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Book Reviews

Biogeography

By E.C. Pielou
Wiley Interscience, 351 p., 1979.
\$21.50

Reviewed by Willi K. Braun
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The word *biogeography* invokes a wide range of ideas and feelings, not always favourable; yet whatever personal viewpoints one may hold, there is no doubt that the subject is a fashionable topic for discussion. Ecologists approach biogeography from the standpoint of geographic regions, organisms, or from basic ecological concepts, while paleontologists let it ride on the back of moving crustal plates. In itself, the concept of biogeography is so broad that many unrelated topics can be accommodated under its umbrella. Consequently, it has become a collection of a wide variety of facts but, unfortunately, it also includes some fiction.

Biogeography deserves to be recognized as a scientific, intellectually demanding, and stimulating discipline despite its holistic attributes. Dr. Pielou's book supports this view. It is written as a series of essays, each standing on its own and with a thread provided by extensive cross-referencing. The book is descriptive and speculative in part, but mathematical-statistical models and objective approaches and methods are liberally interspersed and discussed. Probably the greatest achievement and novelty of the book is this interesting blend.

To paleontologists, the first two chapters are of greatest interest. The first, entitled "Biogeographic Subdivisions of the Earth" is a mathematical-statistical attempt to quantify certain observations, briefly introduced by a conventional descriptive account of biogeographic realms.

The following chapter "Biogeography and Continental Drift" contains the time-honoured, if somewhat overworked examples of the vertebrate and plant fossil record, and some lesser known examples from the invertebrates. Next follows a brief summary about the state of development in phylogenetic and evolutionary systematics, dispersal, various modes of speciation, latitudinal diversity, and a mathematical modelling on the geographic ranges of related species. Paleontologists will relish these tidbits if only for the malicious joy they derive from seeing biologists struggle with their own species, speciation, and community problems.

For geologists, the following chapters on "The Quaternary Ice Age and Biogeography" and "The Biogeography of Marine Organisms" should make worthwhile reading, whereas the chapters in the second half of the book are only of peripheral interest, except for those paleontologists who are intimately familiar with the modern thoughts of evolutionary theory. These chapters on "Island Biogeography", "Geographical Ecology", "Dispersal, Diffusion, and Secular Migration", "Disjunctions", and the "Geography of Genes and Chromosomes", are heavily laced with mathematical models and approaches not directly applicable to the Earth Sciences.

An extensive system of cross-reference comprising author, taxonomic, and subject index concludes the book. The text is lucidly written, and the author demonstrates her mastery of "mathematical ecology". Most text figures are clearly labelled and to the point. Understanding the message of the book, however, requires an extensive background knowledge. It is addressed to senior undergraduates, graduates, and scientists of both the Biological and Earth Sciences who need to review their knowledge in the field or who require a short course in biogeography.

MS received November 12, 1980

The Encyclopedia of Paleontology

Edited by R.W. Fairbridge
and D. Jablonski
Dowden, Hutchinson and Ross,
886 p., 1979
\$90.00

Reviewed by R.K. Pickerill
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The Encyclopedia of Paleontology is the seventh in the series of Earth Science encyclopedia compiled and edited by the Rhodes Fairbridge-Dowden, Hutchinson and Ross combination. It contains 147 entries written by 122 authors, 7 of whom are now deceased. The majority of authors are well-known in their field, and perhaps understandably so, are from North America (78 from the USA and 9 from Canada). It is refreshing to see entries from so many well-established contributors in the one volume.

The volume follows the general format adopted by its predecessors, with alphabetically ordered concise articles on a variety of selected subjects. Entries are essentially either broadly taxonomic (e.g., acritarchs, annelids, archaeocyathids, arthropods, etc.) or conceptual (e.g., actualistic paleontology, biogeochemistry, biometrics in paleontology, biomineralizations, etc.) in nature. Each is usually illustrated by line drawings and/or photographs and represents a concise summary, including the current status, of the selected topic. All articles include a short but well-chosen and up-to-date bibliography as well as extensive cross-references to related topics.

It is clear from the content of the articles that authors were given a free rein but generally (and there are odd exceptions) the content is good. As a result, some articles are given more emphasis than others and, for example, I found it

somewhat enigmatic that 10 pages were devoted to "aves" and only 7 to "brachiopods".

In a book of this size and scope, typographical errors are inevitable, and the space permitted in this review would not allow me to list the ones I spotted. Nevertheless one is unforgettable - that of "Ellis Youchelson" (p. 462). In addition, the incorrect figure in the "Hystrichospheres" entry (p. 400, Fig. 1) was printed. Incidentally, the correct figure and an errata sheet are available from Dowden, Hutchinson and Ross on request.

The quality of the plates and line diagrams is, on the whole, reasonably good considering that the majority are not originals. The quality of others, however, is unforgivable. As an example I have chosen one close to my own heart - the article on "Trace Fossils" by the late Walter Häntzchel and Robert Frey. Figure 5 (p. 819) is verging on the nauseous and I cannot envisage anyone unfamiliar with the topic recognizing the grazing traces a)-e) as, in fact, *Muensteria bicornis* (my spelling), *Spirorhapha* sp., *Helminthoida crassa*, *Cosmorhapha* sp., and *Helicolithus sampelayoi*.

In spite of these shortcomings I believe the overall quality of the book, both in terms of content and production, to be extremely good. As a quick, simple, and yet detailed reference book on the majority of topics in paleontology it is unrivaled. Both specialists, particularly those wishing to find a quick source of information on unfamiliar topics, and non-specialists will find the book useful. In this context the encyclopedia has fulfilled its objectives and the editors are to be congratulated on their endeavours. Nevertheless, the list price of \$90.00 U.S. represents a serious price leap from the encyclopedia's previously published sister volumes which ranged from \$45.00 to \$65.00 U.S. As a consequence, the book is well beyond the means of any student population, and the majority of paleontologists, stratigraphers and sedimentologists will probably decide that at \$90.00, a walk to the library would be more feasible and perhaps more healthy. Clearly, however, every library should have this volume - in the space of 886 pages I believe it has achieved its objectives.

MS received September 30, 1980

Biogeochemical Cycling of Mineral-Forming Elements

Edited by P.A. Trudinger and D.J. Swaine
Elsevier Scientific Publishing Company,
616 p., 1979
\$97.50 U.S.

Reviewed by M.A. Barnes
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The role organic matter plays in geochemical processes is commonly ignored or relegated to a black box. This volume introduces some light in a series of reviews of the role biological processes play in the geochemical formation, solution and transformation of minerals. The editors selected elements (C, S, Si, P, Fe, Mn, U) for review on the basis of their abundance, economic value of mineral forms, role in common metabolic reactions and the impact of their biogeochemical cycles on sediment geochemistry. Eighty per cent of the text explores the physical, chemical and biological processes that act as checks and balances on organisms, their external environment and the cycling of elements between the biosphere and geosphere. The final 20 per cent considers man as an active agent in the biosphere, the impact of agriculture on the system, and the limits that reserves of soil fertility, essential micro-nutrients and geochemically scarce metals may place on man's growth.

An excellent overview by the editors and several other features make the book readable by those with a minimal background in biology and organic chemistry. Terms are defined in their context; there is a good glossary and a useful index. Effective use is made of figures to illustrate biogeochemical cycles. There are numerous cross references between chapters. The book shows a welcome cohesion which reflects well upon the editors.

Biogeochemical cycles result from the interaction of biochemical, chemical and physical processes which cause a rapid exchange of elements in "cycling pools" between organisms and their immediate environment, followed by a slower exchange in large, non-biological "reservoirs" of the hydrosphere, atmosphere and lithosphere. Primary processes affect mineral cycling directly through metabolic functions essential to the organisms; elements are oxidized, reduced, incorporated in specific tissues and pre-

cipitated as minerals as a result of catalysis on organic templates and of micro-environments created by physiological reactions. Secondary processes affect mineral stability and solubility when the release or consumption of substrates by organisms change environmental Eh, pH and the availability of complexing agents. Microorganisms contribute the bulk of the biomass, have rapid rates of growth and decay, have occupied a wide range of environments through geological time, and include a unique array of photosynthetic, chemotrophic and heterotrophic reactions, many of which are keyed to specific mineral transformations: as a result, primary and secondary processes associated with microorganisms are major factors in element cycling.

The impact of these processes was developed in reviews on: carbonate deposition in bacteria, algae and metazoa; silica deposition in marine organisms and terrestrial bacteria and plants; weathering, bioerosion and dissolution of carbonates and silicate minerals; the role of microorganisms in mineral mobilization and deposition of Fe and Mn in banded iron formations, marine and fresh water ferromanganese and manganese deposits; phosphate and uranium deposits. Four reviews on the sulphur cycle effectively integrate the ecology of sulphur oxidizing and reducing microorganisms, their biochemistry, kinetics and isotope effects with biodegradation of sulphide minerals and the cycling of sulphur between the biosphere and geosphere.

The book should interest geochemists, sedimentologists, limnologists and economic geologists interested in mineral mobilization and ore genesis in sedimentary environments. Unfortunately, the high price of the book (US \$97.50) will preclude its use as a textbook. It will, however, provide an excellent reference for advanced undergraduate and graduate courses.

MS received December 3, 1980

Diagenesis in Sediments and Sedimentary Rocks

Edited by G. Larsen
and George V. Chilingar
Elsevier Scientific Publishing Company,
579 p., 1979
\$78.00 US; Dfl 160.00

Reviewed by David A. McDonald
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With recent rapid advances in the understanding of diagenesis of sediments and sedimentary rocks there is an obvious niche for a modern textbook on the subject. Such a book should be reasonably priced for students, comprehensive for non-specialists, and authoritative and up-to-date for specialists. Regrettably, *Diagenesis in Sediments and Sedimentary Rocks* has serious shortcomings on all counts.

A introductory chapter by the editors is followed by six chapters on different aspects of the diagenesis of various sediments and rocks. These are: sands and sandstones by E.C. Dapples, silica by E.C. Dapples, organic matter by E. Degens and K. Mopper, coal by M. & R. Teichmuller, carbonate sediments and limestones by G.V. Chilingar, H.J. Bissell and K.H. Wolf, and dolomites by G.V. Chilingar, D.H. Zenger, H.J. Bissell and K.H. Wolf.

It would have been helpful to the general reader and would have provided a unifying thread to the book if the authors of the different chapters agreed upon a general definition of diagenesis. This was clearly the purpose of the introductory chapter in which the editors review the history, definitions and classifications of diagenesis. Although they briefly discuss the broader definition of diagenesis - the changes which occur in the character and composition of sediments from the moment of deposition until the onset of metamorphism - they state a distinct preference for the more restricted view that diagenesis is limited to the processes modifying sediments between deposition and lithification at low temperatures and pressures. Not surprisingly, the authors of the various chapters each proceed to use their own favourite definition and classification system. Unfortunately, the eminently practical (for carbonates and sandstones, at least) and widely used classification system of Choquette and Pray (1970) is neither used nor even discussed.

The most recent reference I could find in the book was 1975, and most of the data sources are from the 1955-1970 period. This is an especially serious shortcoming in the discussion of sandstone diagenesis since some major new developments have occurred in the last few years. Much of this work is included in SEPM Special Publication No. 26 published in 1979. It is similarly surprising to find a categorical denial of any role for submarine cementation in carbonate sediments, since work in recent years has shown it to be one of the more important processes in the early lithification and diagenesis of limestones.

I found the chapters on dolomites, coal, silica, and organic matter to be the most authoritative and satisfying, while the chapters on diagenesis of sandstones and limestones were the most flawed. The chapter on organic matter dealt specifically with the early diagenesis of sugars and amino acids and is possibly out of place in this volume.

The readability, naturally, varies from chapter to chapter but is generally quite reasonable. The illustrations are similarly fairly good although the distribution is rather strange with long sections of uninterrupted text followed by a barrage of photographs. The captions of the thin-section photographs are sometimes inadequate and the scales difficult to make out. A number of disturbing errors have escaped the editors although they seldom obscure the sense. A forewarning of this is perhaps provided when the name of one of the principal contributors is misspelled on p. 13.

At C\$90.00 *Diagenesis in Sediments and Sedimentary Rocks* does not represent very good value for the individual specialist who can go to other more up-to-date sources for his information. I will, however, recommend that a copy be purchased for my company library since the book does represent reasonably up-to-date information on a number of broadly related subjects, and for the multiple user there is value to be had.

MS received November 7, 1980

Granitic Magmatism and Related Mineralization

Edited by Shunso Ishihara
and Sukune Takenouchi
Mining Geology Special Issue, No. 8,
The Society of Mining Geologists of
Japan, 1980.
8000 yen

Reviewed by D.F. Strong
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This volume is destined to be the last word for a long time on granitoid mineral deposits of Japan and Southeast Asia, just as their Special Issue No. 6 has become so for Kuroko deposits. Most of the papers were presented at a symposium held in Tokyo in January, 1979, aimed at stimulating Society members' activity toward research on granitoids and related mineral deposits.

Section 1 begins with a review of "late-stage processes of felsic magmatism" by C.W. Burnham and H. Ohmoto in which they consider granitoids from their origin, through magmatic processes, to post-magmatic processes. Their emphasis is on water and its various roles in these processes, building on Burnham's (1979) earlier more theoretical paper. However, they also evaluate other parameters such as thermal energy, strength of roof rocks and composition (especially sulphur and metal content) of the magma.

Takahashi *et al.* exhaustively compare the Japanese "magnetite/ilmenite series" classification of Ishihara (1977) with the Australian "I-/S-type" classifications of Chappell and White (1974). They demonstrate that, although each of these schemes is elegant and useful as and where formulated, neither is readily applicable outside. This is also true of Appalachian granites where neither scheme is readily applicable (Strong, 1980), and should serve as a warning against the present North American epidemic of using such terminology.

Other papers in this section deal with characteristics and melting experiments of granites in Southern China (Wang *et al.*), Cl and F contents of rock-forming minerals (Nedachi), hydrothermal activity indicated by oxygen and hydrogen isotopes (Matsuhisa *et al.*), hydrothermal alteration (Utada), and cauldron subsidence as a possible inhibitor of porphyry Cu formation (Sillitoe), the last paper addressing itself directly to the question raised by the symposium, i.e., "Why are there no porphyry deposits in Japan?"

Part II is titled "Island Arcs" and the first paper by D. Taylor and T. van Leeuwen reviews what is known about the fourteen porphyry Cu or Mo deposits known within Southeast Asia outside of the Philippines and Taiwan. Other papers of this section are more detailed studies of individual porphyry Cu deposits in Papua-New Guinea (Asami and Britten) and the Philippines (Takenouchi), porphyry Sn deposits of Bolivia (Grant *et al.*), and Sn-polymetallic deposits of Southwest Japan (Sato and Akiyama).

Part III, "Continental Regions", begins with a brief review, unfortunately lacking maps or illustrations, of granitic rocks and related mineralization in South China (Tu *et al.*). Other papers concern the Jiangxi porphyry Cu deposit of China (Yan and Hu), porphyry-type mineralization in Southern Korea (Sillitoe), tungsten metallogeny in Southeast China (Yan *et al.*), and Sn-W deposits of Peninsular Thailand (Ishihara *et al.*).

Although most of the material of the Western authors has already been published, it is welcome and supporting material to the other papers. Together they make a valuable addition to our knowledge of granitoid mineral deposits, at a manageable cost if you get it before the Canadian dollar drops any further.

MS received September 26, 1980

Petrology and Genesis of Leucite-Bearing Rocks

By A.K. Gupta and K. Yagi,
Springer-Verlag, 252 p., 1980
\$39.00 US

Reviewed by J. Gittins
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The past fifteen years has seen a succession of specialist books on aspects of petrology that are most useful to the expert and general reader alike. We now have a work on that rare group, the leucite-bearing rocks. These rocks have held a curious fascination for petrologists, and the present book conveniently reviews the geological occurrence, tectonic setting, petrography, nomenclature and mineralogy of leucite rocks as well as a selection of related phase equilibria. It is an ambitious undertaking but it is, of necessity, a review in the sense of a précis of what anyone has ever said about leucite rocks, rather than a critical

appraisal and synthesis. For many years these rocks have failed to attract modern geochemical and experimental study, and for close to two decades some of their best occurrences in central-west Africa have been in regions that would deter even the most ardent alkaline rock enthusiast from risking his neck, so that new field data and collections have been lacking. During the past three years this situation has begun to change rapidly with the publication of experimental melting data on natural rocks from the University of Western Ontario, Manchester and Canberra. We are on the verge of having clear answers to some of the problems of petrogenesis for the first time, and in that respect the book is dated from the outset, but this is the fate of most books. It remains a useful reference work.

The summary of petrographic nomenclature is useful historically, and some sort of glossary is essential in reading the older literature; it serves at least in part, however, to emphasize that most of the names are old, confused or overlapping and have not been re-evaluated in the light of modern knowledge. One recalls the terminology of the nepheline rocks at least ten of which hailed from the Haliburton-Bancroft district of Ontario where they have now been shown to be hybrid, metasomatic or assimilation products and largely invalid. Many of the old geographically based names are probably local variants from the mists of petrological history. Certainly any rock with 90% leucite is a cumulate and unlikely to deserve a name. Some of the mineralogical summaries are a bit lacking. Kalsilite, for example, has turned up in several Italian lavas when it was searched for with the microprobe, and while the description of melilite as a solid solution of gehlenite, akermanite and soda-melilite may be adequate for common metamorphic melilites it is an inadequate description of alkalic rock melilites. These are, however, small matters.

The treatment of the pseudo-leucite problem is sketchy and is rendered partly obsolete by recent discussions that recognize more than one type of intergrowth of nepheline and alkali feldspar and set aside the fingerprint intergrowth as a separate problem. Davidson's work on this type at Kaminak Lake, NWT, is overlooked.

Inevitably one could quibble ad nauseum with small omissions or differences of opinion but this would only distort the basic purpose of the book which is a general summary of the available literature of leucite rocks. In this it succeeds reasonably well as long as the reader is

prepared to look to *Contributions to Mineralogy and Petrology* and to the *Journal of Petrology* for the emerging saga of the petrogenesis of mafurite and ugandite! As Bowen's anguished *cri de coeur* in 1923 put it "De profundis clamavi".

MS received November 11, 1980

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Trondhjemites, Dacites, and Related Rocks

Edited by F. Barker
Elsevier Scientific Publishing Company,
659 p., 1979.
\$65.75; Dfl 135.00

Reviewed by L.D. Ayres
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Trondhjemite has been part of petrologic literature since 1916 when the term was first introduced by V.M. Goldschmidt for Norwegian plutonic rocks composed mainly of oligoclase, quartz, and biotite. In 1922 Goldschmidt also recognized that trondhjemite was an important component of a potassium-poor fractionation trend (biotite-diorite series or trondhjemetic trend) distinct from the potassium-enrichment trends of the more familiar calc-alkaline suite. In spite of this early use in Europe, North American petrologists, steeped in the classical Bowen fractionation concepts, largely ignored this potassium-poor rock sequence. The lack of use certainly does not reflect a dearth of these rocks. As ably demonstrated in this volume, a collection of 22 papers by 31 authors, trondhjemites are widespread in North America and elsewhere in Archean gneissic complexes and plutons, Phanerozoic orogenic plutons, ophiolite complexes, and volcanic sequences where it occurs as low-K dacite.

Fred Barker, the volume editor and author or co-author of five of the papers, is one of the leading North American proponents of proper recognition of trondhjemites. He has assembled a varied collection of papers, many of which are excellent new research contributions or reviews by experts in the field. Most papers combine field, petrographic and geochemical detail to derive models of magma genesis. Although the magma genesis sections of most papers are remarkably similar and reiterate ideas previously enunciated by Barker, Arth, Peterman, and others, the papers are a major repository of data on trondhjemites.

Like many books of this type the volume suffers from uneven coverage, varied style, and lack of continuity. This is partly offset by the first five papers (168 pages) which review the general features of trondhjemites (Barker), mineralogy and chemistry of Cenozoic dacitic to rhyolitic volcanic rocks (an excellent review by Ewart), rare-earth elements and magma genesis (Arth), strontium-

isotope geochemistry (Peterman), and trondhjemites (plagiogranites) of ophiolite complexes (Coleman). Subsequent research papers are arranged in order of decreasing age.

Seven papers (245 pages) and part of another document Archean trondhjemite orthogneiss complexes and associated plutons. These include pre-3.6 Ga gneisses of Greenland (McGregor) and Labrador (Collerson and Bridgwater), pre-3.1 Ga gneisses of South Africa (Hunter) and pre-2.8 Ga gneisses of Scotland and Greenland (Tarney, Weaver, and Drury) and Wyoming (Barker, Arth, and Millard; Barker, Millard, and Lipman). The 2.7 Ga trondhjemites which are a major component of Archean plutons in the Canadian Shield are discussed only by Ermanovics, McRitchie, and Houston (Manitoba) and Longstaffe who focused on oxygen isotopes. Although the ancient gneisses are obviously an important field of study, the paucity of data on the volumetrically more abundant Archean plutons is a major shortcoming of this volume.

Paleozoic examples are covered by five papers (111 pages) but coverage is spotty. The papers include an examination of trondhjemite layers in Alpine eclogite (Nicollet, Leyreloup, and Dupuy), trondhjemites within ophiolites (Maipas) and orogenic plutons (Payne and Strong) of Newfoundland, plutons in the type area of Norway (Barker and Millard), and associated volcanic rocks and plutons in California (Barker, Millard, and Knight).

Mesozoic trondhjemite plutons of the United States Cordillera are considered in a paper by Phelps, and in part of a second paper (Barker, Millard, and Lipman) in which Archean gneisses of Wyoming are also considered. Three papers (68 pages) consider Cenozoic low-K dacites and associated plutons of island arcs. These papers cover the Tonga-Kermadec arc (Bryan), Fiji (Gill and Stork) and the Lesser Antilles (Tomblin).

Production of the volume is excellent with a minimum of topographic errors. The numerous photographs are extremely well reproduced. I was bothered, however, by the light weight of the type. Reading this book is somewhat of an eye strain.

In spite of any shortcomings mentioned above this book is an excellent state-of-the-art survey of trondhjemite and dacitic rocks. Although somewhat expensive it is a must addition to the libraries of all igneous petrologists.

MS received November 17, 1980

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