Biostratigraphy and paleoecological implications of calcareous microfossils in the Afales section (Oligocene), Ithaki Island, western Greece

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The biostratigraphy of a deep bathyal, Oligocene sequence, along the coastal zone of Afales Bay, in Ithaki Island, western Greece, is presented. We interpret the depositional environment and identify foraminiferal and nannofossil bioevents potentially useful in biostratigraphy. Our approach aims to reveal trends in biotic and environmental development and to distinguish global from regional paleoenvironmental signals.

The studied sequence is located in the eastern margin of the Afales Basin which was formed in the early Oligocene, when the depositional setting gradually changed from a shallow carbonate platform to a deep basin (de Mulder, 1975). The section is well exposed and apparently continuous at the resolution of our samples. It covers a total sediment thickness of about 26.5 m and it consists of well-bedded, beige-coloured, detrital limestone beds. These beds show positive grading and nearly all of them are merging into more or less indurated, green-grey calcareous marls, steeply dipping to the west. The hemipelagic marls contain abundant planktonic foraminifera and calcareous nannofossils, common small benthic foraminifera, some ostracodes and rare fragments of echinoids and molluscs. These deposits have been designated as Flysch or flysch-like beds.

Samples for planktonic foraminiferal analysis were prepared using standard micropaleontological techniques, washed on a 63 μm sieve. Planktonic foraminifera are very abundant, well preserved and diversified. The assemblages are dominated by the species *Paragloborotalia opima opima, Catapsydrax dissimilis* and *Catapsydrax unicavus, Globigerina venezuelana, Subbotina gortanii, Globigerina tripartita.* The high abundance of *Paragloborotalia opima opima* defined the planktonic foraminifera P21 biozone of Berggren et al. (1995) and Luterbacher et al. (2004).

Smear slides for calcareous nannofossil analysis have been prepared following the standard preparation technique. The nannofossil biostratigraphic results are based on the biozonal scheme of Martini (1971), as this has been incorporated in the magnetobiochronologic framework of Berggren et al. (1995) and revised by Luterbacher et al. (2004). Samples yield of abundant, high diversity, well-preserved, calcareous nannoplankton assemblages. The calcareous nannofossil species *C. floridanus, C. abisectus, R. bisecta, S. predistentus, S. distentus, S. ciperoensis* defined at the studied samples, are characteristic for the Early Oligocene NP23 –NP24 biozones. The remarkably high abundance of the placolith species *C. floridanus, C. abisectus* and *R. bisecta* may indicate increased productivity in the water column during deposition times.

Benthic foraminiferal assemblages are moderately to well preserved. A preliminary study of the benthic foraminifera is included in Drinia (2009). The benthic foraminiferal assemblages are dominated by calcareous taxa with most common species the *Cibicidoides mundulus-praemundulus, Oridorsalis* spp., *Gyroidinoides* spp. and *Globocasssidulina subglobosa.* We estimate a constant depositional environment corresponding to the lower bathyal zone, at a water depth of more than 1000 m. The benthic biofacies indicate oxygenated deep waters with low and pulsed organic flux due to high seasonality during the Early Oligocene interval.

These results are discussed as reflecting both the global sea-level rise during the Oligocene and the regional tectonic and climatic evolution.

Keywords: Early Oligocene, foraminifera, calcareous nannofossils, biostratigraphy, paleoenvironment

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