IGCP 521-INQUA 501 Sixth Plenary Meeting and Field Trip, Island of Rhodes, Greece

27 September - 5 October 2010

ORGANIZERS

Hellenic Centre for Marine Research at the Hydrobiological Station of Rhodes, Greece

Avalon Institute of Applied Science

SPONSORS

INQUA

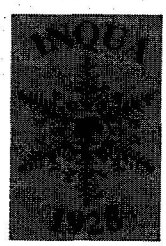
Avalon Institute of Applied Science, Canada

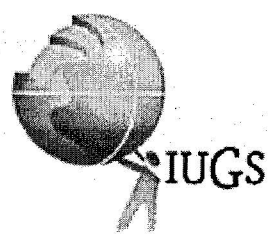
Hellenic Centre for Marine Research

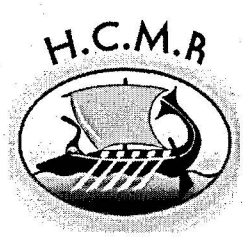
Editors

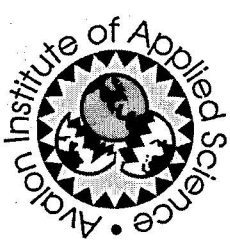
Allan S. Gilbert, U.S.A

Valentina Yanko-Hombach, Canada, Ukraine









Factors controlling the distribution of small-sized planktonic foraminifera in the Late Quaternary landlocked basin of North Evoikos Gulf, central Aegean Sea

Antonarakou, A.,[1] Drinia, H.,[2] and Anastasakis, G.[3]

[1, 2, 3] University of Athens, Faculty of Geology and Geoenvironment, Department of Hist. Geology-Palaeontology, 157 84 Athens, Greece, [1]*aantonar@geol.uoa.gr*, [2] *cntrinia@geol.uoa.gr*, [3] *anastasakis@geol.uoa.gr*

Keywords: palaeoecology, palaeoceanography, climatic variabiity

Introduction

Late Quaternary climatic events are recorded in detail in the Mediterranean successions due to the semi-enclosed character of the basin, which favors the influence of local factors and modifies the effects of global changes.

Planktonic foraminifera are free-floating marine protists that are widely distributed in the surface waters of the world's ocean. The excellent preservation, global occurrence, and high abundance of planktonic foraminifera within Cenozoic marine deep-sea sediments are the prime reasons for the extensive application of their study in paleoceanographic and paleoclimatic studies. Therefore, the statistical analysis of planktonic foraminiferal assemblages provides a reliable and detailed tool for Late Quaternary paleoceanographic and paleoclimatic reconstructions.

Changes in environmental conditions affect not only the species composition, but they can also cause intraspecific size change. Previous studies (e.g., Hecht, 1976) have shown that foraminifera can grow larger in optimum ecological conditions, whereas smaller sizes result from unfavorable environments.

The goal of this work is to understand the ecological, paleobiogeographical, and evolutionary significance of size variability in planktonic foraminiferal tests during the Late Quaternary of the Aegean Sea. Previous studies have demonstrated pronounced peaks of small-sized planktonic foraminifers, mostly *Turborotalita quinqueloba*, in Late Quaternary records from the North Evoikos Gulf, central Aegean Sea. For this reason, we present the down-core composition of planktonic foraminifers in small-sized fractions from these Late Quaternary sediments in six cores distributed across the North Evoikos Basin (Fig. 1).

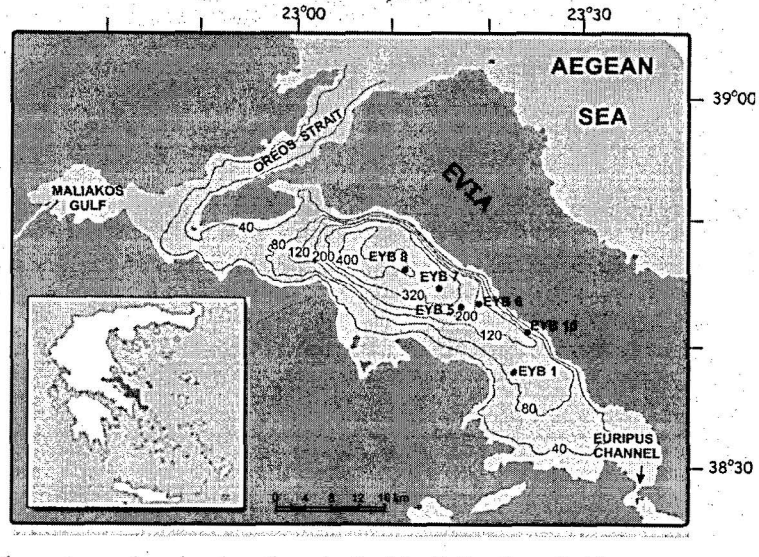


Figure 1. General bathymetry and coring locations in the North Evoikos Gulf.

Material and Methodology

As part of a multidisciplinary and integrated study, six gravity cores from the landlocked, semi-enclosed embayment of North Evoikos (central-western Aegean) were analyzed for foraminifer assemblages as well as for abiotic parameters (grain-size, organic matter, calcium carbonate), in order to reconstruct the

local and regional paleoenvironmental changes caused by several forcing factors. The samples considered in this paper were taken from cores investigated for different research projects. The cores are derived from the North Evoikos Gulf, and their stratigraphic frame was provided by radiocarbon dating. One core (EYB6) was investigated in the most detail, with respect to both the age model and the comparison of planktonic foraminifers in different size fractions.

Small-sized foraminifers are commonly counted in fractions as small as 63 μm, however, discrimination between very small juvenile *T. quinqueloba* and *N. pachyderma* is tenuous and may result in considerable errors (Kandiano and Bauch, 2002). For this reason, we have chosen a relatively narrow, medium-sized fraction of 106–125 μm that closely approximates the content of planktonic foraminifers in a wide size range.

Results and Discussion

Planktonic foraminifers are always present but in very low numbers in the studied sediment cores. They consist mainly of a limited number of cool/eutrophic water indicators such as *Neogloboquadrina pachyderma* and *Turborotalita quinqueloba*, with an absence of warm epipelagic, more oligotrophic species (e.g., *Globigerinoides ruber*), indicating generally eutrophic conditions in the surface waters and a good supply of high-quality food (labile organic matter) to the benthic ecosystem. Benthic fauna characteristically contain *Bulimina aculeata*, probably also indicative of elevated productivity.

The occasional presence of planktonic foraminifers, mainly represented by small-sized *T. quinqueloba*, in relatively low numbers, is a puzzle. It is apparent that potential changes in a broad spectrum of ecological controls should be considered in order to interpret this phenomenon.

The observed depletion in planktonic foraminifera may be due to taphonomic processes and/or certain factors affecting the living assemblages. Taphonomic processes include (1) current-dependent transport of dead individuals before deposition on the sea floor (Bé and Hutson, 1977; Schmuker and Schiebel, 2002) and/or (2) carbonate dissolution, which is also known to occur in shelf seas, lagoons, estuaries, and parts of epicontinental seas because of water mass depletion of calcium carbonate or enhanced organic carbon fluxes (Alexandersson, 1978; den Dulk et al., 2000; Schmuker and Schiebel, 2002). Moreover, planktonic foraminifers are generally more prone to disintegration than benthic forms (den Dulk et al., 2000). Factors affecting the planktonic assemblage include a restricted connection to the Aegean Sea and brackish water influx. Moreover, high river discharge could locally have produced a salinity decrease in the surface water. As a result, the depletion of planktonic foraminiferal assemblages may relate both to taphonomical processes and environmental parameters like freshwater influx.

References

Alexandersson, E.T. 1978. Destructive diagenesis of carbonate sediments in the eastern Skagerrak, North Sea. *Geology* 6:324–327.

Bé, A.W.H., and Hutson, W.H. 1977. Ecology of planktonic foraminifera and biogeographic patterns of life and fossil assemblages in the Indian Ocean. *Micropaleontology* 23:369– 414.

den Dulk, M., Reichart, G.J., van Heyst, S., Zachariasse, W.J., and Van der Zwaan, G.J. 2000. Benthic foraminifera as proxies of organic matter flux and bottom water oxygenation? A case history from the northern Arabian Sea. *Palaeogeography Palaeoclimatology Palaeoecology* 161:337–359.

Hecht, A.D. 1976. Size variations in planktonic Foraminifera: implications for quantitative paleoclimatic analysis. *Science* 192:1330–1332.

Kandiano, E.S., and Bauch, H.A. 2002. Implications of planktic foraminiferal size fractions for the glacial-interglacial paleoceanography of the polar North Atlantic. *Journal of Foraminiferal Research* 32:245–251.

Schmuker, B., and Schiebel, R. 2002. Planktic foraminifers and hydrography of the eastern and northern Caribbean Sea. *Marine Micropaleontology* 46:387–403.