
Reefs and Related Carbonates—Ecology and Sedimentology

Edited by Lawrence A. Hardie
Johns Hopkins University Press,
Baltimore
Studies in Geology No. 22,
202 pages, 1977.
 \$22.50

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Hardie and his co-authors have produced the new standard reference work on sedimentation of the Andros tidal flats and have done it in a well illustrated, finely constructed book that is not overpriced. This book may be placed alongside the two AAPG Memoir volumes on Shark Bay and in the Springer-Verlag volume on the Persian Gulf to provide an invaluable reference set on modern peritidal carbonate environments and processes.

This volume is the product of a long period of activity by faculty and students of The John Hopkins University. Contributors to the volume in addition to Lawrence Hardie (editor and principal contributor) are Owen Bricker, Peter Garrett, Robert Ginsburg, and Harold Wanless. The main papers or chapters in the book deal with the "Exposure Index" method of defining position within the tidal zone (all authors), an environmental summary (Hardie and Garrett), a paper on the origin and significance of lamination and bedding (Hardie and Ginsburg), a paper on biological communities and their sedimentary record (Garrett) and a paper on the morphology and significance of algal structures in cemented crusts (Hardie). A summary paper by Hardie synthesizes the principal features of the Andros rainy, low-energy tropical tidal flat in a manner that allows easier comparison with the more arid tidal flats of the Persian Gulf and Shark Bay. Finally, two short papers or notes comment on some of the implications that arise from the preceding papers.

Although the tidal flats of northwestern Andros Island have been the inspiration for a great volume of published papers dating back at least to the early 1930s, it is gratifying to have the physiographic, climatic, biological and physical sedimentary framework of the area synthesized in one book. A number of years ago, when finally I set foot on the famous Andros tidal flats with the skilled guidance of Bob Ginsburg, I was somewhat disappointed initially to find that the area was not as varied environmentally or as spectacular visually as Shark Bay or some other modern carbonate terrains. The lesson to be learnt, however, is that only by careful and prolonged observation, measurement and sampling of modern environments, particularly environments subject to physical extremes, may we begin to understand these environments and to separate real from hypothetical or imagined processes. One of the most significant contributions in the book is the result of this type of prolonged analysis – the paper by Hardie and Ginsburg on the origin and significance of lamination and thin bedding. The principal conclusion of this paper is that most of the laminae and thin beds within the tidal sediment package are the result of storms or hurricanes – that is, they are the result of abnormal events. Much of the sedimentologic and stratigraphic record may be the result of such abnormal processes.

The "Exposure Index" method of defining spatial and physical position on a tidal flat has been presented in abbreviated form earlier, but is documented more fully in this book. It provides a more quantitative basis for the analysis of the tidal flat sedimentary record, and in turn allows a more rigorous comparison between tidal deposits in different physical-climatic settings. Its practical application to the geologic record is dependent totally on the definition and recognition of sedimentary and biologic structures that may be tied back to modern analogs that in turn are diagnostic of specific ranges of exposure indices.

In summary, this is a valuable and useful book for the sedimentologist working with either modern or ancient sediments and rocks, and one that, unlike some books in related subjects by other publishers, is priced reasonably.

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Sedimentation on the Modern Carbonate Tidal Flats of Northwest Andros Island, Bahamas

Edited by S. H. Frost, M. P. Weiss and J. B. Saunders
Studies in Geology, No. 4,
American Association of Petroleum
Geologists, 421 p., 1977.
 AAPG and SEPM members U.S. \$19.00,
 others U.S. \$24.00

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This book, which deals with the ecology and sedimentology of reef environments, represents an excellent addition to the "Studies in Geology" series published by the AAPG. Twenty-eight papers are included, grouped into three broad categories: Modern and Ancient Reefs (9 papers); Reef Biota (13 papers); and Sediments and Diagenesis (6 papers). The majority of the papers were first presented at the symposium on "Caribbean Reef Systems: Holocene and Ancient" held as part of the 7th Caribbean Geological Conference on Guadeloupe in 1974. A few of the contributions however are from an AAPG-sponsored Research Conference held at the West Indies Laboratory on St. Croix in the same year.

The first group of papers, on modern and ancient reefs, provides an overview of the broader aspects of reef ecosystems and associated sedimentary processes. It is evident that although reefs from different areas are grossly similar, in detail they are by no means mirror images of each other. Significant variations are produced by differences in the marine environment itself, by variable response to past, rather catastrophic events such as storms, partial exposure, or man-induced stress, and by fundamental contrasts in the nature of antecedent topography and substrate type. Both broad overviews and more specific studies are presented, the latter drawn from areas such as the Netherlands Antilles, Puerto Rico, Belize, and Venezuela.

These papers also provide ample documentation of large volumes of sediment that is derived from the reef environment and subsequently driven back toward the more leeward lagoons or transported down the fore-reef slopes. Submersibles have been instrumental in investigating this latter region as is evident in Land and Moore's article on North Jamaica. Much additional information on comparable environments now exists in the literature but this article well illustrates that framework construction by deeper-water corals and sclerosponges is both extensive and volumetrically significant in the deep fore-reef, supplemented by complex submarine cementation.

The section on reef biota focusses on the contribution to modern reefs of a number of specific organisms: corals, mollusks, bryozoa, foraminifera, ostracods, sponges, crinoids, parrot fish, and sea urchins. Special emphasis is placed on the constructive or destructive roles played by these organisms and on ecologic relationships that might be applied to the interpretation of ancient environments. By way of an example, an article by Ball *et al.* on Pennsylvanian limestone sequences recognizes phylloid algae as important sediment producers, but argues that they were not builders of depositional topography, a role for which they have often received credit.

This section also contains three short but noteworthy review articles: Hartman outlines the very impressive role of sponges in building and shaping reefs; Cuffey illustrates the significant contribution of bryozoa through geologic time; and Warne describes how important carbonate borers have been to reef ecology, modification, and preservation. A fourth, equally thoughtful, summary article by Frost appears in the previous section. Through comparative examination of the Cenozoic reef systems of the Caribbean he points out some of the limitations of a uniformitarian approach to paleoecologic synthesis.

The last group of papers deals with the deposition and diagenesis of Cenozoic carbonates. Holocene sedimentation patterns are reported from the continental shelf off southern Brazil and from around Barbuda (West Indies). In the latter case a comparison is also made with older Tertiary-Pleistocene limestones on the island. In a somewhat

similar vein, a study on St. Croix compares an interesting Miocene sequence, consisting largely of shallow-water carbonates interbedded as turbidites and debris flows with basinal pelagic chalks, to comparable modern deposits laid down in an open basin and basin margin position.

Two final papers provide insight into specific aspects of diagenesis. The first deals with the evolution of porosity and permeability in modern and Pleistocene coral reefs from the Red Sea area, and provides yet another illustration of how extensive subaerial diagenesis can be prior to burial of these sediments in the subsurface. The second article leaves the reef environment *per se* and moves ashore to address the problem of sabkha (supratidal flat) hydrology in the Persian Gulf. Careful documentation reveals the presence of marine, continental, and mixed waters beneath the sabkha, and it is clear that an understanding of diagenetic processes in such an environment requires an appreciation of the direction and rate of movement and chemical make-up of these brines.

To summarize, the majority of the papers in this volume are highly recommended and mark a transition, in the study of coral reef systems, from descriptive exploration and data gathering to a more consolidated integration of data and subsequent development of tentative geological and biological models. The text is well laid out, the photos and line drawings are abundant and, with only a few exceptions, crisp, uncluttered, and clearly legible. All in all, this view of coral reef systems provides sufficient flavour to attract the non-specialist and enough meat to satisfy the most serious student.

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Natural Resources of British Columbia and the Yukon

By Mary L. Baker
Douglas, David and Charles,
Vancouver, B.C., 155 p., 1977.
\$14.95

Reviewed by V. A. Preto
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This concise, but readable, outline of the Natural Resources of British Columbia and the Yukon, provides useful and interesting reading for the layman, student and professional. It is a fundamental description of the natural principles, processes and laws involved that combined to form the Canadian Cordillera; indeed, a truly splendid section of North America, rich in mineral wealth and beauty. The protagonist, Nature, is shown in its many roles which include landforming, mountain building, the creation of mineral deposits, soils, forests, rivers, climate and the causation of earthquakes, floods, and landslides.

The book is divided into five chapters. These are: 1) Minerals, Energy, and Water, 2) Land and Forest Resources, 3) Fish and Wildlife, 4) Parks and Recreation, and 5) Natural Hazards.

The section dealing with minerals offers a brief outline of the physiography and tectonics of the Canadian Cordillera. This is followed by a discussion of the main commodities, including their distribution, the main types of deposits, and their mining histories. References are made to some of the more colourful chapters of the mining history of some metals, consequently lending added attraction to each section. Coal, oil, gas and hydroelectric power are dealt with in a similar manner. The section dedicated to water resources is essentially an elementary course in ecology, profiling the natural processes which produce these resources and how man has proceeded to develop them.

The Lands and Forest Resources chapter, begins with an efficient account of the climatic variability over the land, stressing its dominating influence on the glacial history, soil types, and forests of