Geoscience Canada

Book Reviews / Critiques

Volume 14, Number 3, September 1987

URI: https://id.erudit.org/iderudit/geocan14_3br01

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Publisher(s)

The Geological Association of Canada

ISSN

0315-0941 (print)
1911-4850 (digital)

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Cite this review

(1987). Review of [Book Reviews / Critiques]. *Geoscience Canada*, *14*(3), 193–198.

Book Reviews / Critique

Book Reviews

Magnificent Voyagers. The U.S. Exploring Expedition, 1838-1842

Edited by Herman J. Viola and Carolyn Margolis
Smithsonian Institution Press, Washington
303 p., 1985; $39.95 US, cloth; $19.95, paper

Reviewed by W.A.S. Sarjeant
Department of Geological Sciences
University of Saskatchewan
Saskatoon, Saskatchewan S7N 0W0

Some expeditions of scientific exploration have become sufficiently renowned to be known, by name at least, to all natural scientists: the Lewis and Clark expedition and the voyages of the *Beagle* and *Challenger* are examples. Many others, though of comparable importance, have faded from public memory.

One of the latter is the U.S. Exploring Expedition of 1838-1842, the first major marine expedition to be sponsored by the United States government. It yielded extensive collections — more than four thousand zoological specimens, half of them of undescribed species; more than fifty thousand botanical specimens, ten thousand being of new species; several thousand ethnographical specimens and comparable numbers of mineral crystals, fossils and corals — which were destined to serve as the foundation for the collections of the Smithsonian Institution. Its scientific results filled nineteen handsome volumes. Yet, even at the time when the battered survivors of the small fleet that had set forth returned eventually to port, they were received only with polite indifference by the American government and public. The expedition's leader, the dynamic and handsome Charles Wilkes, gained little renown from his achievement: he is remembered principally for his involvement in a later, minor Civil War affray. As for the expedition, it has passed into near-oblivion.

The lack of any modern account of this major exploration has been a deficiency in scientific history. This deficiency is now remedied by the handsome volume here reviewed. The careful essays by a group of distinguished authors on different aspects of the expedition's achievements are supplemented by excellent end-paper maps and an abundance of fine illustrations in full colour or monochrome. The only deficiency worthy of remark is that the binding of the paperback edition is inadequate to long sustain the weight of quality paper it contains; my copy, after only one reading, is showing serious wear. Consequently, I would recommend purchasers to choose the hardback edition, even at double the price, rather than face eventual rebinding costs.

Herman J. Viola provides a lucid history of the expedition to commence the volume. Of the nine scientists taken on board, the names of two will be familiar to most readers — artist and naturalist Titian Ramsay Peale and geologist James Dwight Dana.

Though Wilkes' sound leadership and stern discipline prevented serious discord, the activities of the Scientifics seem to have been outside the comprehension of the sailors. Some of the latter derided them as "clam diggers" and "bug catchers" (p. 14): others, however, were more tolerant. Midshipman Reynolds wrote: "To watch them is another source of gratification ... All they did was Greek to us, but ... here's success to them, may they have a large book to publish when they return" (p. 13). And so indeed many of them did, though, as George E. Watson reports (p. 43-70), the story of Peale and the vertebrate collections proved rather one of lost opportunities than of major achievement. It is especially frustrating that Peale should have written so little about the behaviour of bird species he saw, in Hawaii and elsewhere, that were soon to be extinct: no Steller, he.

In contrast, as Daniel Appleman demonstrates, Dana made the fullest use of his opportunities, the resulting publications having an importance that extends far beyond the mere reporting of new observations. Dana's experiences on Pacific atolls not only allowed him to endorse and amplify Darwin's hypothesis concerning the origin of coral reefs, but also to recognize the ecological controls on reef coral distribution (p. 90-94). His brief visit to New South Wales added massively to the understanding of that colony's geology (p. 95-96), while he so fully exploited his chance to study Hawaii's volcanoes as to come to be regarded as the foremost North American volcanologist of his time (p. 99-106). Peale's magnificent paintings of the volcanoes also merit especial praise.

However, Dana's most original observation was one whose significance has been properly appreciated only recently. In studying the volcanic island chains of the Pacific, he noticed how the age of the volcanic activity changed from older to younger as one passed from island to island along their line (p. 109-110). Thus he was perceiving, even so early as the mid-19th century, one of the key evidences for the process of plate tectonics.

Other chapters by different specialists deal with the plant, invertebrate and ethnological collections amassed during those four hazardous years, with the logistics of the expedition, with the problems of surveying and charting the Pacific basin and with Wilkes' life and career as a diplomat. In a final chapter, Nathan Reingold and Marc Rothenburg recount how, despite the long-sustained unwillingness of secretary Joseph Henry to accept the expedition's collections, they came to serve as the foundation for the Smithsonian's museum complex.

In terms of quality of presentation and illustration, this splendid book compares well with such works as Alan Moorehead's *Darwin and the Beagle* (1969) and Eric Linklater's *The Voyage of the Challenger* (1972). Yet it is more lastingly important than these, for it has brought a forgotten episode back into memory. Might one hope that it will set a new trend and that some other episodes of comparable importance — Huxley's circumnavigation of the globe in the *Rattlesnake* and the marine explorations of the *Meteor*, for example — might soon be similarly favoured?

Sandstone Depositional Models for Exploration for Fossil Fuels, Third Edition

By George deVries Klein
IHRDC Press, Boston
209 p., 1985; $48.00 US, cloth

Reviewed by F.G. Young
Home Oil Company Limited,
324 Eighth Avenue SW
Calgary, Alberta T2P 2Z5

Perhaps the easiest rock for the layperson or beginning geology student to understand is a sandstone — simply sand grains cemented together. Everyone has seen sand on beaches, along river banks, or perhaps in wind-blown dunes. How far beyond these simplest environmental images does modern science take us? Klein's book, in its latest, much improved edition, leads us into the obvious as well as the obscure places on Earth, where sands are laid down.

The book could use more preamble on sand, its movement, volumetric and economic significance, composition, tectonic setting as a backdrop for the fifteen sedimentary environments discussed. These are divided into six main classes, including alluvial and fluvial, eolian, coastal, deltaic, continental shelf, and turbidites.

Wherever the author has done no great amount of personal research, the discussion of the depositional system is well balanced, concise, and readable (*e.g.*, eolian systems). However, in those cases in which he has carried out considerable research himself for example, intertidal flats and turbidites the treatment is far more detailed, and probably beyond that necessary for the stated purpose of the book.

Klein's writing tends to be factual, logical, and readable. The style is reminiscent of a court lawyer reviewing the facts of a case, who then provides the logical conclusions. He is not given to speculation and rhetoric, which may induce some readers to reflect on many standard conclusions, thus fostering a healthy skepticism in student geologists. However, he is to be commended for attempting to make a predictive science out of clastic sedimentology. It should be pointed out, however, that he has been accused of finding more order in certain depositional systems than really exists (*e.g.*, tidal range from tidal vertical sequences). In this vein, his ideal vertical sequences for various depositional systems need to be viewed with a "grain of salt".

Figures are largely borrowed from published sources, and thus are inconsistent in their styles and graphics. Many photographs are dark and smudgy. The quality of seismic profiles ranges from good (Fig. 3.19) to poor (Fig.5.12, 5.32). There are very few spelling errors — the mystery word "reg" on p. 56 and 60 is either a misspelling or a completely undefined term.

Oil field examples are provided for all types of sandstones, and even coal, uranium, and gold deposits are discussed in relation to certain environments. These examples are too often just a mention with a literature reference, instead of a proper description of the reservoir sandstones of the fields cited.

No mention is made of plate tectonics and the associated relationship of sand environments, nor is there much discussion of the secular and spatial peculiarities of various depositional systems. The curious reference to comminuted organic matter (p. 43) in braided stream channels of the Precambrian Witwatersrand and Huronian supergroups remains a peculiar mystery to this reviewer.

In summary, the book offers a sound survey of our current knowledge of sand-prone depositional systems, and how this knowledge has been applied to the interpretation of ancient sandstones. The low quality of the paper and figure reproductions, and short length of text, do not warrant the relatively high price, particularly from a student's point of view. However, the book is a valuable summary monograph on sandstones for the nonspecialist.

Applications of Electron Microscopy in the Earth Sciences

Edited by J.C. White
Mineralogical Association of Canada, Toronto
Short Course Notes Number 11
213 p., 1985; $12.00, paper

Reviewed by Alan Oldershaw
Department of Geology & Geophysics
University of Calgary
Calgary, Alberta T2N 1N4

The GAC and MAC are well-known for their publication of short course notes on advanced techniques in the Earth Sciences. These have been very well received and have formed the basis for regularly scheduled credit courses in the graduate programs of many of Canada's leading universities. This 1985 production of the impact of electron microscopy on mineralogical research in the earth sciences is an excellent example of the imaginative applications of established technology to pervasive geological and mineralogical problems.

The publication, initially, appears imbalanced with a very heavy emphasis on Transmission Electron Microscopy (TEM) and little mention of the many contributions of Scanning Electron Microscopy (SEM) although Chapter 6 by G.E. Lloyd of the University of Leeds presents a very worthwhile review of that area. Lloyd gives an excellent account of what an SEM is, how it works and what its advantages and inherent limitations are. A similar review of Scanning Transmission Electron Microscopy (STEM) would have been equally worthwhile and its absence must be considered an awkward omission.

Chapter 7 by Chauvin is informative and instructive for those unfamiliar with the capability of electron microscopes for very useful qualitative and quantitative X-ray analysis of materials at the superior resolutions attainable in the SEM. Chauvin does a first rate job of explaining the basic principles of X-ray Energy-Dispersive Microanalysis and explains clearly the problems and pitfalls of the technique in the SEM mode.

It may seem a little strange to review briefly the last two chapters of a publication before considering the bulk of the offering. Most earth scientists are familiar with the dramatic results of SEM technology and are comfortable with high resolution semi-three-dimensional views of framework grains, clay mineral morphologies and X-ray Intensities Profiles of the same. So am I. But, the progressive development and refinement of TEM has opened up new and important possibilities in minerology and igneous and metamorphic petrology that have witnessed many advances in the 1970s and 80s.

Applications of Transmission Electron Microscopy in the Earth Sciences began in the early 50s but gave way to the dramatic impact of SEM technology in the 60s and 70s. The resurgence of TEM in later years is largely the result of the increased friendliness of TEMs based on advanced design, greater availability in the earth science community, new materials preparation techniques and an increase in awareness of the TEM potential. Chapters one to three (McLaren, Kohlstedt, Veblen) are excellent treatments of the theory of TEM operation and should be of great value to all earth scientists interested in the analysis of the fundamental properties of geological materials. Chapters Four and Five (Boland, White) deal with quite specific aspects of the application of TEM to the behaviour of earth materials and serve as models for what can be achieved with suitable innovation.

I recommend this product of the MAC to all serious geologists and geophysicists and, at the current price, consider it to be a first rate bargain. One final comment! Despite the tendency of GAC/MAC to produce tiny little books, the figures and photographs are remarkably good.

Practical Seismic Interpretation

By Michael E. Badley
IHRDC Press, Boston
266 p., 1985; $62.00 US, cloth

Reviewed by Dr. A. Easton Wren
Petrel Consultants Ltd.
565, 800 - 6th Avenue SW
Calgary, Alberta T2P 3G3

In the current crop of seismic texts targeted to the neophyte, it is inevitable that one or two should come along and just miss the target. Regrettably this is such a case, and it may simply be an indication that for the present we have reached a point of saturation and there is not much more that can be said about the old familiar topics and make them appear to be presentable, even for the neophyte.

This text begins with a bold statement of its primary objective...the practical aspects of reflection seismic interpretation, written by a working explorationist for explorationists. It is not intended to be mathematical, theoretical or comprehensive. It will include little in the way of detail. It will deal with everyday practicalities and problems facing the interpreter. It is aimed at the new interpreter. The penultimate paragraph of the Preface emphasizes that the interpreter must have a thorough grasp of the seismic method so that both the potential and limitations are appreciated.

Chapter One (Introduction) is an oversimplified text that in its oversimplicity simply confuses. A poor example of simple language suggests that "the sound wave *rushes* down ...". The section on seismic data acquisition is basically a sequence of definitions. The following section, on processing, gives cameo discussions on demultiplexing, statics, deconvolution, trace sorting, velocity analysis, NMO, stacking, filtering and migration but does not once mention to the reader that all his is performed with a computer system! The language goes on to suggest that "once the sections have *landed* on the interpreter's desk, the next step is interpretation. One can almost hear the trumpet fanfare! Then the basic requirements and equipment...knowledge, coloured pencils and, last but not least, an eraser." (Is this an appropriate question for Trivial Pursuit?) At this point, the reviewer almost abandoned the task. This chapter is so inane it should never have been allowed access to the printer. Even allowing for some tongue-in-cheek by the author, it is inescapably banal and redundant.

Chapter Two (Essential Theory) suffers from being almost a duplicate of earlier texts by Nigel Anstey which makes it decidedly unoriginal. Not that the material is inadequate, it is simply a rehash and again the language irks..."It all starts with a bang". Only Nigel Anstey can say this and get away with it. The discussion on resolution is quite acceptable but fails to acknowledge the two classical papers on the subject, by Widess (1953) and Kalweit and Wood (1982).

Chapter Three (The Real World) gets to the point and makes the first two chapters unnecessary. This chapter includes a much more mature discussion on CDP, statics, multiples, deconvolution, diffractions, migration, velocity anomalies, sideswipe and line orientation. Figure 3.38 is unfortunately labelled "velocity *pull-up* underneath two submarine canyons" when it is clear that the phenomenon present is *sag* or *push-down*. The only questionable aspect of this chapter is the use of some seismic sections which are not of textbook quality.

Chapter Four (Geology and Seismic Sections) could also have been inserted as the first chapter. I recognize that all authors of seismic texts face the problem of sequencing of seismic topics but this appears to be a random selection. The early discussion is good but the redoing of Exxon's seismic stratigraphy should be reduced to a page or two. The discussion on diapirs is appropriate but the reef examples are poor and Figure 4.36 has the dubious title of being a *phase section*. There are occasional windows of quality here but the beginner who felt a sense of comfort at the Preface may be feeling abandoned by now.

Chapter Five (Structural Features) covers much basic geological terminology but becomes too refined for the beginner.

Chapter Six (Data Preparation and Preliminary Studies) is almost too late. The text is now back to the basics with discussion on shot point maps and section labels but also returns to deconvolution (for the third time) and migration (for at least the second), followed by velocity analysis again and then some good material on logs, synthetic seismograms and V.S.P.'s.

Chapter Seven (*The* Interpretation) The use of the definite article in the chapter heading is unusual. In any event, here we go on the roller coaster again by "making a start" and then discussing what we have already discussed in Chapter Six!

Chapter Eight (Contouring and Mapping) The fundamentals of this topic are given in a perfunctory fashion with nothing said about an intrinsic aspect of the subject ... krieging.

Chapter Nine (Questions and Answers) An interesting conclusion to a text whose readers will probably ask "why was it published?".

This reviewer has the greatest respect for the perseverance of an author in compiling a text in the contemporary earth sciences, and in earlier reviews has been complimentary where the text had merit. There is little to cheer about here. It suffers from too much repetition between its covers of standard material from other sources (notably Anstey and Exxon); it is confused in its sequence and simply fails to fulfill the commitment of the Preface. The book almost appears to be a series of chapters written by different authors with its lack of continuity and focus, and its irritating repetition.

In summary, I fail to see much value to this book as I fail to identify its target audience. In any event, it may find a market by virtue of the IHRDC banner but could not on its own merit, since it is by no means practical in its confused treatment of seismic interpretation.

Vulkanismus

By Hans-Ulrich Schmincke
Wissenschaftliche Buchgesellschaft
Darmstadt, West Germany
176 p., 1986; $20.00, cloth

Reviewed by Burkhard Dressler
Ontario Geological Survey
77 Grenville Street
Toronto, Ontario M7A 1W4

Schmincke's *Vulkanismus* is an excellent first introduction to modern volcanology both for the undergraduate geology student and the interested layman, be it high school student, teacher, or student of any natural science. The book, written in German, is not intended to replace any modern textbook of volcanology.

Schmincke structured his *Vulkanismus* in a way that leads the reader from a historic overview on volcanology, through the concepts of continental drift and modern plate tectonics to recent concepts on — amongst other subjects — magma differentiation, the origin of magmas, and the location of volcanic centres. This is tied together in a logical sequence. Each of the twelve chapters deals with a specific aspect of volcanology in a general, easily understandable manner. Each chapter concludes with a summary that leads to the next chapter.

Four chapters are more specific, reflecting Schmincke's own field of expertise on explosive volcanism. The author uses examples from his work in Germany as well as observations made during the eruption of Mount St. Helens. In the last chapter, entitled "Mensch und Vulcan" (Man and Volcano), Schmincke deals with aspects of volcanology affecting climate, earthquakes, earthquake forecasting and volcanic energy. These are topics that are of general interest.

An extensive reference list includes all important modern textbooks and many recent and historic publications on volcanology and represents an invitation for future reading.

Schmincke's presentation style is excellent and combined with first class colour photography and many good, informative figures makes this book interesting, enjoyable reading. The Wissenschaftliche Buchgesellschaft and the author should be encouraged to publish an English version of this book. The photographs and figures alone, however, make the German edition a valuable addition to any personal or institutional library.

Planetary Landscapes

By Ronald Greeley
Allen and Unwin, Winchester
265 p., 1985; $44.95 US, cloth

Reviewed by Rex Gibbons
Department of Mines
P.O. Box 4750
St. John's, Newfoundland A1B 3X5

I like this book. For anyone with an interest in planetary science, this book is an invaluable source of information on the solar system.

It is spectacularly illustrated with numerous images of the inner planets, our moon, and the moons of Jupiter and Saturn. The many varied features resulting from meteorite bombardment, tectonism, volcanism, gradation, and other processes operative in the solar system are vividly portrayed. The author has done an excellent job of selecting from the 400,000 or so images that he reviewed.

This book consists of ten chapters, which can be divided into two parts. Chapters 1 to 3 provide an introduction to the solar system; Chapters 4 to 9 provide detailed information on the Moon, Mercury, Venus, Mars, the Jupiter System and the Saturn System. Chapter 10 is just a brief Epilogue.

The author's stated objective is to introduce the surface features of the planets and satellites in the context of geomorphic processes.

In the three introductory chapters, he includes the "hows" and "whys" of solar system exploration and reviews the primary processes that shape our planet, Earth, and which appear to be important to planetary sciences. Chapter 1, for example, covers a brief history and objectives of solar system exploration, and comments on the relevance of geomorphology to the derivation of geologic histories through mapping and comparative planetology. Chapter 2 reviews in more detail the history of geologic exploration. It includes pre-space-age planetology studies as well as the lunar and planetary missions since 1959. With regard to planetary images, this chapter reviews the types of imaging systems used, *e.g.* film, television, facsimile, radar and digital, and how planetary images are used to determine the physiography of the planets, and to interpret the processes that have shaped their surfaces. Chapter 3 reviews the main planetary morphologic processes (listed above) in more detail primarily using Earth examples; these Earth analogs are used for comparison with features observed on other planetary bodies.

Chapter 4 is on the Moon (Earth's Moon). It covers general physiography, tectonic features, craters, degradational features, and history. Chapters 5, 6 and 7 cover Mercury, Venus and Mars, respectively. In each case, the text is accompanied by an abundance of images of the features being described.

Chapters 8 and 9 cover the Jupiter System and the Saturn System, respectively, with most attention being given to the satellites of these two planets. Data from the flybys of Voyager 1 and 2 in 1979 and 1980-81 provided the basis for the descriptions in these two chapters.

In summary, I consider this book well worth having for any planetary scientist or student. It would make a good text book or source book for anyone teaching planetary geology. I believe it would also be of interest to any other reader with an interest in extraterrestrial worlds and the processes that have shaped them. I recommend it for their bookshelves.

Carbonate Depositional Environments: Modern and Ancient Part II: Carbonate Platforms

By P.M. Harris, C.H. Moore and J.L. Wilson
Colorado School of Mines Quarterly
(v. 80, #4) Boulder, Colorado
60 p., 1985; $15 US, paper

Reviewed by Alan C. Kendall
Department of Geology
University of Toronto
Toronto, Ontario M5S 1A1

Publications dealing with depositional environments of carbonates have to compete with an impressive array of competition, in particular, *Carbonate Depositional Environments* (AAPG Memoir 33, 1983, by Scholle *et al.*) with its numerous and magnificent colour photographs (perhaps the first sedimentological coffee-table book!), not to mention contributions in *Facies Models* (Walker, 1984), *Sedimentary Environments and Facies* (Reading, 1986); textbooks written by Bathurst (1975) and Wilson (1975), and an ever increasing number of Special Publications of the Society of Economic Paleontologists and Mineralogists. The specialist and student alike is presented with a wealth of material and choice. So along comes the Colorado School of Mines contribution — how does it stack up? Not very well, I'm afraid.

In 1985, the Colorado School of Mines (CSM) presented a short course on carbonate depositional environments given by fourteen experts, world-class in their respective fields. Material given at this course is now being successively published with the CSM Quarterly. Part I on reefs (by James and Macintyre) has already been published (and reviewed in this journal). Part II deals with carbonate platforms and consists of three papers, each written by a single author. Little in these papers is new (not published elsewhere in other compilations), either in text or illustrations. In addition, some of the other illustrations have been so poorly reproduced from the original (in particular, figures 7, 8, 26, 46, 48, 52, 67) that they are useless.

Clyde Moore wrote the first paper, "A Review of Carbonate Depositional Systems", which deals with (1) differences between siliciclastic and carbonate sediments, (2) sites of carbonate deposition, and (3) evolution of carbonate platforms through geologic time (but concentrating on carbonate platform margins). It is essentially a repetition of material previously published by Moore (1979, AAPG Course Notes #11), James (1979, Facies Models) and James and Mountjoy (1983, SEPM Special Publication 33). It contains no new material or illustrations.

J.L. Wilson's paper entitled "Tectonic Controls of Carbonate Platforms" is an update of similar chapter in his 1975 textbook. Again most of the paper is a repetition. Of 30 text-figures, 24 are reprinted from Wilson (1975) — some without attribution to the original authors. Of 17 references cited, only 7 post-date the 1975 textbook.

The last paper, "Depositional Environments of Carbonate Platforms", by P.M. Harris, is more of a new synthesis than the other two papers, but is seriously flawed. Most of the paper deals with modern carbonate environments — but only those from Florida and the Bahamas. Ancient examples are barely mentioned and then without references or illustrations. The subject matter of this chapter is much better handled by Scholle *et al.*'s (1983) book or by Purser (1983, *Sedimentation et diagenese des carbonates recents*; Edition Technip). It is difficult to understand how platform carbonates can be interpreted without reference to Recent sediments of Belize, Shark Bay, the Great Barrier Reef province, or the Persian Gulf. Too much of an emphasis on Recent environments also obscures the fact that many ancient platform carbonates have no known (or well known) Recent analogs. One is given the impression that the Recent provides the entire key-chain to the past.

Throughout the three papers, one will look in vain for information about the influence of sea level changes, rates of deposition and comparison of this with subsidence rates, *i.e.* the basic building blocks by which platform carbonate successions can be interpreted. Schlager's work in this area goes unmentioned. Reid's synthesis of different platform and ramp models is barely mentioned, and even more surprisingly, Hine *et al.*'s (1981) studies of Bahamian sand bodies on differently facing platform margins, although discussed by Harris, is ignored by the other two authors at appropriate points in their papers. One would never guess from this publication that the majority of platform carbonates display markedly cyclic (or rhythmic) facies developments at various scales, or that considerable work has focussed on understanding, predicting or simulating this phenomenon.

It is difficult to understand the reasoning behind the publishing of this issue of the CSM Quarterly so shortly after the Scholle *et al.* (1983) opus. I cannot recommend anyone to purchase it and my copy now resides on an upper shelf, there to collect dust!

The Ocean of Truth

By H.W. Menard
Princeton University Press, Princeton, NJ
353 p., 1986; $29.50 US, cloth

Reviewed by Andrew D. Miall
Department of Geology
University of Toronto
Toronto, Ontario M5S 1A1

The title of the book is part of a quotation from Sir Isaac Newton: "I do not know what I may appear to the world; but to myself I seem to have been only a boy playing on the seashore, and diverting myself now and then finding a smoother pebble or a prettier shell than ordinary whilst the great ocean of truth lay all undiscovered before me". The title is also a kind of pun, because the book is in fact about the ocean, exploration of which was the stimulus which lead directly to the discoveries of plate tectonics.

Menard describes the evolution of our knowledge about global tectonics beginning with the seemingly wild ideas of Wegener in the nineteen twenties, up to the publication, in 1968, of the first papers dealing with the geometry of plate rotations, which provided plate tectonics with a quantitative kinematic framework. The subtitle of the book is "A personal history of global tectonics". Menard himself was one of the major figures in these developments, as a senior marine geologist during the 1950s and 1960s when all the critical discoveries were being made, mainly by the geologists and geophysicists at the Lamont Geological Observatory and Scripps Institute of Oceanography. Menard knew all the key players. Many he worked with at sea, others he came to know well through the numerous conferences and symposia where the evolving ideas about global tectonics were presented to a sceptical geological public.

This is a fascinating, and humbling book, for those of us whose careers span this period. Why ever didn't we think of some of these things? What were we doing all that time? It is fascinating to be reminded of the time sequence of the discoveries. The key papers dealing with symmetrical magnetic striping of the ocean floor, the definition of transform faults and the recognition that ridges, fracture zones and transform faults could be described using the geometry of small circles and Euler poles, were all published within a space of about five years, from 1963 to 1968. This spanned most of my undergraduate days and the first couple of years as a graduate student, yet I received no inkling whatever from my instructors of the revolution that was building out there. I remember going to a GSA sectional meeting in about 1966 where Tuzo Wilson used his famous paper model to illustrate transform faults, and I still remember that the main reaction from the audience was one of amusement. Nobody would take a piece of torn paper seriously as a demonstration of a fundamental scientific concept.

The history recounted in this book is an important illustration of a fact often repeated by such commentators as John Polanyi and David Suzuki, that major advances in science are often unappreciated at the time they are made, and their significance may not be recognized for several years. Basic scientific research, in this case marine geology and geophysics, was being carried out initially without any serious thought that it would provide the key to the second great geological revolution (the first being uniformitarianism). The first thoughts about sea-floor spreading, by Hess, Heezen and Dietz, were not taken seriously by anyone, including their authors. Hess referred to his musings on the subject as "geopoetry".

Marine geology and geophysics was at the time partly "curiosity" research, in the best traditions of undirected basic research. New technology developed during and after the Second World War made it possible. However, it must be admitted that there were some ulterior motives for it, quite unrelated to the progress of science itself. These motives had to do with the evolving technologies of submarine warfare. Much of the early research was funded by the US Office of Naval Research. The navy needed to know as much as possible about the morphology of the ocean floor, and was also interested in the behaviour of water masses, their acoustic properties, and so on. The discovery of the tectonic implications of the research was quite accidental though, once made, it began to enable academic scientists to spring funds loose from such bodies as the National Science Foundation. We are fortunate that the data were not classified by the Navy. Some of it was but, fortunately, not the parts critical to plate tectonics, such as the magnetic stripes. This is a problem that still persists. Enormous improvements in our abilities to see the sea floor have come about in the last few years with the evolution of side-scanning radar techniques. These are revealing a fascinating complexity in ocean-floor physiography and in depositional patterns on the continental shelves and in the deep oceans. Much of this research, also, has been funded by the Office of Naval Research, particularly that carried out within the US Exclusive Economic Zone, and much is in danger of being classified, just as before. The scientific community is virtually helpless in the face of this kind of impediment to research, because of our dependency on government agencies for the huge sums of money necessary to carry out the work. Wherever possible scientists should not accept funding from defense-relate agencies if they are at all interested in the progress of the science in the world at large.

One of the interesting facts documented with some care by Menard is that many of the key ideas occurred to more than one scientist simultaneously but independantly. Most of us, by now, know of the parallel discoveries of the significance of magnetic striping by Vine and Matthews and by Morley. Menard recounts many such cases of simultaneous discovery. For example, in the 1950s, many scientists were developing ideas about sea-floor spreading analagous to, but not identical with, those of Harry Hess. The main ideas about transform faults were thought out by an English graduate student, Alan Coode, and submitted for publication before Tuzo Wilson's famous paper was published, but did not appear in print (as a short note in *Canadian Journal of Earth Sciences)*, until after Wilson's paper had been published. Wilson's paper was much more complete, in that he followed through to their logical conclusion many more of the implications of transform faults for marine geology, and his paper contained a useful and workable terminology for the faults, so it is appropriate that he gained most of the credit.

Another interesting fact to emerge is that many of the key syntheses were not made by those closest to the data. The marine geologists and geophysicists, such as Menard and Ewing, who spent months at sea every year, seemed to have been so busy collecting data that they often did not have the time to think through fully the implications of what they were finding. Menard is credited with the discovery of fracture zones, but it was Wilson who realized what they meant. Similarly, it was people like Bullard, Morgan and McKenzie, who were not at the centre of the data-collection activity, that wrestled with the geometrical implications of rigid, rotating plates. This should be an important lesson for earth scientists, who often tend to be data-obsessed. In my years at the Geological Survey of Canada I saw many examples of geologists going out into the field year after year, at taxpayers' expense, and never thinking about, let alone writing up, their field results.

One of the really serious problems with being at the forefront of a revolution is that nobody believes you. This book is full of tales of individuals being unable to get their papers accepted because they were regarded as too speculative. Similarly, several of those close to the developments were unable, for the same reason, to obtain research grants to fund critical tests of the sea-floor spreading hypothesis. This is a familiar problem with the system of peer review that is used to assess publications and grant applications. Unknown, but possibly brilliant scientists may have great difficulty breaking into the system, whereas older, well known individuals may find it all too easy to achieve publication and large grant awards on the strength of their name, regardless of the quality of the work. It is difficult to know what to do about this, other than to cast the reviewing net as widely as possible and to give younger applicants and authors the benefit of the doubt as often as possible.

This, then, is a book that should be read by anyone who has an interest in the the way science works, not just by those who have a particular interest in the early days of the plate tectonics revolution. Readers may detect a slight smugness in the memoirs of a man who looked back on his life to find that it was more significant than he knew at the time, but that is understandable. Somebody had to be there, and we should be grateful that the author went to the considerable trouble to write up this history while the main participants were still alive to be interviewed. The author had to cut short his plans to cover some of the later developments, presumably because of sickness. He died while the book was in galley proof stage. But the critical story is there, and it makes fascinating reading.

Micropalaeontology of Carbonate Sediments

Edited by Malcolm B. Hart
Ellis Horwood, Chichester, England
for the British Micropalaeontological Society
296 p., 1987; $128.95, cloth

Reviewed by William A.S. Sarjeant
Department of Geological Sciences
University of Saskatchewan
Saskatoon, Saskatchewan S7N 0W0

A micropalaeontologist chancing upon this title in a bookseller's list, or even glancing at the book's cover and title hastily in the bookshop, might well assume it to be a comprehensive text devoted to this topic. It is not; it is an assembling of papers presented at a one-day meeting of the British Micropalaeontological Society at Kingston-upon-Hull in July 1980 and is only as comprehensive as was permitted by the chances of topics decided upon by the speakers. To give such a volume a comprehensive title like this, *unmodified* by the addition "Proceedings of a Symposium", is a confidence trick played by publishers upon public. Though not of course illegal (unfortunately!), such tricks are in my view reprehensible in the highest degree.

This book is well printed on good paper, and very attractively bound. The text-figures and sections are well reproduced. Unfortunately, however, the photographic illustrations are often of too poor a quality — commonly over-reduced and either very grey (*e.g.*, p. 14, 90, 129, 150) or much too black (*e.g.*, p. 253) — to be acceptable. That is to the discredit of the publisher; but the over-reduction of figures, the excessive amounts of grey background and the even more excessive amounts of unused white paper in one group of photographs (p. 171-175) must be blamed instead on author and editor.

The authors and the editor must also shoulder the blame for the inadequate proof-checking that has led to the frequent and tiresome mis-spellings — "Foraminilferal" (p. 5); "evnironments" (p. 50; "Dioflagellate" (p. 6); "palaeontogoly" (p. 6); "foraminferal" (p. 10, 79); "Districution" (p. 167); "Acknowldegements" (p. 222) and far too many others. The editor must take prime responsibility for the improper handling of capitalization in French and German references (the Seibertz and Troger references, p. 168, are extreme examples of the resultant confusion), the inconsistency in allocation of French and Spanish accents (*e.g.*, p. 196-197; and what does "Neumann, M(ccord)" mean?) and the frequent confusion between dashes and hyphens (*e.g.*, "Dinoflagellaten–Zysten", p. 166). One gains an impression of a carelessness by publishers, editors and many authors that is quite inappropriate to so expensive a work.

In contrast, the scientific quality of the papers is generally high. John Murray's elegant review of the criteria for distinguishing between assemblages from temperate and subtropical carbonate environments and R.T.J. Moody's study of Tunisian Ypresian carbonates as a model for foraminiferal facies distribution were, for me, the most intriguing among the nine papers on foraminifera that occupy the greater part of this volume, while B.M. Corfield's study of evolutionary patterns in relation to the early Palaeogene carbon isotope event will be of interest to geochemists and "event stratigraphers" alike.

Kenneth Dorning's synopsis of the organic palaeontology of the Palaeozoic carbonate environments is useful, while his joint study with D.G. Bell of acritarch distribution in the Silurian Much Wenlock Limestone presents new information on these microfossils as environmental indices. A study of Late Cretaceous (Turonian) dinoflagellate cysts by Bruce A. Tocher and Ian Jarvis interestingly supports earlier work demonstrating a correlation of forms having ornate processes with an "open ocean" environment, while Christopher Hunt analyzes their relation to cycles of decreasing or increasing salinity in sediments at the Jurassic-Cretaceous boundary (however, he does not provide the plates illustrating the species referred to; these would have served a useful guarantee of his identifications, which must be taken on trust). A paper on Carboniferous conodonts by R.L. Austin completes the volume.

Like most geologists, I am becoming uneasily accustomed to the fact that books such as this are priced so high as to be out of the reach of my pocket. Even today, however, a cost of some 40 cents per page is surely excessive, especially with plates so often so poor and such evident editorial carelessness. The cost may, of course, be significantly lower in Britain, since we Canadians often suffer from a considerable transatlantic publisher's markup; but, even so, I'm sure it must remain too expensive a volume for most micropalaeontologists to contemplate purchasing. Moreover, I wonder whether the authors received offprints for distribution? I suspect not.

If the British Micropalaeontological Society decides to publish further symposia, I would urge them to consider doing so as special parts of their own excellent *Journal of Micropalaeontology*, rather than as special volumes at such high cost and with so many production faults. Papers published in such volumes do not well serve their authors, since they are less, rather than more, likely to come to the attention of fellow researchers than are articles appearing in good journals.