BOOK REVIEWS

Thermodynamics in Geochemistry. By Greg M. Anderson and David A. Crerar. Oxford University Press, 70 Wynford Drive, Don Mills Ontario M3C 3J9, 1993, 588 pages, CAN $105 hardbound (ISBN 0 195-06464-X).

Thermodynamics surely boasts the largest number of textbooks of any established scientific discipline. Twenty years ago, textbooks on the geological uses of thermodynamics were rare, but today such texts based all the various approaches, axiomatic *versus* experimental, rigorous *versus* heuristic, and the rest, are widely available. What is the point of another book? The authors' answer is twofold. First, they emphasize that classical thermodynamics is an idealized model, which real substances and processes only approximate more or less closely. They, therefore, subtitle the book "The Equilibrium Model". Second, they wish to explore and elucidate some well-known (and some less well-known) obscurities and ambiguities in the subject using a standard textbook-type treatment in terms of subject matter and organization. Although no prerequisites beyond the most elementary calculus are assumed, the derivations are quite rigorous. Discussion of fundamentals is extensive. For example, the first law is not reached until page 72, easily a record among the thermodynamics texts on my shelf. Yet, in addition to standard definitions and the zeroth law, the mathematics of thermodynamics, constraints on metastability, and the philosophy of applying mathematical models to physical data also are discussed in those pages.

The choice of topics in the book as a whole is conventional, although the treatment of electrolyte solutions and the last chapter on speciation and calculations of reaction path go well beyond standard elementary topics. There are shortcomings in the coverage. The treatment of the mathematics is inferior to that in older texts, such as those of Margenau and Murphy or Courant. The treatment of statistical mechanical estimations of thermodynamic quantities is superficial. Computer-based schemes for deriving self-consistent data-bases are merely mentioned. None of the many problems in the book requires use of a computer, and the overall presentation could as easily have been written a generation ago. Despite the title, the presentation is not particularly oriented toward geochemistry, although the problem sets seem directed toward an earth science audience. On a more positive note, the physical presentation is excellent in terms of typography and diagrams, and contains few errors. In addition to a list of errata supplied by the authors, I discovered only trivial errors (for example, the temperature of the human body is given as 96°F on p. 61).

This book would be difficult to read as an introduction to the subject. Although none of the discussion of concepts (which is a feature of this book) is particularly difficult, they do obscure the development of the subject. The style is also allusive, referring to distinguished textbooks of the past in a way that may leave the student mystified. Those acquainted with the senior author will have no trouble recognizing his style. These caveats do not touch the real merit of this book, namely the leisured, precise dissection of the premises and methods of thermodynamics. Everyone practising thermodynamics will find something of interest here, and something with which they disagree. The audience of this book has some acquaintance with thermodynamics and wants to know more, as the preface puts it. It will take an honored place on my own shelf, alongside the handful of texts that leave the beaten track. It is a pity that the price is liable to keep it off the shelves of many of my peers.

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Igneous and Metamorphic Rocks under the Microscope: Classification, Textures, Microstructures, and Mineral Preferred Orientation. By David Shelley. Chapman and Hall, New York, 1993, 445 pages, CAN $56.50 (soft cover).

The author states in his preface that "this book covers aspects of igneous and metamorphic petrology best studied with the polarizing microscope". The book is divided into four parts: (1) classification, terminology, and description of igneous and metamorphic rocks, (2) textures and microstructures and their origins, (3) preferred orientations of minerals and how to measure them, and (4) glossary and index.

Familiarity with the polarizing microscope and an ability to identify minerals in thin section are assumed. The author asserts that the book is aimed at all levels of study, which is a difficult task. This book contains a large number of figures, including many black-and-white microphotographs. Some of the microphotographs are well presented and useful to the student.

Unfortunately, many other microphotographs are not very useful. For example, Figure 4-23 (p. 199) on flow layering in volcanic rocks is not instructive. Neither are Figures 2-4(b) and (c) on page 71, which show pumpellyite and lawsonite in some low-grade metamorphic rocks.

In Part 1, the author uses the recommendations of the IUGS subcommission for the terminology of igneous rocks. Many metamorphic petrologists are not obsessed with terminology, and consequently there is much more latitude in the section on metamorphic rocks. The author has attempted to make the book self-contained, including classification and description as well as genetic interpretation of textures, *etc.* In my opinion, it is very difficult to cover adequately both types of material in one book.

I am impressed by the wide range of topics in igneous and metamorphic rocks covered by the author. This is a daunting task, even to describe the principal textures of igneous and metamorphic rocks, much less to interpret them. Owing to the complexity of the subject matter, the author has to make numerous cross-references, both to text and to figures. The book contains a combined index and glossary. For example, under "blueschist" is the following: "Schist that typifies the blueschist facies, usually of basic composition, which is blue in hand specimen and contains oriented blue amphibole (glaucophane and crossite)." Because of the large number of terms used in this book, this is a valuable feature for students.

Clearly, some readers of this book will find points with which they disagree or sections where they feel the emphasis is wrong. Because of the large number of topics covered, the discussion in many cases is simply quotation of what the author feels is the relevant literature. This leads to some rather terse sentences, which the student will not find very informative. One of my concerns is the fact that although some advanced topics are mentioned, the reader is not given enough discussion to indicate what type of quantitative reasoning is necessary. As an example, in the section on compaction of igneous rocks, the values of grain size, density contrast, porosity, viscosity of magma, and crystal-network viscosity are cited to indicate how long it would take to compact a 1-m layer and a 1,000-m layer of anorthosite. A student will need to be sufficiently interested to look up the reference to see how these parameters were used in the calculations.

In my opinion, the book would not be suitable as a primary text in an undergraduate North American course on igneous and metamorphic petrology or petrography. Its value will be as an introduction to the literature on textures and microstructures. It would prove useful as a supplementary reference. The price of the book is reasonable by present-day standards.

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Dictionary of Earth Sciences, English – French, French – English / Dictionnaire des sciences de la terre, anglais – français, français – anglais (second edition / 2^{e} édition). By/par J.-P. Michel & R.W. Fairbridge. John Wiley & Sons Canada, Ltd., 22 Worcester Road, Rexdale, Ontario M9W 1L1, 1992, 301 + xv pages. CAN $59.95 (soft cover). (ISBN 0 471-93535-2).

A French–English, English–French dictionary for the earth sciences is particularly useful to Canadian mineralogists and geologists living, as they do, in a bilingual country. Nevertheless, the dictionary here under review has shortcomings and, in my view, falls shy of its intended goals. Also, this dictionary might be judged differently by Francophones and Anglophones. Accordingly, what follows is divided along linguistic lines, the first part being in French, the second part in English.

Le *Dictionnaire des sciences de la terre* est la deuxième édition d'une oeuvre dont la première édition fut publiée en 1980. Ce livre débute avec une préface concise, suivie de deux pages de suggestions aux traducteurs et d'une "échelle des temps géologiques" (premier bobo: la même figure, titrée en anglais "geological time scale", est traduite en page 63 du dictionnaire par "échelle stratigraphique"). Ensuite, la section anglais–français prend 179 pages, tandis que la section français–anglais n'en comporte que 110. Le dictionnaire se termine avec un "répertoire d'abréviations scientifiques anglo-américaines" de trois pages comportant des erreurs orthographiques, tels: Mg/d = million of gallons by day; SSS = standart stratigraphic scale; YP = yeald point), une page de "conversion d'unités" très insuffisante, et une liste des vingt-sept ouvrages consultés.

Les bobos majeurs, cependant, se trouvent au sein même des traductions ou définitions. Quelques exemples. Stake = électrode; rift = grande faille à décrochement horizontal; foyaite = syénite néphélinique contenant % feldspathoïdes / % feldspath ≥ 2; dip fault = faille perpendiculaire à la direction de la couche; et plusieurs autres. Ces insouciances sont inacceptables.

The *Dictionary of Earth Sciences* is a second edition, the first having been published in 1980 (the little orange book familiar to many). Whereas the first edition cost under ten dollars US, the second sells for CAN $59.95 plus taxes. One must ask: If one already has the earlier edition, is it worth shelling out five times as much to buy the second? For a variety of reasons, my answer is an unequivocal "no". The difference between the two editions is really minimal. The second edition sports fancier typography and some ancillary pages ("Suggestions for translators" and so on). Except for the various units of the geological time scale (Aalenian to Zyrjanian), little new has been added. Most of the dubious translations are direct carry-overs (although "stake" is correctly translated as

"piquet" in the orange book).

French is an intricate language. Francophones themselves consult their *Grevisse* and their *Bescherelle*. Woe to the poor Anglo who uses the dictionary here under review. Inexcusable is the absence of such basics as the gender of nouns and the forms of adjectives. Just a few examples: How many of us, Anglos *and* Francos, know that it's *un* gabbro, but *une* théralite; *un* oligoclase, but *une* albite; *un* grès, but *une* grauwacke, and so on. Adjective endings can be tricky, too. Three more examples: éolien, nne; distal, e, aux; normatif, ive. The absence of such basics undermines the usefulness of this book.

Bref, je ne peux pas recommander, ni pour les Francophones, ni pour les Anglophones, l'achat de ce dictionnaire. On attend qu'une troisième édition sera plus précise géologiquement, plus complète grammaticalement, et moins chère.

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Advances in X-ray Analysis, Volume 36. Edited by J.V. Gilfrich, T.C. Huang, C.R. Hubbard, M.R. James, R. Jenkins, G.R. Lachance, D.K. Smith and P.K. Predecki. Plenum Press, 233 Spring Street, New York, N.Y. 10013, U.S.A., 1993, 685 p. US$125.00 hardbound (ISBN 0–306–44571–9).

These are the selected proceedings of the 41st Annual Convention on Applications of X-ray Analysis held in August 1992 in Colorado Springs. The material is gathered under ten headings: Mathematical Techniques in X-ray Spectrometry, Analysis of Light Elements, XRS Techniques and Instrumentation, On-Line Industrial and other Applications of XRS, X-ray Characterization of Thin Films, Whole Pattern Fitting – Phase Analysis by Diffraction Methods, Polymer Applications of XRD, High-Temperature and Non-Ambient Applications of XRD, Stress and Strain Determination by Diffraction Methods – Peak Broadening Analysis, XRD Techniques and Instrumentation.

As with all such collections, these articles represent a snap-shot of the areas of development of the subject at a particular moment rather than a considered view of the whole subject. The previous Annual Convention (reported in Volumes 35A and 35B) was part of the first International Congress on X-ray Analytical Methods; the present volume perhaps suffers just a little from following so successful a venture. However, the subject matter in Volume 36 is well focused on the selected topics. The section on the analysis of the lighter elements is particularly welcome and successful, both as an overview of the subject and a compilation of useful source references. Similarly, the section on Industrial Applications provides a useful introduction for university students looking to the wider applications of the subject. Here an article on the applications of XRF to the Aluminum Industry nicely complements a presentation on aluminum oxide in the previous volume. These proceedings are often the first (and occasionally the only) source of good descriptions in the public record of new commercial instruments. Volume 36 is no exception, with a good description of the development of the Rigaku R-AXIS II D, a four-crystal monochromator to improve the resolution of a Siemens X-ray Diffractometer, and an ingenious mirror-heater for a STOE-STADIP powder diffractometer. These and other descriptions are scattered throughout the volume, and the index has no general subject headings to help locate them. The work is not without its peripheral interests too, which range from an intriguing article on the elemental imaging of fossils and its possible application to the measurement of the metabolic rate in dinosaurs, to the development of a cost-effective (cheap?) technique for small urban communities to use for the estimation of lead concentrations in paint flakes. The volume thus has something to offer both the specialist and those with a general knowledge of X-ray analysis.

Each contribution was obviously provided in camera-ready copy, so that the presentation is nonuniform. However, the level of production of all the contributions is highly professional, and all are easy to read. It makes a good companion to volume 35.

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