

## BOOK REVIEWS

*Muller, G. and Friedman, G. M. (Editors): RECENT DEVELOPMENTS IN CARBONATE SEDIMENTOLOGY IN CENTRAL EUROPE. 255pp. Springer-Verlag Berlin. Heidelberg. New York. 1968. \$14.50 (U.S.).*

Over the last few decades a steadily increasing emphasis has been placed on the study of carbonates and carbonate rocks. This stimulus has in large part stemmed from the awareness of their economic significance as oil reservoirs; today, at least a half of the world's petroleum is produced from carbonate reservoir rocks. Realisation of the complexity of the carbonate rocks ushered in detailed studies of their constituents and fabrics and so to their classification, diagenesis and geochemistry, and the broader fields of genesis and facies relationships.

The review volume contains 30 short papers (most are less than 10 sides) that summarise recent advances made in many of the above fields by carbonate researchers in Central Europe. The papers were presented at a carbonate symposium at Heidelberg University on the occasion of a visiting professorship by G. M. Friedman of Rensselaer Polytechnic Institute, New York, one of the editors of the present volume, and the author of a number of recent carbonate articles.

The book is divided into five sections:

- A. Processes of Carbonate Formation and Diagenesis (10 papers): Aspects of such controversial topics as dolomitization, pressure-solution and stylolitization, and the fabric and environment of formation of aragonite and low — and high — Mg calcites are discussed. Of particular interest is Friedman's suggestion that aragonite and high-Mg calcite form a cement or matrix in marine environments only, whereas low-Mg calcite cements are restricted to freshwater environments; where low-Mg calcite occurs as a cement in marine rocks it is thought to have been emplaced post-depositionally by fresh-water. These concepts are likely to arouse considerable interest and debate. Dolomitization processes are divided into early — and late — diagenetic and phase systems considered in establishing the formative mechanisms; low temperature laboratory synthesis of  $\text{Ba Mg}(\text{CO}_3)_2$  (norsethite), which has similar structure to dolomite, is used to demonstrate that in addition to magnesium, a suitable alkalinity (carbonate ion supply) is required for dolomitization:



The papers on stylolitization and pressure-solution phenomena, although invaluable in outlining a systematic and objective approach to the subject, have appeared in a more complete form in the *Journal of Sedimentary Petrology*, Vol. 38, 1968.

- B. Microtexture and Microporosity of Carbonate Rocks (2 papers): This section includes a critical review on the use of the electron microscope in carbonate petrology. In particular its use in studying the problematical micrites in order to distinguish between biotrital and chemically deposited origins is outlined. Application of the electron microscope in studying diagenetic fabrics is considered to be of future importance. A comprehensive list of references is included.
- C. Geochemistry of Carbonates and Carbonate Rocks (5 papers): The distribution of Ca, Mg and Sr, and the importance of amino-acids and microflora in selected carbonates, are discussed. The correlation of high Sr values with high aragonite content is lost during diagenesis and may be replaced by a correlation between Sr values and insoluble residue because of the absorption of Sr by clay

minerals. The use of Sr in equating fossil and recent carbonate environments is then rightly questioned, as is the use of Sr in determining salinity values.

The organic origin of calcareous crusts and stromatolites is strengthened by the finding of amino-acids in ancient crusts and the presence of a well-developed microflora producing large amounts of calcite in modern crusts.

- D. Regional Carbonate Petrology (12 papers): The papers, describing both fresh-water and marine carbonate rocks, are concerned to varying degrees with the reconstruction of the environments of formation, facies relationships, diagenesis and classification of the carbonate sequences. Modern petrographic nomenclature and genetic interpretation are used.
- E. Applied Carbonate Petrology (1 paper): The last paper in the volume briefly outlines a gasometric method for continuously logging the carbonate and approximate calcite/dolomite values of cuttings from drill holes.

The book is well presented and well bound, and has logical grouping of subject matter, although section E would appear to be a somewhat lonely afterthought with its one 1-page article. Each of the papers has a journal format with abstract and frequent use of sub-headings and illustrations. Unfortunately misprints are quite common.

The book is likely to have interest at the specialist level only; most articles assume a knowledge of the techniques, nomenclature and problems of carbonate petrology. To the specialist the brevity of some of the articles may prove frustrating in that the theme of the paper is not fully exploited; however the appeal of the volume is the wide spectrum of up-to-date carbonate material housed under the same cover making it an important reference for carbonate research-workers. Finally, in this day of rapid publication one is often unaware of significant developments in other languages, and the translators of the original symposium are to be congratulated for bringing this book to English speaking audiences.

C. S. Nelson

*Day, Vice-Admiral Sir Archibald: THE ADMIRALTY HYDROGRAPHIC SERVICE 1795-1919*, 378 pp., London, H.M.S.O., 1967, £5.5.0 (U.K.)

The contribution of the Admiralty Hydrographic Department to the development of the science of oceanography is considerable, and few need to be reminded of their cartographic achievements. This book is a continuation of Dawson's *Memoirs of Hydrography* Parts I and II, completed in 1885, and follows a similar plan. However, for the general reader Chapter I provides an excellent summary, in 97 pages, of the work of the Hydrographic Department from its founding in 1795 to 1884. Subsequent activities are dealt with in separate chapters for the period of office held by successive Hydrographers of the Navy up to 1919. Each chapter begins with a section on the contemporary scene, a brief survey of current events of concern to the Navy, and then moves into the activities of the Hydrographic Department. The chapter is concluded with biographies of senior officers, afloat and ashore, and a summary of the principal surveys, year by year during the period under review. Appendices include Admiralty Orders-in-Council, an account of the Admiralty Records in the Public Records Office and Hydrographic Department and a full annotated bibliography.

This book must become the standard reference on the work of the Hydrographic Department of the Navy. Nevertheless, the general reader can easily skip over the lists of surveys, and perhaps even the biographies, although some of these make interesting reading, to find a coherent, well written history of the achievements of the Hydrographic Department. The general reader will also find much of interest in the 43 illustrations covering a selection of marine charts, 1801-1920, survey ships, and Hydrographers of the Navy 1795-1919.

E. M. Stokes

*Mehnert, K. R.: MIGMATITES AND THE ORIGIN OF GRANITE ROCKS. 388 pp., Elsevier, Amsterdam, 1968. Dfl 72.50.*

The publishers claim that the present volume is the first published special textbook about migmatites. It "deals primarily with the petrography and genesis of migmatites". The author spent many years studying these problems, especially in central and northern Europe. Therefore, examples given in this book are mainly taken from these regions. However in detailed discussions, results achieved by researchers all over the world are taken into consideration. A large number of photographs is included since the principles of migmatite formation can best be understood by demonstrating their conspicuous penetrating structures.

The author intended to "give a presentation of the recent state of investigation" about this particular rock type, starting with a critical revision of nomenclature accumulated since the early work by Sederholm and Niggli. Parallel to the tendencies in other disciplines (lately for the description of mineral deposits) the use of purely descriptive, geometric, connotation-free terms is recommended (5 pp. glossary in appendix). Twelve principal megascopic structural types, successively well discussed as to origin of terms and their use by various authors are represented by instructive line-drawings and excellent photos (42pp. with 21 figs).

Discussing the microfabric of migmatites (38 pp., 23 figs) the author emphasizes the bias of approach. This "can either be perceived from the point of view of metamorphic rocks (initial stages) or the viewpoint of magmatic rocks is adopted (advanced and final stages)". Leucosomes and melanosomes are characterised by their structural appearance and mineralogical composition. Both reflect the differential behaviour during migmatization from a paleosomatic to a neosomatic fabric.

The results of experimental petrochemical studies of dry and water-bearing silicate systems are reviewed and their bearing on a genetic interpretation shown (13 pp., 5 diag.). Emphasis is laid on the behaviour of feldspars (as the most important mineral group besides quartz and others) for the discussion of the temperature range of formation of migmatites (20 pp., 2 figs).

Since the physicochemical processes and ranges of migration "by ionic diffusion, transport by hydrothermal solutions, by gases or melts" are still very incompletely known, the nomenclature should again be descriptive (mobilizates and restites); the feature of feldspathization is discussed as an example of long-range migration (9 pp., 4 figs).

Pointing out the inadequacy of data regarding metamorphic and anatectic rocks coupled with the "particularly complex petrogenetic processes leading to metamorphism, anatexis and granitization" (simultaneous change of temperature, pressure and concentration), the author discussed in the next chapter rather thoroughly the geochemistry of granite rocks (38 pp., 15 tab. and diag.). The petrochemical processes are reviewed through the full range of metamorphic stages, i.e. 1. "conservative" metamorphism (little or no migrations), 2. alkali displacement through effects of hydrothermal mobilisation (especially albitization), 3. mobilisation of potash feldspar, 4. formation of pegmatoid mobilizates (feldspars and quartz) (range cm-dm), 5. formation of granite (s.l.) "neosomes" (migration range up to km), following the principle that "[granite] can be regarded as the ultimate product of a variety of different convergent petrogenetic processes". As a last stage 6. with decreasing temperature reactions in reverse order of succession may take place.

Under the titles "magmatic"—, "anatectic"—, "metosomatic formation of granitic rocks", the three following chapters review the problems of interpretation of origin of granitic rocks. The discriminatory criteria for each of the mentioned three possibilities are exposed and discussed in great detail (56 pp., 23 figs; 57 pp., 29 figs; 57 pp., 28 figs). This well balanced exposure reflects the most recent state

of investigation by reference to many clear and well documented studies of world-wide origin.

The last chapter "summarises once more the facts and theories presented in this book especially for those who are interested in the results of the problem but not familiar with all the details, special facts and hypotheses given" (8 pp.). A long list of references (29 pp.) documents the wide coverage of the subject and will guide the interested student to the pertinent literature on every aspect of the migmatite problem.

The author achieved the purpose of the study in an adequate, comprehensive and well balanced, admirable manner. The fluent style of the text (occasionally disturbed by "germanisms" and a few printing errors), the profuse illustration by excellent photos and line-drawings and the frequent cross-references to pictures and text make the reading a pleasant adventure. The extremely glossy paper, however, is somewhat irritating because of the practically unavoidable reflections, and does not allow underlining or marking with pencil.

The book is an excellent introduction to advanced students as well as a comprehensive summary for scientists already familiar with the subject.

H. W. Kobe

Groen, P.: THE WATERS OF THE SEA. xiv + 328 pp. London: Van Nostrand, 1967. 65s. (U.K.)

The non-physical scientist may, upon reading the opening sentence of Groen's book ("This is a book about the sea, with particular reference to its physics") think that this text is not for him. Nothing could be further from the truth. *The Waters of the Sea* is an excellent book for anyone — specialist or non-specialist — who has an interest in the sea and its physical phenomena. It is *not* limited to persons whose backgrounds include algebra, trigonometry, analytical geometry, differential and integral calculus and differential equations, as so many of the recent textbooks in physical oceanography are. Instead, it is a "popular" treatment of the physics of the oceans.

Following a lively introduction and a chapter on the exploration of the oceans (from Homer through the Vikings, Cook, Maury, Murray etc. to Piccard and the bathyscaphe), there are in turn sections on the properties of sea water, ice in the oceans, waves (the longest chapter), tides, ocean currents and the circulation of matter and heat in the oceans. In these chapters some of the most fascinating non-biological aspects of the oceans — submarine currents, the origins, movements and life cycles of icebergs, radioactivity of sea-water, 'dead-water', the relative ages of ocean waters, light in the sea and the colour of sea-water, tsunamis, and those "world travellers" swell waves — all receive attention.

All chapters are well written and well illustrated, although most of the examples cited are from the 'continental hemisphere' and specifically the North Atlantic Ocean. For instance, in the chapter on ice in the seas, 18 pages are devoted to the Arctic and North Atlantic and only six pages to Antarctica. While this is expectable in view of the disparity between the amount of research carried out in the northern and southern oceans, it is nevertheless somewhat ironic because in the first chapter Groen clearly distinguishes between the 'continental hemisphere' and the 'Marine hemisphere'.

Throughout this book the reader gets personally involved in making discoveries, going on expeditions, devising instruments, posing problems, and evaluating data. Indeed, the reader, through Groen becomes involved in the reasoning process. This involvement is very much the result of the author's lucid style of writing, and especially his liberal use of punctuating the text with exclamations and questions. Take the following for instance: "If anyone asks you what makes waves,

you will be likely to answer 'the wind'. Certainly if one is standing on the shore of the southern North Sea, it would seem that the stronger the wind is, the more boisterous are the waves. Those who have seen more of the oceans, however, know that it is not as simple as all that . . . (in) southern California, for instance . . . huge waves will batter the coast, breakers six metres or more high, without so much as a breath of wind . . . So where do these high waves come from, when there is little wind? The answer is that great breakers can be produced by a *swell* at sea . . . By attributing the existence of high surf on windless days to a swell in the open ocean, we have shifted our problem, not solved it; for the next question immediately arises: what causes the swell? . . ." (p.123). While this particular extreme example, may as it stands, read a little like something from a schoolchild's popular science book, there is plenty of 'meat' leading up to, and from, the many questions; facts, figures, charts, tables and photographs abound. Moreover, for persons interested in following up most topics, there is a bibliography of about 20 references for each chapter.

*The Waters of the Sea* is an authoritative introduction to the oceans, written by a Dutch oceanographer of considerable standing. Dr Groen, establishes and develops his arguments and conclusions clearly and consistently over a wide range of diverse subject matter. He does it in such a way as to make this a fascinating book.

Roger McLean

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## NOTICE

### NEW ZEALAND GEOGRAPHY CONFERENCE

The Sixth triennial conference of the New Zealand Geographical Society (Inc.) will be held at the University of Canterbury, Christchurch from August 24th to 28th, 1970. Papers are invited in all fields of geography including the teaching of geography. Intending contributors are asked to submit titles of papers and brief indication of their content as soon as possible but not later than February 1st, 1970.

The programme will include excursions, field trips and a social function. Residential accommodation will be available at the recently built Christchurch College.

For further information write to the Conference Secretary, Sixth New Zealand Geography Conference, Department of Geography, University of Canterbury, Christchurch, New Zealand.

## NOTES FOR CONTRIBUTORS TO THE EARTH SCIENCE JOURNAL

### *Aims of the Journal*

Articles and communications submitted for publication should be either reports of research or other original contributions of wide interest to those concerned with geology, geomorphology, pedology, climatology, oceanography and physical geography. Reviews and summaries of the present state of knowledge in the various branches of the earth sciences, and papers which explore the interrelations of these sciences and the borders of traditional disciplines will also be welcomed. The journal will accept long articles but authors should consult the editor before submitting them.

### *Typescripts*

Contributions should be typed on good heavy-grade quarto paper, double spaced, with wide margins all round. The top copy and the top carbon copy should be sent to the editor and a third copy retained by the author. All matter to be printed in italic type (e.g. generic and specific names) must be underlined. Style and layout should follow "Selby, M. J., 1967: Aspects of the geomorphology of the greywacke ranges bordering the lower and middle Waikato Basins. *Earth Sci. Jnl.* Vol. 1, No. 1."

### *Abstract*

A brief summary indicating the scope of the paper and its principal conclusions should be included at the beginning of all articles exceeding 1000 words in length. Contributions in languages other than English must have an English language abstract.

### *Units*

These should be consistent throughout the paper.

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These should be avoided.

### *Tables*

These are expensive to reproduce and must be kept to a minimum. Each table should have a heading and be numbered in arabic numerals. Units of measurement should be placed in parentheses at the head of the column and not in the body of the table.

### *Figures*

These are to be numbered consecutively in arabic numerals regardless of whether they are half-tones (photographs) or line blocks (graphs, etc.). Each must be referred to in the text and only such figures as are essential to elucidate the text can be published. Figures must be submitted ready for reproduction with all lettering and shading finished in Indian ink, and lettering done by stencil or Letraset in a simple style. The originals should be prepared on high quality dense white paper or on stable tracing materials with a good surface and need not be more than twice the size of the printed figure which cannot exceed  $8\frac{1}{2}$  x 6 inches (21.5 x 16 cms.). Figure numbers should not be on the figure itself, only in the caption.

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Authors who require a large number of illustrations may be charged for whole or part of the cost of reproduction.

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Photographic prints should be on glossy paper. Components of a composite figure should be firmly mounted on white card and lettered as required — A, B, C, etc. In general no more than two plates will be permitted per article, unless special arrangements are made with the editor. The place at which each figure and table is to appear should be indicated in the margin of the text.

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In the text references are by author's name and year, e.g. "(Smith, 1960)" or "... as stated by Smith (1960)". The list of references at the end of the paper is to be arranged in alphabetical order of authors' names.

### *Examples:*

Cotton, C. A., 1942: *Geomorphology: An Introduction to the Study of Landforms*. Christchurch, 505 pp.

—————1958: The Rim of the Pacific. *Geogr.J.* 124 (2): pp. 223-31.

Two or more publications by the same author in the same year should be distinguished by a, b, c, etc., after the year. Any abbreviations used should conform with those in the *World List of Scientific Periodicals*, 4th ed., 1964.

The manuscript should be arranged in the following order: title page, abstract, text, references, tables, illustrations, captions. Each page of the manuscript must have a number in the upper right-hand corner, beginning 1 on the title page and continuing in sequence to the last page of copy.

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Only minor corrections in wording can be accepted at proof stage and the author will be charged for any alterations.

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