Canadian Mineralogist
Vol. 27, pp. 159-162 (1989)

BOOK REVIEWS

The Origin of Granites. Transactions of the Royal Society of Edinburgh, Earth Sciences, Volume 79, Parts 2/3, 1988, 276 pages. £25.00, $50.00 U.S. (overseas).

The genesis of granitic rocks is as significant as that of the continental crust. However mineralogically simple it appears to be, a granite records a complex evolutionary history; the controversial and enigmatic problem of its origin has long been realized, and the famous statement of H. H. Read (1957), "There are granites and granites", will probably live with us for many years to come.

The extensive use of stable and radiogenic isotopes and rare-earth elements during the past two decades, as well as the development of petrogenetically significant LIL and HFS trace-element tracers to interpret tectonic regimes and magma provenances, have proved to be powerful tools in evaluating the source and evolution of granitic magmas. The fruit of many years of such research led to the characterization of four contrasting granite types, known as the I-type, S-type, A-type and M-type granites.

This volume integrates 19 papers, presented during an international symposium on "the origin of granites" organized jointly by the Royal Society of Edinburgh and the Royal Society of London. The symposium took place in Edinburgh on 14–16 September, 1987. The volume contains papers by 32 authors, many of whom are the leading experts of various aspects of granite petrology. The authors attempt to document the diversity of source regions, evolution and emplacement of silicic magmas. The origin of infracrustal I-type granite magmas, written by Chappell and Stephens, is the subject of the first paper of this volume; the last paper is an interesting summary of some of the processes of formation of granite magmas in relation to plate tectonics, given by W.S. Fyfe. In general, the contents of this volume include; source and evolution of granite magmas, crustal melting, crust *versus* mantle input, thermal modeling of anatexis, fluid dynamics, segregation and transport of granite magmas, zonation in magma chambers, emplacement mechanisms and tectonic controls, silicic plutonism *versus* volcanism, major- and trace-element case studies, stable and radiogenic isotopic studies, a detailed study of accessory minerals in granites, and a fluid-inclusion study on the Tanco zoned granite-pegmatite pluton.

Perhaps the most significant feature of this volume is the excellent case-studies of typical examples of I- and S-type granites and rhyolites from many regions around the world, and mostly from well-known tectonic regimes. These include the Australian I- and S-type granites (the Lachlan Fold belt), the Peruvian Coastal Batholith and the Peruvian ignimbrites, the North American Cordilleran batholiths, the Andean granites of South America, the Himalayan "collisional" granites, the Tanco pegmatite of Manitoba, and others.

In general, the quarto-sized, soft-covered volume is well edited and notably free of printer's errors. Particularly impressive are the high-quality reproductions of most photographs and illustrations. However, it suffers slightly from the lack of consistency in the size of the illustrations, many of which are unnecessarily large.

In addition to this minor drawback, the volume has two main shortcomings. The first concerns the lack of an appropriately wide left margin. Forcing the book flat to photocopy, for example, will destroy the binding. Secondly, whereas the coverage is thorough for both I- and S-type granites, this volume regretably lacks information on the two other types of granite, A-type and M-type granites; consequently it is somewhat incomplete. Nevertheless, it represents an excellent summary of the results of modern research, of interest to most igneous petrologists, and is highly recommended to all granite petrologists.

Abdel-Fattah M. Abdel-Rahman
McGill University

Methods and Practices in X-Ray Powder Diffraction. R. Jenkins, editor. International Centre for Diffraction Data, Swarthmore, Pa., U.S.A. 1987, 91 pages. $75.00 U.S.

Methods and Practices in X-ray Powder Diffraction is a loose-leaf handbook that concerns itself with the many varied aspects of powder diffraction. The binder contains dividers for each of the major subjects which are:

1) General Introduction
2) X-ray Sources
3) Camera Techniques
4) Diffractometer Techniques*
5) Specimen Preparation*
6) Standard Reference Materials*
7) Data Collection Strategies
8) Data Treatment
9) Powder Data File*

10) Search Strategies*
11) Special Methods
12) Test Data Sets
13) Round Robin Tests*
14) Radiation Safety
15) Glossary
16) Bibliography
(* denotes a subject which contains material at present).

In addition there are tables of atomic properties and principal emission lines of X-ray spectra.

The papers presented in each of these subject divisions are, for the most part, reprinted from the journal *Powder Diffraction*; 23% of the material is unique to this volume, based on the number of pages. The papers, by a variety of authors, are of high quality, having passed through the normal peer-review process before being accepted in *Powder Diffraction*. Subjects presently covered are the design and alignment of diffractometers, methods of sample preparation, manual search–match methods, and examples of cell-dimension determinations by various least-squares programs. Papers not already present in print include: Calibration using *d*-spacing standards by W. Wong-Ng and C.R. Hubbard, The Powder Diffraction File by R. Jenkins and D.K. Smith, and a description of the PC-PDF program distributed by the JCPDS.

The book will be of use to researchers who regularly use powder-diffraction methods, as it gives a collection of very practical papers in a useful format. This is especially true if they do not have the journal *Powder Diffraction* readily available. The loose-leaf format allows for easy updating of the manual through either purchase of updated material (the current update costs $20 US) or by adding the reader's own selection of relevant papers. This should ensure that the publication remains current.

One should not be misled by the many subject headings into believing that this collection is in its final form. It would not be suitable as a textbook for an undergraduate or graduate course, as it lacks most of the material fundamental to course instruction. *Methods and Practices in X-ray Powder Diffraction* will become a more valuable asset to any powder-diffraction laboratory as more material is added.

Ronald C. Peterson
Queen's University

Introduction to Thermal Analysis, Techniques and Applications. By Michael E. Brown. Chapman and Hall, London, 1988, 211 pages, £17.50.

True to its title, this book provides an excellent, well-balanced, notably clear and thoroughly up-to-date introduction to the various techniques and methods of Thermal Analysis (TA), exemplified by critically chosen applications. As such it fills a long felt need for a reliable, comprehensive, well-written and well-referenced text at this higher degree level, where most scientists are first introduced to the intricacies of TA.

This rapidly expanding field is also showing a resurgence in the earth sciences, *e.g.*, from applications to fossil fuel characterization, through the detection of magnetic decomposition and transient phases by thermomagnetometry, to mineralogy, with particular reference to the application of simultaneous techniques.

In the text, the major TA techniques are afforded chapter status, whereas other chapters are devoted to Less common techniques, Reaction kinetics from thermal analysis, Purity determinations using DSC, The use of microcomputers in thermal analysis, The literature and nomenclature of thermal analysis, and Thermal analysis equipment. Particularly pertinent are the appendices on introductory experiments in thermal analysis and thermal analysis software. This is a high-quality text, which at the recommended price represents top value. In the reviewer's opinion, it will become a much-used part of the personal library of thermal analysts, ranging from specialists to those starting in this important field of scientific investigation, with its numerous individual, complementary and simultaneous applicable techniques.

Slade Warne
The University of Newcastle
Australia

Gemstones. By Christine Woodward and Roger Harding. Sterling Publishing Co. Inc., New York, 1988. 60 pages. $9.95 US.

This book is a splendidly illustrated introduction to gemmology and gemstones. It is a lucid, concise, well-organized and beautifully designed presentation. It provides the reader with the essential data required for a basic understanding and appreciation of gemstones, and contains the most up-to-date developments in this field. The authors are both mineralogists and gemmologists associated with the British Museum (Natural History).

The authors divide the book into three sections, although there are no physical divisions and no table of contents; instead, the subject matter of each page is clearly indicated by a heading on the top outer corner of the page. The first section (13 pages) defines gemstones, explains mineralogical properties (crystal structure, optics and color), and describes the cutting of gemstones.

Descriptions of individual gem varieties comprise the second and largest section (32 pages). Twenty-two of the best-known gemstones are described in adequate detail, including a tabulation of properties and discussions on color varieties and causes of color, current color-alteration treatments, inclusions, sources, and distinguishing features. Brief descriptive notes are presented for five minerals used for carving or sculpting, twelve less common or collectors' gemstones, and six gem varieties of biogenic origin. Imitation and synthetic stones, and inclusions that distinguish them from gem minerals, are discussed.

The final section (12 pages) provides the reader with a brief explanation of the geological occurrence, genesis and mining of gem minerals, and methods of gem identification. A world map of gem occurrences is included; the entries for Canada include amethyst, agate, garnet, nephrite, labradorite and other feldspars, amber and sodalite; the symbol indicating deposits that 'yield little or nothing today' could well apply to our amber. The section closes with notes on famous and historical gems. An index of gem varieties and selected terms is supplied.

The outstanding illustrations, all in color, are skillfully and artistically used to supplement the text. There are 140 photographs (3 are duplicated in the text), 13 diagrams and a map. The 39 close-cropped gemstone photos and panel strips sprinkled along margins and borders and between paragraphs provide delightful and imaginative detail. The illustrations are briefly but adequately captioned and are referred to in the text. The reader would, however, benefit from some reference to the spectacular photo showing light leakage in a diamond and its simulants. Magnification is unspecified for all but one of the photomicrographs. The minerals and gems featured in the photographs are from the gem and mineral collections of the British Museum.

Putting this book together must have been a work of joy for the authors. Using it to explore the nature of gemstones is both a pleasure and a joy.

Ann P. Sabina
Geological Survey of Canada

Clay Minerals for Petroleum Geologists and Engineers. By Eric Eslinger and David Pevear. Society of Economic Paleontologists and Mineralogists, Short Course No. 22, 1988. 413 pages. $33.00 U.S., soft cover.

With the exception of the 1981 MAC short course handbook, *Clays and the Resource Geologist,* few sources are available that combine the mineralogy and identification of clays with their sedimentary and diagenetic petrology. Add one more volume to the list. The latest offering from the successful SEPM series of short-course notes primarily is intended as an introduction to clay minerals for nonspecialist geologists and engineers. However, Eslinger and Pevear have added a number of chapters on the relevance of the study of clays to other subjects, including sedimentology, sandstone and shale diagenesis, hydrocarbon production, and log analysis. In doing so, the authors have produced a relatively inexpensive and comprehensive text, which will be of use to those interested in the role of clays in sediment diagenesis and petroleum recovery.

The first chapter provides a short introduction to the nature of clays and their origins. The second chapter, at well over 100 pages, is a long and somewhat tedious review of the structures of clay-mineral groups and their identification by X-ray diffraction (XRD). The treatment is thorough, but readers would have been better served if the authors had separated the classification of clay-mineral groups from their identification. Although the theory behind XRD is provided in an appendix, those unfamiliar with XRD may have to consult other texts to fully understand the application of XRD techniques to clay mineralogy. Properties of clays are reviewed in chapter 3.

The last six chapters alone are worth the price of this volume. Although they are not written at the level of the specialist, they present a cross section of applications useful to geologists and engineers involved in hydrocarbon exploration and exploitation, and to those interested in the clay mineralogy of sedimentary rocks. Chapter 4 deals with the distribution of clays in modern geological environments; the roles of clays in shale and sandstone diagenesis are covered in chapters 5 and 6, respectively. Not surprisingly, the discussion of shale diagenesis centers around the reaction of smectite to illite which, although important, is often used as a panacea to explain many phenomena in diagenesis of siliciclastic rocks. Recent work has shown that in the Western Canada Basin, many shales contain illite, not smectite, at all burial depths. Clearly, the reaction of smectite to illite is not the whole story in shale diagenesis. A useful review of the applications of stable and radiogenic isotope geochemistry to paleohydrology, paleothermometry, and dating of clay minerals is given in chapter 7. The last two chapters, dealing with the effects of clays on production and log response, will be of interest to those directly involved in petroleum exploration and production. Unfortunately, a large body of experimental and field data relating to the role of clays in thermal recovery of heavy oil has not been tapped.

In summary, this volume is a welcome addition and will be of use to engineers and geologists wishing to learn more about the identification and sig-

nificance of clay minerals. It will also be of use to clay mineralogists wanting more detailed information on the geological and economic implications of their work. There are, however, a number of drawbacks. The binding is poor; during the review process, numerous pages separated from the spine. The editing is variable, with a number of spelling mistakes and unlabeled diagrams. No discussion of methods for extracting clay fractions is given. Despite these flaws, this short-course volume is recommended to the targeted petroleum engineers and geologists and to others wanting a comprehensive introduction to the identification and importance of clay minerals in sedimentary rocks.

Hugh J. Abercrombie
Geological Survey of Canada
Calgary

Ore Deposit Models. Edited by R.G. Roberts and P.A. Sheahan. Geoscience Canada Reprint Series 3. Geological Association of Canada, c/o Memorial University of Newfoundland, St. John's, Nfld. A1B 3X5. 1988. 194 pp. $20 Cdn (softbound only).

Last year, for my fourth year 'Mineral Deposits' class, I recommended one or two key references for each major type of ore deposit. These included a large majority of the 'Ore Deposit Model' articles that began to appear in Geoscience Canada in 1980. I felt that as a group, these articles are concise, clearly written and up-to-date; they avoid excessive descriptive aspects of the deposit types, and concentrated on the most important and most interesting aspects of the genesis of the ore systems. In fact, I began to feel a little guilty that by emphasizing these articles, I was not encouraging the class to use their rather expensive textbook.

It came as a pleasant surprise when, in November 1988, one of the students in the class informed me that the whole collection of articles had been collated into a single volume. 'Ore Deposit Models' is the third volume of the Geoscience Canada Reprint Series, of similar style to the immensely popular first volume, 'Facies Models'. It contains thirteen review papers published in Geoscience Canada between 1980 and 1988. The following deposit types are covered: stratiform chromite, platinum-group elements, granophile deposits, porphyry copper, Cordilleran epithermal gold–silver, disseminated gold, Archean lode gold, volcanogenic massive sulfides (two articles), stratiform clastic-sediment-hosted lead–zinc, Mississippi Valley-type carbonate-hosted lead–zinc, unconformity uranium, and the evolution of uranium deposit types with time. The articles on porphyry copper, Mississippi-Valley-type lead–zinc and uranium deposits have been brought up to date since their original publication.

As is to be expected in a collation of articles published separately over a period of time by different authors, there is some unevenness in approach, amount of detail, clarity of exposition and emphasis. The articles are generally pitched at the level of upper-year undergraduate or first-year graduate student, and provide an excellent overview of each deposit type. Most articles distinguish between what is generally accepted about the characteristics and genesis of the deposits, and what aspects still remain in question. This is especially helpful from the point of view of someone new to the subject. There is usually an excellent set of up-to-date references at the end of each article.

For the deposit types discussed, 'Ore Deposit Models' is a first-rate summary reference for specialist professionals, as well as a mature introduction for upper-year undergraduates. I will probably recommend it as a textbook for my fourth year class, partly because the articles are clearly written and emphasize the process of ore formation, and partly because the book is such excellent value at $20 Cdn. This recommendation as a textbook does carry some reservations, however, because several deposit types are not included. These include: sedimentary iron and manganese deposits (*e.g.*, Banded Iron Formation), mafic–ultramafic copper–nickel sulfide deposits (*e.g.*, Sudbury and Thompson); vein ores other than gold and silver (*e.g.*, copper, lead, zinc and mercury); skarn ores; supergene ores; and placer or paleoplacer ores. Consequently, as a textbook, it will have to be supplemented with other references.

David R.M. Pattison
The University of Calgary