

Review

Marcelle Bou-Dagher Fadel: *Evolution and geological significance of larger benthic foraminifera*. Amsterdam: Elsevier. *Developments in Palaeontology and Stratigraphy*, 21, 540 pp.

For stratigraphic or paleogeographical purposes, the larger foraminifera are equal in usefulness to the microscopic planktonic foraminifera, and over a far longer span of geologic time that begins in the later Paleozoic. Many monographic studies have been devoted to the groups and families of larger foraminifera, and even to single genera (for example, Hans Schaub's studies of *Nummulites*). It would thus seem almost inconceivable that a single work of any scientific depth, and not just a superficial review, could contain all the basic information that researchers would need to work with the larger foraminifera. This, however, was the challenge that the author has successfully met in the work under review. Dedicated to the memory of Frederick Thomas Banner (1930-2008), this book easily qualifies as a treatise, in consideration of the amount of numbers of genus level taxa. data covered in its seven chapters and in its treatment of grea

The first chapter gives strict definition to the apparently informal term "large foraminifera," beginning with a useful review of the main features of foraminifera *sensu lato*, followed by a history of these hugely abundant fossils and their living descendants, with their original descriptions as varieties of mollusca, subsequent recognition as unicellular eukaryotes, and present position according to the most recent genetic studies. The author then proceeds to detail the different aspects of these organisms, to explain how they have played such an important role as rock builders for over 200 million years. The review includes the life cycle, geological range, classification (primarily based on complex wall structures), ecology and evolutionary history of the various lineages, with numerous well-executed figures and plates, including some very informative syntheses such as the orrelation between the the extinction of major lineages and significant events in geologic history.

In the following six chapters the author considers the larger foraminifera in their stratigraphic context, divided into late Palaeozoic (Carboniferous and Permian), Triassic, Jurassic, Cretaceous, Palaeogene and Neogene. Given the amount of information to cover, the treatment does not extend beyond the genus level, any more than Loeblich and Tappan's (1988) two-volume classificatuion of all foraminiferal genera. In fact, the three volumes of the "Catalogue of Index Foraminifera" put out by Ellis and Messina in 1965, was only able to describe 500 of the most important species of large foraminifera.

For each of the six geological intervals considered, the author gives a brief description of each genus that has been recorded, together with its stratigraphic range and systematic position. The relevant suprageneric taxa are concisely defined as well, from subfamily, family, and superfamily up to any of the six suborders in which "large foraminifera" occur — namely Fusulinina, Lagenina, Involutinina, Miliolina, Textulariina and

Rotaliina. Inevitably, this leads to some repetition, when the range of suprageneric taxa extends into more than one period. The higher level definitions in particular tend to be repeated from chapter to chapter. There can be no question that this was intentional, and indeed it is rather convenient to have the full set of definitions at hand in each chapter.

Despite the author's clearly stated view that the "larger" benthic foraminifera should be distinguished as a group on the basis of the complex internal structure of their test, and not simply because of their greater size, the reader can be somewhat surprised to see genera included in which some species do not exceed 0.5 mm in maximum dimension, and some (for instance, *Meandrospira pusilla*) that are less than 0.1 mm. But these are few, compared to the vast majority of relatively giant forms, and the fact that they are so useful in stratigraphy would make it bad form to complain about the discrepancy.

All of the genera are illustrated by images of one or more characteristic species, generally shown in thin sections in order to point out their internal structure, and also as they usually appear to researchers who deal with these rock-forming organisms. Also seen half-hidden in hundreds of these photographs are sections of other microorganisms such as green algae (*Palaeodasycladus mediterraneus*, *Clypeina jurassica*), stromatoporoids (*Cladocoropsis mirabilis*) or incertae sedis (*Thaumatoporella parvovesiculifera*, *Cayeuxia piae*) that all play important roles in microfacies characterization.

Sizeable as it is, the systematic and taxonomic part of these chapters is far from the only aspect of the larger foraminifera treated here. Each chapter also contains detailed discussion of the biological and geological significance of these fossils in biostratigraphy, phylogenesis, palaeoecology, and palaeogeographic reconstructions. The discussion is centered on very pertinent figures, plates and charts. The text, as well as the illustrations, reflects both the author's own research and the many publications that she took into account, as indicated by the 25 pages of references (including numerous online sources) that stretch out at the end of the book. The volume has many well-considered features overall, as for instance the inclusion of R. C. Blakey's regional palaeogeographic and tectonic reconstructions for the various time periods.

In sum, with this book, Marcelle Bou-dagher Fadel has given the scientific community, and in particular stratigraphers and micropaleontologists, a single comprehensive source for basic relevant information about one of the major contributors to our knowledge of earth history, the strange but long-enduring group of giant protists known as the larger foraminifera.

Review by Hector Bismuth