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# Book Reviews

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## Two Hundred Years of Geology in America

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Edited by Cecil J. Schneer  
*Proceedings of the New Hampshire Bicentennial Conference on the History of Geology,*  
University Press of New England  
Hanover, New Hampshire, 385p., 1979.  
\$20.00 (U.S.)

Reviewed by W. O. Kupsch  
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The second of the New Hampshire Interdisciplinary Conferences on the History of Geology, held in 1976 (the first one took place in 1967), was part of the bicentennial celebrations in the United States. Both conferences owed their existence to the initiative and persuasion of Dr. Cecil J. Schneer, the editor of the proceedings of the meetings he organized. Being a professor of geology as well as of the history of science, Dr. Schneer is particularly well suited to act as the cement to hold an otherwise loose conglomeration of individuals together. The Bicentennial Conference was held in Durham amidst the glorious October colours of rural New England. This provided the right atmosphere for a gathering of geologists (whose professional interests ranged widely from paleontology to oceanography) and historians (both plain and specialized, particularly in science or medicine) with some naturalists, humanists, and artists added to provide an agreeable interdisciplinary mix.

No papers were delivered at the conference but armed with pre-prints the 32 participants deliberated the contributions of five formal sessions and in almost continuous informal discussions. Two opposing views became evident: those of the *internalists*, concerned with the independent development of geological thought, and those of the *externalists*, who view science as a dependent part of

society's total culture. Scientists were taken to task by historians for their tendency to "... appraise ideas of the past in the light of the understanding of the present ...", their "presentism" or "Whiggery". In turn, scientists took exception to historians re-evaluating past histories of geology in the light of our present social and cultural insights. Is it not a peculiarity of our time to write the history of science and technology with people other than practitioners put into that history? Are we, perhaps, overly concerned with cultural history to the detriment of a historiography of science and technology *per se*?

The reader benefits by keeping in mind such questions and others, which emerge from Dr. Schneer's introductory remarks, when reading the 27 papers that follow the Introduction. The papers are grouped into eight parts: Themes for the history of geology in America; Acts of God, Acts of Man; Whigs and Tories; The Image and the Idea - Two Artist Naturalists; From the State Surveys to a Continental Science - I The Institutions, - II The Men; Geology comes of Age - The American Themes I; Natural Science in a Post-Industrial World - The American Themes II. The arrangement of these chapters and the papers within them is roughly chronological.

A book such as this, which is of necessity a collection of rather disparate papers, cannot provide a complete history of either geological organizations or the development of concepts. What is presented then is a series of vignettes dealing with certain aspects and persons of both state geological surveys and the federal organization. It is fortunate that, incidentally also a product of the 1776-1976 Bicentennial, the first volume of the official history of the United States Geological Survey is now available (Mary C. Rabbitt, 1979, Minerals, Lands, and Geology for the Common Defense and General Welfare, Volume I, Before 1879: USGS, Washington D.C., United States Government Printing Office, 331 p.). For those wanting a comprehensive treatment it provides an indispensable reference as

does Morris Zaslow's "Reading the Rocks" for the Geological Survey of Canada (1975, Toronto, Macmillan of Canada, 599 p.). Dr. Schneer's collection, however, gives us those special and deeper insights so necessary for a critical evaluation of singular past events and the people involved in them. For these the essay is the most suitable literary form.

Stephen J. Pyne's essay on Grove Karl Gilbert of the USGS deals with the intelligence, emotional constitution, and education of the man and (more importantly to the majority of readers who, I suspect, are geologists rather than historians) with his interpretation of the geological features Gilbert observed in the Henry Mountains in light of those personal attributes. In Thomas Manning's essay on George Otis Smith (fourth Director of the USGS), on the other hand, there is little that deals with geological observation or thought but here the man's actions in his life as an administrator are stressed and correlated to his individuality and his philosophy. The temporal change in that philosophy is not only recorded but explained and interpreted. Both Pyne and Manning contributed valuable papers. They are singled out here merely to illustrate different approaches to the history of geology.

Similar to the treatment of geological organizations, that of concepts is eclectic. The choice here was for obvious stress on contributions made by Americans or on typically American problems.

In the first category those contributions made by Harry Hess of Princeton to ocean floor spreading and the new global tectonics hold a prominent place, both in the first and last chapter of the book. James Hall receives his due as the originator of the first major geological concept "Made in America" - the geosyncline.

In the second category, that of typically American geological problems, are those dealing with the opening of the West. The collaboration of Meek and Hayden, which contributed so much to Cretaceous stratigraphy and paleontology, is dealt with.

And so are the spectacular finds of dinosaurs and other vertebrates by museum collectors, again in the West.

There is much information in this book for teachers of classes in structural geology, stratigraphy, geomorphology, and paleontology. There is less, if anything, on petrology and mineralogy. Nevertheless, the book should be helpful in improving most lecture notes by giving greater depth through the historical approach. Besides, the book also contains some priceless stories that can be used for occasions when it is necessary to rekindle the flagging spirit of students. How many of you know about the duel fought over an insult hurled at the Mississippi River? If you don't but want to, read about the proud, arrogant, ambitious, ardent French nationalist Marie-Joseph Raymond Thomassy on page 202 of this book.

MS received January 14, 1980

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## Volcanology

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By. H. Williams and A. R. McBirney  
*Freeman, Cooper and Co.*, 397 p., 1979.  
\$25.00 (U.S.)

Reviewed by W. R. A. Baragar  
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This is a textbook for advanced students or professional geologists with a taste for a fairly disciplined approach to the subject. Wherever it has been practical to do so, the authors have introduced experimental results and quantitative relationships. The result is a valuable reference book as well as a very readable narrative on physical volcanology, but it will probably not have the same appeal to the non-specialist as have other recent texts on volcanology. Its scope is strictly limited to the physical aspects of volcanology; petrography and petrology are not included.

The plan of the book roughly parallels the course of a volcanic eruption. Following initial chapters on the history of volcanology and the physical nature of magmas, the account begins with the generation of magmas by partial melting in the upper mantle, their transfer through the plastic regime of the lithosphere, and their rise to the surface through the brittle outer shell of the earth. At each stage the authors discuss the physical parameters of the environment which shape the concepts that have been proposed to form, to transfer, and to replace the

resulting magmas. In the region of magma generation the concepts, of necessity, are based upon geophysical and experimental data and on the interplay of geothermal gradients and initial melting of projected mantle material. With the rise of magma into the brittle lithosphere, the discussions enter the realm of physical volcanology and are illustrated by reference to field examples of magma conduits and storage chambers. This is followed by a chapter on eruptive mechanisms, which is primarily an examination of the role of gases in determining the style and strength of the eruptive process. The quantity and distribution of water in magmas, the rates of vesiculation, the effects of pressure, and the viscosity of magmas, are some examples of aspects of the process that have a vital bearing on the character of an eruption and are dealt with here in some detail. The next few chapters are concerned with the products of eruption (lava flows, airfall pyroclastics, pyroclastic flows, and lahars) and the resulting edifices (cones, domes, and shields) and excavations (craters and cauldrons). These are largely descriptive chapters except for one section on the physical properties of lavas, but in terms of physical and kinematic parameters such as the dimensions and velocity of flows, they are rich in quantitative data. For several of these features, notably pyroclastic flows, shields, domes, and craters, classifications are given and the descriptions follow through from the classification. The remaining chapters are a mix of subjects: Principal Kinds of Eruptions, Basaltic Fissure Eruptions, Oceanic Volcanism, Volcanism and Orogeny, Volcanic Gases and Hydrothermal Phenomena, and Volcanism and Man.

Although the tectonic aspects of volcanism are not a major focus throughout much of the book they are, of necessity, an integral part of the chapters on Oceanic Volcanism and Volcanism and Orogeny, where they are discussed very briefly in connection with volcanism of the oceanic ridges and plates and with island arcs and continental edges. Other points of interest in these two chapters include the characteristics of volcanism under high decreasing water pressures, the development of sea mounts and guyots, the spacing and spatial relationships of volcanoes along volcanic chains, the distribution of volcanism in space and time, the mechanics of dyke and sill formation, and facies classification of some types of volcanic deposits. The last two chapters deal with aspects of volcanic activity that are of direct concern to man; hydrothermal activity and its promise as a source of geothermal energy and volcanism as a hazard to life and property. The former is a

particularly informative summary of many aspects of magmatic or magmatic-influenced gases and liquids, notably their compositions, their sources, their thermal properties and their behaviour.

*Volcanology* is a well-planned and well-presented book, commendably quantitative in its approach to the subject, and a rich source of vital statistics and references. I am particularly appreciative of the mass of useful data which it contains in every chapter; velocities of lava and ash flows, representative dimensions of lava flows and ash falls, rates of eruption per kilometre of ridge or arc, rates of growth in sea mounts and volcanic cones, and many more. A compilation in tabular form of all such data would have been a useful addition to the book. It also has one or two blemishes which are more in the nature of disappointments than serious shortcomings. The photographs commonly do not print well and although most are adequate they are not as clear nor attractive as one might expect. The chapter on basaltic fissure eruptions I thought to be a very meagre treatment of a phenomenon that must represent the most voluminous production of magmas on earth and an associate of some of our finest examples of magma chambers, e.g., Skaergaard, Muskox Complexes.

Editorial errors are not abundant, but a few are present, the most serious of which is an omission in one place of a mathematical equation. However, the reference is given and the missing relationship should be readily obtainable.

This volume is recommended for all geologists with an interest in volcanology and the price of \$25 U.S. is certainly no deterrent.

MS received February 27, 1980

## The Realm of the Terrestrial Planets

By Z. Kopal  
*John Wiley and Sons, Halstead Press,*  
 223 p., 1979.

Reviewed by H. P. Schwarcz  
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This reviewer recollects the dim, dark past of lunar exploration, when the Moon was an object of interest only to astronomers, lovers and poets. In those days three books about our satellite stood alone as harbingers of exciting times to come. The books were by Gilbert Fielder, R. Baldwin and a collection of papers edited by Zdenek Kopal (1962). In those days Kopal's book represented a valuable synthesis of astronomical data from which one might guess what the first astronauts would encounter on that day, still only bright in the imagination, when they stepped off their "space ship". It was therefore with some eager anticipation that I opened Kopal's present book, expecting to be thrilled once more with promises of the planetary adventure to come. I regret to say that I was severely disappointed. The author has presented a loosely constructed, overly romanticized sketch of the moon, the inner four planets and the asteroids (with a few words about Pluto mystifyingly thrown in). There is scant scientific substance, mostly broad generalizations. Tables of data or graphs of quantitative observations are wholly lacking. The photographic illustrations are clear and include some fine colour plates but they are largely presented out of context, with little attempt to analyse the wealth of information they contain. Much quantitative data is strung out in prolix, overly elegant paragraphs; the book could have used the services of a hard-bitten editor.

I am somewhat puzzled as to what role the author and publisher intended for this book. It is so non-technical that it would not be adequate as a textbook in a course on planetology, but perhaps it might serve as a text for a general science course on this topic (for non-science students). Indeed, the several references to history and literature (e.g., Thucydides' description of the naval victory of 413 BC enhanced by a solar eclipse, or quotations from Jules Verne's early lunar thriller) might help stimulate the interest of the lay reader. The most striking omission, hardly credible in even such a general interest text, is that of references. There is not a single title or place of publication cited,

although the extensive index refers by name to over 100 authors! Even Kopal's earlier books are not cited (to be perfectly fair). This would make it rather difficult for an interested reader (lay or expert) to follow up any discoveries alluded to by the writer.

Finally, the orientation of this book is strongly astronomical and not geological, unsurprising in view of the author's background (Professor of Astronomy at Manchester University). There are of course many descriptions of geological phenomena, but they are scattered and marked by serious errors (e.g., on p. 59: "All the 382 kg of rocks brought back by the successive Apollo missions consist entirely of . . . igneous rock" (!) while further down the same page: "the bulk of the material . . . appears to be formed by breccias"). Therefore, I cannot recommend this book for a geologically oriented, general interest course on the terrestrial planets. As for an astronomically oriented course, I suppose the instructor would have to find (or write himself) a companion volume on Jupiter *et al.*

### References

Kopal, Z., ed., 1962. *Physics and Astronomy of the Moon*: Academic Press, New York, 538 p.

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## Tidal Friction and the Earth's Rotation

Edited by P. Brosche and J. Sündermann  
*Proceeding of a Workshop held at the*  
*Centre of Interdisciplinary Research (ZiF)*  
*of the University of Bielefeld, September*  
*26-30, 1977*  
*Springer-Verlag, 241 p. 1978.*  
 \$24.00

Reviewed by Christopher Garrett  
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Just as there are unifying concepts, like plate tectonics, which lead to advances in a variety of fields, so are there unifying problems, which call for contributions from many different disciplines. This book is about such a problem, one which brings together astronomers who measure discrepancies in the lunar orbit and the earth's rotation, classical scholars who can unravel the times and locations of solar eclipses observed in ancient times, paleontologists and marine biologists who strive to interpret the growth periodicities

in fossil corals, physical oceanographers concerned about tides and the energy they dissipate, and geophysicists interested in earth tides, the geophysical aspects of the earth's rotation, and the shape of ancient oceans.

The central issue is the loss of energy from the earth-moon system by tidal dissipation, and the effect of this on the lunar orbit and the rotation of the earth. It is discussed in a number of books, notably the classic by Munk and MacDonald (1960) and its successor by Lambeck (1979). Nonetheless, a multi-authored conference proceedings, such as the volume under review, is useful in bringing together expertise from different disciplines. The book opens with a nice introduction by P. Brosche, summarising the relevant types of observation and the theoretical questions. The 12 papers that follow are generally well-written, with the authors apparently making a real effort to put their contributions into context for the non-specialist, but unfortunately there is no record of the discussion that must have followed each paper.

Some of the articles resolve old problems. For example, F. R. Stephenson shows how the inclusion of partial eclipses in earlier interpretations of mediaeval solar eclipses biased the lunar orbit towards centres of population! Other papers show how modern observational techniques, using atomic clocks, lunar laser ranging and Doppler satellite measurements are beginning to produce results, though these are somewhat reduced in value by uncertainties in the computation of the non-tidal lunar acceleration.

Many different approaches now seem to be converging on a value of about  $4 \times 10^{12}$  W for tidal dissipation, with nearly all of this occurring in the oceans. Some of this agreement may be a "bandwagon" effect, as discussed by K. Lambeck in a short paper reviewing the acceptable values for the earth's paleorotation provided by fossil corals and bivalves. He writes "... it may be that both sets of results are biased towards a priori 'suspected' results". (His next sentence is "I object to the removal of the sentence in the script", suggesting editorial censorship and a printer who chose to print an author's comments on the proofs!)

Of course, the advantage of fossils as pointed out in a long review paper by C. T. Scrutton is that their growth periodicities may provide data on the length of the day and the month on a much longer time scale than available from astronomical observations, and may eventually make it possible to say how tidal friction and hence the evolution of the moon's orbit has varied with time.

Two papers are devoted to earth tides, one by M. Bonatz referring mainly to the Proceedings of the 8th International Symposium on Earth Tides, held in Bonn immediately prior to this conference. In the other article, J. Zschau concludes that the tidal dissipation in the solid earth due to ocean loading may be a significant fraction of that due to the body tide, but that their sum is still not more than a few per cent of the total dissipation.

The conclusion that dissipation of tidal energy occurs mainly in the oceans seems to be confirmed by estimates of the rate of working of the tidal force on observed (or modelled) ocean tides, and by studies of the orbital perturbations of artificial satellites, as summarised by K. Lambeck. Much of this energy loss is known from observations to be associated with bottom friction in shallow seas, but some may occur in the deep oceans. Unfortunately the issue is not resolved by the numerical models of global ocean tides reported in this volume, in which a rather large eddy viscosity is applied, without justification, in the ocean interior, forcing most of the dissipation to occur there. This shortcoming is carried over into a computation by Sündermann and Brosche of the paleotide for a Permian ocean. They find significantly reduced dissipation, but the result is rather meaningless without a discussion of its sensitivity to the shape of the ocean basins, the depth area of continental shelves and the parameterisation of friction.

The volume closes with a long paper by J. D. A. Piper on the distribution of continents in Precambrian times. Parts of the article seems somewhat out of place, but it draws attention again to the interesting and unsolved problem of hindcasting tidal friction and the evolution of the moon's orbit.

All in all this volume is recommended reading, both for the specialist in one of the disciplines involved, and for the general geoscientist interested in a unifying and fascinating scientific problem.

#### References

- Lambeck, K., 1979, The Earth's variable rotation: Geophysical causes and consequences: Cambridge University Press, in press.  
Munk, W. H. and G. J. F. MacDonald, 1960, The Rotation of the Earth: Cambridge University Press, 323 p.

MS received January 7, 1980

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## Geology and Fossils: Craigleith Area

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By Harish Verma  
*Ministry of Natural Resources,  
Ontario Geological Survey Guidebook 7,  
61 p., 1979  
\$.75*

Reviewed by C. G. Winder  
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Most papers in *Geoscience Canada* and the *Canadian Journal of Earth Science* are sufficiently technical that the layman could not gain an insight into geoscientific research and its usefulness and significance to him. But as scientists we should be making a greater effort to communicate our results and understanding to the layman. He is probably paying the bills, and of greater significance - he will gain some of the pleasure that professionals have about this world in which we live. This volume is a good example of an endeavor to communicate with the public (and it should have a special appeal to youngsters).

At Craigleith, Ontario, along the south shore of Georgian Bay, some ledges of very fossiliferous Ordovician limestone are exposed. Stratigraphically above the limestones is a petroliferous black shale. The volume begins with a statement made by Alexander Murray in 1845 who recognized the unit as similar to black shales at Whitby on Lake Ontario. In a subsequent section, the history of an oil distillation project located here in 1859 is neatly summarized by a picture of the historical plaque. Interest in the abundant fossil fauna and especially the trilobites is generated by a few "folksy" questions - "What were the animals like when they were alive?, etc." The geologic setting is established by regional maps, a block diagram of the flat lying sections exposed in the shoreline and escarpment, and a paleogeographic map. The layman indeed will blink to see the equator of Ordovician time trenching in a north-south direction.

The author discusses the multitude of fossils - trilobites, brachiopods, cephalopods (why two line drawings?), graptolites and others and illustrates them with excellent photographs, although some of the line drawings could be more realistic. Most of the technical terms are in a glossary. Carapace used for trilobites is missing. The layman will need a dictionary for paleoecology, and he will realize from this section that geologists have vivid imaginations.

A couple of sections could be omitted. A substantial discussion of radiometric dating is not applicable to these sediments. The formation name, Lindsay, is in the text but not obvious on the map. I wonder about the wisdom of discussing the use of a pavement saw to remove fossils. Craigleith is a Provincial Park and collecting fossils is forbidden. But outcrops which have been "sampled" even by professionals using pavement saws can be left a sorry sight. The critical professional reader will find a few interpretive statements which may grate on his own professional bias. The layman won't know.

More volumes like this should be produced. The potential harm in misinformation is of lesser importance than the education provided for the general public.

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## Petroleum Geochemistry and Geology

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By John M. Hunt  
*W. H. Freeman and Company, San  
Francisco, 617 p., 1979.  
\$30.00*

Reviewed by S. W. Burnie  
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Calgary, Alberta T2P 0Y2*

In the past few years, two outstanding texts have been written on petroleum geochemistry. The first, "Petroleum Formation and Occurrence" by B. P. Tissot and D. H. Welte was published in 1978. The second is the subject of this review. It is, according to the author, a text and reference book "written for students who have had the basic courses in geology and chemistry and also for oil company operating personnel who are interested in the application of geochemistry to petroleum exploration". Indeed, this objective is met and even the geologist with little knowledge of chemistry can grasp the basic concepts presented in this book once he or she becomes at ease with the chemical terminology. A glossary is provided to make this familiarization period as brief as possible. Although the title suggests a duality of topic, John Hunt's book is principally about petroleum geochemistry.

The book is in four main parts. Part one contains a general introduction to petroleum geochemistry. In part two the origin and migration of petroleum and natural gas are discussed. Part three outlines the habitat of oil and gas. Such important

concepts as source rock and reservoir petroleum and the processes that effect them such as maturation and degradation are discussed. In part four the applications of petroleum geochemistry to exploration are reviewed under the following headings: seeps and surface prospecting, subsurface prospecting, crude oil correlation, and prospect evaluation.

The subjects in this text are presented in a logical order and they are well referenced. The liberal use of case histories makes many of the concepts more easily understood. A number of the case histories are taken from Russian and European literature to which the reader would not normally have access. The author writes with an easy style and the topics are illustrated with clear, informative diagrams. At the end of each section a summary is provided so the reader can reflect on the main points of the chapter or review its contents before reading.

Where this book covered my field of speciality I found cases where the use of generalities could misinform the reader. For example, the author states (on p. 386) that oils can be degraded by sulphate reducing bacteria. Sulphate reducers cannot metabolize a substance as complex as crude oil but could utilize the more simple metabolic by-products of other anaerobic and aerobic oil degrading bacteria. In the discussion of the alteration of reservoir oil by sulphur, Hunt states (p. 391) that hydrogen sulphide is a catalyst for the reduction of sulphate by hydrocarbons. The mechanism of this reaction has been studied and researchers generally agree that sulphate is reduced by hydrogen sulphide and not by hydrocarbons. Hydrogen sulphide was found to be both a reactant and a product and is therefore not a true catalyst.

This substitution of detail with general statements is compensated for by providing references to the original paper so the reader can clarify any misunderstanding that could occur from reading the text. This book is a good buy for the geologist or chemist interested in petroleum geochemistry.

MS received February 13, 1980

## The Encyclopedia of Sedimentology

Edited by R. W. Fairbridge and J. Bourgeois  
*Dowden, Hutchison and Ross;*  
901 p., 1978.  
\$65.00

Reviewed by R. G. Walker  
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*The Encyclopedia of Sedimentology* is the sixth in a series of Earth Science encyclopedias put together by the Fairbridge/Dowden, Hutchison and Ross team. This one contains 354 entries, written by 192 authors (1.844 entries per author), and the entries fill 874 p. or 2.469 pages per entry.

One of the important aspects of an encyclopedia is the ease with which one can find one's way around. This one has a reasonably comprehensive index, and lots of cross-referencing between entries; nevertheless, I have a minor criticism about the difficulty of locating information. Each entry has its own list of citations.

The authors are mostly well known in their field, but one could wish that the "editorial" contributions (60 entries, from Fairbridge, Bourgeois and Charlotte Schreiber) had been farmed out to appropriate experts.

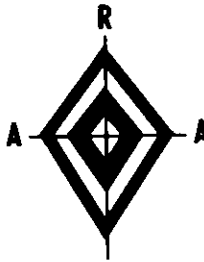
But ultimately, I suppose, an encyclopedia has to be "encyclopedic". A brief look through the index shows that several items are not mentioned or are hard to find. For example, "Sediment Transport" does not appear in the index, despite an entry titled "Sediment Transport, Initiation and Energetics". This one is particularly hard to find - it is not listed under

transport, nor under initiation or energetics. And all items beginning with *Sedimentary* . . . are listed before those beginning with *Sediment* . . . in the encyclopedia, making Sediment Transport even harder to find. Having found it, I am astonished that Shield's diagram is neither shown nor even mentioned. I suspect there are other examples of entries that are hard to find, but I see no excuse for entry titles not being in the index, nor for listing *Sedimentary* before *Sediment*.

My other major criticism concerns oversplitting of topics. For example, there are entries on Grain-Size Frequency Studies; Grain-Size Parameters - Environmental Interpretation; Grain-Size Studies; and Granulometric Analysis, by four different authors. But Sorting, Skewness and Kurtosis are considered under separate headings, by two different authors. In all of this, Moment Measures were lost, and never get mentioned. Surely these aspects of size analysis could have been comprehensively covered by one author, with all of the sub-items listed in the index. Similarly, Turbidites; Turbidity Currents; Submarine Fan Sedimentation; Submarine Canyons and Fan Valleys, Ancient; and Bouma Sequences are considered by separate authors, and in the confusion, the best real evidence for turbidity currents (Grand Banks Flow of 1929) is not mentioned.

Despite my feelings about too much topic fragmentation (leading to omission of important items) and entry titles not being present in the index, the encyclopedia will be useful to non-specialists needing a couple of pages plus references on a topic, or to sedimentologists needing a quick source of information on an unfamiliar topic. But only you, the reader, can decide whether owning such an encyclopedia is worth \$65.00 (U.S.).

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## **A Color Illustrated Guide to Constituents, Textures, Cements, and Porosities of Sandstones and Associated Rocks**

By Peter A. Scholle  
*American Association of Petroleum Geologists, Memoir 28, 201 p., 1979, \$19.50 U.S.*

Reviewed by John F. Lerbekmo  
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 University of Alberta  
 Edmonton, Alberta T6G 2E3*

This book is a companion volume to AAPG Memoir 27 by the same author giving a similar treatment to carbonate rocks. It is essentially a petrographic manual to assist the non-specialist who is examining sandstones and related sedimentary rocks in thin section.

Of the 201 pages (8½ x 11 inches), 140 are taken up with 360 color photomicrographs of thin sections with 56 black and white Scanning Electron micrographs interspersed. The photographs are 3 x 4 inches, three to a page and accompanied by a description of usually 50 to 60 words. The order of consideration and numbers of pages of photographs devoted to each category are as follows: Detrital Grains - Quartz (10), Feldspars (8), Rock Fragments (10), Others (23); Clays and Shales (10); Associated Sediments (cherts, phosphates, evaporites, tuffs) (13); Sandstone Types (3); Textures (3); Cements (33); Replacement or Displacement Fabrics (6); Deformation Fabrics (7); Porosity (10); Techniques - Staining (1), Cathodoluminescence (1), Fluid Inclusions (1), SEM and Electron Microprobe (3).

A selected bibliography following each section usually contains 50 to 100 references, although the one on Diagenesis and Porosity following Cements has more than 200. A General Selected Bibliography at the beginning of the book has 55 publications listed. In addition, the Memoir contains a number of classification schemes for both sandstones and mudrocks, a table of the Wentworth-Udden grain-size classes in millimetre and phi units with corresponding U.S. Standard Sieve Mesh numbers, a chart for visual percentage estimation, the Michel-Lévy interference color chart, visual and numerical textural maturity diagrams, and porosity recognition criteria.

The majority of photographs are of good technical quality, although a number appear to be slightly out of focus, and a few thin sections were too thick to give the correct birefringence. Color fidelity is

somewhat variable, but generally very good. The descriptions are well done, covering the important features of the photograph. Editing has been excellent; I noticed only two or three misplaced commas and periods.

My overall assessment of the book is that it is excellent. The coverage of the subject matter is in general very good. The principal short-coming in this area is the treatment of rock fragments. Recognition of rock fragments is the most difficult aspect of sandstone grain petrography, and more examples of problem distinctions would have been in order.

The weakest section in the book is 'Clays and Shales'. Most of the photographs here are of sandstones with deformed rock fragment clasts, or with authigenic pore-filling clays (both of which should appear in other sections), or are of soils. Only six typical representatives of the whole mudrock group are shown, which is inadequate. The section on 'Other Detrital Grains' also suffers a little in having a number of photomicrographs from igneous or metamorphic rocks rather than the detrital form of the minerals.

Mistakes or inaccuracies are few. I noticed one incorrect formation name spelling - "Gesso-Solfifera" (p. 85, 86) should be "Gessoso-solfifera". In the realm of 'knit-picking', the birefringence of staurolite (p. 49) is described as moderate to strong, whereas it is usually described as weak to moderate (0.012-0.014).

This book will be very useful to the practicing geologist whose petrography of sandstones is a little 'rusty' or out date; particularly the good coverage of secondary porosity and porosity reducing cements. In addition, it will be of great help to the teacher of sedimentary petrography who has not had the time or the opportunity to acquire a comparable group of specimens and thin sections. Even for those who have, it is a useful adjunct as a laboratory reference book. A set of 100 selected 35 mm color slides keyed to the book are also available at a cost of \$128 U.S.

For anyone who has any use at all for a book of this type, this one is worth much more than its very reasonable price.

MS received March 4, 1980

## **Currents in Submarine Canyons and Other Seavalleys (AAPG Studies in Geology No. 8)**

By E. P. Shepard, N. F. Marshall, P. A. McLaughlin, G. G. Sullivan.  
*American Association of Petroleum Geologists, 173 p., 1979, \$11.00 (\$9.00 AAPG and SEPM members).*

Reviewed by A. J. Bowen  
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My reaction on reading this monograph for the first time was a feeling of disappointment. The problem lay not so much in the actual material, which was interesting enough on its own terms, but in my prior expectation that a long monograph on currents in submarine canyons would provide me with new insight into the important geological processes in submarine canyons. The announcement received in the mail had stressed that this was an important publication for sedimentologists, would provide new insights for petroleum geologists, and cover topics such as the origin of submarine canyons, turbidity currents and threshold velocity. Perhaps a certain caution should have been induced by the equal weight given to such topics as alternating current directions, unidirectional flow, consistency of speed, cross-valley currents and internal waves.

In fact, the feeling of disappointment would have been avoided altogether if the monograph had been titled 'Some Observations of Currents in Submarine Canyons' for it is the description of a specific set of current meter records that provides the theme for this book. These current meters were deployed in different canyons for fairly short periods, typically four or five days. With this type of data base the chances of observing a major event are obviously small, the chances of the meters surviving a major event, problematical. Consequently, the majority of observations show currents induced by waves, internal waves, tides and other external forces. However, in four cases strong down-canyon currents were observed although, other than in La Jolla Canyon, these lasted a relatively short time and were not recorded at current meters further seaward down the canyon. They seemed to be local events.

One of the peculiarities of the monograph is the absence here of ancillary data, there is no mention of the sedimentary characteristics of these canyons and

nothing is said about the local slope or local geometry other than can be gleaned from the large scale location maps. In fact, throughout the monograph, sedimentary description is sparse to non-existent. While the motivation for the study is clearly geological, the level of discussion of the geological implications is both brief and very general. One gets the impression that the various examples, particularly those with ancillary data on winds, waves and river outflow, are of interest primarily as physical oceanography. However, the record lengths are rather short for detailed analysis and the discussion is necessarily descriptive rather than quantitative.

In summary, I would suggest that this is a book which may find a rather limited readership. It is very nicely presented at a very reasonable price but it is very specifically a compendium of current meter observations.

MS received February 25, 1980

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## Geological and Geophysical Investigations of Continental Margins (AAPG Memoir 29)

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Edited by Joel S. Watkins, Lucien Montadert, and Patricia Wood Dickerson  
*American Association of Petroleum Geologists, 479 p., 1979.*  
\$24.00 (\$19.50 for AAPG and SEPM members)

Reviewed by R. T. Haworth  
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The International Geodynamics program included a concerted effort to investigate the continental margins of the world and the basic transition they represent between continental and oceanic crust. As a result of this effort, we have been treated to such excellent published syntheses as "The Geology of Continental Margins" edited by Burk and Drake (Springer-Verlag), "The Ocean Basins and Margins" series, edited by Nairn and Stehli (Plenum) and some volumes of the Maurice Ewing Series (AGU). Each of these had a slightly different focus, thereby creating a distinct market. Going into the 1980s, we learn that "Son of Geodynamics" will concentrate on the continental crust, and I know of at least three subsidiary programs that will be looking at the ancient continental margins now incorporated within continental crust, and the relationship between those ancient margins and the present day margins. It is therefore safe to predict that we have not yet seen the end of the present series of publications about continental margins.

Impetus for preparation of this volume was the increasing economic interest in continental margins as the "largest remaining frontier for petroleum exploration." It contains 32 papers which were presented at two research conferences and a short course sponsored by AAPG, and is divided into sections on rifted margins (primarily the U.S. east coast but also including Australia, Argentina, and Iceland), convergent margins (southeast Asia and Alaska), small basin margins (primarily the Caribbean and Gulf of Mexico) with a concluding pot pourri on resources, seismology, and sea level changes. Within each section, the papers are arranged alphabetically by author rather than geographically, which is

awkward. There is a reasonably comprehensive key-word index, but the choice of key words in some cases seems irrational (e.g. no reference to sediment "drifts" in the North Atlantic, p. 47). I would have preferred a more thorough index to this volume alone rather than the (dubious?) benefits of having it part of the AAPG 5-year composite index.

The volume is dominated by papers describing the U.S. Margin (approximately 50% of the geographically oriented papers). The papers by Grow et al. (an overview of the seismic data collected on the U.S. east coast margin) and by Klitgord and Behrendt (the first published interpretation of the new aeromagnetic survey of the U.S. east coast margin) are particularly useful. The inclusion of many examples of the deep-water multichannel seismic data collected in recent years is an outstanding feature of the volume; but considering the economic pressures against publication of foldout seismic sections, it is a crime that of the four foldouts included, two had been published previously elsewhere, and one is illegible. There is some overlap in content with the other volumes mentioned earlier, but the minimal extent of that overlap does not detract from its content. Unfortunately, Pitman provides what must be an ideal test case of U.S. copyright laws in his republication of his interpretation of stratigraphic sequences at margins in terms of sea level changes, while Vail is to be congratulated for rejecting a similar temptation.

It is impossible to adequately describe the scope of the book without copying the table of contents because it neither has a specific focus, nor is it all encompassing. It is merely a collection of papers rather than a cohesive unit. Because of this, for the reader who wants an overview of margin studies, I would still recommend Burk and Drake (despite its age) rather than this volume. However, as a volume which documents changes in the state of knowledge in the same way as a journal, its price (compared with the \$81 price tag of similar recent ELSEVIER volume) may woo purchasers who would otherwise, like me, merely recommend that our institutional libraries acquire the book.

MS received February 25, 1980



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## Ocean Dumping and Marine Pollution: Geological Aspects of Waste Disposal

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Edited by H. D. Palmer and M. G. Gross  
*Dowden, Hutchinson and Ross, Inc.*,  
 268 p., 1979.  
 \$18.00 (U.S.)

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About 55 to 85 million cubic metres of waste materials are dumped into the coastal marine waters surrounding the continental United States each year. Of this quantity, 85 to 95 per cent is dredged material that is dumped within 6 km of the shore and in less than 30 metres of water depth. Because most of these materials are natural sands, waste rock and muds from harbours and navigable waterways, the proper management of ocean disposal relies heavily on expert knowledge of marine scientists, and particularly marine geologists.

The editors of this volume have bound 13 papers together between hard covers for the purpose of bringing "geological perspective to a serious environmental concern . . ." these papers were derived mainly from a symposium convened during the Annual Meeting of the Society of Economic Paleontologists and Mineralogists in Washington, D.C., in 1977. The resulting 262 pages of text, illustrations and references do indeed concentrate on geological aspects of evaluating the effects of ocean dumping, in parts of U.S. coastal water. Eight of the 13 papers pertain to the Atlantic coast ocean dumping studies, three papers report on various aspects of shelf dynamics and waste disposal on the west coast, and two papers are concerned with the general aspects of ocean dumping and management. This geographic distribution of reports can hardly be considered representative of U.S. dredging and dumping activities and concerns, especially when it is known that more than 50 per cent of the dredged disposal of solid waste takes place on the Gulf Coast. Furthermore, the book contains no mention of the problems of ocean dumping in the deep sea - an area of concern to many developed countries.

Regulation of the ocean disposal activities in the U.S. is under the authority of the U.S. Army Corps of Engineers in accordance with criteria developed by the

Environmental Protection Agency. It is therefore surprising that out of the 21 authors that contributed to this volume only one author representing either of these two agencies could be found to have anything to say about the problem.

The book gets off to a slow start with two rather elementary and non-specific articles. They are followed by a series of papers which do a credible job in documenting evidence for the dispersal patterns of sediment dumped at ocean disposal sites off the Columbia River, in the New York Bight, off Savannah Georgia, and in Long Island Sound. The main point made by these articles is that coarse-textured spoils (sand size and greater) tend to remain in place at the dump sites if the competence of the local ocean currents and wind-driven currents is insufficient to resuspend the material. In the case of the New York Bight, 29 to 37 per cent of the solids dumped in the area over a 70-year period can be accounted for by measured changes in the bathymetry.

Two papers report on the experience and anticipated future need of dredging and dumping program for Chesapeake Bay and provide a framework for making sensible recommendations concerning site selection for spoil disposal. The main points are: a) that the quality of waste materials should be a very significant factor in developing a disposal strategy, and b) that understanding estuarine dynamics and sediment transport patterns before deciding on dredging and disposal sites can avoid the self-perpetuating aspects of these operations.

Three papers deal specifically with the problems of sewage disposal on the continental shelf. Each of the papers relies on a different technique to determine the effects of such practices. Sampling and chemical analyses, combined with observations from a submersible, lead to the conclusion that only relatively short-term effects in the water column are significant. The paper contributed by Folger, Palmer and Slater contains some truly non-sensible statistical reporting of geochemical data. David O. Cook's paper describes a mathematical modeling approach based on standard advective and diffusive equations and indicates that most sewage sludge stays in suspension for several days and is therefore dispersed with the prevailing currents. Extensive turbidity surveys in the vicinity of the Los Angeles City outfalls in Santa Monica Bay confirm the indication that sewage plumes are widely dispersed by processes controlled by density stratification and currents.

The last paper in this book should have been the first paper because it contains the most appropriate information for an introduction to the problems of ocean

disposal as well as a useful summary of the U.S. regulatory agencies and how they have attempted to regulate the practice of ocean dumping. In Canada a similar but less extensive maze has also evolved to regulate the 1975 Ocean Dumping Control Act. The problem of developing suitable disposal criteria and mechanisms for reviewing Ocean Dumping Applications appears to have generated a nearly unworkable system in the U.S. It would be useful for those involved in the Canadian regulatory maze to read even this one chapter of the book.

This book appears to have been put together in haste after the SEPM Symposium. There are many minor editorial errors; there is a general lack of consistency in reference citations; a very obvious lack in quality control of illustrations, some plates being so poor that they are unusable for conveying information. Finally there is an annoying inconsistency in the use of English and metric units throughout the text. In general the book contains articles that may be of interest to the student or perhaps the scientist and engineer who has had only limited experience working in the field of marine geology. It is doubtful if the investment of \$18.00 (U.S.) would be redeemable in value for most practicing professionals in the area of ocean dumping.

MS received December 20, 1979

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## Books Received

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### **Paleoceanography**

by T. J. M. Schopf (Harvard Univ. Press, 341 p., 1980, \$25.00 U.S. hard cover)  
 "The recent expansion in oceanographic studies has produced a burgeoning of data on ancient ocean circulation, climate, bathymetry, chemistry, biology and temperature - data that now should be considered in a more general geological paleontological framework" (From the Cover).

### **Paleogeographic Principles of Oil and Gas Prospecting**

by N. I. Markovski (John Wiley and Sons, Toronto, 256 p., 1978, Translated from Russian)  
 "The present work discusses the importance of paleogeographic reconstruction as part of the overall regional and other investigations on which exploration drilling for oil and gas is based" (From the Introduction).