

Original article

Opal phytoplankton assemblages of the Late Quaternary sapropel layers S5 and S7 from the southeastern Mediterranean Sea (“Meteor”-Cruise 40/4, Site 67)

Associations de phytoplancton siliceux des sapropèles S5 et S7 du Quaternaire supérieur de la Méditerranée sud-orientale (Campagne « Meteor » 40/4, site 67)

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Abstract

Well-preserved opal planktic assemblages containing diatom and silicoflagellate species were discovered in the finely laminated sapropels S5 and S7 from Site 67, core GeoTüKL51 during “RV Meteor”-Cruise 40, Leg 4 (34° 48 N; 27° 17 E). The siliceous microflora, composed quasi-exclusively of warm water species, is here studied for taxonomy, stratigraphy and ecology, as well as for quantitative distribution. The diatom assemblage is very diverse and dominated by rhizosolenids, which are generally characteristic of stratified, oligotrophic waters. A significant shift to higher abundances of *Pseudosolenia calcar-avis* is observed in the upper part of Sapropel S5, with a simultaneous decrease in the abundances of *Thalassionema bacillaris/frauenfeldii*, *T. nitzschioides*, *T. oestrupii* and *Chaetoceros* sp., which is probably due to nutrient – poor conditions in the surface waters. © 2007 Published by Elsevier Masson SAS.

Résumé

Des associations planctoniques siliceuses bien conservées à diatomées et silicoflagellés ont été découvertes dans les lits finement laminés des sapropèles S5 et S7 de la carotte GeoTüKL51 du site 67, Leg 4 (34° 48 N; 27° 17 E) de la croisière 40 du « NR Meteor ». Le phytoplancton siliceux est composé presque exclusivement d'espèces d'eaux chaudes. Il est étudié qualitativement et quantitativement au point de vue taxonomique, stratigraphique et écologique. L'association de diatomées est très diversifiée, avec une dominance du genre *Rhizosolenia* sp., considéré généralement comme un bon indicateur des eaux oligotrophes. Une augmentation significative de l'abondance de *Pseudosolenia calcar-avis* est observée dans la partie supérieure du sapropèle S5, simultanément à la diminution d'abondance de *Thalassionema bacillaris/frauenfeldii*, *T. nitzschioides*, *T. oestrupii* et *Chaetoceros* sp. Ces variations sont probablement dues à un appauvrissement en nourriture des eaux superficielles. © 2007 Published by Elsevier Masson SAS.

Keywords: Diatoms; Silicoflagellates; Late Quaternary; Sapropel S5 and S7; Mediterranean Sea; Taxonomy; Stratigraphy; Ecology

Mots clés : Diatomées ; Silicoflagellés ; Quaternaire supérieur ; Sapropèles S5 et S7 ; Méditerranée ; Taxonomie ; Stratigraphie ; Écologie

1. Introduction

The occurrence of siliceous microfossils is generally very scarce in the Pliocene-Quaternary sediments of the Eastern

Mediterranean, which are largely dominated by carbonate-rich sediments. Opal assemblages, however, are exceptionally well preserved in the organic-rich sapropels (Dumitrica, 1973a, 1973b; Sanfilippo et al., 1973; Schrader and Matherne, 1981; Anastasakis and Filippas, 1990; Rohling, 1994; Sancetta, 1994; Pearce et al., 1998).

In order to understand the paleoceanographic and depositional processes that led to the accumulation and preservation of

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sapropels in the E. Mediterranean (a main topic of ODP Leg 160; Emeis and Shipboard Scientific Party, 1996; “Meteor”-Cruise 40/4, Hemleben et al., 1999), scientific interest has focused on their age and cyclicity, sedimentology, mineralogy, geochemistry and microflora.

In recent years, paleoecological information from the flora and fauna found in the Pliocene-Quaternary sediments has provided new insights into the puzzling question of sapropel formation in the Eastern Mediterranean, a basin reputed to be “a nutrient desert in a nutrient desert” (Emeis and Shipboard Scientific Party, 1996). In contrast to calcareous plankton, siliceous plankton preserved in sapropels has not yet been well explored, mainly because of their scarcity in the sedimentary record.

The abundant biogenic silica preserved in sapropel S5 covers a significantly extensive area of the E. Mediterranean south of Crete (Fig. 1). During “Meteor” Cruise 40/4, well-preserved siliceous assemblages from sapropel layers S5 and S7 (Fig. 2) were encountered at Station 67 in the southeastern Aegean Sea.

2. Material and methods

Piston core KL51 (Station 67: 34° 48.83’ N; 27° 17.77’ E) was recovered from 2.158 m water depth ESE of Crete (Fig. 1) (Hemleben et al., 1999). In total, 6.91 m of pelagic sediments were recovered, containing a number of tephra and sapropel layers (likely sapropels S1 to S7), indicating a maximum age of 215 to 220 kyr. Average sedimentation rates are around 3.5 cm/kyr.

The laminated, greenish black sapropels S5 and S7 were sampled at 5.0 cm intervals for examination of diatom and silicoflagellate assemblages (Figs. 3 and 4). In a 250 ml beaker, about 10% HCl was added to 1 cm³ of sapropel sediment until the carbonate reaction ceased. The residue was then heated in 10%

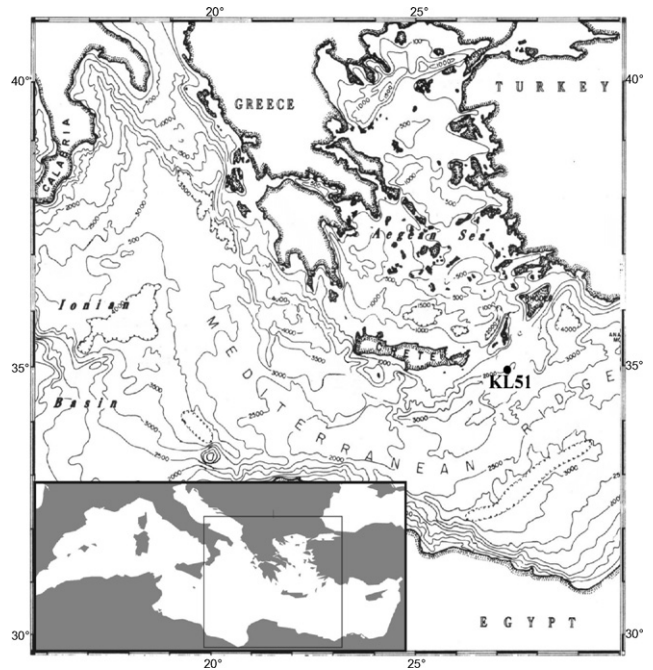


Fig. 1. Bathymetric map of the Eastern Mediterranean Sea with the location of core site M40/4-KL67 (Station 67).

Fig. 1. Carte bathymétrique de la Méditerranée orientale avec localisation du carottage M40/4-KL67.

H₂O₂ and washed repeatedly in distilled water. Smear slides of the cleaned material were prepared using a Hyrax mounting medium and 50 × 24 mm² cover glasses. The diatoms were identified at magnifications of approximately 850× and 600×. From each slide, 325 to 551 partly complete diatom valves, as well as silicoflagellate skeletons, were counted (Table 1).

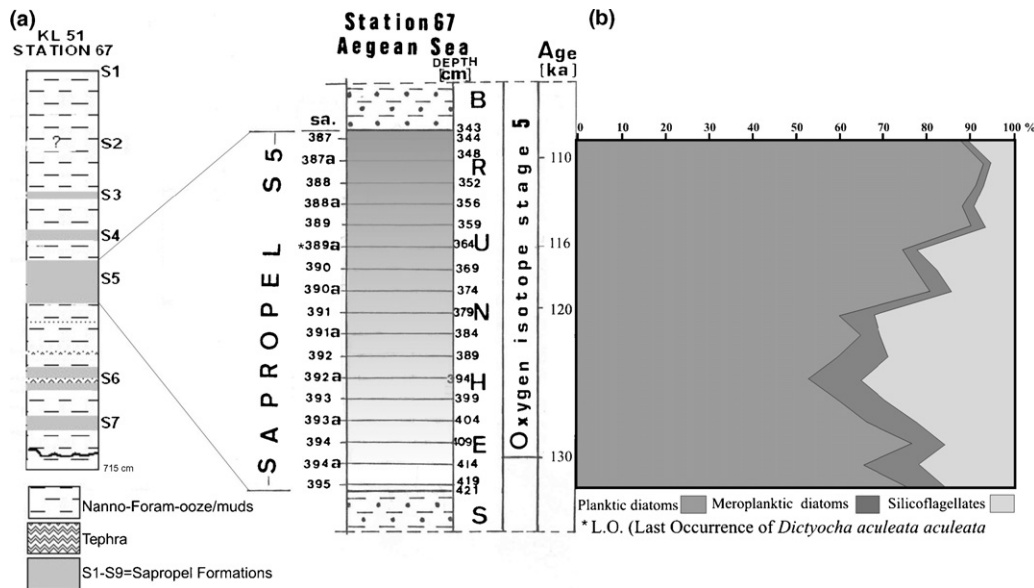


Fig. 2. a. Detailed lithologic and structural description of piston core KL51 (Station 67) from the southern Aegean Sea (ESE of Crete), Hemleben et al. (1999). b. Percent abundance of siliceous phytoplankton assemblages in sapropel S5, which corresponds to the lower part of MIS 5 (according to Imbrie et al., 1984).

Fig. 2. a. Description lithologique et structurale de la carotte KL51 (station 67) du sud de la mer Egée (ESE de la Crète), Hemleben et al. (1999). b. Variation de l’abondance relative des associations de phytoplancton siliceux au sein du sapropèle S5 qui correspond à la partie inférieure de MIS 5 (d’après Imbrie et al., 1984).

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