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The bibliography is comprehensive and appears to contain references to most of the major contributions in this field. As it stands, the book is a valuable addition to the library of any economic or mining geologist and is to be generally recommended despite the formidable price.

MS received March 1, 1978

Principles of Isotope Geology

By Gunter Faure
J. Wiley and Sons Inc., 464 p. 1977,
$19.95

Reviewed by R. H. McNutt
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This is a book written for the student, and as such, succeeds admirably. It is the most comprehensive book yet written on the subject, and will make an excellent text for a course at the senior undergraduate or graduate level. I also recommend it for lay scientists and indeed professionals in the (isotope geology) field.

The book consists of 21 chapters, two appendices and an author and subject index. References are given at the end of each chapter and total approximately 900 (the author index has over 1,000 entries). Literature coverage is up to early 1976.

As I read this book I was again reminded of the impressive role Canadian scientists have played in the development of this field, beginning with the pioneer work of Rutherford and Soddy at McGill. Since that time there have been many significant contributions particularly in the area of Pb and S isotope studies. In the index, approximately 40 authors are listed whose work was carried out in Canadian laboratories.

Chapters 1 to 5 cover the fundamentals of physics and chemistry that are a necessary background to the remainder of the book, i.e., the internal structure of atoms, radioactive decay, mass spectrometry and neutron activation analysis. These chapters will be of particular value to students without a strong science background. Faure presents the pertinent mathematical derivations in great detail, exactly what the student needs in a textbook, but often does not receive. Chapters 6 through 17 deal with the important radioactive decay schemes and the interpretation of the daughter isotopic compositions. Naturally, most attention is given to the Sr, Pb and Ar daughter systems, but a brief chapter of Os, Hf, and Ca is included. A separate chapter deals with each of fission track dating, the U-series disequilibrium method and C-14 dating. Chapters 18 to 21 cover the stable isotopes of H, O, C and S. Faure breaks the discussion on H and O into two chapters, concerned respectively with isotopic fractionation in the hydrosphere and atmosphere and in the lithosphere. Two of the more difficult topics in isotope geology, namely model Pb ages and U-series disequilibrium are well presented and made as clear as possible in such a textbook treatment.

Each chapter is followed by a set of problems (and answers) with data taken from the literature. Thus the student is confronted with real situations.

Appendix I lists a Fortran IV program for statistical analysis of Rb/Sr isochrons using the York (1969) treatment. It is fairly standard and similar to many programmes now used by workers in the field. Appendix II is the Phanerozoic time scale with age estimates from five sources.

The text is remarkedly free of typographical errors. The tables and diagrams are clear and uncluttered and most figures have extensive captions. The index has approximately 900 entries and seems adequate.

Finally at $19.95 (U.S.), the price is right.

MS received February 28, 1978

Chemical Petrology with Applications to The Terrestrial Planets and Meteorites

By Robert F. Mueller
and Surendra K. Saxena
Springer-Verlag New York, Inc.,
394 p., 1977.
$29.80

Reviewed by J. J. Fawcett
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The judicious blending of information gained from field observations, from mineral and rock analyses, from textural observations and from chemical theory has been a goal of many petrologists (geochemists?) for almost a century. Undoubtedly many significant advances in petrological concepts have resulted from the adoption of chemical considerations in problems of rock genesis. Frequently the first application of innovative techniques from areas of basic science to petrological problems has been initiated by scientists with extensive training in that basic discipline. It does not necessarily follow that the best geologist is the one with the greatest capability in basic science. However, one of the more sensitive aspects of geological training is probably the balance to be achieved between geological content and basic science content. Perhaps fortunately for our science each of us views that balance from a slightly different perspective. Hence any attempt to produce a single volume bringing together aspects of petrology and chemistry is almost certain to draw fire on the selection of subject matter. This certainly applies to the Mueller and Saxena's *Chemical Petrology*. Although the text makes no claim to be comprehensive, it includes short sections on a number of standard topics in igneous and metamorphic petrology but omits items such as the role of carbonate and oxide minerals, the behaviour and patterns of minor element abundances in natural assemblages, the role of fluid inclusions in petrogenesis and the significance of isotopic studies. Admittedly each of these could

occupy a volume itself, but then so could several topics included in the text.

The subject matter of the two chapters on meteorites and the terrestrial planets is not often covered in igneous and metamorphic petrology texts, and the 30 and 22 page chapters can serve only as a bare introduction to the subjects. As such they are somewhat out of place beside the more detailed treatment given to other topics.

As one may expect from a knowledge of the research contributions of each of the authors, the chapters dealing with metamorphic rocks lean heavily on model reactions that have determined experimentally, or deduced from theoretical analysis. A great many reactions are listed and illustrated in various graphical presentations, but the end result may be somewhat confusing for a student because there is only very limited discussion of the possible pitfalls involved in applying such reactions to real mineral assemblages. Classification of igneous rocks is dealt with in purely chemical terms, and this may be justified by the treatment in subsequent chapters. A student should be encouraged to relate to rocks by reference to the Streckiesen or an alternative mineralogical classification. The book presents as facts a number of concepts that others may consider controversial, but it achieves a broad coverage of igneous and metamorphic processes in a manner that will stimulate the top students to further investigation. I would have great difficulty using this book as a text because of the mixed level of introductory petrology and more advanced chemistry. However, it could play a useful role in a supplementary reading list for undergraduate courses.

MS received March 2, 1978

Concepts and Methods of Biostratigraphy

Edited by Erle G. Kauffman
and Joseph E. Hazel
Dowden, Hutchinson and Ross, Inc., 658 p., 1977.
$35.00

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Almost two centuries ago, William Smith made known his momentous dual discovery that formations are arranged in a regular order and that each is characterized by its own peculiar fossils; since then, however, the literature has remained devoid of a comprehensive account of the concepts and methods governing the application of fossils in stratigraphy, over and above the rather cursory treatment included in textbooks on paleontology, stratigraphy and earth history. In this setting, the publication of a book which, in the words of the editors, was "conceived to at least partially fill this void", must rank as something of a landmark in the annals of biostratigraphy irrespective of the merits (or defects) of the work itself.

Some 30 or so invited contributors, two-thirds located in the United States, authored the 25 papers of which the book is comprised. These are grouped into four major sections, each consisting of six papers, covering: 1) conceptual aspects of biostratigraphy, 2) biostratigraphic methods, and the biostratigrapic utility of selected groups of 3) mobile, and 4) essentially sessile organisms. In addition, an introductory paper by J. M. Hancock outlines the historical development of classification and correlation in terms of the personalities involved, from William Smith and his contemporaries in the early nineteenth century to the influential Hollis Hedberg of more recent date.

The first two papers in the conceptual section (N. Eldredge and S. J. Gould; P. C. Sylvester-Bradley) discuss the relative merits of different evolutionary models and their applications in biostratigraphy. In this same section, biological and ecological factors which contribute to the attributes of the 'good zonal fossil', such as wide geographic distribution and rapid rate of evolution, are explored in the contributions of J. B. C. Jackson, R. S. Scheltema, E. G. Kauffman, and J. W. Valentine.

The section on biostratigraphic methods includes two papers which approach the issue of correlation from the mathematical standpoint, one by F. X. Miller reviewing graphic correlation methods and the other by J. E. Hazel on multivariate analytical techniques. A further three papers describe the establishment of biostratigraphic schemes in selected geographic areas over restricted time intervals: the Cenozoic of the Gulf Coast (C. W. Poag), the Central European Neogene (F. F. Steininger), and the Maastrichtian of northwest Europe (F. Surlyk and T. Birkelund). The sixth contribution in this section, by J. A. Van Couvering and W. A. Berggren, seeks to integrate Neogene biostratigraphy with the paleomagnetic and radiometric time scales formulated for the same period.

The final two sections of the book consist of papers devoted to the biostratigraphic utility of selected fossil groups, ranging from consideration of such classics as the ammonites (W. J. Kennedy and W. A. Cobban) and graptolites (W. B. N. Berry) to more unlikely contenders such as the gastropods (N. F. Sohl), a group not usually in the forefront of biostratigraphic endeavour. Other contributions in these two sections deal with conodonts (F. H. T. Rhodes and R. L. Austin), foraminiferans (B. Mamet; R. C. Douglass), trilobites (M. E. Taylor), corals (W. J. Sando), brachiopods (J. B. Waterhouse), and echinoids (G. Ernst and E. Seibertz), while a token indication that biostratigraphy is not the sole preserve of the invertebrates is provided by the inclusion of one paper each on spores and pollen (J. A. Doyle) and vertebrates (D E. Savage).

Inevitably, in a compilation involving so many authors, individual contributions vary widely in approach, content and quality, even within the confines of a single major section; contrast, for example, the generalized overview of ammonite biostratigraphy presented by W. J. Kennedy and W. A. Cobban with the detailed treatment accorded to the fusulinid foraminfera by R. C. Douglass.