

PREFACE

Microbial mats are multilayered sheets of microorganisms, generally composed of both Prokaryotes and Eukaryotes, growing at interfaces. They can reach a thickness of a few centimeters. Microbial activities cause the formation of steep concentration gradients of different chemicals, and the components of the microbial communities arrange themselves so that each finds its optimal conditions for life. In shallow aquatic environments where sunlight is available, the uppermost layers are generally dominated by aerobic photosynthesizing cyanobacteria, diatoms, and other oxygenic phototrophs, while the lowest layers are usually dominated by different types of anaerobic bacteria. In moist conditions the mats are held together by slimy extracellular polymeric substances secreted by the microorganisms. In many cases, filamentous microorganisms form tangled webs that add to the coherence of the mats.

Prior to the evolution of algae and higher plants on early Earth, photosynthetic microbial mats probably were major forms of life on our planet. Microbial mats are therefore extensively found in the fossil record as early as 3.5 billion years ago, and they are the earliest form of life on Earth for which there is good fossil evidence. Stromatolites are petrified microbial mats and these often show structures similar to those found in recent stratified microbial mats. In a later stage in the geological history, after oxygenic photosynthesis had originated, the mats started releasing oxygen. Later when plants and animal evolved, extensive microbial mats became rarer, but they still are present in many ecosystems and have a great impact on the global biogeochemical cycles.

Today extensive microbial mats only exist in special places where they have little competition from plants or grazing organisms. They may be found in salt marshes, beaches rich in carbonates, as well as in extreme environments such as in high temperature areas and in hypersaline environments, where competition by higher organisms is absent and grazers are excluded.

In view of the importance of microbial mats for the understanding of life on Earth under extreme conditions, both current and in the past, we decided to compile this volume to spread knowledge of these mat complexes. This volume is a new book in the *Cellular Origin, Life in Extreme Habitats and Astrobiology* series, published by Springer (www.springer.com/series/5775). This book focuses on the study of microbial mats in a variety of environments. The 30 chapters were written by 72 authors and coauthors from 15 countries: Australia, Austria, Canada, the Czech Republic, Germany, India, Israel, Italy, Mexico, The Netherlands, Oman, South Africa, Spain, United Kingdom, and the USA. The editors thank all contributors for their chapters and their cooperation during the compilation

of this volume. We extend our appreciation to the reviewers whose comments helped us to ensure the high scientific standards of the chapters. We hope that the readers will enjoy the wealth of information provided in this book on the intriguing world of microbial mats, now and in the past.

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August 2009

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Microbial Mats

Modern and Ancient Microorganisms in Stratified
Systems

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2010, XXVI, 606 p., Hardcover

ISBN: 978-90-481-3798-5