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BOOK REVIEW

Eh-pH Diagrams for Geochemistry by D. G. Brookins. Springer-Verlag, New York, 1988, $89.50. (ISBN 0-387-18485-6).

ANY BOOK WITH the title *Eh-pH Diagrams for Geochemistry* has promise. After all, many important geochemical processes occur at or near the Earth's surface and Eh-pH diagrams provide the most convenient way to illustrate stability fields of competing phases and/or chemical environments of specific interest. This book, which contains 97 Eh-pH diagrams for 67 elements, along with free energies for over 400 species, is certainly a step in that direction. The inclusion of Eh-pH diagrams for the rare earth elements and many elements with only radioactive isotopes greatly expands the coverage of previous Eh-pH summaries.

The book begins with a brief discussion of the historical and theoretical basis for the use of Eh-pH diagrams, and the section for each element contains a short discussion of the diagram(s). Much of this material is so brief that it is most useful to those already familiar with the subject, however. The explanation of procedures for calculating Eh-pH diagrams, for example, would permit only the most determined beginner to make a more specialized diagram. Elements are treated in the book in the order used by the U.S. National Bureau of Standards, from gases through alkali elements. Those among us to whom this order is not second nature will have difficulty locating elements of interest in the Table of Contents. That means using the Index, which was found to list only 50 of the 67 elements treated in the book, and to omit some minerals shown in the diagrams, including old standards such as magnetite (shown on p. 73) and tenorite (p. 60).

The diagrams are clearly drawn and understandable, although some legends and diagrams do not agree. For instance, the legend of Fig. 32 indicates that Au activities of 10^{-10} and 10^{-12} are used, but a label within the diagram indicates that it depicts relations for an Au activity of 10^{-12}. Free energies are also listed for some species that do not appear on diagrams. While this is useful to those wishing to investigate relations not depicted in the book, it is not easy to understand why time was not taken to construct diagrams containing these species. A case in point is the gold section, where free energies are given for $Au(CN)_2^{-1}$ and $Au(SCN)_2^{-1}$ (common forms in which gold dissolves during cyanide leach treatment of ores), but no diagram is shown for a system that contains these widely used complexes.

All in all, the book contains some very useful material and is an important reference for anyone with an interest in near-surface geochemical processes. There is no question, however, that it could have been better. The text contains more than its share of typos, including a listing of H^+ as H^- on p. 13. Most, though not all, of the diagrams were drawn for only one activity of the dissolved element of interest (10^{-6} for most-abundant elements and 10^{-8} for less-abundant elements), making it difficult for the reader to get a quick idea of how relations change with changes in activities of dissolved species. It would have been particularly helpful to draw the S-O-H and C-O-H diagrams, which are so important to many of the other diagrams, in a way that would illustrate not only the dominance field for each ion, but also the variation in individual S and C complex ion activities within dominance fields. More complex but realistic systems, such as Cu-Fe-S-O-H, are also missing. Thus, the eager reader, who opened this book in search of a comprehensive depiction of Eh-pH relations for all important natural systems, has some very worthwhile and important material to digest, but must await the second edition for the real feast.

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