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## COCCOLITHOPHORES: CENOZOIC DISCOASTERALES - BIOLOGY, TAXONOMY, STRATIGRAPHY

Aubry, M. P. 2021. 452 pp + supplemental online appendices. SEPM (Society for Sedimentary Geology) Concepts in Sedimentology and Paleontology 14. ISBN 978-1-56576-376-0 (print). eISBN 978-1-56576-377-7 (eBook).

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### CRANIAL PATHWAYS IN NOTOUNGULATES

New morphological evidence supports that the internal carotid passed directly into the endocranium via the piriform fenestra, rather than coursing through the middle ear.

### AMORPHOUS SILICA MICROFOSSILS FROM THE SOUTHERN PAMPAS

Paleoenvironmental reconstruction based on microfossils indicates temperate humid paleoclimate during the pedogenesis of a hydromorphic paleosol.

### NEW BRYOZOANS FROM THE MIOCENE OF PATAGONIA

Two new species of cheilostomes associated with gastropod shells are described from the Monte León Formation.

**COCCOLITHOPHORES: CENOZOIC DISCOASTERALES - BIOLOGY, TAXONOMY, STRATIGRAPHY.** Aubry, M. P. 2021. 452 pp + supplemental online appendices. SEPM (Society for Sedimentary Geology) Concepts in Sedimentology and Paleontology 14. ISBN 978-1-56576-376-0 (print). eISBN 978-1-56576-377-7 (eBook).

I remember that many years ago when I was starting my Ph.D., I used to read an old newsletter from the International Nannoplankton Association (INA). There was a section where the editor transcribed discussions of the INA members in the coccolith-list, an e-mailing list of the association. One of these discussions was triggered by a member's question that was something like this: In your opinion, which was the most significant contribution in the last years in nannopaleontology? In the newsletter, many replies were copied including many important papers and books. When I was reading it, I also thought an answer for myself. I concluded that the most important contribution in the last years was the paper of Young *et al.* (1992), where authors describe the ultrastructure of heterococcoliths, defining characters that could be traced as homologies in the different lineages. This paper allowed the later contributions of a higher phylogenetic classification of the most important group of nannofossils, the heterococcoliths (Bown & Young, 1997; Young & Bown, 1997a, 1997b). Until those works, there was no testable phylogenetic classification of nannofossils, and this is of a major importance to interpret the fossil record and apply it to biostratigraphy, palaeoecology and palaeoceanography. When I read Aubry's book, *Coccolithophores: Cenozoic Discoasterales - Biology, Taxonomy, Stratigraphy*; it immediately reminded me of that moment, and I think it will have the same impact in nannopaleontology.

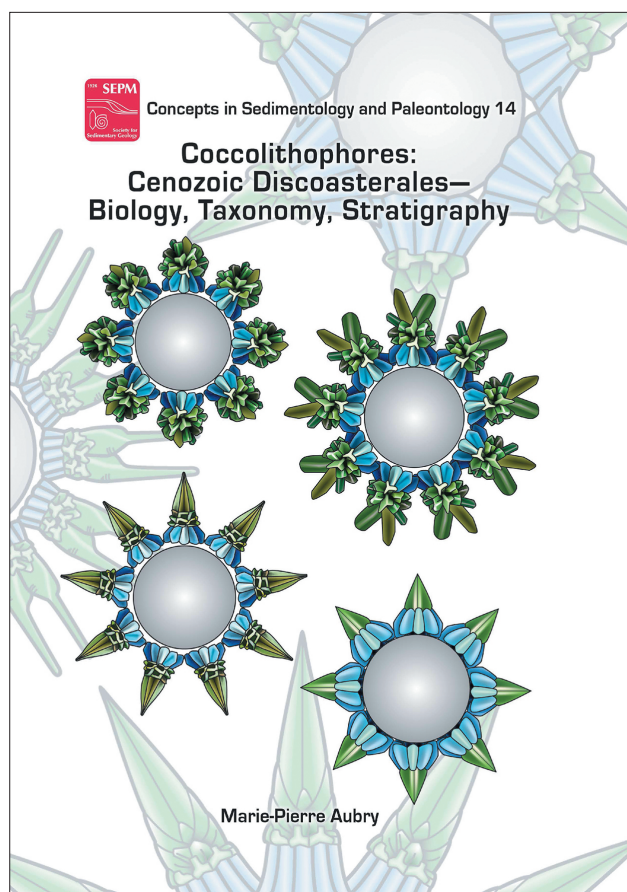
This book, published by the Society for Sedimentary Geology (SEPM) in 2021, is a monumental and exquisitely illustrated work focused on a complicated, diverse and vital group of nannofossils, the Order Discoasterales (Fig. 1). It compiles and synthesizes many years of work by Aubry and collaborators. The first important thing about this book is that Aubry formalizes a well-argued morphostructural criterion, which is the rationale of a new phylogenetic classification for the Order Discoasterales, considering them as true heterococcoliths (diploid life-cycle phase coccoliths of

Coccolithophores). She also profoundly analyzes the taxonomy, biology, palaeoecology, and stratigraphy of each family and genera in this Order.

The book is presented in electronic support and hardcover. It has a total of 452 pages and four appendices of free download from the SEPM web page. It is organized in 14 chapters, which are: an Introduction to the Order Discoasterales, followed by seven chapters that deal with every family within the order. Chapter 9 is a glossary of terms. Chapters 10 and 11 are a formal taxonomic framework and a taxonomic list which is a compilation of all species, including in some cases, a synonymy list, remarks and emendations. In chapter 12, Aubry presents a detailed historical review on the study of discoasterales, with the reproduction of original descriptions and illustrations. Chapter 13 deals with the impact this work has in biostratigraphical application and biozonations; and chapter 14 presents a very useful and welcomed key determination of genera, which is linked to the appendices.

The Introduction (Chapter 1) is the core of this contribution. There, Aubry presents a brief historical background, defines the general characteristics of the Order Discoasterales: its crystallographic properties, structural units, elements organization in the coccolith, and defines morphostructural groups, which are the basis for the presented phylogenetic classification, main lineages, and their evolutionary history. The text is accompanied by many beautiful diagrams, draws, charts, and microphotographs.

Chapters 2 to 8 are dedicated to each family within the discoasterales. All of them are nicely organized in the same way. They are subdivided by genus, and for each one, it starts with a list of highlights and selected bibliographic references, mainly classical papers or monographs. They have a brief introduction, an overview of the morphology and structure of the coccoliths, accompanied by original and new drawings, schemes, charts, and diagrams; an extensive



**Figure 1.** Cover of the book “Coccolithophores: Cenozoic Discoasterales – Biology, Taxonomy, Stratigraphy” – SEPM Concepts in Sedimentology and Paleontology 14.

discussion about their biology, ecology, biogeography, and physiology; a detailed section dedicated to the evolutionary history dealing with the origin, phylogeny, diversity, morphological change and evolutionary trends; and finishing with the biostratigraphy, biozonation, chronostratigraphy, and biochronology of the considered group. Diagrams, drawings, charts, and tables in these sections are abundant and delightfully summarize the essential data and concepts.

Another chapter that deserves a detailed comment is Chapter 13, Taxonomic impact on zonation; since it is where all this in-depth review and new taxonomic criteria for the discoasterales effect on the application field. In this chapter, Aubry presents a series of tables, charts, and schemes regarding biohorizons (*i.e.*, first and last appearance datums) of the most important discoasterales species; their reliability, synchronicity or diachronicity between different locations; where and how these were calibrated with

magnetostratigraphy, with an indication of the type sections and bibliographic references; and incorporate that information in the standard biozones of Martini (1971), Okada and Bukry (1980) and Agnini *et al.* (2014), among others. This chapter is the most significant contribution of this book for nanofossil specialists and non-specialists whose work focuses on biostratigraphy, both in academia and industry.

Finally, the Appendices, a catalog of all species of discoasterales; is a tremendous work, beautifully organized and easy to work with for nanofossil specialists, other micropaleontologists interested in nanofossils, and students. All seven families are separated in the four appendices and include a foreword on how the catalog is organized and an explanation for codes and abbreviations. It is followed by an advantageous key determination to easy identification of genera. The catalog include original descriptions of genera and species (translated to English if necessary), original illustrations of type material and a large number of Scanning Electron Microscope (SEM) and optical microscope (OM) photographs of specimens. For each species, size, biochron, type locality, type level, description, and remarks are given. An interesting and welcomed thing about this catalog is that species are ordered from two to six per page, with selected OM photos, descriptions and remarks; making the comparison between them very comfortable and easy. Another interesting thing is the large number of microphotographs for each species and the fact that the ones reproduced from the literature are twisted so that specimens are shown correctly oriented.

This book is an obligated reference for nanofossil researchers and will be a landmark material for many, many years in Cenozoic biostratigraphy and palaeoceanography both in academia and industry.

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