

petrology. The plates vary in quality from extremely good to poor: it is clear that the publishers have done their best with the material submitted to them. Both they and the author have unfortunately failed to eliminate numerous misprints, especially of names, in the text. Some are hilarious but the joke pales when one remembers the extremely high price of this book. There are many thought-provoking textural features illustrated that might make the volume worth consideration by specialists in this field. All potential buyers are advised, however, to take a careful look before committing themselves to a purchase.

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Fraser (D. G.), editor. *Thermodynamics in Geology*. Dordrecht, Holland (D. Riedel Publ. Co.), 1977. xiv + 410 pp., 104 figs. Price Dfl. 90.00 (\$36.50).

The aim of the petrologist to understand and predict the stability fields of mineral assemblages over a wide temperature and pressure range can be more readily achieved if the thermochemical properties of minerals, melts, and solutions are established. That the application of thermodynamics has become one of the most important aspects of modern petrology is emphasized by the occurrence of a NATO Advanced Study Institute on this topic, held at Oxford in 1976. This book is the proceedings of that meeting, which had attempted to bridge the information gap between those researching in thermodynamical methods and the more 'conventional' petrologist and geochemist. This educative aim does not, however, come over strongly in the proceedings, as many of the chapters will be of little benefit to a reader unless he is conversant with more than just the elementary basis of thermodynamical petrology.

The book contains nineteen chapters, many of them written by leading authorities in the various subjects chosen for the volume. The coverage is quite wide ranging from high-temperature calorimetry (Navrotsky) to calcite solubility in sea-water (Broecker and Takahashi). The standard is generally good throughout but, perhaps inevitably, the depth to which the different subjects are treated varies significantly. Two chapters (Wood, Newton) deal in some depth with the thermochemistry of garnets and pyroxenes. These are followed by more general topics: activity-composition relationships (Powell); determination of atomic occupancies (a well-written and concise account by Whittaker); two excellent chapters on dehydration equilibria (Anderson, Chatterjee) and one on mixing in multi-

component systems (Grover), which includes an annotated list of relevant publications that use the Margules type equations.

An interesting contribution by J. Holloway shows that a simple equation of state (modified Redlich-Kwong equation) adequately describes the thermodynamic behaviour of pure and mixed fluids above the critical point. Three chapters deal with melts, one on molten salts (Kleppa) discusses their thermodynamic properties but does not enlighten us as to the geological applicability. D. Fraser gives a useful and critical review of the polymer model of silicate melts and shows us the geological relevance, while J. Nicholls does the same, but rather uncritically, for the determination of component activities. The metamorphic petrologist is additionally catered for by a chapter (Eugster) on metamorphic solutions.

Three of the contributions, although interesting in themselves, seem inappropriate to a book (or conference) of this kind, principally because their contents are too specialized or pay too little attention to the general thermodynamical aspects. These chapters are on phlogopite stability (Wones and Dodge), fluid inclusions in metamorphic rocks (Touret), and opaque minerals in lunar rocks (El Goresy and Woermann). A brief but lucid account by O'Nions and Powell on trace-element distribution is one of the few chapters that could be used as a teaching text. It is particularly useful because it deals also with gas solid reactions—a topic of current interest to meteoriticists and the like. But, in general, the aspiration of the editor that the whole book will be a teaching aid is unlikely to be realized as far as first-degree students are concerned. However, twelve of the chapters end with related study problems and although of limited applicability they could be useful to students of the subject. Five of the study problems are supplied with their solutions.

This is a worthwhile and interesting text in that it nicely captures the state of the science at the time. It is relatively well produced from camera-ready typescript but some of the illustrations have been reduced to a size much below the limits of clarity and legibility. While it is unlikely to be purchased by students of the subject other than those involved in thermodynamical application for its own sake, it should be in the library of any self-respecting earth science institution. We are reminded by the last chapter on disequilibrium thermodynamics (Fisher) that kinetics is an equally important aspect of petrology. Perhaps that topic will form the subject of another NATO Advanced Study Institute in the near future.

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