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THE COMPOSITION OF SEDIMENTS FROM THE NORTHEASTERN MEDITERRANEAN

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ABSTRACT: *Mediterranean waters are quite oligotrophic and water becomes increasingly poor as it moves eastwards. Thus the sediments underlying these waters is not as rich in organic material as have been expected. Analysis of core samples from the coastal area of Northeastern Mediterranean showed about half of the sediment to be calcium carbonate while the organic content was as low as 1%. Some sediments were enriched 1 "terrestrial organic matter and/or relatively high values of organic material might be attributed the presence of sapropelic layer in the investigated area. The percentage of opal was very low in the analyzed core samples contributing the low primary organic production in the water column and the less accumulation of organic material in the sediment since the opal is a measure of detrital organic material in the marine environment. The amount of alkali extractable humic acid which comprises the significant portion of the organic material, was quite low in the sediment samples being about 1% and the humic acid content was calculated as 2-5.5% of the sedimentary organic material which was relatively low when compared with the humic acid content in the sapropelic layer in the Eastern Mediterranean.*

KUZEYDOĞU AKDENİZ'DE TABAN ÇÖKELTİSİ BİLEŞİMİ

ÖZET: *Akdeniz suları verimlilik açısından oldukça fakirdir ve doğuya doğru gidildikçe daha da fakirleşir. Bu durumda bekleneceği üzere dip taban çökeltisi organik madde bakımından zengin değildir. Sunulan çalışmada Kuzeydoğu Akdeniz kıyı taban çökeltilerinden örneklenen karotlar analiz edilmiş ve analiz sonuçları çökeltilerin hemen hemen yarısının kalsiyum karbonat, sadece % 1'nin organik karbon olduğunu göstermiştir. Bazı taban çökeltisi örneklerinin kıyı etkisi ile yüksek organik karbon içerdiği gözlenmiş ve/veya bu yüksek değerler çalışılan alanda taban çökeltisinde sapropelik tabakanın olabileceği varsayımını getirmiştir. Analiz edilen taban çökeltisi örneklerinde opal yüzdesinin - ki bu parametre de-*

niz ortamında ilk organik üretimin bir göstergesidir- çok düşük olması nedeniyle çökeltide organik maddenin az miktarda birikmekte olduğunu göstermektedir. Deniz ortamında organik maddenin önemli bir kısmını teşkil eden ve baza ekstrakte edilebilen hümik asit miktarı da % 1 gibi çok düşük bir değerdir ve taban çökeltisindeki maddenin % 2-5,5'u olarak hesaplanmıştır. Bu değerler Doğu Akdeniz'de taban çökeltisinin sapropelik tabakasındaki değerlerle karşılaştırıldığında bağıl olarak düşüktür.

INTRODUCTION

The sediment underlying the oligotrophic waters of Eastern Mediterranean is not rich in organic material but 1-10 cm thick Halocene and Pleistocene sapropels (dark coloured layers of organic rich clays) are widely distributed in the Eastern Mediterranean (1,2). The current hypothesis is the formation of bottom water stagnation when the sea surface was markedly fresher than at present due to the excessive fresh water water run off from Africa during glacial retreat (2). The other contributing assumption on the formation of the sapropelic layer especially in the Northeastern Mediterranean is the result of increased supply of terestrial organic matter carried principally by Turkish rivers during a period of climatic warming between 9000 and 7000 years BP (3). In the past the most commonly advanced hypothesis to explain the formation of sapropel in the Eastern Mediterranean was the influx of glacial maltwaters from the Balck Sea and these fresh waters have caused stratification of the Eastern Mediterranean and allowed anoxic bottom conditions in the area and the sapropel to be formed (4). However recent evidence suggests that this influx from the Black Sea took place much earlier than the formation of the sapropel (5). The nature, distribution and origin of sapropels in the sediments of especially the Norteastern Mediterranean is lacking therefore the detail analysis of core sediment samples is quite necessary. Thus the present study is just a start for the future investigation of the composition of the sediments and especially the sapropel and sapropelic layer in the Northeastern Mediterranean.

EXPERIMENTAL

Sediment core samples were collected during the April, 1983 cruise of R/V Bilim to Northeastern Mediterranean. The sampling locations of core samples are shown in Figure 1. The sediment samples were collected using a piston corer lined with plastic tube and the samples were stored at -20^{o}C in a deep freezer for about two years and then they were air dried under ambient conditions.

Opal and quartz were determined on smear slide sediment samples by Philips Model 1410 X-Ray Fluorescence Spectrometer with CuKα radiation following the methods of Eisma and Van der Gaast, (6) and Calvert, (7) respectively. The results were calibrated against a mixture of Skye diatomite, 68.5% natural rock, 25.05% quartz and 6.4% Al_2O_3.

The total organic carbon and carbonate were determined using a Leco Gravimetric Carbon Analyzer and measuring the carbon dioxide evolved by dry combustion at 1100 ^{o}C and by hot 10% HCl respectively. Inorganic carbon was then recalculated as calcium carbonate.

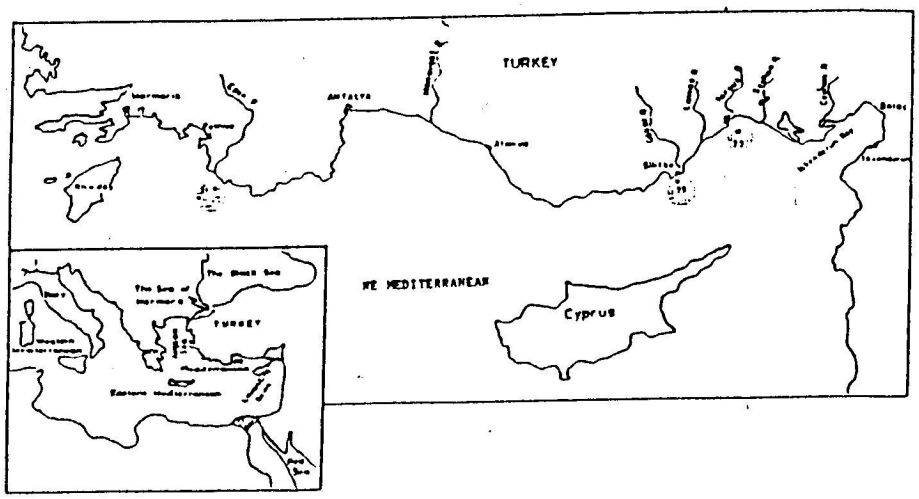

Figure 1. Core sampling stations in the Notheastern Mediterranean

The extraction of humic substances was carried out on dried sediment samples. The sediment portions were prewashed with distilled water and the sediment was extracted until colourless with excess amount of 0.5 M NaOH at reflux temperature for approximately 20 hours. The extracted humic acid was separated by centrifugation and the filtrate was acidified to approximately pH=2 with 0.1 M HCl and allowed to stand over night. The precipitated humic acid was purified by redissolution and reprecipitation with cold 0.1 M NaOH and 0.1 M HCl respectively. The final residue was washed with distilled water and dried at 50^{o}C.

RESULTS AND DISCUSSION

The organic carbon and calcium carbonate values in the core samples found in this study (Table 1) are similar to those found in the core sediment samples from Hellenic Outher Ridge (8) and in the core samples from Lavantine Basin (9) (Table 2). As it is well known, the water column in the euphotic zone in the NE Mediterranean is poor in terms of productivity (10) and the rate of sediment accumulation is relatively low (Table 2). Thus the sediment underlying these waters is poor in organic matter and the low percentage of opal is also consistent with the low organic carbon content of the sediment samples analyzed from the Turkish coastal area. The concentration of quartz, usually a good measure of terrigeneous input, was very low and clay minerals were also low in quantity. Thus the major component of the NE Mediterranean sediment is calcium carbonate. The concentration of total organic carbon was found relatively high at Station 23 and the area seems to be

Table 1. The Chemical Composition of Core Samples From NE Mediterranean

Core Samples	Total organic carbon (%dry wt)	CaCO3 (% dry wt)	Opal %	Quartz %	Others (Clays, etc)	Total amount of extractable humic acid. (mg/g dry wt)	Organic matter associated with humic acid, %
Station 23 (0-36 cm)	3.80	61.1	-	-	-	1.38	2.02
Station 25 (0-15 cm)	0.22	62.7	<5	4.3	27.8	-	-
Station 25 (15-30 cm)	0.33	62.4	<5	7.1	25.2	-	-
Station 31 (0-27 cm)	<1	63.1	-	-	-	0.99	5.50

Table 2. Chemical Composition of the Recent Sapropel From Eastern Mediterranean

Core Sample	Average Organic Carbon, (%wt)	Average $CaCO_3$ (%wt)	Accumulation Rate, cm/10^3 year	^0C Age Years	Source
0-28 cm	0.21 (0.15-0.26)	48.13 (43.70-52.55)	7.2 (org.) 4.6 (inorg.)	2590±280 (org-C)	Sutherland et al., (1984)
Sapropel 29-103 cm	2.35 (1.71-3.34)	52.80 (43.70-63.15)	22.7 (org. +inorg.)	6395±90 9145±130 (org-C)	
105-115 cm	0.33	51.30	4.1(inorg.)	12320±60 (inorg-C)	
Sapropel 21-141 cm	2.58 (0.51-7.02)	40.0-50.0 (10.0-80.0)	-	-	Initial Reports of the Deep Sea Drilling Project, (1978)

under the effect of land (Figure 1). Sinse the natural input and pollutants carried by the rivers may cause the increase of the organic carbon content of the sediment. On the other hand the core sample was deep enough (36 cm in length) to include the sapropelic layer, therefore there is weak possibility of the presence of sapropelic layer in this sediment core sample. The assumption is weak because the total depth of the water column was around 70 m depth where the core sample was collected and it was previously shown that the sapropelic layer was observed in the sediments of 400 m depths or more in the Northeastern Mediterranean (3).

The data characterazing the efficiency of humic acid extraction and amounts of organic matter associated with the humic acid are shown in Table 1. The amount of humic acid extracted from the NE Mediterranean sediment samples is quite low, being approximately 1% of dry weight of sediment. From the approximate relation, organic matter = 1,8 x organic carbon (11), the fraction of organic matter in these sediments present as humic acid has been estimated and it was found that humic acid accounts for about 2.02-5.50 % of the organic matter in these sediments. In the Eastern Mediterranean sapropels humic acids were found to amount 22-60 % of the total organic material. Such high proportion of humic material in a moderate evaluationary stage-end of diagenesis, begining of catagenesis-is typical of continental detrital organic material (12).

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