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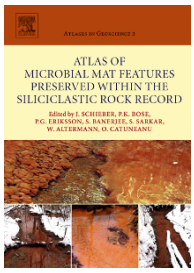
Atlas of Microbial Mat Features Preserved within the Siliciclastic Rock Record, edited by Juergen Schieber, Pradip Bose, P.G. Erksson, Santanu Banerjee, Subir Sarkar, Wladislaw Altermann & Octavian Cataneanu, 2007. Atlases in Geoscience, vol. 2 Elsevier, P.O. Box 211, 1000 AE Amsterdam, The Netherlands. Hardback, 324 pages. Price EUR 160.00; USD 195.00; GBP 115.00. ISBN 978-0-444-52859-9.



The purpose of this latest volume in the series "Atlases in Geosciences" is to acquaint geologists (particularly sedimentologists) with the range of ways in which microbial mats can affect clastic sedimentation, preservation, and diagenesis.

What is a microbial mat? The answer may seem obvious to anyone who has ever seen the multicolored microbial growths on the floors of hot-spring outflow systems or thick, rubbery accumulations in tidal flats or evaporative ponds, but there is actually no universally agreed-upon definition. Most microbiologists think of mats as particularly thick examples of biofilms, or communities of surface-attached micro-organisms. Biofilms can range from the thin layer of plaque currently developing on your teeth and the relatively tenuous microbial coatings that develop on any particle within a few minutes of exposure to seawater, to the more extravagant green slimes and streamers that grow on stream rocks.

To a sedimentologist, a microbial mat is a community of surface-attached micro-organisms which lends cohesiveness to the associated clastic or precipitated substrate. This is a rough, pragmatic definition, but it emphasizes something significant: because an important subset of benthic microbial communities modify the material properties of siliciclastic sediments, micro-organisms can leave a sedimentary record even if no organic matter and body fossils are preserved. In other words, microbial mats can produce more-or-less distinctive sedimentary structures in the absence of actual microbial fossils.

The atlas under review here is an edited volume documenting sedimentary structures attributed to various processes occurring in microbial mats, both in the modern and in the ancient. These structures and the chapters that discuss them are organized according to the genetic classification system first proposed by Juergen Schieber (2004), although other genetic systems are briefly discussed. Features are grouped first by lithology (sandstone or mudstone) and then according to whether they are inferred to have formed due to mat growth, metabolism, physical destruction, or decay/diagenesis. The editors acknowledge that this system is unlikely to be the final word on the subject since we are still in the early stages of understanding the geneses of these structures. This suggests that discussing a contrasting descriptive classification system would have been appropriate. Such a contrast would have also drawn attention to the fact that processes other than mat growth can lend cohesiveness or the appearance of cohesiveness to sediments and thus potentially mimic some of the behaviors described in this book. This is an important consideration in the search for evidence of early life on Earth and Mars and, to the authors' credit, other processes are discussed in the context of certain specific outcrop features. This is a relatively minor quibble, however, and the organization of this book functions well as an introduction to the field.

Roughly equal spaces are devoted to describing mat features in the modern and evidence of mats in the ancient. A chapter near the end covers new avenues in mat research, including

research on mats constructed by iron-oxidizing bacteria, seismic deformation of mats, transport of mat fragments, and mat influence on subsurface hydraulics. The final chapter attempts to place mats in larger chronological and stratigraphic contexts.

As one would expect from an atlas, photographs and figures are plentiful. In a real sense, this particular atlas is all about the figures and taking advantage of the format to stroll through features that would otherwise receive only a quick glance in the sprint through a journal article. The photographs (field and micrographic) are uniformly beautiful and illustrative, qualities which will make this book an excellent starting point for anyone interested in Precambrian sedimentology or paleobiology.

It would be good to view this book as another kind of starting point, as well. As Schieber, Bose, Eriksson and Sarkar point out in the final chapter, a geological record of microbial mats inhabiting clastic/detrital environments exists all the way down to the Paleoarchean. What this implies about microbial evolution is not at all clear, however. Microbial mats are complex constructions of communities of micro-organisms. Significantly, it has yet to be established that the specific processes responsible for properties of microbial sediments (such as cohesiveness) in modern analogs were the same processes operating to produce ancient examples. This point is critical since most studied modern mats have been constructed primarily by organisms from a single clade of bacteria, the cyanobacteria. Just as the prominent inclusion of pictures of mats constructed by iron-oxidizing bacteria on the cover of the book would seem to suggest, future studies examining mats constructed by other groups of organisms in a wide range of environments should shed further light on fossilized mats and the processes that constructed them. The results summarized in this book have already helped to open up an exciting avenue in the study of microbial evolution, and the atlas will itself undoubtedly serve as an invaluable aid to researchers in the field.

Reference

Schieber, J., 2004. Microbial mats in the siliciclastic record: a summary of the diagnostic features. In: Eriksson, P.G., Altermann, W., Nelson, D.R., Mueller, W.U. & Catuneanu, O. (Eds), The Precambrian Earth: Tempos and Events. Developments in Precambrian Geology, vol. 12. Elsevier, Amsterdam, pp. 663-673.

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