

and repetition of material has generally been avoided. Overall it should be most strongly recommended.

J. N. WALSH

Brown, M. E. *Introduction to Thermal Analysis: Techniques and Applications*. London and New York (Chapman and Hall), 1988. viii + 211 pp., 113 figs. Price £17.50.

Most mineralogists are familiar with differential thermal analysis and thermogravimetry, and possibly with differential scanning calorimetry and evolved gas analysis, but what about thermomagnetometry, emanation thermal analysis and thermosonometry? All is revealed in this fluently written book. Following a prominent definition of thermal analysis (the measurement of changes in physical properties of a substance as a function of temperature whilst the substance is subjected to a controlled temperature programme) and two introductory chapters, these techniques and many others are described systematically, starting with theory and principles, through relevant equipment, ending with well chosen examples of applications (a good number of these from the Earth Sciences). There are also chapters on the use of microcomputers in thermal analysis, derivation of reaction kinetics from thermal analysis data, and purity determinations of compounds from measurement of melting points, and guides are given to the literature of thermal analysis and to the main manufactures of thermal analysis equipment. Appendices list introductory experiments in thermal analysis and computer programs for data capture and processing.

This book is an excellent introduction to thermal analysis both at the undergraduate level and for established workers in other disciplines who might wish to apply these techniques in their research. It is also priced realistically!

D. J. MORGAN

Dyer, A. *An Introduction to Zeolite Molecular Sieves*. Chichester (John Wiley & Sons), 1988. xiii + 149 pp., 94 figs. Price £29.50.

This short but rather expensive book is intended as a general introduction to zeolite science and covers the geological occurrences of zeolites, structures of natural and synthetic forms, techniques used to characterize zeolite structures, their synthesis and stability, and the theoretical and practical background to the uses of zeolites as ion exchangers, catalysts, molecular sieves and

drying agents. It concludes with a short account of recent research into the synthesis of zeolite-like compounds containing Ga, Ge or P substituting for Si and Al in framework sites.

Although useful and readable summaries are given of zeolite structures, synthesis and uses, the overall value of the book is marred—most certainly for a mineralogist—by a superficial account of the genesis of natural zeolites (one section heading reads ‘hydrothermally treated’ for hydrothermally-formed zeolites) and a very poorly organized account of methods for zeolite structure identification. Under ‘X-ray methods’, X-ray diffraction gets a very brief treatment and the reader is left in doubt as to exactly *how* diffraction data are used to determine structures; in this section the statement is also made that X-ray fluorescence analysis is normally limited to atoms of atomic number greater than 20. Scanning and transmission electron microscopy are dealt with under ‘Other diffraction techniques’ and the section on nuclear magnetic resonance spectroscopy fails to explain satisfactorily the principles of this powerful technique for determining atom distributions within zeolite frameworks. Techniques are not, in fact, a strong point of this book: a separate chapter on the relative stabilities of zeolite structures to heat makes extensive use of differential thermal analysis and thermogravimetry but is illustrated by very poor-quality curves—for instance, the DTA curve in Fig. 82 is featureless and shows marked baseline drift, yet is cited as an example of quantification of a dehydroxylation process.

There is no doubt that parts of this book should have been subject to a more critical pre-publication review than has obviously been the case. Unfortunately, there is also little evidence of serious proof checking—the old favourite ‘minerologist’ and ‘phosphorous’ appear in Chapter 4, ‘data’ are often treated as singular, and the horizontal axis of Fig. 80 has ‘tonic’ for ionic radius. The idea for this book was a good one but the author has been badly served by his publishers.

D. J. MORGAN

Kalló, D. and Sherry, H. S. (editors). *Occurrence, Properties and Utilization of Natural Zeolites*. Budapest (Akadémiai Kiadó), 1988. xii + 857 pp., 256 figs. Price \$69.00.

Synthetic zeolites are used extensively by the petrochemical industry as catalyst and as molecular sieves to separate, on the basis of size and/or shape, components of liquid or gaseous mixtures. They are also now important constituents of

detergents, where they replace previously used water-softening agents such as polyphosphates which have been shown to damage the environment. In contrast, natural zeolites are still generally only used in low-value bulk applications such as soil conditioning or as constructional raw materials, despite their similar properties and the common occurrence of near-surface volcano-sedimentary deposits of relatively high grade. In one of the key papers in these proceedings of an international conference held in Budapest in 1985, Dr Fred Mumpton argues that this situation has arisen through poor marketing techniques that have attempted to sell the natural products for sophisticated applications without the necessary background research to match the specific zeolite with the intended use. He must therefore have been encouraged by the volume of such information provided by his fellow contributors to this book. Of the 66 papers included (abstracts of all these in *Mineralogical Abstracts* 89M/3037–3102), about half provide use-related data obtained either in the laboratory or from pilot-plant or field trials.

A group of six papers deals with the removal of ammonia, phosphate, heavy metals and organo-chlorine compounds from drinking water and industrial waste effluents—practical examples of ion-exchange that make a welcome change from the still-common studies in the literature which present exchange isotherms for a range of cations on yet another natural zeolite (although it should be noted that there are a few such papers in this volume!); three papers also discuss ion-exchange properties of natural zeolites in relation to radioactive waste disposal. Other equally useful groups of papers describe applications of adsorption properties (removal of organo-sulphur compounds from oil, oxygen enrichment of air, and heat-exchange due to the adsorption-desorption cycle of water molecules) and catalytic properties (mainly for dehydration and cracking of hydrocarbons). Only one paper is concerned with the use of zeolites for soil conditioning but there are four describing the beneficial effects of zeolite addition to livestock feeds. There is no doubt that this works—in the sense of increasing meat yields—but as G. V. Tsitsishvili describes in one of three papers taking overviews on applications, the mechanism is complicated and involves interplay of a number of zeolite properties with the metabolic processes of the animal.

The other papers in these proceedings cover zeolite geology, mineralogy and crystal chemistry. As with those dealing with applications, there is a strong bias towards contributions from Eastern Europe, and the book is thus useful for drawing

attention both to the quantity and quality of zeolite research being carried out there. The book itself is well-produced from uniformly typed camera-ready copy and there is an adequate index; the only disappointing feature is the quality of the half-tones which are no better than photocopies. It will be a valuable addition to the small number of texts dealing specifically with natural zeolites.

D. J. MORGAN

Skinner, H. C. W., Ross, M. and Frondel, C. *Asbestos and other Fibrous Minerals*. New York and Oxford (Oxford University Press), 1988, iii + 204 pp. Price £26.00.

Asbestos, it seems, is a continuing subject of interest. Several publications in recent years have presented the theme from differing aspects, and this book finds yet another one, although the content is familiar.

The background is the Occupational Safety and Hygiene Administration (USA) definition of respirable asbestos fibres, stating that they should be greater than 5 μm in length and have an aspect ratio of at least 3:1. This definition, and its parallel in the UK, has raised a controversy because it can apply to a great number of minerals which are not asbestiform, including a few which are already known to bring about biological effects in man.

The authors start by asking what is a fibre, and consider the meanings of the words asbestiform, fibrous, acicular and fibrillar. The general properties of fibres, both structural and physical, are explored in an attempt to ascertain their distinctions. Chapter 2 deals with the structures and crystal chemistry of naturally occurring minerals which may be found in fibrous or acicular form, including asbestos, micas, talc, clay minerals, vermiculite, zeolites, silicas and a number of non-silicate minerals. Synthetic fibres such as those of glass and carbon are also covered. Most of this is familiar mineralogical data, but it is put together with excellent structural diagrams and a clear and informative text which emphasises chain structures and fibrous habits. Specifically the work of Wicks, Whittaker, and Zussman on the serpentines and chrysotile, and that of Veblen and Buseck on microstructures in the amphiboles is well summarized. Erionite, the zeolite strongly implicated in pleural diseases in the Karain area of Turkey, is given a few worthy paragraphs, which illustrate, if anything, its acicular nature. An appendix to the book records 388 mineral species, mainly from Dana's System of Mineralogy,