distribution of chemical element.

In fact the distribution of water salinity on the continental shelf was given by Karam (1977). He recorded two zones near sea bottom with low

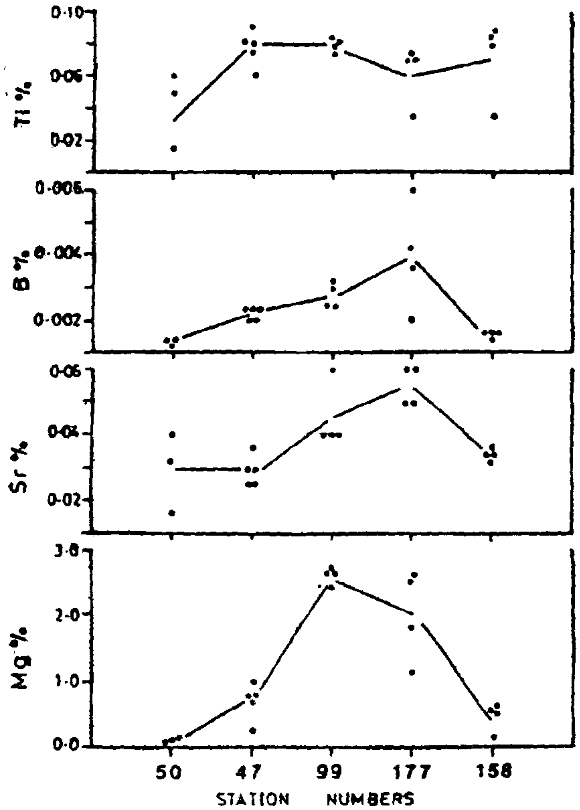

Fig. (3)
Distribution of Mg. Sr, B and Ti along west-to-east transect in the studied shells.

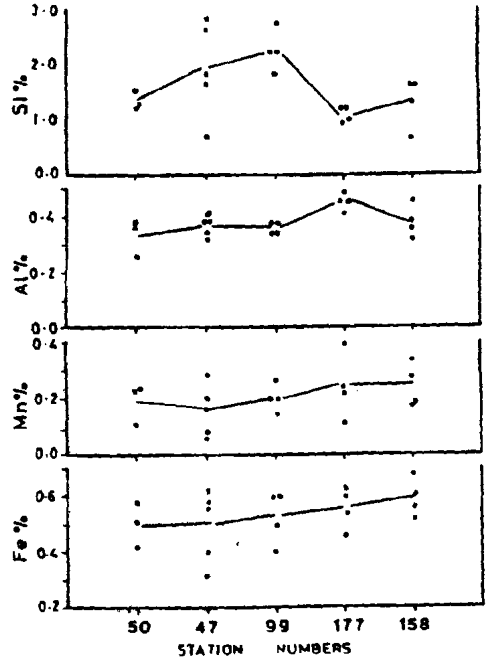

Fig. (4)
Distribution of Fe, Mn, Al and Si along west-to-east transect in the studied shells.

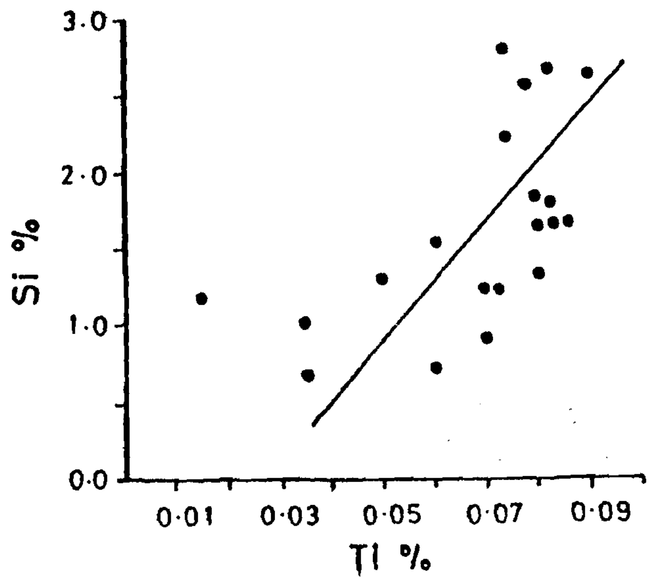

Fig. (5)
Relation between Si and Ti showing a reasonable positive correlation in the examined shells.

salinity ranging from 38.8-38.7‰ sea ward infront of the Rosetta and Damietta promontories. The relation between chemical element and salinity changes have been also discussed in earlier studies by Degens (1959) who pointed out that freshwater limestone have a lower Sr content than the marine ones. Moreover, the Mg content in skeletons also increases as water salinity rises, (Chave, 1954).

The remarkable high concentration of Mn (0.11-0.34%) in the examined species is belived to be due to their adsorption from the seawater, while the presence of Fe (0.35-0.62%) may be largely extracted from the sea food during the Bryozoan nutrition. This agrees with the results achieved by Abdel Aal and Frihy (1988).

The existance of a considerable content of both Si and Ti (Fig. 5) probably indicates the influences of diagenesis of these shells. These two elements (Si and Ti) are found to be also closely correlated with each other i.e. Si increases with Ti, (Fig. 5). The association of these two elements largely

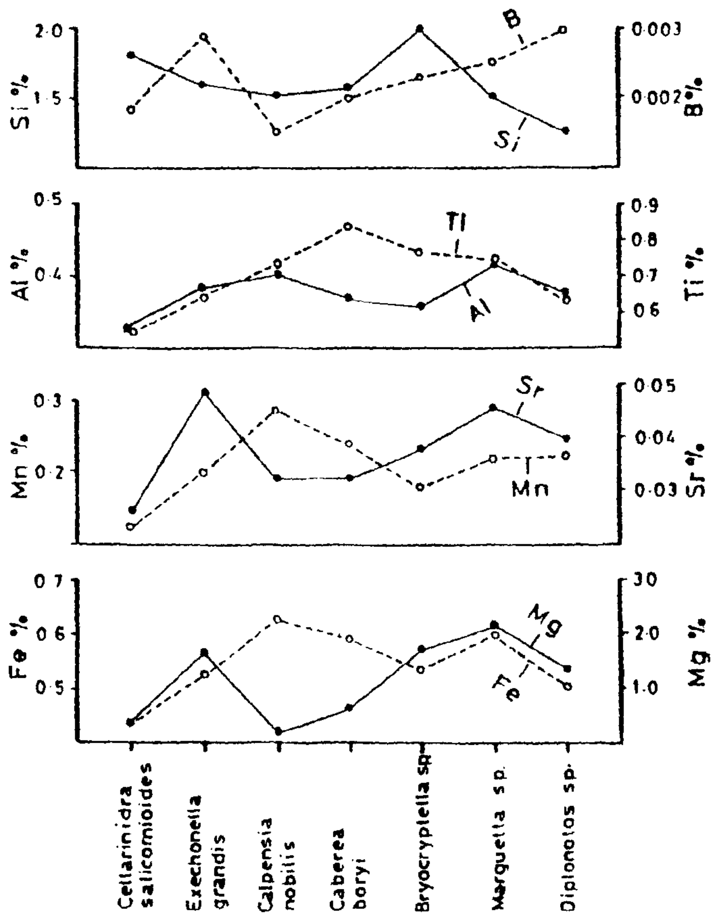

Fig. (6)
Mean concentration of Mg, Sr, Fe, Mn, Al, Ti, Si and B among the studied species.

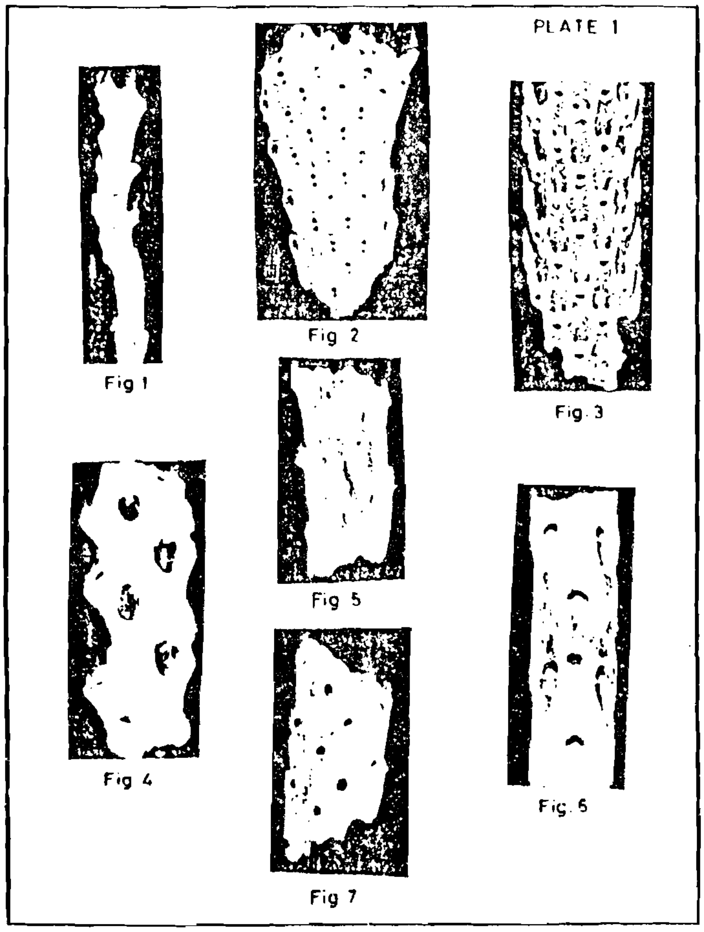

PLATE I

Fig. (1): **Cellarinidra salicornioides** Lamouroux (X 22).
Fig. (2): **Exechonella grandis** (Duvergier) (X 25).
Fig. (3): **Calpensia nobilis** (Esper) (X 25).
Fig. (4): **Caberea boryi** (Audouin) (X 50).
Fig. (5): **Bryocrptella sp.** (X 30).
Fig. (6): **Marguetta sp.** (X 50).
Fig. (7): **Diplonotos sp.** (X 30).

provide a direct diagnostic evidence, confirming that the occurence of the examined species on the Egyptian shelf are relict, probably extends back to the Late Pleistocene. In fact, the discharge of the fresh water through Rosetta and Damietta branches into the Mediterranean and its interaction with the typical saline water, might change the pH value of the sea water and subsequently affected the Aluminium valency. From this consideration it seems possible that the amfoteric chemical behaviour of Al in the studied shells may have been influenced by such salinity oscillations.

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