

BOOK REVIEWS

Leontief, W., Koo, J. C. M., Nasar, S., and Sohn, I. *The future of Nonfuel Minerals in the US and World Economy*. Lexington, Massachusetts (Lexington Books: D. C. Heath & Co.) and Aldershot (Gower Publishing Co. Ltd.), 1981. xxviii + 454 pp., 112 figs., 126 tables. Price £32.50.

Some years ago the United States National Commission on Supplies and Shortages considered institutional adjustments that would improve the government's ability to detect and anticipate problems of supply of materials. It was impressed, not so much with the lack of data, but with the lack of adequate analysis of the existing data. This volume endeavours to deal with this deficiency by methods of systems analysis; its authors all belong to the Institute for Economic Analysis of New York University.

Twenty-six industrially important elements are considered. In a recent review (*Mineral. Mag.* **48**, 305) I have complained about the practice by writers on this kind of subject, especially economists, of describing these elements as *minerals*. They include: (1) Iron and alloying elements Fe, Ni, Mn, Cr, W, Mo, V, Si; (2) Nonferrous elements Al, Cu, Pb, Zn, Ti, Hg, Sn, Mg; (3) Precious metals Au, Ag, Pt; and (4) Elements used in the fertilizer and chemical industries P, K, Na (here put down as soda ash), Cl, F, B, S. Mineralogists reading this list will realize that only four of these elements occur naturally in the native state and, in that condition, can properly be regarded as minerals; two are, in fact, gases. All the elements are, of course, obtained from minerals, but this is nowhere recognized. The book, in short, is not for mineralogists but for mineral economists.

The chapter on the place of minerals in the United States and world economy gives a brief but useful summary of world and more local models involving mineral resources, from Peccei's Club of Rome report to Mallenbaum and to the as yet unpublished United States Bureau of Mines/Geological Survey project Minerals Availability System. The methodology of the present study places much reliance on input-output analysis and the assumptions made, too lengthy for discussion here, command a whole chapter. Models are then generated from which alternative predictions to the year 2000 are derived. These are well presented, commodity (element) by commodity, giving for the United States the base-year (1972) supply pattern, the projected demand pattern, and the projected supply; these are then placed in a world context. It will be noted that the base year upon which the

modelling depends was in fact a peak year for mineral production; the recession of more recent years has halted and reversed the exponential growth so apparent from the First World War to the early 1970s. It is hard to be sure that account is taken of more recent history, in spite of the subtitle of the book. For example, is it realistic to believe that United States demand for iron will rise from 87.7 million metric tons in 1972 to 140.8–196 MMT in 2000? The usefulness of the very numerous figures and of the data so ably summarized in the book and its eight lengthy appendices turns to no small extent on the answer to this question.

KINGSLEY DUNHAM

Chernov, A. A., and Müller-Krumbhaar, H. (eds.). *Modern Theory of Crystal Growth I (Crystals: Growth, Properties and Applications, Volume 9)*. Berlin, Heidelberg, and New York (Springer-Verlag), 1983. vii + 146 pp., 42 figs. Price DM 88.00 (\$36.40).

Although crystal growth technology is sufficiently advanced to enable us to produce good-quality specimens for research and industrial applications, it seems that we do not fully understand *how* crystals grow. In the latest volume of the Springer-Verlag series on *Crystals*, the editors suggest that current growth theories are deficient in three main areas: realistic microscopic 'building brick' models; descriptions of melting and freezing; interface structures and transport processes. Accepting that such problems do exist, they have attempted to provide an extended review of existing mathematical models, simulation techniques and their capabilities. Part I of the series comprises five invited articles by authors from as many countries.

The book gets off to an unfortunate start with some stilted phraseology in the preface, but most of the text and figures are clear and well presented. The first two contributions by A. Bonissent and P. Bak follow an atomistic approach and deal with equilibrium properties of solid-liquid and solid-epitaxial layer systems respectively. W. Haubenreisser and H. Pfeiffer examine the growth of two component systems via kinetic theories based on lattice models. In contrast, V. V. Voronokov adopts a macroscopic approach to describe the kinetic properties of clean crystal surfaces in terms of growth elements. Finally, J. van der Eerden provides models for the motion of surface steps under the influence of coupled surface and volume diffusion. The subject mixture may seem slightly

arbitrary, but it will be complemented by a second volume which should include dislocations, patterns in dendrites, and the properties of ionic crystal surfaces.

For anyone wanting to come to terms with current theories for crystal growth, the book is an excellent starting-point for each of the selected topics. However, it should be stressed that the reader will need a strong stomach for mathematics. Applications of the theories to real, rather than model, systems are rare. Specific test examples include the melting of graphite intercalation compounds, and mercury chain compounds. With such a flavour it is likely that the book will appeal more to physical chemists rather than earth scientists. Despite these drawbacks it should still be useful as a reference book for mineralogists concerned with the fundamental details of crystal growth mechanisms.

R. FREER

MacDonald, E. H. *Alluvial Mining: the Geology, Technology and Economics of Placers*. London and New York (Chapman and Hall), 1983. xvi + 508 pp., 192 figs. Price £35.00.

This book draws together a range of disciplines involved in the search for, evaluation, and exploitation of placer deposits. These include geology, engineering, mineral technology, and economics. Eoin Macdonald, a consulting mining engineer, has aimed his book primarily at the professional or those undergoing professional training.

There are eight chapters on the following topics: (i) placer environments; (ii) placer sedimentation; (iii) geology of placers and their formation; (iv) exploration and prospecting; (v) centrifugal slurry pumps and pumping; (vi) placer mining; (vii) placer minerals processing; (viii) placer valuation. Each chapter is approximately the same length although the last chapter could have been a little more comprehensive bearing in mind the increasing importance of geostatistics in ore evaluation. There are adequate reference lists at the end of each chapter. The text is well organized and readable but occasionally marred by sketchy, inadequately labelled diagrams.

As a student of mining geology and mineral exploration, I found the book, on the whole, worthwhile reading, though I must admit to acute lapses in concentration when it came to the chapter on centrifugal slurry pumps and pumping. Mineralogists, geochemists, and petrologists would probably find the book outside their interest and would certainly be alarmed at a few glaring inaccuracies in citing the chemical compositions of common minerals. For example, ilmenite is given

the formula FeTiO_2 and pyroxene is reported as FeSiO_3 . However, the book is essentially a practical guide for anyone involved in placer mining and in this respect it achieves its purpose. Engineers with a sound geological background or geologists with a thorough grasp of basic engineering principles are perhaps the people who can most readily appreciate the author's desire to seek common ground between geology and engineering as applied to the minerals industry.

A. H. RANKIN

Brooks, R. R. *Biological Methods of Prospecting for Minerals*. Chichester and New York (Wiley-Interscience), 1983. xiv + 332 pp., 72 figs. Price £40.80.

In this updated and expanded version of his *Geobotany and Biogeochemistry in Mineral Exploration* from 1972, R. R. Brooks provides a comprehensive and well-laid-out guide to the subject. A brief introduction covers the role, literature, and research centres of biological prospecting and emphasizes the multidisciplinary nature of the book. The substance of the text is formed of three main parts related to mineral exploration: geobotany, geozoology, and biogeochemistry.

The first includes useful tables of plant indicators of mineral deposits and continues to cover more subtle morphological and mutational changes. Remote sensing is accorded an important place, covering ultraviolet, visible, near infrared, thermographic, and radar spectrometries. The desirability of multiband satellite imagery is stressed.

Geozoology is accorded a new section: it is fairly short since active prospecting by this method is relatively uncommon. Epidemiology is, however, long established although difficult of interpretation.

For many readers, the meat of the book will be found in the largest section, that on biogeochemistry. Starting with a brief description of soil types, he continues with mobilization of minor elements and mechanisms of ion absorption. The complications of hyperaccumulation and exclusion are amongst the factors discussed affecting elemental uptake by plants. A problem with this method can be the increase in degrees of freedom of a system if care is not taken with respect to species, organ, season, and so on. Hence there is a considerable portion on statistical analysis. Those who have read the earlier volume may be a little disappointed by the analytical section. Although some modernization has been achieved by addition of three new methods, much is as before (e.g. the detection limits shown for XRF are identical in spite of a new generation of spectrometers of higher sensitivity).