

Biogeochemistry of Marine Systems

Edited by Kenneth D. Black
and Graham B. Shimmield
Blackwell Publishing, CRC Press,
2003, 384 pages, ISBN 0849328187,
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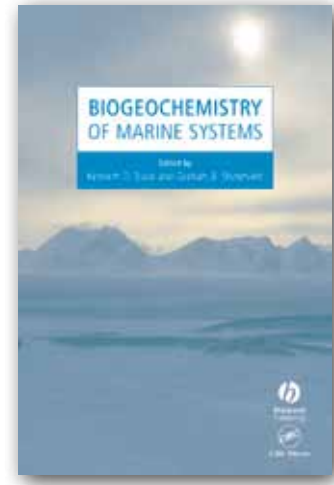
REVIEWED BY ADINA PAYTAN

Steamy, humid mangrove forests; clear blue waters with colorful coral and fish; large river mouths and iceberg-covered coasts; meter-long tubeworms in the dark oceanic abyss: what is common to these very distinct marine environments? They all represent complex systems where biogeochemical processes take place to shape Earth's surface. Biogeochemical research, the balanced study of the mutual interactions (and feedbacks) between the biology and chemistry of the Earth system, is fundamental to our understanding of global change and its consequences and thus assumes a pivotal role for society.

The book *Biogeochemistry of Marine Systems*, edited by Kenneth Black and Graham Shimmield, gives an unusual and unique perspective: "a system approach" rather than the more traditional overview of biogeochemistry centered on "element cycling" or "global processes." This is a well-written, up-to-date review of the fundamental mechanisms and interactions operating in some representative marine systems. The book could serve as a nice introduction, reference guide, and source of current literature

for students and researchers interested in an overview of any of the specific systems presented in the book (mangroves; coral reefs; fjords; the Mediterranean, Arctic, Arabian, and European shelf seas; the Northeast Pacific; and hydrothermal vents and seeps). It is unlikely to be used as a textbook or read by students or researchers interested in a global, general perspective of marine biogeochemical processes as it fails to emphasize the common aspects fundamental to all systems.

The book is an assembly of rigorous case studies of specific systems chosen to emphasize different marine settings, and thus covers a range of forcing factors and processes. The first chapter, "Mangroves of Southeast Asia," presents a high-productivity, low-dissolved-nutrients coastal system with a high capacity for retaining and recycling nutrients within the system. The nutrient dynamics are linked to the mangrove forest vegetation and structure. The second chapter, "Coral Reefs," also pertains to a high-productivity, low-nutrients coastal system; however, different processes, spatial arrangements, and rates are at work. The chapter discusses the stoichiometry and mechanisms that govern nutrient dynamics in coral reef systems, in particular, the hydrodynamic controls on nutrient mass balance. Chapter three, on "Fjords," deals predominantly with biogeochemical processes that result in oxygen depletion, denitrification, and sulfate reduction in both sediments and



the water column. In the fourth chapter, "The Eastern Mediterranean," an oligotrophic, land-enclosed basin is described with significant emphasis on links to water circulation. In Chapter five, the geographic (small sea with a wide, shallow shelf area) and climatic characteristics (strong seasonality, sea-ice cover, large river discharge) are related to ecosystem structure and function of "The Arctic Seas." The "Arabian Sea" chapter (six) represents a highly productive area with severe oxygen deficiency in the water column. Bacterial productivity and heterotrophic abundances are also discussed in relation to the pelagic food web. The remote, deep, cold, dark habitats of the abyssal plain of the Pacific (corresponding to two-thirds of the global seafloor) are discussed in chapter seven, and the deep-sea hydrothermal vents and their unique characteristics are presented in chapter eight. The last chapter assumes a different flavor, and rather than emphasizing a specific system, it provides a summary of nutrient sources, sinks, and cycling and of the control of nutrient distribution on plankton composition.

Thus, the biogeochemical forcing and ecological consequences of nutrient dynamics on ecosystem structure are examined with emphasis on the coupling between coastal and pelagic, and terrestrial and marine environments.

There is an attempt to provide a common structural thread to all chapters. Each chapter starts with a description of the main geographic and hydrographic features of the system, continues with a presentation of the biogeochemical interactions, and concludes with some remarks about environmental change. This structure, although providing a link among the different chapters, neces-

sitates that a large fraction of the book be devoted not to biogeochemistry, but rather to the physical setting unique to each system. On the other hand, because the fundamental biogeochemical interactions (e.g., primary production, respiration, assimilation of nutrients, redox chemistry) have parallels in all the systems, some redundancy could not be avoided when taking the “system approach.” Despite these limitations, the book certainly provides a comprehensive introduction to the major biogeochemical processes operating in the various systems presented, and it serves as a great starting point for any one interested in

learning more about and conducting research in these specific marine systems. The bottom line: this book is a wonderful resource for students or researchers, especially those desiring an introduction to specific marine systems, and a list of the primary literature related to those systems. However, the reader will need to search elsewhere for a more global picture of marine biogeochemistry. ■

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Frozen Oceans *The Floating World of Pack Ice*

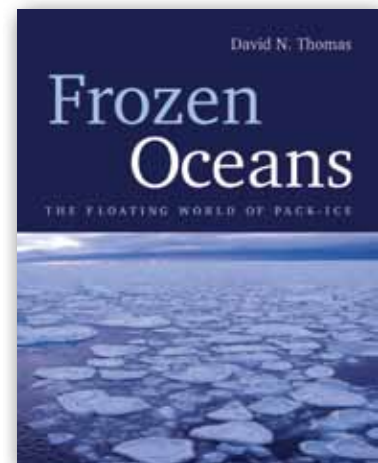
A Book by David N. Thomas
Firefly Books Ltd., 2004, 224 pages,
ISBN 1-55407-000-7, hardcover: \$45.00

REVIEWED BY HAROLD WELCH

Frozen Oceans by scientist David N. Thomas is a glossy, well-produced book with nearly 200 color figures and photos, an introduction to polar and sub-polar pack ice regions of the northern and southern hemispheres. Pictures are generally high quality but the reader will wish there were a few more that illustrate specifics. The writing is straightforward and concise, reminiscent of scientific

papers, with little deviation from the presentation of facts. There is a great deal of information given in an accessible, if somewhat dry, manner. None of the material is referenced, which makes the book easier to read, but this means there is no way to access the sources for the facts given—they have to be taken on faith. However, I noted only a few minor factual and editorial errors, which gives one confidence that the content is well researched and accurate.

The layperson who perseveres will find the book very rewarding, even if not always easy to understand. Oceanographers and people with some first-hand



knowledge of either the north or south polar regions, or science in general, will find the going easy and interesting. The subject of frozen oceans is covered very thoroughly, with virtually every aspect touched upon no matter how cursorily.

Dr. Thomas approaches the subject logically. The first third of the book is