



Studies on Mediterranean Sea floor microalgae, Egypt

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Abstract

The diatom and other microalgal flora of 274 sediment samples taken from 70 different localities along the Mediterranean Sea floor within the Egyptian territories were studied. This study explored the diversification of the microalgal community structure and revealed a clear variation in the paleogeographic and paleoclimatic conditions during the late Holocene. A total of 79 species and varieties from three different divisions (Bacillariophyta, Chlorophyta and Ochrophyta) were identified from the selected studied samples. The predominant taxa recorded were heavily silicified and robust such as *Coscinodiscus radiatus*, *Thalassiosira oestrupii*, *Paralia sulcata* and *Actinocyclus octonarius*, and mat-forming, e.g. *Rhizosolenia pungens* and *R. settigera*. Those diatom taxa were used according to their habitat preferences

and ecological conditions to predict the water quality and water level fluctuations.

Diatom taxa belonging to fresh water habitat, counted in all sampling sites and at all depths, represent 26.6% of the total number of taxa identified; while the marine species are more represented, being 73.5% of the number counted for all samples studied. The number of fresh water individuals counted in all sites and at all depths was representing 23.3% of the total count, while the brackish and marine individuals represented 76.3%. This showed the quantitative and qualitative dominance of the brackish and marine taxa at all the sites examined.

The relation between the quantitative and qualitative pattern of distribution of planktonic and benthic forms of diatoms may throw some light on the water depth at the sites of sedimentation. The total number of planktonic taxa recorded at all the sampling sites represented 62% of the total number of diatoms, silicoflagellates and green algae identified; while the benthic taxa represented only 38% . The dominance of planktonic taxa is also evident in terms of number of individuals recorded at all the sampling sites, but with higher proportions. The total number of planktonic individuals represented 88% of the total count of diatoms, silicoflagellates and green algae; while the total number of benthic taxa represented only 12% of the total count.

Diversity and diatom paleotemperature indices as well as sea level interpretation model showed an increase in sea water temperature during the late Holocene accompanied by a variation in the water level and abundance of marine and fresh water taxa which in turn throw light on the impacts of global warming. In addition, the diatom analyses showed the influence of

the flow of Atlantic Ocean warm water and the Nile River fresh water on the hydrology, hydrography and flora of the Mediterranean Sea.

Table No.	Title	Page No.
-----------	-------	----------

LIST OF TABLES

1	The locations (X=easting and Y=northing) of each core, its concession and depth of the sampling sites.	42
2	The degree of frustules and cells preservation, the presence of foraminifera and other accompanying groups and the physical properties of each sample examined in the different sites.	62
3	Mean frequencies of diatoms and microalgae recorded at the first 25 sampling sites that were examined in the sediment samples of the Mediterranean Sea, Egypt.	75
4	Mean frequencies of diatoms and microalgae recorded at the 25 sampling sites (from no. 26 to no. 50) that were examined in the sediment samples of the Mediterranean Sea, Egypt.	81
5	Mean frequencies of diatoms and microalgae recorded at the sampling sites from no. 51 to no. 70 that were examined in the sediment samples of the Mediterranean Sea, Egypt.	87

L I S T O F

FIGURES

Fig. No.	Title	Page No.
1	The Mediterranean Sea, landlocked between Africa, Asia and Europe	28
2	The distribution of the sampling sites across the Mediterranean Sea within the Egyptian boundaries as shown from the concession map of BP Company.	40
3	Piston core technique used for collecting sediment sea floor samples.	41
4	The location of the sampling sites across the	50

	Mediterranean Sea on a satellite map (Google Earth satellite imaging).	
5	The variation in the degree of preservation of the microalgae recorded among the studied localities of the Mediterranean Sea.	95
6	The percentage of Bacillariophyta, Chlorophyta and Ochrophyta (as total no. of taxa identified) at the sampling sites.	96
7	The percentage of Coscinodiscophyceae, Mediophyceae, Bacillariophyceae, Dictyophyceae and Chlorophyceae (as total no. of individuals counted) in the collected samples.	97

Fig. No.	Title	Page No.
8	The families represented in the collected samples of the Mediterranean Sea and the number of species identified in each family.	101
9	Total number of genera, species and varieties recorded in the 70 sampling sites of the Mediterranean Sea.	102
10	The percentages of the most common species (as total no. of individuals counted/100 valve) recorded in the sediments samples of the Mediterranean Sea.	103
11	Distribution of <i>Coscinodiscus radiatus</i> (as total number of individuals counted) in all	104

	samples of the Mediterranean Sea.	
12	Distribution of <i>Rhizosolenia pungens</i> (as total number of individuals counted) in all sampling sites of the Mediterranean Sea.	106
13	Distribution of <i>Thalassiosira oestrupii</i> (as total number of individuals counted) in all sampling sites of the Mediterranean Sea.	107
14	Distribution of <i>Paralia sulcata</i> (as total number of individuals counted) in all sampling sites of Mediterranean Sea.	109
Fig. No.	Title	Page No.
15	Distribution of <i>Cyclotella ocellata</i> (as total number of individuals counted) in all sampling sites of the Mediterranean Sea.	110
16	Distribution of <i>Aulacoseira granulata</i> (as total number of individuals counted) in all sampling sites of the Mediterranean Sea	111
17	Distribution of <i>Actinocyclus octonarius</i> (as total number of individuals counted) in all sampling sites of the Mediterranean Sea	113
18	Distribution of <i>Ulnaria ulna</i> (as total number of individuals counted) in all sampling sites of Mediterranean Sea.	114
19	Distribution of <i>Rhizosolenia setigera</i> (as total number of individuals counted) in all	115

	sampling sites of the Mediterranean Sea.	
20	Distribution of <i>Coscinodiscus curvatulus</i> (as total number of individuals counted) in all sampling sites of the Mediterranean Sea.	116
21	Distribution of the foraminifera genera <i>Amphicoryna</i> , <i>Archaeoglobigerina</i> , <i>Gyroidina</i> and <i>Spirillina</i> as percentage of the total number of individuals counted in all sampling sites investigated in the Mediterranean Sea.	119
Fig. No.	Title	Page No.
22	Distribution of the foraminifera genera <i>Spiroloculina</i> , <i>Textularia</i> , <i>Globigerina</i> and <i>Ammonia</i> as percentage of the total number of individuals counted in all sampling sites investigated in the Mediterranean Sea.	120
23	The percentages of fresh water taxa (as total number of taxa recorded at all sites) compared to marine and brackish taxa.	122
24	The percentages of fresh water individuals (as total number of individuals recorded at all sites) compared to marine and brackish individuals.	122
25	The total number of fresh water taxa and brackish/marine taxa investigated at each of the studied sampling sites in the Mediterranean Sea.	125

26	Distribution of fresh water and brackish/marine individuals in different sampling sites studied across the Mediterranean Sea.	126
27	The percentages of planktonic taxa compared to benthic taxa.	128

Fig. No.	Title	Page No.
28	The percentages of planktonic individuals (as total number of individuals) compared to benthic individuals.	128
29	The number of planktonic and benthic taxa recorded at each of the sampling sites studied in the Mediterranean Sea.	130
30	The percentage of planktonic and benthic individuals calculated at each of the sampling sites studied in the Mediterranean Sea.	131
31	Richness of species (as total number of species recorded in each sampling site) recorded in the Mediterranean Sea.	133
32	Diatoms Diversity Index (H) referring to different sampling sites examined across the Mediterranean Sea.	134
33	The assumed water level at different sampling sites across the Mediterranean Sea as indicated by the percentage of planktonic individuals in each site.	136
34	The diatom paleotemperature as calculated	137

	in each of the sampling sites studied across the Mediterranean Sea.	
35	TWINSPAN analysis of the 70 sampling sites across the Mediterranean Sea according to their microalgal flora.	149

Fig. No.	Title	Page No.
36	The diatom assemblage zones (DAZs) investigated at all the sampling sites according to their depths; the distribution of the most common taxa.	154
37	The DAZs investigated at all the sampling sites according to their depths; the distribution of the most common taxa, their diversity index, species richness, water level and Td value.	155
38	The diatom assemblage zones investigated at all the sampling sites according to their depths; number of taxa, preservation, % of planktonic, benthic, freshwater and marine individuals.	156

Introduction

It is now generally accepted that palaeolimnological studies and interpretations of closed-basin saline water can be an important source of high resolution palaeoclimate data (Antón-Garrido *et al.*, 2013; Wang *et al.*, 2014; Zhang *et al.*, 2014; Smirnova *et al.*, 2015; Boeff *et al.*, 2016 and Maier and Bigler, 2016).

Many organisms and groups of organisms produce specific molecules and, if preserved in sediments, these so-called biomarkers can be used to deduce their sources. In marine environments, biomarkers may be buried in sediments after the death of their source organisms and settle to the sea floor (Rampen *et al.*, 2009). The range of biological remains includes diatoms, calcareous microfossils (silicoflagellates, ostracods and foraminifera), plant macrofossils and invertebrates (Reed, 1996).

Diatoms are the world's largest contributors to biosilicification (Martin-Jézéquel *et al.*, 2000). Diatoms are the best indicators of the physical and chemical conditions (Kashima, 1994; Patrick *et al.*, 1995 and Silva Benavides, 1996). Their indicator value is based on their well-defined ecological tolerances (Laušević and Cvigan, 1994). Fossil diatoms have been widely used to reconstruct past changes in pH, salinity, nutrients and climatic changes (Brooks *et al.*, 2001 and Taffs, 2001). Developments in diatom analysis have also been promoted by improvements in sediment coring and in the availability of powerful numerical techniques (ter Braak, 1986; Birks, 1995 and 1998) that together enable robust quantitative reconstruction of environmental change to be made (Battarbee and Renberg, 1990). Dead diatom frustules form sediments at the base of their habitats