

Book Reviews / Critiques

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Book Reviews

Collision Tectonics

Edited by M.P. Coward and Alison C. Ries
Geological Society of London
Special Publication No. 19
Blackwell Scientific Publications, Palo Alto
 415 p., 1986; \$60.00 US, cloth

Reviewed by R.A. Price
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This volume is the outcome of the Geological Society of London's William Smith Meeting of April 1, 1983, at which Professor Robert M. Shackleton, the 1983 William Smith Lecturer, addressed the subject of "Precambrian Collisional Tectonics in Africa". The William Smith Lectures, established by the Geological Society in 1944 to provide annual reviews of topics of current interests, clearly have grown into substantial symposia. This particular volume comprising twenty-two papers, covers a wide spectrum of geographical areas, earth history, and disciplinary perspectives on collision tectonics.

The stated aim of the 1983 meeting and the ensuing special publication was "to discuss the geometries, kinematics and mechanics of plate collision, in particular the distribution, sequence and timing of deformation, magmatic and metamorphic processes within a collision zone". Most contributions discuss specific regions, mainly parts of the Himalayan - Alpine Belt but also of Southern Africa and northwestern Europe, western North America, the southern Andes and the Banda Arc as the basis for addressing the questions and themes specified by the organizers of the meeting. There are only three papers that are not rooted in specific geographic examples, and they deal with thermo-tectonic modelling, mechanics of deformation and geochemistry of magmatism. Accordingly, this special publication is primarily a collage of descriptive-interpretive papers, each of which analyzes a specific segment or attribute of a collisional orogen. The result is a broad regional overview of

collision mountain belts, focussed mainly on the Himalayan - Alpine Belt.

Some of the papers include substantial contributions of information and ideas that were new and exciting when they were presented in 1983, but had faded somewhat in the light of rapidly growing new information and ideas by the time they were published and fully accessible. Other papers were mainly reviews of older publications, and they also have faded, but still serve the useful purpose of bringing together information that was dispersed and therefore less conveniently accessible.

The highlights of the volume for me were the elegant generalized global models for collision tectonics developed by John Dewey and his colleagues on the basis of their analyses of Eastern Anatolia; and the incisive review of the essential attributes of the collision process by Robert Shackleton, and his application of this to the Precambrian tectonics of southern and eastern Africa.

This volume should be in demand as a standard reference in the libraries of universities and other research institutions. However, the price (\$80US) should make most individuals want to examine the book before committing themselves to the necessary financial investment.

Manual of Carbonate Sedimentology

Edited by T.J.A. Reijers and K.J. Hsü
Academic Press, London
 302 p., 1986; \$123.25 CDN, cloth

Reviewed by Noel P. James
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This unusual book is designed for the non-specialist and unilingualist, others need read no further! It is an outgrowth of a manual Hsü was asked to prepare while at Shell Oil Company research laboratory some 20 years ago. The purpose of this manual was to convey, in an easily understandable form, the relevance of research results to exploration and production of petroleum reserves from carbonate rocks. This volume is a revised and updated version by Reijers with the aim of presenting a concise overview of the entire field of carbonate sedimentology with special emphasis on trends of porosity development.

The volume is organized into 4 chapters: Elements of Carbonates (68 p.), Carbonate Environments, Settings and Bodies (93 p.), Carbonate Diagenesis (73 p.) and Carbonate Reservoirs (16 p.). Sub-sections of each chapter are introduced with a concise text outlining the main aspects of the topic about to be covered. Each section is encyclopedic and lexiconographic in organization with entries grouped thematically. There are a total of 500 key words and each is defined and translated into German, French, Dutch and Spanish. Widely used informal abbreviations are given for all and alphanumeric codes designed for computer use are also included for many. Adjacent to each entry there is also a graphic symbol, mostly drawn from the standard Shell legend, for use in stratigraphic columns, cross-sections and facies maps. Cross-references are common and all alphabetic language indexes are located at the end of the book. There are 5 pages of references, somewhat short for a

book of this type, with few post-1980 entries. A total of 126 line drawings (no photographs) accompany the text, a barely adequate number. Most diagrams are from the published literature but some are original.

On balance this is a useful volume which achieves its purpose. The text is clear and to the point, if somewhat dated by recent research, and so useful for the non-specialist. It suffers from several drawbacks, mostly related to illustrations. The drawings are mostly from Shell publications or publications of the mid-1970s and heavily rely upon 6 to 7 sources. It is worrying to see my own diagrams of that era used, which have since been superceded in print! More important, however, is that the citations to diagrams are poorly done; some are cited only to journal and not to author, others give the author but the citation is not in the references, others are incorrect and finally some come from the published literature which is not cited at all. This, while perhaps forgivable in a textbook, is unpardonable in a lexicon because it means that the reader, a non-specialist, cannot easily get into the literature from the diagrams — which is in part the purpose of the book.

In spite of these drawbacks and lack of attention to detail, I would recommend this book if it were not for the price. When it is published in soft cover at 1/4 the price it will be good value, until then, unfortunately, only well-endowed libraries will be able to afford the luxury of such a publication.

The Flavor of Ed Owen — A Geologist Looks Back

Edited by Samuel P. Ellison, Jr., Joseph J. Jones and Mirva Owen
University of Texas at Austin
Geology Foundation
ix + 142 p., 1987; \$10.00 US
(Available from Earth Enterprises Ltd.
P.O. Box 672, Austin, Texas 78767, USA)

Reviewed by William A.S. Sarjeant
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Unquestionably, one of the greatest contributions this century to the history of geology, and surely the greatest ever to the history of petroleum exploration, came when the American Association of Petroleum Geologists published, in 1975, its Memoir No. 6, *Trek of the Oil Finders*. This enormous work — it runs over 1650 pages — was the culmination of many years of patient research by one man, Edgar Wesley Owen (1896-

1981), himself a participant in many of the great oil plays of this century. Upon his death six years later, Robert H. Dott Jr. published obituary notices of Owen in the *AAPG Bulletin* and in the *Geological Society of America Memorials*, but these were too brief to give any adequate portrait of a very remarkable person.

The volume here reviewed is a compilative work of autobiographical jottings by Owen in the last decade of his life, together with some other philosophical and geological writings and a few poems and aphorisms. These were assembled, organized and typed by his sister-in-law, Mirva Owen, and edited for publication by two of his former colleagues at the University of Texas, a brief connecting text being provided. As the editors comment in their preface (p. ix):

Ed's language remains as he presented it, some portions gracefully done in his exemplary English, other portions more like notes, brief and composed like a diary.

Though the result is inevitably an unequal production — a scenario for an autobiography, rather than an autobiography — it serves greatly to amplify our knowledge of Ed Owen's life and is an invaluable historic document.

Since Josiah Owen, Ed's paternal grandfather — p. 2 says "fraternal"! — was a geologist successively with Southern Pacific Co. and Kern Trading & Oil Co. and since Samuel Thorniley, his maternal grandfather, was one of Ohio's earliest oil operators (pages 2, 5, 7), it seems almost as if Ed was predestined to become a petroleum geologist. Certainly that was the career he followed all his days; his brief venture into mining geology (p. 55-58) merely an unsuccessful sideline activity of an employer whose interests were primarily in petroleum. This career took Ed on many long miles of travelling through Oklahoma, Wyoming, Kansas, Montana, New Mexico and Texas. Not that he minded, for he commented (p. 53):

Travel was a pleasure of which I never tired.

Only twice did it take him out of the United States, however — and both times to Alberta (in 1921 and 1922), where his employer's attempts to lease in the Viking gas field were ultimately to be frustrated by the extreme slowness of decision-making by the Utilities Commission.

Ed's accounts of his pre-Second World War activities are lucid and detailed, but rather dry; few attempts are made to bring to life the numerous other persons he mentions and his comments are as spare as if presented in an official report to a company. Even so, they give something of the flavour of that frenetic period of market climbs and plunges and of the excitement of striving always to make discoveries ahead of those other geologists, the ones representing the competitors.

In contrast, Ed's account of his involvement in the Second World War in the Pacific — this was through voluntary enlistment, for he was by then old enough to be immune from the draft — is, if much more episodic, also much more vivid. He was responsible for photographic intelligence work in the south-west Pacific region, serving principally in Australia and New Guinea, and did his job so well that he won four campaign medals, five battle stars, a distinguished unit citation, the Legion of Merit and elevation to the rank of Lieutenant Colonel. Also vivid, and quite unexpected, are his sensitive accounts of the birds in his Texas garden (pages 58-61, 64) and a sort of mosaic of pen-portraits of places visited and experiences in them (p. 97-124).

Ed wrote little about his post-war years. Although the editors have given a summary of these and brought together material on his teaching at the University of Texas and his philosophical and religious musings, this remains a major gap. Indeed, all in all, this collection of his writings is at once fascinating and frustrating; fascinating for what it tells, frustrating for what it does not tell.

Ed Owen summarized his career thus (p. 1):

The work was done for fun, and I never got rich at it; at the age of 79 I felt that I was still "working for the experience", but manifestly if I didn't have it by that time it was already too late!

This book reflects, in part, his sense of the fun of it all and the editors deserve credit for putting it together. Yet, inevitably, it is like an unfinished portrait painting, in part colourful and detailed, but elsewhere only a shadowy outline in monochrome. Some day, a full biography of Ed Owen ought to be written; it would be well worth writing and reading. In the meantime, this book serves indeed to give us the flavour of the wisdom and humanity of a distinguished petroleum geologist and geological historian.

Phylogeny, Speciation and Palaeoecology of the Early Carboniferous (Mississippian) Conodont Genus *Mestognathus*

By Peter H. von Bitter, Charles A. Sandberg, and Michael J. Orchard
 Royal Ontario Museum, Toronto
 Life Sciences Contributions 143
 115 p., 1986, \$25.00, paper

Reviewed by Lars E. Fähræus
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This monograph deals exclusively with the five so far recognized species (by the authors) of the Early Carboniferous conodont genus *Mestognathus*.

The volume is divided into the following major headings: Morphology; Palaeoecology; Geographic Distribution; Late Viséan and Early Namurian Provincialism; Phylogeny, Phyletic Gradualism, and Speciation; Phylogenetic relationships; Previous Biostratigraphic Applications of *Mestognathus*; Proposed *Mestognathus*-based Shallow-Water Zonation; and Systematic Palaeontology. Several of these headings have various sub-headings. In other words, the volume is very well organized and comprehensive in its coverage.

Among themselves the co-authors have long-time and considerable experience of *Mestognathus* and related or homeomorphic genera like *Clydagnathus*, *Cavusgnathus*, and *Scaphignathus*. Experience which has resulted in a very credible monograph, particularly the sections dealing with Morphology, Palaeoecology, Geographic Distribution, and Systematic Palaeontology.

Due to its subject matter, the volume is, unavoidably, highly technical and of direct interest to a somewhat limited readership. Nevertheless, clear and concise language free from unnecessary technical jargon and so-called science-required turning of phrases, together with excellent editing, have combined to produce a very good example of how science written by the specialist for the specialist should be produced.

Considering that the volume only deals with five species of a unimembrate (*i.e.*, only one type of element in the conodont apparatus of the organism) conodont genus, and a few synonymous species, it is profusely, not to say extravagantly, illustrated with 338 scanning electron microscopy figures of generally excellent quality displayed on 29 plates.

I find very little to argue with in this volume and in the few areas where I do have a dissenting opinion it is rather a matter of

philosophy and approach than a different interpretation of the data at hand. In this volume two such areas fall under the headings: "Phylogeny, Phyletic Gradualism and Speciation" and "Proposed *Mestognathus*-based Shallow-water Zonation".

Under the first heading, the authors write (p. 26): "The morphologic features that define the five recognized species of *Mestognathus* develop through time in an apparently gradualistic manner (Text-fig. 5)" (my emphasis). Since "phyletic gradualism" as a mode of evolution is neither defined nor discussed as an alternative to "phyletic transition" and the "punctuated equilibrium" model of Eldredge and Gould, I take it that it is this "gradualistic manner" of evolution of the conodont element that has convinced the authors that phyletic gradualism was at work.

Considering actual known occurrences, as indicated in Text-fig. 5 of the volume, phyletic transition could, as an equally possible alternative, have occurred in the lineage *M. harmalai* - *M. groessensi* - *M. prebeckmanni* - *M. beckmanni*, whereas allopatric (or parapatric) speciation may have occurred during the evolution from *M. beckmanni* to *M. bipluti*; whether this last occurring speciation event was of the punctuated equilibrium or the phyletic gradualism (or any other) mode I do not believe possible to determine with a reasonable degree of confidence.

Other authors have also tried to assign a specific mode of evolution to conodont phylogenies, an exercise I believe to be fraught with so many complications and uncertainties caused by the nature of the conodont elements themselves and the samples from which they are extracted, that it borders on being futile.

Firstly, the conodont elements are but one part of the anatomy of the conodont animal, we know nothing about the mode and rate of evolution of the soft tissue anatomy of the organism. Secondly, internal non-skeletal organs, whether of hard or soft tissue, of many organisms evolve at a much slower rate than other parts of their anatomy. Thirdly, conodont samples are always more or less (mostly the former) time-averaged, resulting in genealogical as well as ecological mixing. In the case of the volume I am reviewing there is a fourth complication, *viz.* the conodonts studied come from isolated samples which in turn are from, in the majority of cases, widely separated localities in Europe and North America; none of the localities yields any members of the supposed phylogenetic lineage in stratigraphic succession. There are other complications introduced by the samples studied by the authors but a discussion of those would go beyond the purpose of a book review. I am not arguing the possibility that the *Mestognathus* phylogenetic lineage may represent an example of phyletic gradualism but the

near impossibility of supplying a reasonable argument for such an assumption.

Under the second heading the authors propose four "time zones" (p. 30): "The proposed zonation comprises, in ascending order, the *Mestognathus harmalai*, *M. Prebeckmanni*, *M. beckmanni* First Occurrence zones and the *M. bipluti* Range Zone". Each of these zones is also characterized by particular associated faunas.

Given the documented very isolated stratigraphic and geographic occurrence of members of this genus, and the fact that they favoured nearshore environments and with at least some members living in the tidal lagoon and sabkha environment (pp.18-19, text-fig. 4), I find it difficult to consider these zones as "time zones". First occurrences most certainly were environmentally controlled. Considering that the stratigraphic ranges for all *Mestognathus* species concerned are unknown (Text-Fig.5 in the volume) there is little if any control on the amount of diachroneity of these first occurrences. Since the associated faunas appear to play a major role in the identification of these zones I would rather consider them assemblage zones. For example, the *M. harmalai* Zone is said to be represented in a borehole in Poland, but the particular sample from the particular bore-hole does not yield the zonal fossil. I entirely agree with the authors when they write (p. 30): "The major tools for establishing these zones, the limits of which are firmly fixed conceptually (but are tentatively aligned in terms of the "standard")", but I disagree when they continue: "is the phylogeny and range chart depicted ... on Text-figure 5". These are, however, only minor criticisms of a scientifically solid contribution.

As final words, I would like to make a suggestion to the Editors of the LSCV Series. Why not get some "free" advertising of other contributions to the series simply by including a listing of such publications that are still in print, on the inside back cover of the current issue? I, for one, would be interested in perusing such a list.

Formation Evaluation sub-titled Geological Procedures

Written and compiled by EXLOG staff
and edited by Alun Whittaker
IHRDC Press, Boston
163 p., 1985; \$29.00 US, cloth

Reviewed by Glynn N. Wright
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This manual is designed to aid the well-site geologist or technician "logging" sample chips, and to provide a review of geological classifications and sample examination techniques. The illustrations are in black and white; there are no photographs or photomicrographs.

The most informative section is the introductory chapter, which could interest graduate geologists looking for tips on well-site practises, however, this should be read in conjunction with the chapter and appendices on formation evaluation procedures in EXLOG's *Field Geologist's Training Guide*, (reviewed by Jim Taylor in *Geoscience Canada*, v. 13, p. 131). Perhaps that guide should be expanded to contain this section, and the remainder of the book reviewed here be called "A summary of rock classifications".

Chapter 1 discusses sample retrieval from the borehole, and also provides a brief but interesting discussion of the rate at which drill cuttings rise up a fluid-filled borehole under varying conditions of density and velocity. I also enjoyed the paragraphs about cation exchange capacity.

The remaining chapters deal in turn with detrital, carbonate, chemical, and igneous and metamorphic rocks. Classification terms are mentioned which are not typically used in current Canadian industrial or academic circles, however this could help the user relate to whichever system is used by his or her client, or which may have been used in nearby wells. I suspect some terms are of purely historical interest.

I feel more comfortable with CANSTRAT symbols than those used here ... but this is a manual designed for the employees of Exploration Logging Inc., not for general circulation.

Two comments on these early chapters: I would like to see a warning about the reliability of samples caught by the rough-necks, and also about the reliability of gauging permeability from the rate of escape of hydrocarbons from sections of retrieved core.

The chapter on carbonates, which is divided into clastic and chemical sections, includes brief notes about dolomitization and

cementation, along with classifications by Pettijohn, Dunham, Folk, etc., and refers to Choquette and Pray for porosity. I did not notice the term isopachous cement ... and I would have liked a comment on the use of some standard terms for colours, perhaps relating to the USGS scheme, with a comment about the variety of lights (in terms of colour) used by other well-site geologists.

In chapter 5, Wentworth's grain size scale is recommended for igneous and metamorphic sample description ... a quite practical approach.

The appendix contains illustrations of the company's symbols for lithology, and the index is good in that references are made to text and the many clear tables and illustrations.

For EXLOG staff and for well-site geologists without a background in geology this book has its appeal, but I doubt that others will find it very useful.

Theory and Evaluation of Formation Pressures — A Pressure Detection Handbook

Written and compiled by EXLOG staff and
edited by Alun Whittaker
IHRDC Press, Boston
231 p., 1985; \$32.00 US, cloth

Reviewed by Stephen W. Burnie
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This book is one of the EXLOG series of Petroleum Geology and Engineering handbooks. It is primarily a reference handbook for the detection of geopressures (abnormally high pore pressures) in the subsurface. The book is written for the well-site geologist - engineer - driller who needs to predict and detect abnormal formation pressures that could cause a blowout while drilling. The book is not a manual of hydrology but it does provide a good discussion of the causes of abnormally pressured reservoirs often encountered in hydrologic studies.

The text is quite technical with many equations but with examples and illustrations that allow the reader to understand the significance and application of the mathematical arguments.

This book is divided into five major sections: Introduction; Geology; Engineering; Pore Pressure Evaluation Techniques; and

Lost Circulation, Hydraulic Fracturing and Kicks. The chapter on Geology is principally a discussion of the causes of geopressures. Some of the concepts discussed are compaction disequilibrium, aquathermal pressuring, montmorillonite dehydration, and tectonism. The chapter on Engineering discusses the concept of static and dynamic pressures and the interplay of these stresses while drilling a well. Elementary topics such as hydrostatic and overburden pressures are discussed as well as other concepts such as formation balance gradient, effective circulating density and log derived fluid densities. In the fourth chapter, several techniques used to evaluate pore pressures are presented. Topics such as seismic evaluation, mud density/gas relationships, the significance of gas cut mud, drilling exponents, shale density, wire line log profiles, etc. are evaluated. The last chapter is quite technical, dealing mainly with well control procedures and therefore of interest primarily to the drilling engineer.

Typing errors are few ("is" should be "are" in the third paragraph on page 74) but when they occur in equations they are confusing. For example, on page 144, the definition of the "Ki" term in equation 5-3 is unclear. On page 146, the Greek letter " μ " has been left out and the argument loses clarity.

The thorough mixture of field units with SI notation and with "metric" units introduces the reader to the reality of the oil patch but also causes confusion. The authors should have used one system of units.

Verifying the many equations used in this text was not possible. I was, however, familiar with Darcy's law and checked with the example on page 38 in which the dewatering of a geopressed reservoir was discussed. The author used the common elevation form of the Darcy equation. This confuses the problem since the normally pressured unit is at an elevation different from the abnormally pressured zone. The hydrostatic effect of the elevation difference on the pressure potential was not commented on but corrected for in the calculation of the pressure differential term at the top of page 39. A more straightforward approach would have been appreciated.

I do not recommend this book to the uninitiated in the field of drilling engineering or to the non-mathematician unless you are willing to be patient and follow the equations through. Some chapters are less mathematical than others. The first two chapters (Introduction and Geology) are relatively equation free. The remaining three chapters are, however, a lesson in applied math. The book is informative and a worthwhile addition to the library of an oil company.

The Facts on File Dictionary of Geology and Geophysics

By Dorothy Farris Lapidus,
Donald Coates, Ph.D., Scientific Advisor
Facts on File Publications
347 p. 1987; \$24.95 US, Cloth

Reviewed by Guy Kendrick
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This production is the newest general all-purpose entry in the field of geoscience dictionaries. The book constitutes a ready reference to the basic vocabulary of geology and geophysics. There are more than 3000 clearly and concisely presented entries; many are accompanied by tables and well-drafted illustrations.

This dictionary has been sorely needed and fills a gap that has existed for at least a decade. The concept of sea-floor spreading, for example, has spawned new knowledge, the terms generated by this knowledge are clearly defined in this book.

Each page has been carefully laid out into two columns. Each entry is set in bold face, the first letter of which is set mainly in lower case, whilst other entries start in upper case; Brunton compass for example has a capital "B", but buffalo wallow has "b" in lower case. Why can't buffalo have a capital "B"? Maybe I have a soft spot for buffaloes. This dilemma could have been resolved by starting each entry with a capital letter.

There are some noticeable shortcomings: BOD is just defined as "Biochemical oxygen demand". Why isn't there a more complete definition? Comprehensive definitions, however, are given for "pH", "bog", and "ice age".

The definitions are frequently given in-depth treatment and are written succinctly. The definition for dating methods is one of these, but surprisingly, the neodymium-samarium method which has given rise to a deeper understanding of events in the Precambrian is not mentioned.

Nevertheless, this dictionary is an excellent publication and should be on every geoscientist's shelf. Entries cover the whole range of the geosciences; anything from economic geology to geomorphology. The diagrams, especially the block diagrams, are outstanding.

The author, the Scientific Advisor, and the Series Editor are to be congratulated on producing a dictionary that can be used by the amateur, the professional geologist, and the student alike. The book is highly recommended, should be useful to the professional geologist, and should appeal to college graduates who cannot afford the more expensive stodgy dictionaries.

The Tokuwa Batholith, Central Japan — An Example of Occurrence of Ilmenite-Series and Magnetite-Series Granitoids in a Batholith

By Masaaki Shimizu
University of Tokyo Press
146 p., 1986; \$49.50 US, cloth

Reviewed by G.P. Beakhouse
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Toronto, Ontario M5S 1B3

During the past decade, many Japanese petrologists investigating granitoid rocks have emphasized the importance of distinguishing those rocks which are magnetite-bearing (magnetite-series) and those which are magnetite-free (ilmenite-series). This book summarizes a wide range of geological, petrological, geochemical and mineralogical studies dealing with one Miocene batholith that contains both series.

The first three chapters are devoted to an introduction, summary of previous work and discussion of the regional geology. I found these sections to be the most frustrating reading and biggest disappointment of the book. There is continual reference to a seemingly endless list of geographical-type units (*e.g.*, "the Ogarasu-type granodiorite is chemically similar to the Tokuwa-type granodiorite") for which there is little explanation or description and most references are to Japanese language and/or comparatively obscure publications.

The discussion of regional geology consists largely of a recitation of regional stratigraphy. Very brief descriptions of most rock types are presented, but significant points are often ignored or given only brief mention while details of lesser significance are elaborated on. For example, the author points out that intermediate volcanic rocks of Miocene age are in contact with part of the batholith, but rather than discussing their petrology, chemical affinity or relationship to the batholith, the rest of this brief section is devoted to the zeolite mineral assemblages in amygdules. Furthermore, given the unique opportunities presented by the examination of a comparatively young pluton in an active orogenic belt, I was disappointed that there is no discussion of the setting and significance of the batholith in a large-scale tectonic model.

The next four chapters deal with field relationships, petrography, mineralogy and whole rock geochemistry and are the strongest part of the book. There is a wealth of whole rock and mineral major element analyses and some trace element and oxygen isotope data that may be useful to anyone

wishing to compare the geochemistry of granitoid rocks from different terranes. Much of the discussion focusses on those characteristics that effectively distinguish the two series including opaque minerals, magnetic susceptibility and oxygen isotope composition. There is comparatively little discussion of variability within each of the series, even where this is striking and likely of significance for the petrogenesis of the batholith.

The next chapter is entitled "Discussion" but in fact much of this section deals either with a review of the theory of convection in magma chambers (which seems out of place) or with the introduction of limited new data. The brevity of the section dealing with the formation mechanism of ilmenite-series granitoid rocks seems inappropriate given the emphasis of the book up to this point. Furthermore, the author makes no attempt to evaluate the general applicability of his model (ilmenite-series rocks produced by interaction of the magnetite series magma with graphite-bearing sedimentary rocks) to other examples of the occurrence of these rocks or to discuss alternate hypotheses.

The text contains a minimum of typographical errors. Most of the line drawings and geochemical variation diagrams are clear although some of the geological maps could be more legible.

It is my impression that the content of this book relevant to the magnetite-series/ilmenite-series distinction could have been condensed into a medium length journal publication. The book will be of interest primarily to specialists, especially those interested in utilizing the significant whole rock and mineral geochemical database provided for a young pluton from an active orogenic belt.

Geochemistry and Mineralization of Proterozoic Volcanic Suites

Edited by T.C. Pharaoh, R.D. Beckinsale and D. Rickard
*Geological Society of London
 Special Publication No. 33
 Blackwell Scientific Publications, Palo Alto
 576 p., 1987; \$170.00 US, cloth*

Reviewed by R.M. Easton
*Precambrian Geology Section
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This volume contains 36 of the 65 papers presented at an international symposium on the nature of Proterozoic volcanism held in April 1986 as part of International Geological Correlation Project 217 on Proterozoic Geochemistry. A report on the conference itself was published in *Episodes* in September 1986.

The papers are grouped, mainly on the basis of geography, into seven categories; General Topics and Reviews (3 papers), Early Proterozoic Volcanic Suites of the Baltic Shield (5 papers), Early and Middle Proterozoic Volcanic Suites of the Laurentian and North Atlantic Shields (10 papers), Proterozoic Volcanic Suites of the Guiana Shield (2 papers), Proterozoic Volcanic Suites of Africa (5 papers), Proterozoic Volcanic Suites of Australia (4 papers), Proterozoic Volcanic Suites of Asia (1 paper), and Proterozoic Volcanic Suites of the North Atlantic Borderlands (6 papers). Each section is preceded by a large scale location map showing the areas covered by the respective papers. One-quarter of the volume consists of papers on Canadian volcanic suites covering the Circum-Superior Belt, the Trans-Hudson Orogen, Labrador, the District of Keewatin, and the Grenville Province.

Although by no means a comprehensive survey of Proterozoic volcanism, this volume compiles a wealth of geochemical data from Proterozoic volcanic suites from around the world. Although many details of the Canadian contributions, for example, are probably already known to specialists in the field, this volume provides a useful compendium of this data, and in the case of the Canadian papers, represents a partial update of the out-of-print Geological Association of Canada Special Paper *Volcanic Regimes of Canada*. The same holds true for some of the other contributions, although there is also much new information in the volume.

The papers in the volume emphasize the use of major and trace element geochemistry in determining the tectonic setting of volcanic suites. Consequently, little isotope

geochemistry is featured in the volume, the only notable exception being the paper by Lewry *et al.* on the "U-Pb Geochronology of accreted terranes in the Trans-Hudson Orogen, Northern Saskatchewan". Further, little attention is given to the geochemistry of other rock types, notably volcanogenic sediments and sub-volcanic intrusions associated with the volcanic suites. It is somewhat surprising that in a volume comprising 36 papers, almost all the papers reflect the same approach in using geochemistry to study Proterozoic volcanic suites. Little mention is given to the use, in conjunction with geochemistry, of physical volcanology and facies analysis to help constrain paleo-environment and tectonic setting.

Although titled "Geochemistry and Mineralization of Proterozoic Volcanic Suites" the emphasis is on volcanic geochemistry. Only the papers on the Baltic Shield place an emphasis on mineralization, many of the others, if they refer to mineralization at all, provide little details. Surprisingly, many of the Canadian papers make little mention of mineralization. The so-called review paper in the volume on "Proterozoic volcanogenic mineralization styles" is superficial, and classifies Proterozoic volcanogenic mineral deposits into two categories: volcanogenic massive sulphide (VMS) deposits and Broken Hill-type mineralization (everything else). Many will be surprised to know that sulphide deposits in the Sudbury basin are of VMS type and the Grenvillian Balmat ores are of Broken-Hill type. Part of the problem of the review chapter is that it tries to pigeon-hole Proterozoic volcanogenic mineral deposits, which to a large extent, have not been studied sufficiently to allow for ready classification.

As is typical of most volumes produced lately by Blackwell Scientific Publications, the volume is well organized, attractively laid out, printed on good quality paper, and contains few typographical errors. Figures are legible and are not over-reduced.

Despite the minor flaws outlined above, this volume does contain an abundance of information on the nature of Proterozoic volcanic suites from around the world, as well as considerable discussion about the nature of the Proterozoic mantle and Proterozoic tectonics. This book will be of great interest to most geochemists working on Proterozoic suites as well as volcanologists and geologists studying Precambrian terranes, in part because it compiles a great deal of information in one convenient source thus allowing for comparison of Proterozoic suites with other Proterozoic (rather than Phanerozoic) suites. It should also be present in most geological libraries. Unfortunately, the rather high cost of this volume will prevent many potential users from purchasing their own copies and will increase the likelihood of pilferage from the local library.

Antarctic Science

Edited by D.W.H. Walton
*Cambridge University Press, New York
 279 p., 1987; \$39.50 US, cloth*

Reviewed by R.M. Easton
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This book is an attempt to put Antarctic research conducted by the British Antarctic Survey into a more general perspective. In order to achieve this goal, five British scientists have compiled chapters on the most important scientific developments in a number of research areas, including geology. In essence this book is an attempt to justify to someone (the audience for this book is never outlined in the preface or foreword) the utility and importance of the research done in Antarctica to date, and to lobby for the continuation of this research. The volume is timely, as the Antarctic Treaty, in effect since 1961, expires in 1991 and is currently being renegotiated.

The volume is extremely attractive and is well illustrated with excellently reproduced colour and black-and-white photographs and line drawings. The figures make the book attractive and of interest to the educated layman, and in this regard, it is almost a "coffee-table type" book, but the text was clearly written for a scientific, not a public, audience.

The five, individually authored sections of the book are: (1) Geography, Politics, and Science; (2) Life in a Cold Environment; (3) Antarctic Ice and Rocks; (4) The Antarctic Atmosphere, and (5) Co-operation and Confrontation. Geography, Politics and Science contains a brief history of the Antarctic, early exploration and land claims, development of Antarctic research vessels, and the blossoming of Antarctic research as a result of the International Geophysical Year (IGY).

Part II, Life in a Cold Environment, deals with the ecology and physical adaptation of life in the Antarctic, including man, and the exploitation of the Antarctic fishery from a scientific perspective.

Part III, Antarctic Ice and Rocks is the section that ostensibly deals with geology and geophysics. It was written by a glaciologist, and geology and geophysics is given short shrift. Many geologists dealing with glaciology and glacial deposits will be interested in the summary of the work on the Antarctic ice sheet presented here, although I suspect better, more complete reviews exist elsewhere. With respect to bedrock geology and geophysics, there is as much on this subject in Part I as in this section. There is no

geologic map of Antarctica, even at a large scale, no map of the ocean floor around the Antarctic, no map showing Antarctic volcanoes or a discussion of active volcanism (although they are shown in photographs), no mention of any DSDP or ODP drill holes in the region, no discussion of geophysics with respect to the geology, and little mention of the important paleontological finds made in Antarctica over the last 10 years that have a significant bearing on the history of Gondwana. Economic mineralization is hardly discussed, which is a surprising oversight, since exploitation of mineral resources is one area where the Antarctic treaty negotiations are likely to flounder. The author notes that little is known about metallic or petroleum resource potential on and off-shore of the continent, but this is clearly one area where a greater research effort is called for.

The section on the Antarctic Atmosphere is one of the better written and organized sections. It is ironic that although the ozone depletion over Antarctica in winter is noted, it is given little significance. Perhaps this reflects when the sections of the book were written relative to the publication date. It also shows that research priorities can change very dramatically, very quickly, which is not discussed in the last section which deals with the prospects for future international cooperation and research in Antarctica.

As a general comment, this book could have benefited from the inclusion of a map of the continent on the inside covers. Such a map (or maps) could have included geography, research station locations, details of the ice sheet and extent of sea ice, etc. Fortunately, I have access to several maps of the Antarctic, which I found necessary to refer to while reading the book. If this book is meant to serve a general audience, then this is clearly a major oversight.

This book is not a comprehensive review of our state of knowledge of Antarctica. It does provide a summary of some research done to date, and does list some other sources for further details, but is extremely poor with respect to geology. It is unclear what audience the book is trying to reach. In terms of production and photographs it looks like a "coffee-table book", it is too detailed for a political report, yet it is written in a style that suggests it is a research report of some sort. In some respects, it resembles the Canadian Mackenzie Valley Pipeline Inquiry reports of several years ago. Because of the deficiencies outlined above, *Antarctic Science* can only be recommended to those who work in the Antarctic, or who have an extremely keen interest in the continent. Most libraries can do without it.

The Greenpeace Book of Antarctica

By John May
Macmillan of Canada, Toronto
 192 p., 1988; \$29.95 CDN, cloth

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This coffee table style book serves a dual purpose. In part it is a visually attractive, popular encyclopedia on the seventh continent, and in part it is an account of Greenpeace's campaigns in the region that ultimately presents a strong case for conserving Antarctica in a natural state, possibly even as a world park. In many areas, this volume meets or exceeds the objectives outlined in the book *Antarctic Science* edited by D.W.H. Walton, but which were not realized in his volume.

The book is divided into three sections. The first, which accounts for about 60% of the book is an encyclopedia on Antarctica, covering almost all aspects of the natural history of the continent. It includes good coverage on topics such as the ozone hole, meteorites in the ice, geology, and continental drift, all subjects that were either absent or given only limited coverage in *Antarctic Science*. And, unlike *Antarctic Science*, it includes a map of the continent (although it could still be a bit more detailed).

The second section deals with human activities in the polar region, again, in the same encyclopedic format used in the first half of the book, and covering all aspects of human involvement in the area, such as the impact of the research bases on the environment (locally, quite considerable), the impact of tourism, mineral potential, and commercial activities such as whaling, sealing, and fishing. Many of these aspects are relevant to scientific research in the region and the future of the continent, but most were not dealt with in *Antarctic Science*.

The final section, roughly 20 pages in length, deals with Greenpeace activities in the region and outlines Greenpeace's proposal to make the continent a world park. Although I'm sure many *Geoscience Canada* readers would agree with the principle of such a proposal, many are probably unaware of the obstacles and attitudes standing in the way of what seems to be a desirable goal. For example, one major oil spill would devastate many bird populations on the continent, but offshore oil drilling is seriously being considered in the region. The book also contains several appendices, a bibliography, a gazetteer, and an index.

The book is superbly illustrated, reflecting its coffee table format. However this is a coffee table book with a difference, because the photographs and figures, in addition to being of excellent quality are also informative. Notable examples include the aerial photographs over various glaciers and sea ice, the polarized photomicrographs of ice at various depths, and of mineral specimens from the continent. The photographs and figures alone make this book an excellent buy. The book is also very well-organized. One may quibble over the amount and type of information presented in some of the entries (*i.e.*, more information could be added), but what is present is concise, accurate, and up-to-date. After all, this was meant as a book for a general audience, not a comprehensive reference document. In terms of geologic material, it is more abundant and current than that presented in *Antarctic Science*. The Greenpeace volume could have been improved with the addition of entries on Antarctic volcanoes and the marine geology surrounding the continent, but most lay readers probably will not notice their absence.

This is an excellent volume, and is of interest to those readers who are interested in the continent, as well as researchers familiar with Antarctica. Despite its coffee table guise, it would also be a useful reference book for many geologic libraries. The book is also an excellent example of how scientific information can be presented in an effective and beautiful way without sacrificing too much detail or getting swamped with jargon. There is a message in the book as well, but for the most part it is kept isolated, and with an emphasis these days on the study of global change, it is a message much in keeping with current scientific perspectives.

If you have a choice between *Antarctic Science* and the *Greenpeace Book of Antarctica*, the latter wins hands down. Unfortunately it is now after Christmas, otherwise this book would have been a great gift suggestion for your favourite geoscientist.