

The overall balance is satisfactory, with general introductory and concluding chapters, and the bulk of the text divided between igneous and metamorphic rocks (approximately 200 and 150 pages respectively). Although the organization of the material into chapters is distinctly curious, with the principal chapter on igneous rock associations (surely a 'natural' for subdivision?) reaching nearly 150 pages, there are many good features. Each association, igneous and metamorphic, is illustrated by a type area (almost all in North America), followed first by a brief mention of other important examples, and then by a convenient summary of the main petrogenetic theories applied to the rocks under discussion. Most of the maps and diagrams are commendably clear.

The major criticism of a book expressly designed as an introduction to its subject is its obsession with original references. The reference list occupies an incredible 105 pages (20% of the whole book) and contains approximately 2000 titles. This means that the text itself is cluttered with unnecessary references. The prize entry is Holland (1893) on 'The petrology of Job Charnock's tombstone', while a single paragraph listing 76 references to 17 layered intrusions mentions *Wager and Brown (1968)* nine times! Surely all that is needed for each topic is a reference to the most recent review and research contributions, and the space saved could be devoted to a more adequate treatment of important igneous and metamorphic associations outside North America, or to a sizeable reduction in price (£7.70).

Other disadvantages of the book are as follows: an obsession with the geosynclinal context, to the extent that both lunar and Hawaiian basalts (among other unlikely candidates for this honour) are termed 'post-orogenic'; the truncated treatment of the rock-forming minerals in chapter 1, where feldspars, SiO₂ minerals, olivines, and pyroxenes are the only 'common' groups admitted; many of the photographs are virtually useless (notably figs. 4-3 and 7-7), although this may be partly the result of poor quality reproduction; the world locality maps inside the front and back covers, although an admirable idea, are spoiled by serious errors and omissions.

This book could have been a useful addition to the undergraduate literature on petrology. As it is, the defects sadly outweigh the good points, and its most useful function will be to provide a convenient, but expensive, check list (with chapter and verse referencing) of notable igneous and metamorphic occurrences.

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BROECKER (W. S.) and OVERSBY (V. M.). *Chemical equilibria in the Earth*. New York and London (McGraw-Hill), 1971. xii+318 pp., 67 figs. Price £7.90.

The authors have set out to show—both in the text and in problems at the end of the chapters—how thermodynamic principles may be applied to the interpretation of geochemical processes, and they have done it with commendable success. This is not, as some might imply from the title, a book that deals systematically with our knowledge of the chemical nature of the multifarious processes occurring in the Earth.

The first 5 chapters and chapter 10 (a total of 145 pages) are devoted to a treatment

of basic chemical principles (volume, energy, entropy, kinetic and phase equilibria), which are, in part, required for the developments in later chapters (146 pages). Much of the chemical material could be found in standard texts on physical chemistry, but the authors' approach is, as they rightly claim, of more direct relevance to Earth materials. The remaining six chapters deal with reactions in gases, distribution of trace elements and isotopes, solid-state transformations, and reactions in natural waters. The standard of treatment is, however, patchy. There is, for example, an excellent chapter on solid-solution phenomena, which introduces the concepts of regular solutions and metastable homogeneous solution, but the chapter on trace element distribution is weak and the discussion on ionic size does not, as is implied, have general applicability. Those applications that are discussed are generally treated rigorously but the range is somewhat disappointing. There is little discussion on 'natural' gases in the chapter with that heading and other topics that could well have been included such as hydrothermal activity or fractionation processes in magmas are absent. Occasionally these absences are more critical, such as when oxidation potential is given scant attention in the section on reactions in natural waters. Here it would have been a simple matter to relate Eh to the treatment on free energy given earlier.

The book is lucidly written and well presented, but the absence of many S.I. units, even from the list of conversion factors, is to be regretted. The problems at the end of each chapter (answers are not given) offer the student some good and relevant challenges in applying the theory (although a few proved to be unnecessarily repetitive and tedious to solve). The approach adopted in this book is to be warmly welcomed, and it will undoubtedly prove to be of great benefit to the more advanced undergraduate or postgraduate student in mineralogy, petrology, or geochemistry.

P. HENDERSON

TRÖGER (W. E.). *Optische Bestimmung der gesteinsbildenden Minerale. Teil I. Bestimmungstabellen*. Fourth edition by BAMBAUER (H. U.), TABORSZKY (F.), and TROCHIM (H. D.). Stuttgart (E. Schweizerbart'sche Verlag.), 1971. 188 pp., 376 figs., 3 coloured pls. Price DM42 (\$13.50).

This fourth, revised edition of the 'Determinative Tables' is part I of the complete work, the other 'Text volume' which forms part II having been published in 1967 (M.A. 18-80). The new edition largely retains Tröger's widely acknowledged format; the minerals are presented in order of increasing refractive index within the three large optical groups (isotropic, uniaxial, and biaxial). Each mineral has a fixed code number, which is used throughout this volume and in the supplementary text volume, and most are represented by a three-dimensional perspective diagram or sketch stereogram. The morphological, optical, chemical, and paragenetic characters are also tabulated and where appropriate the relationships between optical properties and chemical composition are represented diagrammatically.

In addition to the updating of graphs and diagrams, changes in this edition include