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 through 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.

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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