

PREFACE

The larger benthic foraminifera, a group of eukaryotic unicellulars with biomineralised calcium-carbonate hard parts, have occupied the shallow marine realm of world oceans since the late Palaeozoic time and have been a useful tool in documenting the history of life and erecting the information on many disciplines as evolution, dating, ecology, climate and geography. This group of foraminifera reached their peak in terms of their diversity and abundance in early Cenozoic time as exemplified by prolific accumulation of nummulitids, orthophragmines and alveolinids in tropics of the Tethys. These thick platform successions, characterized by the accumulation of larger foraminiferal tests and without any modern analogies for comparison, also compose important hydrocarbon reservoirs in the Mediterranean region, such as offshore Libya and Tunisia. The morphological analyses, leading to the identification of the fossil taxa and the understanding of the biology of the organisms, are still the main focus in palaeontology while the resulting data are widely used in evolution, biostratigraphy and palaeobiostratigraphy. One of the major achievements on larger foraminiferal studies in the last decades was the establishment of integrated biostratigraphy of independent groups in late Cretaceous and Cenozoic. For Cenozoic, the integrated biostratigraphic schemes of some stratigraphically important groups such as nummulitids, orthophragminids, alveolinids by Serra-Kiel *et al.* (1998), and lepidocyclinids, miogypsinids by Cahuzac & Poignant (1997) for low latitudes in the western Tethyan realm have been widely adapted in many works in the last decade. However, there has been a substantial progress in the study of composition, ecology, age of regional faunas and functional morphology of some groups with a high potential to improve these biostratigraphic schemes (see the web page of International 'Subcommission on Paleogene Stratigraphy', <http://wzar.unizar.es/isps/LargerForam.htm> for annual reports of the working group on recent publications on Paleogene larger Foraminifera). In addition, new research on the three-dimensional quantification of larger foraminiferal shell opens a new window in the

measurement like 3-dimensional distances, volumes and surfaces of larger foraminiferal shell.

A special session during the 62nd Annual Geological Congress of Turkey was organized in April, 2009 at the congress centre of General Directorate of Mineral Research and Exploration (MTA) in Ankara to discuss the recent developments on larger foraminifera. The session included one day oral and poster presentations as well as two days of field trip to Haymana and Safranbolu basins. The oral and poster presentations covered the following topics: (i) local expressions of global changes; (ii) phlogenetic studies on nummulitidae based on morphogenetic investigations compared with molecular data; (iii) hydrodynamic behaviours of nummulitids and post-mortem foraminiferal events as tools for palaeoenvironmental reconstructions; (iv) Nummulite banks; (v) alveolinids of Palaeogene Adriatic carbonate platform; (vi) biogeography of larger foraminifera in early Palaeogene of Eurasia and biogeographic significance of early Palaeogene larger foraminifera in Middle Asia; (vii) late Ypresian rotaliid foraminifera and their biogeographic significance and new records of larger foraminifera in the Eocene of Greece; (viii) Bartonian–Priabonian foraminiferal events, Bartonian–Chattian reticulate *Nummulites*, and middle Eocene evolution of *Nummulites perforatus* group in western Tethys; (ix) Oligocene benthic zonation in eastern Turkey and palaeobiogeographic aspects of Palaeogene and early Miocene larger foraminifera in Turkey; (x) early Oligocene benthic foraminiferal zonation in Qom Formation in Iran. Contributions in this issue were largely derived selectively from the presentations at the Congress. Meantime, a working group on larger foraminifera (WOLF) was realized during the meeting to assess the recent developments in the study of larger foraminifera to enhance/update the shallow benthic zonation for Cenozoic.

This special issue gives an overview about the recent developments in research on Cenozoic larger benthic foraminifera. The first paper by **Johann Hohenegger** discusses the growth-independent and growth-invariant parameters to model the

planispirally enrolled tests using living nummulitids from the West Pacific, where the molecular genetic relations are known. The author concludes that the use of growth-invariant variables and characters are the strongest tool to shed light on phylogenetic relationships in fossil forms. The next paper by **Antonino Briguglio, Brian Metscher & Johann Hohenegger** demonstrates the potential of three-dimensional biometric quantification by using X-ray microtomography (microCT) on larger benthic foraminifera. The approach is based on the comparison of traditional linear and area measures with three-dimensional characters obtained by actual 3D measurements from volume images. **Andrea Benedetti, Johannes Pignatti & Massimo Di Carlo** describe the late Ypresian rotaliids from Sicily and central Italy by introducing some new taxa and discuss their biostratigraphic potential. The paper by **Katica Drobne, Vlasta Ćosović, Alan Moro & Damir Bucković** provides a detailed account on the distribution of alveolinids in Palaeogene Adriatic carbonate platform with special emphasis on the change in species diversity from early Ypresian to Bartonian. They also describe biosedimentary zones characterized by specific alveolinid associations. The paper by **Elena Zakrevskaya, Vladimir Beniamovsky, György Less & Mária Báldi-Beke** gives a description of larger benthic foraminifera, planktonic foraminifera and calcareous nannoplankton in Eocene units in Gubs section (northern Caucasus) with special attention to Ypresian/Lutetian boundary. The authors suggest that Ypresian/Lutetian boundary falls within the *Acarinina bullbooki* (PF 11) Zone and about the base of the SBZ 12 larger foraminiferal zone in Gubs section and in this respect their results are in accord with those from the Southern Pyrenees

where the GSSP of Ypresian/Lutetian boundary has recently been fixed in the Gorrondatxe section. The paper by **György Less, Ercan Özcan & Aral I. Okay** provides comprehensive data on the stratigraphy and larger Foraminifera of the middle Eocene (Bartonian) to lower Oligocene units exposing in the northern and eastern parts of the Thrace Basin (Turkey). They describe, mainly based on the assemblages of heterosteginids, operculinids, radiate and reticulate *Nummulites* and orthophragminies, six marine flooding periods. The last paper by **Mohsen Yazdi-Moghadam** introduces the larger benthic foraminifera from the Rupelian part of Qom Formation in northwest Iran, close to Iranian-Turkish border and suggests that the described taxa resemble to the fauna previously described from the European marine sequences.

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