Geoscience Canada

Book Reviews / Critique

Volume 6, Number 3, September 1979

URI: https://id.erudit.org/iderudit/geocan6_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 article

(1979). Book Reviews / Critique. *Geoscience Canada*, *6*(3), 152–160.

Book Reviews / Critique

Book Reviews

Energetics of Geological Processes

Edited by S K Saxena and S. Bhattacharji
Springer-Verlag, 473 p., 1977.
$28.50

Reviewed by D M Carmichael
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The title of this book evokes the hope that at last the marriage of thermodynamics and geology has been consummated, but alas, the long flirtation continues. The book is a collection of 18 papers by 26 authors who are "admirers, friends, colleagues, and former students" of Hans Ramberg, and it is dedicated to Professor Ramberg "for his continuing achievements in science".

Part I deals with geodynamics, structural geology, and rock deformation. *V.V Beloussov* discusses thermally induced gravitational instability as a cause of diapirism in the asthenosphere and the lower crust. His synthesis of the tectonic effects brought about by this deep-seated diapirism hinges on the contention that the continents have remained fixed in respect to the sub-asthenospheric mantle, and thus it is resolutely out of step with the prevailing global-tectonic consensus. *J. Sutton* and *J. Watson* review the mechanisms of emplacement of mantle-derived intrusions into continental crust, contrasting the regionally pervasive plutonism of the Archean with the plate-margin-restricted plutonism of the Phanerozoic. *B. Bayly* contends that the mechanical behaviour of a deforming rock is not fully defineable in terms of stress and strain rate, but depends on the changing "structural state" of the rock as well. He recomposes the Weertman equation for steady-state creep so as to contain a "structure factor" in place of the empirical constant A, but he seems not to recognize that the attainment of steady-state creep implies that the microscopic state of the deforming rock (dislocation density, average grain size and grain shape, etc.) is unchanging with time. *H Korde* and *S. Bhattacharji* discuss the relationship of earthquake magnitude to local regions of enhanced compressional or extensional strain within major strike-slip fault systems. *S.M. Schmid* and *M.S. Paterson* find that with decreasing strain rate and/or increasing temperature, the experimental deformation of an oolitic limestone is progressively less homogeneous, the microcrystalline oolites tending to deform more readily than the sparry calcite cement. *S.K. Ghosh* discusses the deformation of initially planar layering around rigid spherical or elliptical domains, for the case of plane strain that can be resolved into a simple shear plus a perpendicularly acting pure shear. *P.J. Hudleston* interprets the fabric of shear zones in glacier ice on Baffin Island in terms of simple shear of variable magnitude. *J.L. Roberts* reviews the techniques of structural analysis of metamorphic rocks, and discusses the problems of regional correlation of structural and metamorphic episodes within orogenic belts. *P.F. Williams and H.J. Zwart* give a fascinating account of the structure and metamorphism of a Caledonian nappe complex in Sweden. Finally, *A. Miyashiro* distinguishes among subduction-zone ophiolites, obducted ophiolites, and island-arc ophiolites, contending that many so-called ophiolites in all three settings do not represent fragments of ancient oceanic crust.

Part II concerns heat flow, petrology, mineral equilibria, and geochemistry. *K.S. Heier* and *G. Gronlie* summarize Norwegian heat-flow measurements, and discuss their relationship to local radioactive heat production and to regional geology. *H.K. Mao* and *P.M. Bell* calculate a P-T phase diagram for the system Fe-O up to 400 kb, and use it to conclude that contrary to the views of Ringwood, the metallic core of the earth is not necessarily in disequilibrium with the oxidized upper mantle and crust. Ramberg himself reached the same conclusion on the basis of sound thermodynamic reasoning more than three decades ago, but ironically, no reference is made to his series of classic papers on chemical differentiation in response to gradients of pressure and gravitational potential, nor to his incisive prognostications of the system Fe-O. The findings of Mao and Bell, however, indicate that the equilibrium state could be approached by means of gravitational separation of phases, kinetically a more plausible process than the diffusion of components envisaged by Ramberg. *J. Ganguly* gives a concise and generally excellent review of the chemical principles that underly the current western approach to determining the physical conditions of equilibration of metamorphic rocks. *L.L. Perchuk* reviews the approach to the same problem that he and his Russian co-workers have taken, and makes some bold but stimulating generalizations concerning the P-T-fH_2O-fCO_2-fO_2 conditions of metamorphism in various tectonic settings. *A.C Lasaga, S.M Richardson* and *H.D Holland* make an elegant attempt to calculate the post-metamorphic cooling rate of an area in central Massachusetts from retrograde Fe-Mg zoning profiles across garnet-cordierite grain boundaries. *P.J. Wyllie*, with his customary felicity, discusses the genesis of batholiths in the light of experimental studies. *E.J. Olsen* reviews the application of thermodynamics to

meteorite mineral assemblages. Lastly, *S.K. Saxena* uses measured and calculated enthalpies of formation for orthosilicates and oxides to compute a revised electronegativity scale that is more relevant to geochemistry than the halide-based scale of Pauling.

On the whole I find this a very stimulating book, a very nice tribute to the breadth and depth of Professor Ramberg's research and to the inspiration of his teaching. However, the diversity of style and content among the various papers makes it unsuitable as a textbook, and in this age of specialization chances are slim that it will be a best-seller among practising earth scientists.

MS received June 4, 1979

Archean Geochemistry

Edited by B.F. Windley and S.M. Naqvi
Elsevier, 406p., 1978.
US $49.75 (Dfl. 114.00)

Reviewed by Charles F. Gower
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This volume is the outcome of a symposium on Archean geochemistry held in Hyderabad, India in November, 1977. Not surprisingly it is strongly biased towards the Archean of India and could be claimed to mark the coming-of-age of India as a "well-documented" Archean terrain. Fittingly the book contains 21 papers; these are grouped under the headings: Geotectonics and Crustal Composition, Geochronology, Greenstone-Schist Belts, Granulites, Volcanics and Sediments, Anorthosites and Ultramafics, and Mineralization.

The section on granulites is the real strength of the book - reflecting their prevalence in India. Studies involving diverse aspects such as geothermometry, radioelement distribution, experimental petrology/thermodynamics, oxygen isotopes and comparisons with Archean and Proterozoic granulites elsewhere combine to give an up-to-date and well-rounded presentation of the topic.

Ultramafic rocks, especially komatiites, are the next-best subject covered but unfortunately the data are scattered as komatiites have not been grouped in a single section. The komatiite classification problem is clearly evident, but if one can thread one's way successfully through the nomenclature maze there are worthwhile rewards in terms of an expanded appreciation of komatiite occurrence and chemical variability.

Other topics are indifferently covered and some papers are entirely out of place. Worthwhile though they are, contributions on Archean geotectonics or the elucidation of polymetamorphic terrain through geochronology should not be here - likely readers would not select a book entitled *Archean Geochemistry* as a potentially fertile reference source.

Typical of multi-authored volumes, the material is variable in quality and presentation, and in its lack of focus. It might have been better to devote the entire book to the Archean of India and/or granulites. An up-to-date foldout geological map of the Archean of India would have been a definite asset - especially as some authors were neglectful of location maps.

The love of shot-gun variation diagrams continues unabated, (with optimistic, but seemingly obligatory, trend lines), as does intercontinental descriptive comparison of data without enlightening comment as to the significance of parallels drawn. Also one would have hoped for a more consciencious reporting of accuracy and precision.

Typographical errors are rare (16 detected) but the style of printing (offset from the original typescript) has been sacrificed in favour of rapid publication. At US $50.00 this book is not a best-buy, but probably should be on the bookshelves of those particularly interested in granulites, komatiites, or the Archean of India.

MS received April 24, 1979

Geological Evolution of North America, 3rd Edition

By Colin W. Stearn, Robert L. Carroll and Thomas H. Clark
John Wiley and Sons, 566 p., 1979
$16.95

Reviewed by Roger G. Walker
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Because of the reputation of the second edition of Clark and Stearn (now Stearn, Carroll and Clark), I adopted the 3rd edition sight unseen for my second year Earth History course next year. Now that I have read the book, I am rather disappointed. It is very conservative and it fails in its aim to integrate fully modern plate tectonic concepts with the geological record. Also, for a text, it is not perfectly edited and will leave students puzzled at several places.

The content of the book can be appreciated from the following breakdown - Framework of the Earth, and the Sedimentary Record, 23 per cent (5 per cent of which is on the Earth in Space - unnecessary in this particular text, in my opinion); the Craton, 30 per cent; the Cordillera, 22 per cent; the Appalachians, 10 per cent; and Pangea, the Arctic and Late Cenozoic Events, 15 per cent.

The section on the Sedimentary Record covers Stratigraphy, Correlation, Time, The Earth in Space, Uniformity and Progress, and Life and Evolution. The authors fail to communicate the basic ideas of stratigraphy - the term formation is not defined, nor do the authors choose to follow the American Commission on Stratigraphic Nomenclature in that they recommend lithological formation names - e.g., Queenston Shale instead of Queenston Formation. Errors in important captions (3-20, 4-1, 4-15) do not help get concepts across. The correlation diagram is particularly bad (4-1) in displaying the correlation of the Reynales (north end of Niagara Escarpment) with Grimsby + Thorold + Reynales + Irondequoit at Niagara and Rochester.

The Craton section is subdivided into the Shield, followed by chapters on the Sauk, Tippecanoe, Kaskaskia and Absaroka sequences. The term Ediacaran

is used as a Period (675 to 570 m.y.) throughout, although this is not common practise in North America. Precambrian (Pre-Ediacaran?) geologists will be surprised to find that the Archean-Proterozoic boundary is drawn at 1800 m.y. (Figs. 5-6, 5-8), although it switches to 2500 m.y. in Fig. 9-2: an example of the poor editing of important topics I referred to earlier. Paleontologists will note that animals evolved calcium carbonate shells 500 million years ago (p. 72) - The Cambrian-Ordovician boundary of Figure 5-6.

Figures 9-8 and 9-14 are almost identical, showing the structural provinces of the shield. Both fail to show the main structural trends of the provinces. Pre-Ediacaran geologists, especially those working in the Grenville Province, will be surprised to find that "each province was affected by one major orogeny" (p. 157). More importantly, the Kenoran event is barely mentioned and the Hudsonian and Grenvillian events are ignored. The Coronation Geosyncline and Athapuscow Aulacogen - with some of the best evidence of early plate tectonics in the shield - are not mentioned. There is little or no discussion of igneous and metamorphic events; this is both a specific comment on the Shield chapter, and a general comment on the book as a whole. At the end of each chapter there are questions, and many are very tough - I am still puzzling about "how would you identify the original crust of the earth" (p. 169).

The Appalachian chapter seems rather brief, and could well have been expanded at the expense of "The Earth in Space". The "Taconic orogeny and plate tectonics" receives half-a-column of discussion, and important plate tectonic items such as volcanism related to initial rifting, the possible opening and closing of a small ocean basin in Newfoundland, and the development of an Ordovician island arc system are either ignored or barely mentioned, let alone integrated into the text.

In many of the diagrams, tones of green are added, which make the diagrams clearer to read - or would have done if the colours had been explained. For example, the cross section of the Appalachians in Quebec (Fig. 17-14) includes a solid green colour that appears to be ultramafic, but this colour reappears in a thin nappe overlying Lorraine Group thrust slices in an area where there are no known ultramafic rocks.

The Acadian event is equally briefly covered - the intrusive rocks are covered in one sentence of text and are located on one diagram. Metamorphism and development of the Piedmont is not discussed.

The emphasis of the book is on the biological evolution of North America, and there are extensive discussions of animal groups and many photographs of organisms. Unfortunately, at least 65 of these photographs have no scale, explicit, or in the caption. Dinosaurs are described and pictured for 12 pages before a half-column is devoted to the possibility of their being warm blooded.

All in all, the book treats rocks, and sequences of rocks, as objects to be described, rather than as items which hold the key to the evolution of the Continent. Facies maps, for example, only show facies distributions - to bring this alive, an interpretive diagram could be placed alongside with the paleoequator, paleocurrent directions and paleogeography shown (as is done in the rival volume by Dott and Batten).

Finally, I refer you to the striking display of bold design and colour in the example of Eskimo art in Figure 8-8 - at least, until you read the caption and find that it's a "stylized drawing of the chromosomes of the fruit fly *Drosophila melanogaster*". And I thought it was mosquitoes that were controlling the geological evolution of North America.

MS received May 28, 1979

Principles of Sedimentology

By Gerald M. Friedman and John E. Sanders
John Wiley and Sons, 792 p., 1978.
$21.95 (US)

Reviewed by Richard N. Hiscott
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The market for general sedimentology text books has blossomed in recent years due to increased interest in depositional models for interpreting ancient rock sequences. This interest has been generated by academics, and by petroleum and coal explorationists in search of facies-controlled accumulations of fossil fuels.

The book by Friedman and Sanders is divided into five broad divisions, each containing one or more chapters. The first section describes sedimentary particles in terms of both composition and texture. The authors then discuss sedimentary processes: physical processes, biological and chemical processes, and diagenetic processes leading to lithification. The third section outlines classification schemes for carbonate rocks, terrigenous rocks, and other less common sedimentary rocks. The bulk of the book (200 p.) is then devoted to a systematic description of modern sedimentary environments and their products, along with selected ancient examples drawn primarily from the eastern United States, the Gulf Coast, and the Middle East. The fifth and concluding section discusses various aspects of classical stratigraphy, field methods, and relationships between tectonics and sedimentation.

The main text (463 p.) is followed by five *complements* (90 p.), which contain more lengthy discussions of special topics. These *complements* can be used as reference material for more than one chapter in the text. They deal with: A) waves and their products; B) deltas; C) sub-aqueous gravity flows, D) water properties related to evaporitic or euxinic basins, and E) tides and tidal sediments. *Complements* A and D are particularly informative, although some students may find the mathematical treatment of wave theory difficult.

The book is written in a chatty informal style, which makes for easy reading Subheadings are numerous, which is probably a plus for students, but which does on occasion give a "cut-and-paste" choppiness to the discussion. The book is abundantly referenced, but references do not clutter the text. Instead, they are listed after each short unit. The extensive bibliography (191 p.) is collected at the back of the book, along with a 22 page glossary of terms which should be of considerable use to students using this book

The book is well written and organized, and contains some truly excellent parts (e.g., sedimentary particles, biological and chemical processes, lake environments, shoreline and peritidal deposits). Weak areas include chapter 4 (physical processes), classification of terrigenous sandstone, fluvial environments, deep-sea clastic sedimentation, and chapter 14 (tectonics and sedimentation). The authors also have a tendency to introduce new terminology, or personal ideas not shared by the majority of sedimentologists, as if they were established ideas. This is an unsafe practice in a text designed, in part, for a first course in sedimentology.

This is the first edition of *Principles of Sedimentology*, which is evident in several editorial and production problems. Printing errors and some factual errors occur with perplexing regularity in some parts of the text (e g., "the term *coprolite* defines particles of animal feces, mostly of *in*vertebrates"). Several of these errors would not be obvious to undergraduates, and would have been prevented by careful proof-reading

The book is well illustrated, but not uncommonly the photographs are overexposed and less useful than intended (e g., Fig 8-12, p 205). Illustrations are frequently located several pages away from the accompanying text, which causes unnecessary interruption

In spite of the above problems, Friedman and Sanders is a welcome addition to the "club" of general sedimentology text books. Its lucid and well-illustrated discussions of sedimentary environments will be helpful to students and instructors alike At a price of $21 95(US) for 792 pages, this book is an economical buy.

MS received May 29, 1979

Deep-Water Carbonate Environments

Edited by H.E. Cook and Paul Enos
Society of Economic Paleontologists and Mineralogists, Spec. Publ. 25. 1977, 336 p.
AAPG and SEPM members $12.00, Others $14.00

Reviewed by E.W. Mountjoy
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Since about 1965 a small but growing number of geologists have been investigating the slope facies adjacent to carbonate shelves and reefs. Some of this research has been stimulated by geologists working on turbidites, by geologists looking for the eastern and western margins of the Paleozoic shelves, by attempts to classify features in deeper water lime mudstones, and by the discovery of various types of gravity flow deposits including debris flows on the flanks of some reef complexes with low slopes and little vertical relief. In 1975 there was a veritable debris flow of papers submitted to the SEPM research symposium on the 'deep, dark and dirty' sediments of carbonate environments, organized by Lloyd Pray and Jim Wilson, and most appear in SEPM Spec. Publ 25.

This volume contains a wealth of data concerning carbonate slope deposits and outlines criteria for recognizing various types of deposits, environments, and depositional mechanisms. Most of the papers are not really concerned with deep-water environments but rather the deeper water carbonate environments that occur on upper carbonate slopes or around carbonate buildups. These fascinating examples (together with others in the literature) help us to understand the complexities of ancient carbonate slope environments.

Ten papers examine Paleozoic examples, all from North America Four papers cover Canadian examples (McIlreath - Middle Cambrian, Field B.C.; Hubert *et al.* - Cambro-Ordovician, Cow Head Breccia, Hopkins - Upper Devonian Miette and Ancient Wall buildup margins; and Davies - Permo-Carboniferous of Sverdrup Basin) Two papers are from Mexico where some debris flow deposits are still being confused with reefs. Hopefully such conflicts will be resolved with the well documented papers of Carrasco-V and Enos. Debris flows are excellent indicators of submarine cementation and provide most useful time stratigraphic markers from the shelf or buildups into the basin. Five papers outline US examples from the Cambro-Ordovician of Nevada, Cambrian of the central Appalachians, and the Mississippian of Montana, Utah, and New Mexico - West Texas. Two general and more theoretical papers are also included, an excellent general model of biofacies patterns in euxinic basins, and an examination of secular variations in the pelagic realm from the Tertiary and Mesozoic geologic record.

Many problems remain especially concerning initiating and transport mechanisms, and the nature of the paleoslopes. An overview paper evaluating these mechanisms and the evidence and interpretations presented would have been most helpful. Certain approaches and interpretations need to be followed up and tested critically; as for example, the suggestion of Byers re estimating the paleoslope and basin contours on the basis of mapping the boundaries between anaerobic and dysaerobic biofacies, and that of Hubert *et al.* utilizing slump sheets, synsedimentary boudins, soft sediment folds within breccias, and clast fabrics to determine paleoslopes. (These data yield a puzzling and irregular paleoslope pattern with paleocurrents mostly occuring at right angles to the inferred slope) Most of these deposits resulted from some type of catastrophic event, but there is little comment on their episodic nature. Are earthquakes the main triggering mechanism and are these deposits more likely to occur close to tectonically active regions? Would they be more frequent on active or passive plate margins? Or is the type of sedimentation and substrate important?

This has important economic considerations especially for the petroleum industry and certain metalliferous deposits, as exploration is extended into ancient, deeper, basinal environments Explorationists students, and academics will find this volume useful for recognizing deeper water carbonate rocks and will gain significant insights into the complexities of slope and

basinal carbonate depositional environments. This volume, however, only includes a small sample of these highly variable environments. The recent review of Carbonate Slopes (Facies Models 13) in this journal gives additional Canadian examples and includes some preliminary and tentative facies models for these environments. The editors and SEPM are to be congratulated for producing a volume of excellent quality at their usual low price.

MS received May 31, 1979

Fluvial Sedimentology

Edited by Andrew D. Miall,
Canadian Society of Petroleum Geologists, Memoir 5.
Calgary, Alberta, 859 p., 1978
$30.00

Reviewed by I. Peter Martini
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Hurrah for Miall and his collaborators for work well done. This memoir appears only 10 months after the Calgary meeting on Fluvial Sedimentology. It collects 29 of the 53 papers presented at the meeting, plus 10 contributions submitted to the editor afterwards. The three day symposium, one day workshop, and two day field trips were most successful in terms of organization, attendance by specialists, quality of papers and work done by participants. Each long day of listening and occasionally criticizing the presentation was followed by evening discussions on specific topics.

The book has been organized into nine sections:

1) Introduction: Historical, written by Miall, reviewing major works primarily by English authors. This introduction set the scene and summarizes the contributions of the Memoir.

2) Texture and Structure of Fluvial Deposits: Two papers dealing with sediment transport. One situation relates to a high gradient stream draining a recent volcano in Guatemala.

3) Bedforms and Bars: Five papers dealing with the problem of terminology of bars, studies of the old favourite "point bar" both in coarse fluvial deposits and in fine tidal materials, sandwaves and sand dunes in a tidal-influenced stream, and good experiments and observations on traverse ribs in gravel.

4) Modern Rivers: Geomorphology and Sedimentation: Six papers dealing with classification of channels, of formation of meanders, and modes of deposition in different types of streams some of which do not fit the models established in temperate and cold regions.

5) Ancient Fluvial Systems: Eleven papers illustrating case studies. Several authors express concern in trying to apply recent models to ancient rocks.

6) Fluvial Facies Models: Nine papers dealing with predictive models derived from both ancient and recent braided and meandering streams. A concern expressed relates to the need to evolve from the two dimensional facies models to the understanding of valley fills in three dimensions.

7) Paleohydraulics: Five papers assess the validity of available empirical formulae, apply them to ancient formations, and analyse the validity of a mathematical model of flow and sedimentation in meandering channels.

8) Economic Application of Fluvial Sedimentology: Two papers dealing with placer deposits and Uranium mineralizations of fluvial sediments in South Africa.

9) Symposium Abstracts: Twenty-two abstracts of papers presented at the symposium, but not followed by a contribution to the proceedings.

The Memoir is as good as the meeting, except in lacking some of the same sense of urgency and enthusiasm perhaps because of the excessive verbosity of a few papers. Although most of the added post-meeting contributions are good, one may well wonder if a shorter version would have been advisable. This might have kept the price of the volume within the range of graduate students, a particularly important consideration, since anybody working in recent and ancient fluvial environments will find this volume indispensable. It is and will become the standard reference for this type of work, summarizing our present knowledge of the subject, stating our inability (or the impossibility) to utilize a unified terminology particularly for large fluvial bedforms. Furthermore it expresses the increasing concern for indiscriminate use of facies models (a comment made at the symposium was that if one tries to distill too much from the data, the result is pure spirit no matter what the starting materials were), and for the use of the principle of uniformitarianism for pre-Triassic and pre-Upper Silurian times. The application of probabilistic models to ancient fluvial sequences, and the application of empirical formulae to reconstruct the paleohydrology of ancient fluvial deposits, offer elegance to presentations, but they are both marred by our lack of understanding of some processes. We do not have a good understanding of the probability of preservation of fluvial sequences and we know too little about streams that do not fit the mid-latitude, temperate climates which have developed under peculiar interglacial wet and cool conditions.

All in all, no new ground has been broken in this meeting and these proceedings. Miall himself in his introductory article, notes that many ideas are very old indeed, but a lot of good work is presented which synthesizes the rapid advances of the last 15 to 20 years in fluvial sedimentology. This Memoir cannot be read from cover to cover all at once, but it is a source of information for years to come. Its success can be measured by two observations among many others: 1) I had bought my copy before I received one to review, and I have already had one semi-permanently borrowed by someone; 2) a sequel to this meeting will be organized in England in 1981. The Calgary one was an Anglophone exercise, let us hope the 1981 meeting will not be a typical British rerun, but the doors will be open to good work done in countries other than North America and Great Britain.

MS received May 16, 1979

Framework, Facies, and Oil-Trapping Characteristics of the Upper Continental Margin

Edited by A.H. Bouma, G.T. Moore, J.M. Coleman
American Association of Petroleum Geologists, Studies In Geology, No. 7, 326 p., 1978.
U.S. $17.00

Reviewed by G.H. Eisbacher
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Properly, the title of this book should read "The geology beyond the shelf break of the northern Gulf of Mexico". This was the topic of an AAPG Short Course offered in 1976 in New Orleans and the contents of this volume are based on the papers presented on this occasion. Some 35 authors explore the physiography, tectonics, seismic stratigraphy, salt movement, deep-sea sedimentation and engineering geology of one of the most interesting exploration frontiers - the deep Gulf of Mexico. The editors have succeeded in producing a well written and coherent story from the course notes although some readers might be left with an unsatisfied sense of curiosity for more geologic data on the Mexican part of the 'Golfo', the focus of Mexico's oil boom. The most instructive part of the book are some 70 shallow seismic reflection profiles scattered throughout which show interpretations of seismic facies, fault patterns and the all-important salt structures. Classical stratigraphers will wonder what happened to their beloved unconformities when they read about hiatus, truncation, downlap, onlap, sheet drape, etc., but the emerging dynamic story of a prograding slope makes for more interesting reading than a list of so many formations. The underlying principles for mapping seismic facies on the continental slope are concisely summarized by Sangree and co-workers following broader syntheses of the physiographic provinces and subsurface geology, all illustrated by excellent line drawings. Three papers discuss the origin and migration of the Jurassic salt with different points of emphasis. Progradation and downbending are analysed in detail for the post-Early Cretaceous West Florida slope by Mitchum. An outstanding article by G.T. Moore, Starke, Bonham and Woodbury describes the growth pattern of the Mississippi fan since Miocene time in a context of on-land and shallow-water physiographic evolution; they also appraise the petroleum potential for this clastic complex and consider it to be low. The effect of slat structures on downslope sediment transport and the origin of complex 'intra-slope' clastic basins and 'anoxic' depressions is illustrated in detailed case studies. The stability of the slope sediments with respect to geotechnical projects is treated in schematic form - one hopes for no unpleasant surprises!

A short paper on the oil-trapping characteristics of turbidites in the Los Angeles-Ventura basins, although relevant, may be out of place in this volume considering the different tectonic settings of the US West Coast and that of the Gulf of Mexico.

Data presented in this book would suggest that development of deep-water resources off the United States and Mexico will eventually make an interesting case history of international use of restricted seas. The provisional boundary treaty of 1978 between these two countries indeed suggests that a good dose of politics will cloud ultimate exploitation of the deeper Gulf.

In summary, this volume in AAPG's new *Studies in Geology* offers a moderately priced, well edited state-of-the-art introduction to the Gulf of Mexico that anyone interested in the structure of marginal basins and deep clastic seas should be aware of.

MS received May 28, 1979

Journal of Petroleum Geology

Editor-in-Chief,
Scientific Press Ltd., P.O. Box 21, Beaconsfield Bucks, HP9 1NS, England
Quarterly: First Issue, July 1978, 122 pages.
£20 per year (Four Quarterly Issues) UK only
$US 40.00 to all other countries - post free surface mail.

Reviewed by Andrew D. Baillie
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This new international journal devoted to the geology of petroleum promises to take its place beside the prestigious American Association of Petroleum Geologists Bulletin as required reading for geologists interested in new developments in the science pertaining to petroleum exploration in most parts of the world. The first three numbers of the first volume have now appeared and the diversity of subject matter, the calibre of the papers and the overall quality of the publication augurs well for its success and acceptance. The Editor-in-Chief is the eminent petroleum geologist Dr. H. V. Dunnington, formerly Chief Geologist and Manager of Exploration, Iraq Petroleum Company. The Editorial Board is comprised of highly qualified representatives from seven countries including the USA and Canada.

The intent of the journal is to present original papers on the origin, accumulation, dissipation, segregation and production of hydrocarbons; studies relevant to petroleum geochemistry, organic diagensis and paleothermal histories; contributions on aspects of exploration or development geology applicable to petroleum search and extraction including case histories of the application of specific techniques. Preference will be shown to papers on oil field regions outside North America and petroleum geology topics of general application.

The 15 full length articles in the first three issues (July 1978, October 1979, and March 1979) cover a broad spectrum and include papers on clay diagenesis as it affects reservoir porosity, tectonic controls of basin development and sedimentation, structure and stratigraphy of Middle East basins, hydrocarbon exploration on continental shelves,

plate tectonics and biostratigraphy. Titles and authors listed for inclusion in forthcoming issues would indicate that the journal will maintain the high standards set in the first issues.

Besides the full-length papers there are review articles, meeting and conference reports, book reviews and short accounts of new equipment and services. A "Notes and Queries" section provides a facility for enquiries, response to enquiries, views and solicitations for information. It is planned to have foreign correspondents report on outstanding papers published in other countries including the USSR and China.

The overall quality of the journal is high with excellent plates and illustrations. Foldouts are utilized to accomodate diagrams larger than page size. The papers appear to have been carefully edited and very few typographical errors were noted.

North American geologists interested in apects of the science relevant to the discovery and development of hydrocarbon reserves in other parts of the world should profit by subscribing to this new international journal.

MS received May 28, 1979

MAC Short Course in Uranium Deposits: Their Mineralogy and Origin

Edited by M.M. Kimberley
Mineralogical Association of Canada, 1978.
$12.00 (post paid)

Reviewed by H.W. Little
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Richmond, B.C. V7A 4L9

Following the GAC-MAC-GSA joint Annual Meeting in Toronto in October, 1978, a three day short course, sponsored by the MAC, was offered on the application of uranium geology, including geochemistry and mineralogy, to exploration. The objective of informing the non-specialist in uranium geology has clearly been met.

The volume was rushed into print resulting in a number of typographical errors, none serious. Most of the papers are of suitable length to do justice to their subjects, and many have extensive lists of references of wide international range. A few are disappointlingly short, such as Langford's paper on Australian uranium deposits, which is unbalanced in content and limited in references. The glossary of mineral names, abbreviations, and geological terms used in the volume is most commendable.

The volume has been organized into five sections: uranium geochemistry, mineralogy, classification and description of selected deposits, roll-type and stratiform deposits, and deposits in northern Saskatchewan. In the first section Langmuir presents a lucid account, well illustrated with diagrams, of the low temperature geochemistry of uranium. Dyck gives an excellent review of the application to exploration of the mobility and concentration of uranium and its decay products. However, he perpetuates the opinion of Lang *et al.* (1962) on the effect on prospecting of surficial leaching at Blind River without also giving Roscoe's (1969) contrary view.

In the second section Steacy and Kaiman thoroughly review uranium minerals in Canada. Morton's paper on identification of uraniferous minerals is directed at students and is purposely brief, the intention being to supply an extensive bibliography. His Table I could have been eliminated from the volume, as it is similar to Steacy and Kaiman's but less informative.

In the third section, McMillan, Ruzicka and Robertson all give thoughtful and extensive treatment to the subject of classification of uranium deposits in Canada, Europe and Ontario, respectively. Tilsley presents a genetic model for uranium mineralization in shallow intrusive environments, and uses this model to develop techniques of exploration and evaluation of such deposits.

In the fourth section, DeVoto's comments on uranium deposits in Phanerozoic sandstones and volcanics are very brief, but well illustrated by diagrams. Bell's extensive bibliography, most of it international, is testimony to the care that has gone into the preparation of his review of uranium concentrations in black shale. Theis presents interesting material on the mineralogy and origin of Elliot Lake deposits. Kimberley's masterful, well referenced study of stratiform uranium deposits is a most worthwhile contribution. Langford covers the subject of uranium deposits in arid surficial environments very well, for information has been sparse.

The final section, on deposits in northern Saskatchewan, contains some of the best papers. Rimsaite's well illustrated paper on mineralogy reflects her meticulous attention to detail. Tremblay, and Hoeve and Sibbald give excellent reviews of, and present new data on "Beaverlodge-type" and "unconformity-type" deposits respectively, and theories concerning their origins. The latter subject was also covered by Langford, but less effectively.

The volume is highly recommended.

MS received May 29, 1979

Pit Slope Manual Chapter 2—Structural Geology

By G. Herget
Energy, Mines and Resources Canada, CANMET Report 77-41, 123 p., 1977.
$3.50 (Canada) or
$4.20 (other countries)

Reviewed by H.A.K. Charlesworth
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Open pit mining now accounts for some 70 per cent of Canada's ore production, a percentage likely to increase as exploitation of tar sands and coal expands. CANMET's Pit Slope Manual was produced to improve slope design in Canada and consists of ten, separately published chapters on such topics as Groundwater and Environmental Planning. The chapter on Structural Geology deals with the gathering and analysis of geological information relevant to pit design. This information has to do mainly with discontinuities such as bedding and joint planes, movement along which causes most pit slope failures. The orientation and other properties of these discontinuities determine the stability and possible mode of failure of most slopes, and without information on them most stability problems cannot be properly analysed.

In the section and related appendices on data gathering, the terminology and properties of discontinuites are described and an account given of such methods as line mapping, core logging, terrestrial photogrammetry and geophysical exploration. A standardized approach is recommended because it facilitates the collection, storage, retrieval, display and analysis of data, particularly if used along with the computer program package DISCODAT described in one of the five, independently published supplements to the Chapter.

The analysis of geological data to be used to design the slopes of a pit is discussed in the next section of the Chapter. This deals first with the geometric analysis of the orientation of discontinuities and then, in less detail, with size, spacing and waviness. Methods of estimating not only the mean values of these properties but also dispersions are treated. Dispersions are required because slope stability analyses, discussed in the Design chapter of the Manual, should be carried out on the basis of probability. The next step in the analytical procedure is to define design sectors within which the properties of discontinuites and their geometric relationship to the proposed pit slopes are similar. The final part of the analysis section describes how sectors can be analysed kinematically with a view to identifying the potential instability modes - rotational shear, plane shear and block flow. Two short sections, discussing the kinds of engineering geology that should be carried out both before and after the decision to mine has been taken, complete the Structural Geology Chapter.

The Structural Geology chapter of the Pit Slope Manual is an excellent Engineering Geology treatise, well written with numerous helpful illustrations, and no engineer or geologist connected with rock excavations can afford to be without it. Apparently prepared with the engineer in mind, it would be extremely useful as a supplementary text in Engineering Geology or Rock Mechanics. With its emphasis on quantifying geological data, it should do much to improve the design of pit slopes in Canada and elsewhere. The price is right and I commend it highly to those of you with interests in Rock Mechanics or Engineering, Structural or Field Geology.

MS received May 16, 1979

Economic Impacts and Linkages of the Canadian Mining Industry

By P.E. Nickel, I.R. Gillies, T.J. Henley, J.O. Saunders
Centre for Resource Studies, Queen's University, 1978, 134 pages.
$4.00

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The development of an industrial strategy for Canada, and the place of minerals in that strategy, has been debated vociferously in recent years. Central to this debate is an understanding of the interrelationships between the mineral industry and the total economy and the concomitant economic development opportunities. This volume is a review of existing literature

Two significant policy issues are addressed, specifically the "size" and the "configuration", of the mining and mineral sectors. Studies by both government and private researchers are reviewed and evaluated in terms of these two issues. Relating to the size of the industry the authors conclude "there does not seem to be any persuasive reasons either for promoting mining as an industry that has unique linkage effects on the rest of the economy, or for discouraging mining because it generates lesser impacts than, say, manufacturing industries".

In terms of the configuration of the industry the authors reach two conclusions. "There is only limited scope for expanded backward linkages". That is, there is little potential for the increase of domestic purchases by the mining industry of other industries' outputs Secondly, "while certain mining sectors export a large proportion of their output in crude form, this does not automatically create viable possibilities for further processing". This latter conclusion would appear self-evident.

Two problems, which deal with aggregation, are pointed out but do not appear to have been sufficiently taken into account in reaching the authors conclu-

sions In making comparisions between mining and other industries the relatively disaggregated mining industry is compared to the highly aggregated "other industries" or a range of such industries A more useful analysis would be based upon a more comprehensive analysis of specific industries This was limited by the authors' attempt to compare the results of several researchers, all of whom used different aggregations.

The impact, sources of intermediate industry purchases, and potential for further processing, differ greatly between mineral commodities. As pointed out such differences exist even for similar commodities within specific regions of the nation General conclusions as to economic opportunities are made difficult by these differences, particularly when a number of value judgements are associated.

The general conclusion reached is that a stronger core of economic research is required before suggestions can be made as to where mineral policy should go from here

The intention of this volume was not to add to the debate as to the place of the mining industry in an industrial strategy: rather, its intent was to review and evaluate the research of others. As a successful review of the current literature on the subject it may be a useful compilation of research for those wishing to enter the discussion.

MS received May 31, 1979

Books Received

The Study of Landforms (Second Edition)
by R.J. Small (Cambridge University Press, 502 p., 1978, $34.50 hard cover; $13.95 paperback).
The second edition contains a new chapter on Tropical landforms plus revisions made to the other chapters

Catalogue of Type Invertebrate, Plant, and Trace Fossils in the Royal Ontario Museum
by J. Waddington, P.H von Bitter and D Collins (Royal Ontario Museum Misc. Publ., 151 p., 1978, $7.50)
"The new catalogue includes all types, figured and referred specimens of fossil invertebrates, fossil plants, and trace fossils at present deposited in the Department of Invertebrate Palaeontology of the Royal Ontario Museum" (From the Introduction).

Geological Aspects of Uranium in the Environment
edited by P. McL D. Duff (Geological Society, London, Misc. Paper No. 7, 1978,£1.25)
Papers delivered at a meeting organized jointly by the Geological Society and the Department of Applied Geology, University of Strathclyde, held at the University of Strathclyde, November 12, 1977.

Rio Grande Rift: Tectonics and Magmatism
edited by R.E Riecker (Amer Gophys Union, 438 p., 1979)
"This volume contains a special collection of papers selected from those presented at the International Symposium on the Rio Grande rift held at Santa Fe, New Mexico, in October 1978" (From the Forward).

Geochemistry
by A.H Brownlow (Prentice Hall, 498 p., 1979, $19.95).
"This book is intended for undergraduate and graduate students taking an introductory course in geochemistry. It will also serve as a reference text for professional scientists" (From the Preface).

The Effect of Tropical Storm Agnes on the Chesapeake Bay Estuarine System
by the Chesapeake Research Consortium Inc (The John Hopkins University Press, 639 p., 1977).
"This volume is an attempt to bring together analyses of the effects of this exceptional natural event on the hydrology, geology, water quality and biology of the Chesapeake Bay and to consider the impact of these effects on the economy of the Tidewater Region and on public health" (From the Preface)

Ocean Fronts in Coastal Processes
edited by M.J. Bowman and W.E Esaias (Springer-Verlag, 113 p., 1978).
The proceedings of a workshop held at the Marine Sciences Research Center, SUNY, New York, May 25-27, 1977.

Fluidization
edited by J F. Davidson and D.L. Kearns (Cambridge University Press, 407 p., 1978, $30.00).
The proceedings of the second Engineering Foundation Conference, Trinity College, Cambridge, England, April 2-6,1978.

Large Ground Movements and Structures
edited by J.D. Geddes (John Wiley and Sons, 1064p., 1978, U S $57 50).
The proceedings of the conference held at the University of Wales Institute of Science and Technology, Cardiff, July, 1977