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DISTRIBUTION OF CHEMICAL ELEMENTS ALONG THE LIFE STAGES OF *GLYCYMERIS GLYCYMERIS* (LINNE')

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ABSTRACT

The present study deals with the distribution of Mg, Sr, Fe and Mn along the life stages of **Glycymeris glycymeris** (Linne') collected from both the modern beach zones of Alexandria and El Ariesh, Egypt. The contents of Mg, Fe and Mn throughout the different life stages of **G. glycymeris** show a general increase starting from the nepionic stage to the adult stage. On the contrary, the content of Sr decreases from the nepionic stage to the adult stage. An attempt also was made to apply multiple correlation between the chemical elements and the shell parameters (length, heigh and thickness).

INTRODUCTION

The geochemical study of Recent and fossil bivalve shells was recently dealt with in detail by several authors noteably: Lowenstam (1954), Turekian and Armstrong (1960), Rucher and Valentine (1961), Pilkey and Goodel (1962), Dodd (1963), Chave (1964), Sultanov and Isayev (1966), Aliev (1971), Smislov (1977), Clark and Lutz (1980), Abdalla Hegab and Abdel Aal (1983), Abdel Aal (1983), Abdel Aal and Frihy (1984) and Ismail and Abdel Aal (1986) to illustrate the relation between chemical composition, mineralogy, metabolism, secondary alteration and ecologic interpretation.

MATERIALS AND METHODS

Thirty-six sheels of **Glycymeris glycymeris** were picked from about 400 shells collected from the beach zones of both El-Ariesh and Alexandria, Egypt (Fig.1). The selected shells represented all life stages of the studied species (Tables 1 and 2) beginning with the smallest specimens which respesented nepionic stages and ending with the largest specimens that represented adults. The aim of the present study was to exhibit the distribution of Mg, Sr, Fe, and Mn along the different life stages of the studied species. An attempt also was made to apply mutiple correlation between the chemical elements and the shell parameters (length, hieght and thickmess).

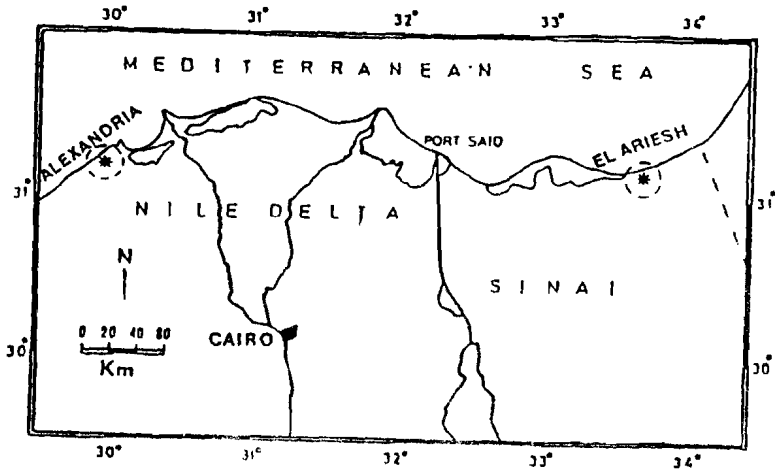

Fig. (1)
Location map of the studied species.

Table (1)
Concentration of chemical elements in the studied shells of Glycymeris glycymeris collected from El Ariesh beach.

Specimen No.	No. of life stages	Shell Parameters in mm.			Mg %	Sr %	Fe %	Mn %
		Lengths	Height	Thickness				
1a	1	12.5	11.7	1.0	0.080	0.460	0.11	0.0010
2a		14.2	13.0	1.2	0.080	0.460	0.11	0.0010
3a		14.6	14.3	1.2	0.085	0.460	0.15	0.0010
4a	2	19.0	18.4	2.1	0.085	0.430	0.11	0.0010
5a		19.4	18.2	2.1	0.100	0.460	0.12	0.0010
6a		20.7	20.9	2.4	0.090	0.440	0.12	0.0020
7a	3	25.5	24.6	2.4	0.100	0.400	0.20	0.0018
8a		28.0	26.5	2.4	0.120	0.420	0.20	0.0020
9a		28.4	28.2	2.8	0.100	0.430	0.23	0.0025
10a	4	30.0	28.0	3.3	0.130	0.320	0.20	0.0020
11a		31.8	30.4	3.1	0.140	0.350	0.26	0.0030
12a		32.6	31.0	3.4	0.130	0.320	0.20	0.0032
13a	5	34.5	32.8	3.4	0.100	0.300	0.40	0.0032
14a		36.2	35.0	3.4	0.150	0.320	0.32	0.0032
15a		37.3	37.0	3.6	0.130	0.300	0.36	0.0035
16a	6	41.3	38.9	4.0	0.180	2.280	0.30	0.0035
17a		43.2	43.9	4.4	0.180	0.300	0.28	0.0035
18a		54.7	43.6	4.6	0.160	0.240	0.28	0.0032

Table (2)
Concentration of chemical elements in the studied shells of
Glycymeris glycymeris collected from Alexandria beach.

Specimen No.	No. of life stages	SHELL PARAMETERS In mm			Mg %	Sr %	Fe %	Mn %
		Length	Height	Thickness				
1b	1	10.9	10.7	1.0	0.080	0.580	0.08	0.0004
2b		11.6	11.5	1.0	0.085	0.520	0.11	0.0004
3b		13.7	13.0	1.2	0.080	0.490	0.08	0.0010
4b	2	17.8	18.3	1.7	0.100	0.620	0.12	0.0006
5b		18.6	17.9	1.9	0.105	0.520	0.08	0.0008
6b		19.7	19.1	2.0	0.085	0.460	0.09	0.0010
7b	3	23.6	23.1	2.2	0.100	0.500	0.12	0.0010
8b		25.1	24.8	2.2	0.100	0.410	0.16	0.0010
9b		25.8	25.3	2.3	0.120	0.400	0.19	0.0010
10b	4	29.3	28.8	2.4	0.120	0.460	0.14	0.0010
11b	29.9	29.8	29.0	2.4	0.120	0.460	0.19	0.0010
12b		30.7	30.2	2.6	0.150	0.400	0.23	0.0018
13b	5	35.1	35.0	3.0	0.110	0.400	0.30	0.0020
14b		35.8	35.1	3.1	0.140	0.420	0.19	0.0032
15b		36.8	36.2	3.3	0.160	0.430	0.36	0.0028
15b		36.8	36.2	3.3	0.160	0.430	0.36	0.0028
16b	6	40.2	39.8	3.8	0.180	0.400	0.25	0.0028
17b		40.9	40.2	4.2	0.170	0.320	0.25	0.0031
18b		42.4	41.7	4.4	0.190	0.320	0.25	0.0030

The analyses were done using the spectrographic method described by Abdel Aal and Frihy (1984).

RESULTS AND DISCUSSION

Distribution of Chemical Elements Along the Life Stages

The chemical-concentration results of the spectral analyses are shown in (Tables 1 and 2), while their ranges are summarized in (Table 3). The contents of Mg (Fig. 2), Fe (Fig. 3) and Mn (Fig. 4) throughout the different life stages of **Glycymeris glycymeris** show a general increase starting from the life stage No.1 that represents the nepionic stage to the life stage No. 6 that represents the adult stage. The content of Sr (Fig. 5) decreases from the nepionic stages to the adult stages.

Table (3)
Ranges of chemical elements concentration in the studied shells of Glycymeris glycymeris.

	Mg %	Sr %	Fe %	MN %
Al Ariesh	0.080-0.180	0.240-0.460	0.110-0.400	0.0010-0.0035
Alexandria	0.090-0.190	0.320-0.620	0.080-0.360	0.0004-0.0032

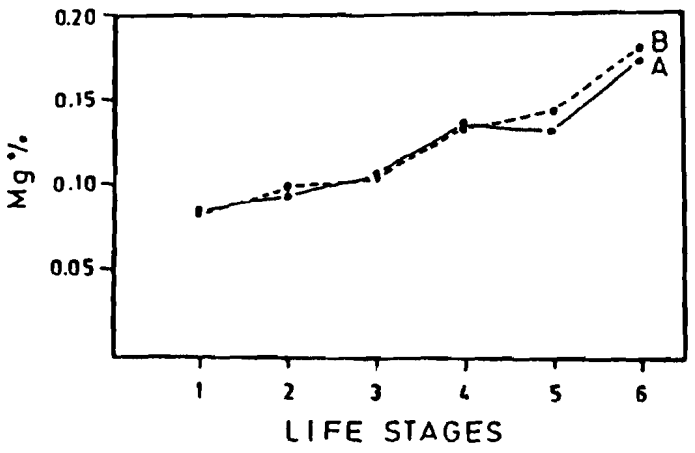

Fig. (2)
Distribution of Mg in the studied specimens of Glycymeris glycymeris.
A = specimens of El Ariesh. B = specimens of Alexandria

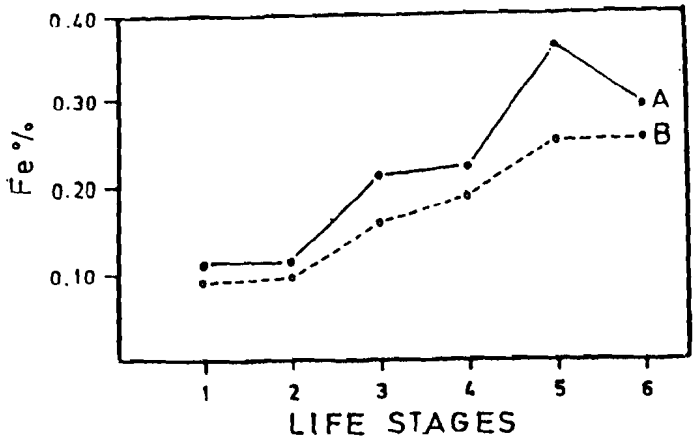

Fig. (3)
Distribution of Fe in the studied specimens
of **Glycymeris glycymeris.**
A = specimens of El Ariesh.
B = specimens of Alexandria.

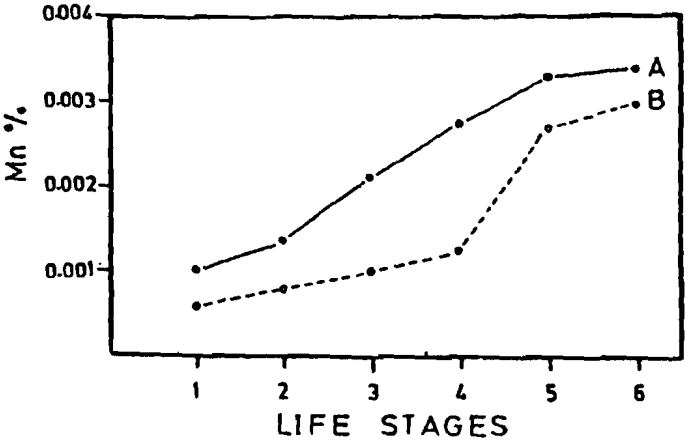

Fig. (4)
Distribution of Mn in the studied specimens
of **Glycymeris glycymeris.**
A = specimens of El Ariesh.
B = specimens of Alexandria.

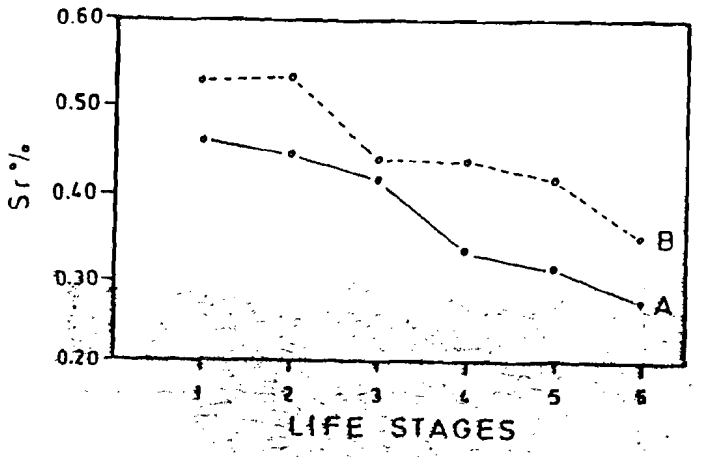

Fig. (5)
Distribution of Sr in the studied specimens of Glycymeris glycymeris.
A = specimens of El Ariesh.
B = specimens of Alexandria.

The content of Mg in the specimens from both Alexandria and El-Ariesh beaches are nearly equal in all life stages.

The contents of Sr in the specimens of Alexandria are higher than in those of El-Ariesh. This indicates that the environmental temeprature in Alexandria seawater is higher than that of El-Ariesh . This agrees with the work done by Lowenstam (1954), Dodd (1963) and Ismail and Abdel Aal (1986) who concluded that the amount of Sr in the shells increases with increasing environmental temperature.

On the other hand, the contents of iron in the specimens of El-Ariesh are higher than those of Alexandria. The concentration of Fe in the studied shells depends to some extent on both the iron concentration in the food supply and on organisms growth rate. Sultanov et al (1978) stated that an element can enter a mollusk's skeletal tissue either in food or by adsorption from the sea water. It is known that iron occurs only in the 3+ oxidation state in sea water, but the iron recorded in the studied shells of living molluscs in the 2+ oxidation state, indicating that iron enters in food.

The contents of Mn in the specimens of El-Ariesh are higher than in those of Alexandria, which indicates that the concentration of manganese in El-Ariesh sea water is higher than at of Alexandria sea water.

Relationships Between Chemical Elements and Shell Parameters

The correlation-coefficient matrix among Mg, Sr, Fe, Mn contents and shell parameters (length, hight and thickness) is given in (Table 4). The combined values show strong positive and negative correlation coefficients, ranging from +0.74 to +0.94 and from -0.82 to -0.89, respectively. These correlation coefficients are statistically significant at the 99% confidence level for all shells collected from El-Ariesh and Alexandria beaches. A representation of the correlation coefficients among the chemical elements and shell parameters is shown in (Fig. 6). It is clear that the shell parameters, Mg, Fe and Mn are positively correlated with each other. Conversely, they exhibit negative relationships whith Sr. This means that Mg, Fe and Mn are associated with the larger shells (adult stages), whill Sr is associated with the smaller shells.

Table (4)
Correlation coefficients of chemical elements and shell parameters of **Glycymeris glycymeris**.

	EL ARIESH					ALEXANDRIA			
	MG	Sr	Fe	MN		Mg	Sr	Fe	Mn
Length	+0.90	-0.89	+0.89	+0.94	Length	+0.90	-0.80	+0.88	+0.91
Height	+0.89	-0.87	+0.89	+0.95	Height	+0.90	-0.80	+0.89	+0.91
Thickness	+0.86	-0.85	+0.80	+0.90	Thickness	+0.91	-0.81	+0.83	+0.92
Mg	1.00	-0.84	+0.74	+0.82	Mg	1.00	-0.76	+0.84	+0.86
Sr		1.00	-0.82	-0.83	Sr		1.00	-0.73	-0.81
Fe			1.00	+0.90	Fe			1.00	+0.80
Mn				1.00	Mn				1.00

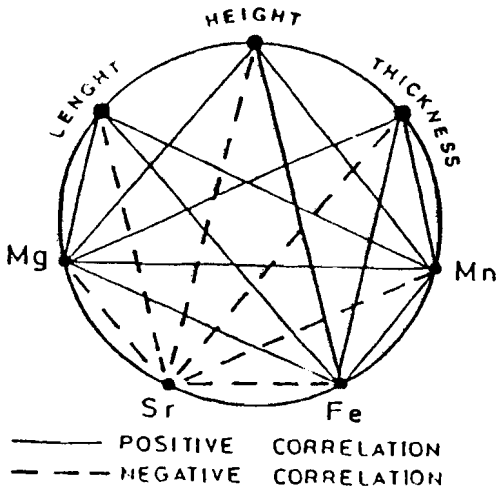

Fig. (6)
Interrelationship between correlation coefficients of multi-element concentration and shell parameters for El Ariesh and Alexandria specimens.

(correlation above 99% significance level).

REFERENCES

Abdalla Hegab, A.A. and A.A. Abdel Aal, 1983. Comparative study of elemental chemical composition of bivalvian shells from the Red Sea and the Mediterranean Sea. **Bull. Fac. Sci., Assiut Univ.**,12 (1), pp. 227-232.

Abdel Aal, A.A., 1983. Structures and chemical composition of some Recent bivalvian shells from the coastal zone of Alexandria, Egypt. **Delta Jour. Sci.**,7 (2), pp. 463-489.

Abdel Aal, A.A. and O.E. Frihy, 1984. Concentration of Mg and Sr in the internal and external shell layer of the Recent pelecypod **Pinctada radiata** (Leach). **N. Jb. Geol. Palaont.**,8 ,pp. 449-454.

Aliev, C.A., 1971. **Paleoecological and biogeochemical investigations of molluscan shells from East Azerbaidjan.** Ph.D. Thesis, Bako Univ., Soviet Union.(In Russian).

Chave, K.E., 1964. **Skeletal durability and preservation. "Approaches Paleoecology".** New York-Sydney (John Wiley and Sons. Inc.).

Clark, G.R. and R.A. Lutz, 1980. Pyritization in the shells of living bivalaves. **Geology**. 8, pp. 268-271.

Dodd, J.R., 1963. Environmentally controlled Sr and Mg variation in **Mytilus**. Geol. Sop. Am. Progr. Ann. Meeting. **Abstract. Geol. Soc. Am., Spec Papers**, 76, pp.46.

Ismail, M.M. and A.A. Abdel Aal, 1986. A geochemical study of Middle and Upper Eocene bivalve shells from the Helwan area, Egypt. **N. Jb. Geol. Palaont.**, 8, pp. 467-474.

Lowenstam, H.A., 1954. Factors affecting the aragonite/ calcite ratios in carbonatesecreting marine organisms. **Jour. Geol.**, 62, pp. 287-317.

Pilkey, O.H. and H.G. Goodel, 1962. Evolution of the use of Sr as a paleoecologic tool. **Geol. Soc. Am. Spec. Papers**, 68, pp. 78-79.

Rucher, J. and J.W. Valentine , 1961. Paleosalinity prediction using trace-element concentration on oyster shells. **Geol. Soc. Am. Spec. Papers**, 68, pp. 257-258. (Abstract).

Smislov, G.A., 1977. Mineralogical and chemical composition of Pleistocene moluscan shells from the Black Sea Basin. **Bull. Sharkov Univ.**, 8, pp. 41-45. (In Russian).

Sultanov, K.M. and C.A. Isayev, 1966. Mg and Sr in some Recent molluscan shells from East Azerbaidjan. **Bull. Bako Univ.**, 5, pp. 3-9 (In Russian).

Sultanov, K.M., C.A. Isayev, and K.F. Oglobin, 1978. Biogeochemical studies of iron in Mollusk shells. **Oceanology**. 18, pp. 669-672.

Turekian, K.K. and R.L. Armstrong, 1960. Magnesium Strontium and Barium concentrations and calcite/aragonite ratios of some Recent molluscan shells, **J. Marine Res.**, 18, pp. 133-151.