NANNOPLANKTON AND URANIUM CONCENTRATION RELATIONS IN THE BLACK SEA DEPOSITS

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ABSTRACT. — Nannoplanktons obtained from sixty-two core samples taken from twenty-three holes penetrated in the Southern part of Black Sea were investigated in this work. Twelve species belonging to the *Emiliania huxleyi* zone (NN 21-Holocene) were determined. *Emiliania huxleyi* (Lohmann) came into existence in Black Sea three thousand years ago and is very abundant in these sediments. This study clearly showed that uranium concentration increases with increasing nannoplankton content of the sediments. It is also observed that the uranium oxide (U_3O_8) contents of the *Emiliania huxleyi* (Lohmann) accumulations on the abyssal plains are higher than those other sediments in the same environments.

INTRODUCTION

A detailed study of the U_3O_8-containing bottom sediments of Black Sea was presented in the "Black Sea Natural Resources Research Project" sponsered by the Mineral Research and Exploration Institute of Turkey, MTA (Gedik et al., 1981). Investigation of nannoplanktons present within the 0-125 cms depth range of the cores studied in this project was undertaken by the present author.

Of the seventy-one holes studied in the aforementioned project cores of twenty-three were investigated in this work regarding nannoplanktons (Fig. 1), and as a result a relationship between nannoplankton content and uranium concentration was revealed. Near-shore sediments are poor in nannoplanktons whereas abyssal plain deposit sare characterized by very high nannoplankton accumulations. Uranium oxide concentrations show similar trend, e.g, sediments containing limited amount of nannoplanktons are also poor in uranium oxide, ranging between 1-5 ppm. On the other hand, uranium oxide contents of samples composing almost of nannoplanktons fell in the range 10-20 ppm. This trend indicates that uranium was arrested by nannoplanktons.

DISTRIBUTION OF NANNOPLANKTONS IN THE SEDIMENTS

Explanation of the distribution pattern of nannoplanktons in Holocene deposits of Black Sea will be based on the studied core samples.

Emiliania huxleyi (Lohmann) is present in almost all samples (Fig. 2). Although *Emiliania huxleyi* appeared first in the Oceans about two hundred thousands years ago, salinity and biotic factors that are essential for its existence prevailed only 3,000 years ago (Bukry, 1973). Therefore this species in Black Sea is no older than 3,000 years.

Nannoplanktons make up 5-35 % of the core samples that were taken from the holes 4,24,26 and 36 sank in on the SW shelf of Black Sea (Fig. 3). The 35 % nannoplankton content of the sediments at the bottom of hole 4 is decreased to 10-15 % at the upper levels. In hole 24, nannoplanktons form 5 % and 35 % of the sediments from the bottom and top parts respectively. This nannoplankton to total volume of the sample ratio ranges between 7-10 % all through the hole 26.

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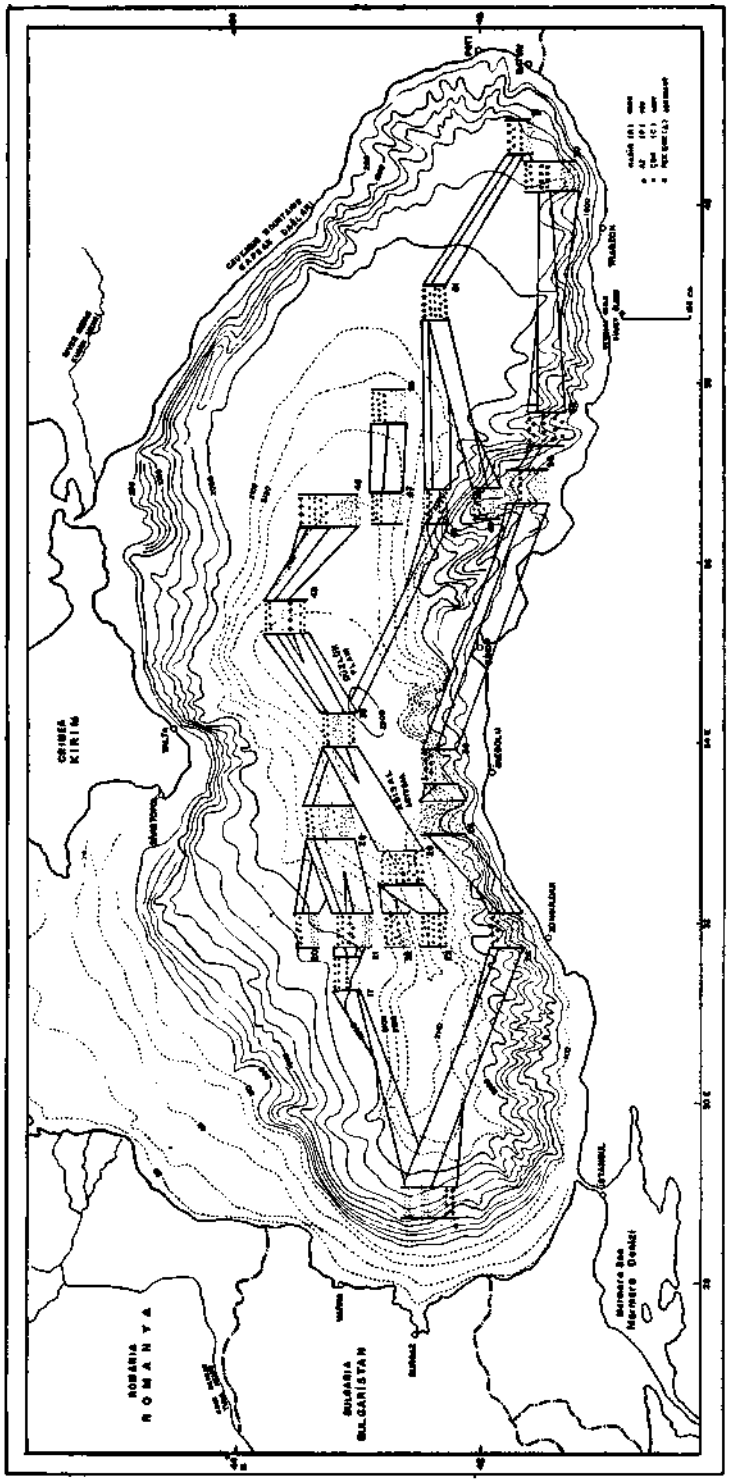

Fig. 1 - Nannoplankton distribution of 23 holes in the southern Black Sea.

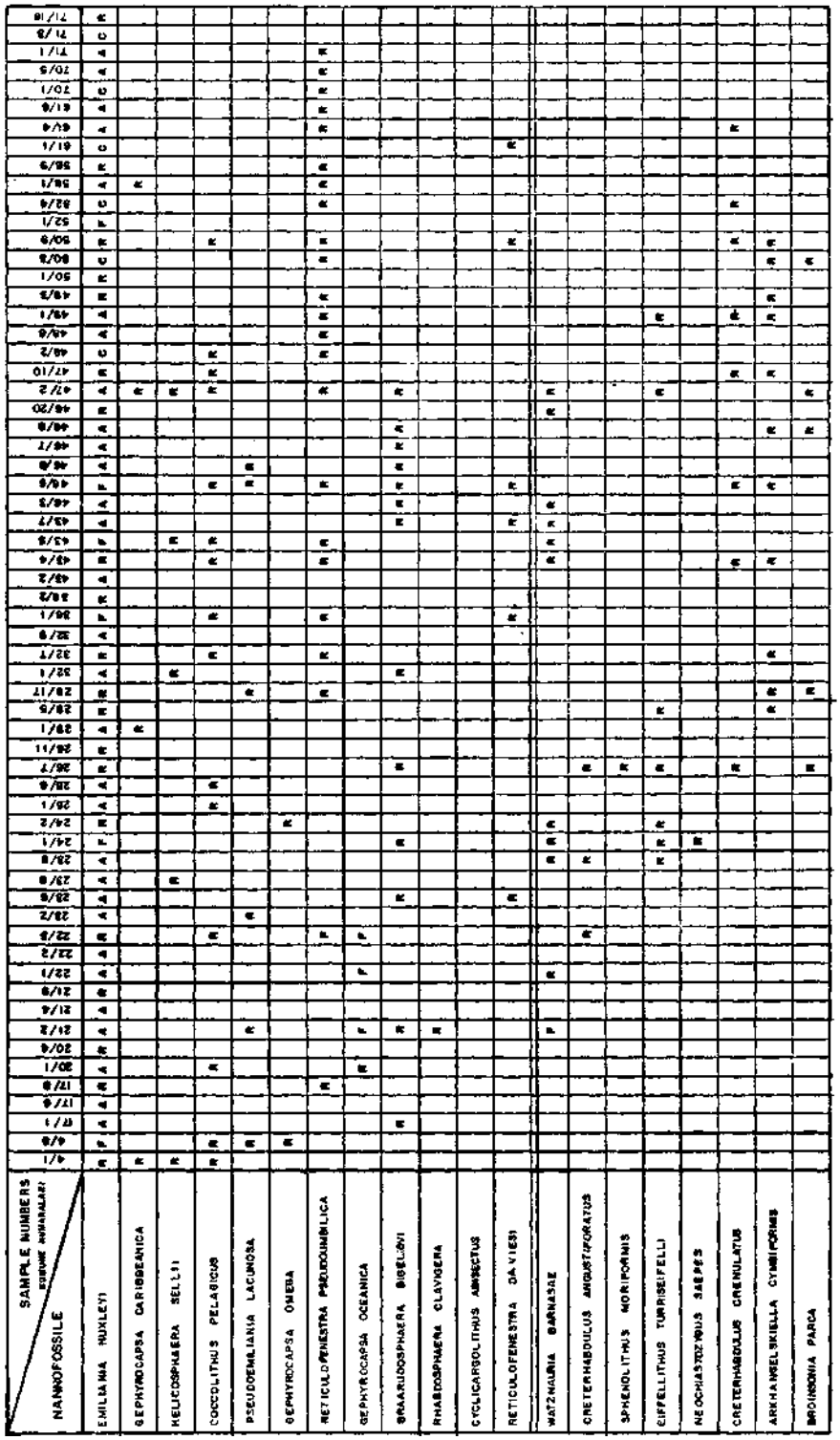

Fig. 2 - Nannoplankton in the hole samples of the Black Sea.

In hole 36, nannoplanktons make up 25 percent of the deposit in 0 to 60 cm depth range and 10 percent of the deposit from 60 to 120 cm interval. Uranium oxide contents of all the samples from these wells fell in the range 2-3 ppm. There are distinct variations between these values and those obtained from the core samples taken from the SW abyssal plains of Black Sea. In the abyssal plain deposits nannoplanktons form 40-90 % of the core samples from holes 17, 20, 21, 22, 29 and 32. Uranium oxide contents of these samples vary between 13-22 ppm. Nannoplankton contents of the samples from the bottom parts (65-120 cm interval) of the holes 17, 20 and 21 fell in the range 40-50 %, and uranium oxide concentrations in these samples are between 2-4 ppm. On the other hand, nannoplanktons constitute 80-90 % of the sediments from the upper parts (0-65 cm intervals) of the same holes and uranium oxide concentration in these samples reaches its highest level measured in the Black Sea sediments (14-22 ppm). Samples taken from the SE shelf areas (holes 50, 52, 70 and 71) contain more nannoplanktons compare to those from the SW shelf areas. Hole 50 is poorer and hole 52 is richer in nannoplanktons with the respective values of 15-25 % and 25-60 %. At some levels in holes 70 and 71 nannoplankton values were estimated to be as high as 90 % of the whole samples. In and around deltaic areas nannoplankton contents are lower whilst with increasing seaward distance from shore increasing values were recorded. Uranium oxide contents of samples from the wells 70 and 71 are low, 2-6 ppm. These values are, however, higher than those recorded in samples from SW shelf areas. Some 70-90 % of SE abyssal deposits represented by samples from holes 43, 46, 48, 56 and 61 are made up of nannoplanktons. In hole 43, nannoplanktons form 85 % of core samples from both 0-60 cm and 80-120 cm intervals whereas this ratio is 35 % within 60-80 cm interval. These samples contain 5 to 9 ppm uranium oxide. The 90-10 cm and 10-0 cm intervals of the sediments in hole 46 contain 80-85 % and 75 % nannoplanktons, with uranium oxide concentrations ranging between 10 and 16 ppm. Nannoplankton content is, in hole 56, 15 % at the bottom and 85 % at the top, and in hole 61, 90 % at the bottom and 60 % at the top. Samples from these two holes contain 13-14 ppm uranium oxide.

HOLE'S No.	DEPTH (cm)	NANNOPLANKTON	URANIUM OXIDE (ppm)
17	5	A	14
17	40	A	14
20	5	A	13
21	10	A	13
21	19	A	22
22	8	A	14
22	15	A	19
29	21	A	3
29	60	A	5
29	70	A	3
29	95	A	2
29	7	A	11
29	80	A	2
29	5	A	17
32	8	A	11
32	71	A	5
43	15	A	13
43	90	A	9
46	5	A	16
46	56	A	12
46	39	A	4
46	42	A	15
47	3	A	12
48	48	A	5
48	15	A	7
56	8	A	14
61	28	A	5
61	52	A	13
70	80	A	2
71	10	A	7

Fig. 3 - Nannoplankton and uranium concentration in same depth.

Thus, Holocene shelf deposits in Black Sea are characterized by both low nannoplankton and low uranium oxide contents. In contrast, contemporaneous abyssal plain deposits are enriched in both nannoplanktons and uranium oxide. *Emiliania huxleyi* (Lohmann) species constitutes 60-80 % of nannoplanktons present. This species characteristically dominates in such boreal waters. Also present is *Coccolithus pelagicus* (Wallich) in cold waters.

The following species which belong to the *Emiliania huxleyi* (Lohmann) zone were determined in the present samples:

Emiliania huxleyi (Lohmann)

Gephyrocapsa caribbeanica Boudreaux and Hay

Gephyrocapsa omega Bukry

Helicosphaera sellii (Bukry and Bramlette)

Coccolithus pelagicus (Wallich)

Pseudoemiliania lacunosa (Kamptner)

Reticulofenestra pseudoumbilica (Gartner)

Reticulofenestra daviesi (Haq)

Cyclicargolithus abisectus (Müller)

Braarudosphaera bigelowi (Gran and Braarud)

Rhabdosphaera clavigera (Murray and Blackmann)

Moreover, the following transported specieses which belong to Cretaceous and Tertiary are present in most of the samples:

Watznauria barnasae (Black)

Creterhabdulus angustiforatus (Black)

Creterhabdulus crenulatus Bramlette and Martini

Sphenolithus moriformis (Broennimann and Stradner)

Eifellithus turriseifelli (Deflandre)

Arkhangelskiella cymbiformis Vekshina

Broinsonia parca (Stradner)

Neochiastozygus saepes Perch-Nielsen

This distribution pattern clearly indicates that transportation process is effective right to the abyssal plains.

Emiliania huxleyi Zone

Definition: First apparence of *Emiliania huxleyi* (Lohmann) came into life to the present.

Authors: Boudreaux and Hay, 1967.

Common species: *Emiliania huxleyi* (Lohmann), (Levha I Şek. 1-6) *Reticulofenestra pseudoumbilica* (Gartner), *Gephyrocapsa caribbeanica* Boudreaux and Hay, *Coccolithus pelagicus* (Wallich).

Region: Black Sea deposits.

Correlation and interpretation: Emiliania huxleyi zone has been determined in the sea bore-holes by numerous workers, e.g. Bukry in 1973 with five species, Ellis in 1975 with nine species and Howe in 1977 with eleven species Gartner (1977) revised Pleistocene zonation and used this zone that was previously defined for the same level. Raffi (1977) and Ellis (1977) both used *Emiliania huxleyi* zone in the recent deposits of sea boreho es. By comparing with defined specieses from other parts of the world, the present author determined this zone in recent deposits of Black Sea.

RESULTS

In this investigation, Emiliania huxleyi zone was determined in the Black Sea sediments sampled at twenty-three stations (holes).

EMILIANIA HUXLEYI ZONE NN21	BUKRY, 1973	ELLIS, 1975	HOWE, 1977	GARTNER, 1977	RAFFI, 1979	ELLIS, 1979	TOKER, 1983
CERATOLITHUS CRISTATUS	X	X	X				
COCCOLITHUS PELAGICUS			X				X
CYCLOCCOLİTHINA LEPTOPORA	X	X	X				
EMILIANIA HUXLEYI	X	X	X	X	X	X	X
GEPHYROCAPSA CARRIBEANICA			X	X	X		X
GEPHYROCAPSA OCEANICA	X	X	X	X	X	X	X
GEPHYROCAPSA APERTA		X				X	
HELICOPONTOSPHAERA KAMPTNERI	X	X	X				
HELICOPONTOSPHAERA SELLII			X				X
HELICOPONTOSPHAERA HYALINA						X	
RHABDOSPHAERA CLAVIGERA		X	X				X
SYPHOSPHEARA AMPHORA			X				
CYCLOLITHELLA ANNULA		X		X			
DISCOSPHAERA TUBIFERA				X			
UMBELLOSPHAERA IRREGULARIS				X			
UMBELLOSPHAERA TERUIS				X			
SYRACOSPHAERA PULCHRA		X					
PSEUDOEMILIANIA LACUNOSA			X				X
BRAARUDOSPHAERA BIGELOWI							X
RETICULOFENESTRA DAVIESI							X

Fig. 4 - General correlation of *Emiliania huxleyi* zone.

It was observed that uranium oxide concentrations are higher where extensive accumulations of *Emiliania huxleyi* (Lohmann) took place. It was also observed that these specieses arrest uranium oxide.

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P L A T E

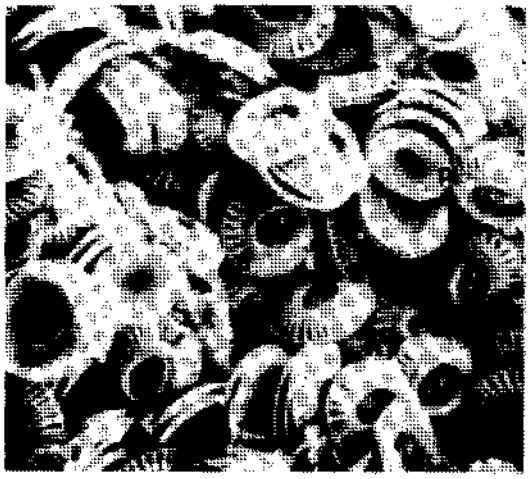
PLATE - I

Emiliana huxleyi (Lohmann)

Fig. 1—2. Abundance of Emiliana huxleyi (Lohmann)

d—distal side, p—proximal side, x 4000

3-6— Distal side, x 8000



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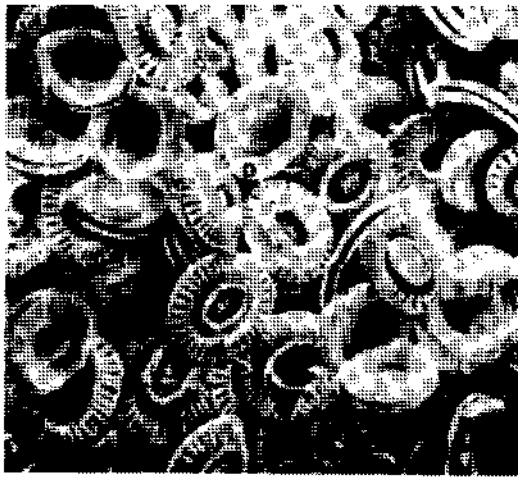

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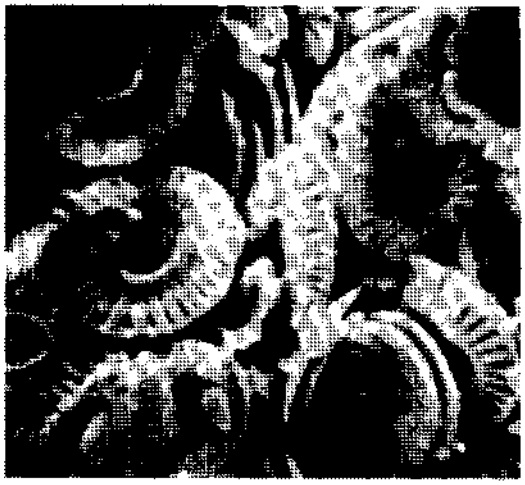

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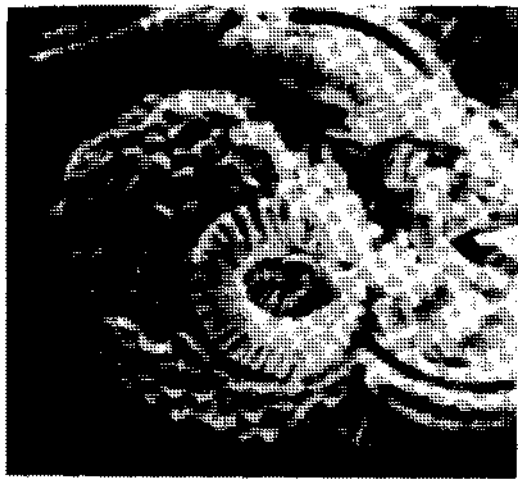

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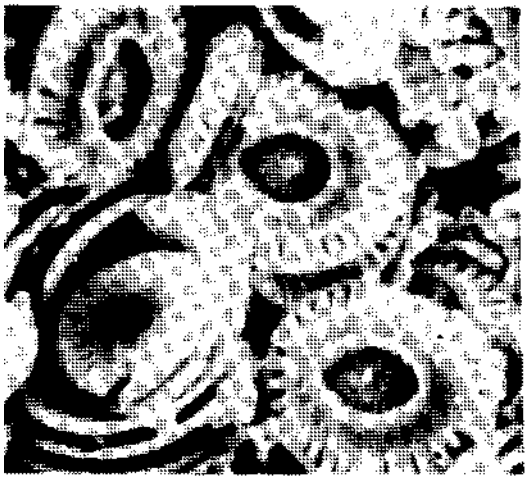

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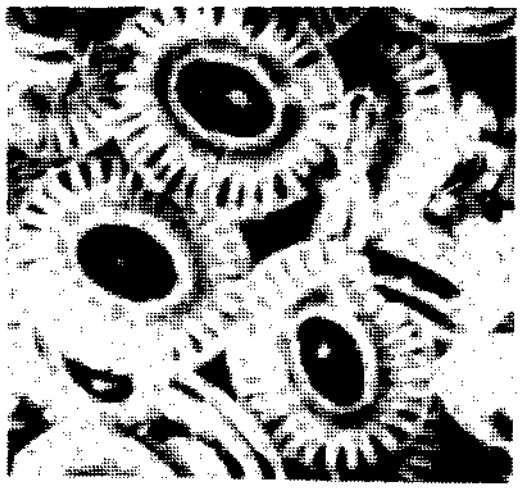

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