Wilks, J. and E. *Properties and Applications of Diamond*. Oxford (Butterworth-Heinemann Ltd.) 1991. xii + 525 pp. Price £90.00.

Diamonds are used in a wide range of applications. Traditional uses rely upon its exceptional hardness and high thermal conductivity, e.g. in drilling for oil, machining motor car engine blocks, sawing quarry faces, grinding and polishing hard materials and drawing non-ferrous wires. Diamonds do not however all behave in the same way: there is considerable variability of properties from stone to stone, and even within the same diamond. So diamonds have to be chosen carefully for each particular job.

The combined experience of two life-times of research into the mechanical properties of diamond are distilled here into this book. John and Eileen Wilks can indeed be forgiven for emphasising diamond's mechanical properties (about two-thirds of the book) since these are the ones mainly exploited in industry. The promotion of their own research is understandable (though in places at the expense of the 'Cambridge School' of Bowden, Tabor, Brookes, Field and others). The copious lists of references (totalling nearly 1300) nevertheless allow the reader to follow up the arguments and they make this text-book useful for the student of diamond mechanics.

Much of the discussion refers to natural diamond, though synthetic material receives adequate treatment, including a chapter on man-made polycrystalline diamond. About 100 million carats (20 tonnes) of diamond are mined annually compared with about 300 million carats manufactured. Carefully controlled growth conditions result in a less variable product; and by doping with boron, the diamond can be made semiconducting. Making diamond from isotopically pure carbon bestows an even greater thermal conductivity.

Early chapters deal with mineralogy: mineral inclusions in diamonds, morphology, defects and cleavage. There are two good chapters on optical properties and luminescence. The subject of optical centres in diamond is very complex, with nitrogen in its various states of aggregation contributing several different absorption spectra, and with irradiation adding further complications.

Although the diamond structure is recognised (in section 1.5) as being two interpenetrating face-centred cubic lattices, the authors confuse matters by referring to this structure throughout the book as a lattice (with the atoms located on lattice points!). Their treatments of twinning and of stacking faults are erroneous. Figure 5.37 and the accompanying text (section 5.7a) rehearse earlier misconceptions. The examples given (section 6.1) of stacking sequences are impossible: *abcaabc* (stacking fault) and *abcabcabbacbacba* (twin). A layer cannot be immediately followed by the same lettered layer! Their examples of synchrotron radiation topographs are exceptionally poor and do not do justice to the technique.

The cover picture of a piece of impregnated diamond wire saw gives the clue to the major emphasis of the book; the exploitation of diamond's remarkable mechanical properties. Part II (160 pages) comprises detailed chapters on strength and fracture, fatigue, plastic deformation, techniques of polishing and shaping diamond, friction of diamond on diamond and on other substances; and the mechanical, electrical and thermal properties of polycrystalline diamond. Part III (180 pages) deals with mechanical wear and surface characteristics; turning, boring and milling; grinding, sawing and drilling; and miscellaneous applications. Here there is helpful practical advice on diamond tool making and tool setting to achieve the best surface finishes on workpieces. There is a useful list of applications of high-precision engineering but electronic applications are mentioned only on the last page.

The text has not been accurately proof-read and, like a real diamond, contains some minor imperfections: typographical errors and odd spellings. In the early chapters one would have liked more detail. For example, although the Raman spectrum of a diamond thin film is illustrated (Fig. 1.17) there is no mention in the text of the characteristic 1332 cm^{-1} shift in wavenumber. The book is well illustrated with over 400 figures (and two colour plates) and there is a good index.

M. MOORE

Howie, F. M., Ed. *The Care and Conservation of Geological Materials*. Oxford (Butterworth-Heinemann), 1992. 138 pp. Price £35.00.

To many people, academics and non-academics alike, geological samples are robust objects needing little to no maintenance and no special storage conditions. This is reflected in the general lack of published information on the care and maintenance of geological collections, and also in the scarcity of geological conservators. At present there are only 10 to 12 specialist geological curators employed in Britain's museums. However, as most geological curators know all too well, geological materials are indeed subject to

deterioration when removed from their natural context, and do require special conditions of storage. This has led to an increasing awareness of the needs for the conservation of geological materials of all kinds, rocks, fossils, minerals, thin and polished sections, and cores, as well as any accompanying documentary matter. Clearly therefore this book is a welcome addition to the scant literature concerned with the conservation of geological materials.

The book covers a range of topics, including: the stability of minerals; conserving light-sensitive minerals and gems; temperature and humidity sensitive mineralogical and petrological specimens; native elements, oxides, sulphides, and sulphosalts and other minerals; pyrite; meteorites; the lunar sample collection; hazards for the mineral collector, conservator and curator; and in appendix form the effects of construction materials on rock and mineral collection, and also the collecting and processing of minerals and rocks. The editor clearly states in his preface that the aim of the book was 'to emphasise more the principles of care through the identification and explanation of basic mineral instabilities rather than describe specialised treatment methods for preservation', and anyone considering buying the book should be fully aware of this. It is not a practical manual detailing procedures to be adopted. To me, this was a disappointment. While I fully accept the editor's statement that 'materials, processes and techniques used in the conservation of specimens and artifacts alter and evolve on a continuous basis', I feel that those few persons around who do have some knowledge and experience of geological conservation should be prepared to share that 'state of the art' with the many curators and collectors who have no such expertise. This would serve as a first measure to halt the rapidly decaying state of many collections.

Another quibble concerns topics covered, and their general imbalance. Considerable attention is paid to the particular case of minerals, and quite rightly so, but other areas are only poorly covered. For example, the collection of rocks and their conservation is all but absent. While aesthetically less appealing, rocks are still scientifically very important, and present their own specific problems, for example the collection and conservation of shales, of wet or unlithified specimens, particularly polished ore sections. While it could be argued that these are rather specialised materials, none could surely be classed as being anywhere near as specialised as the collection and conservation of lunar materials, which is allocated 12 pages.

Overall, therefore, I was somewhat disappointed with the book, but as I said at the outset, there is very little literature concerned with the care and maintenance of geological materials. I would therefore urge those responsible for such collections to have access to this book.

R. E. BEVINS

Parker, A. J., Rickwood, P. C. and Tucker, D. H., Eds. *Mafic Dykes and Emplacement Mechanisms*. Rotterdam, Brookfield (A. A. Balkema), 1990. x + 541 pp. Price £42.00.

This is a collection of 48 papers edited by A. J. Parker, P. C. Rickwood and D. H. Tucker, the convenors of the 1990 international conference on which the collection is based. It represents publication No. 23 of I.G.C.P. Project 257.

The editors state that the papers document progress made, over a period of 5 years, in the understanding of various aspects of mafic dykes and dyke swarms. As recognised by the editors, the works have been somewhat artificially grouped into sections on; (1) emplacement mechanisms, (2) geochemistry, petrology and mineralisation, (3) palaeomagnetism, (4) crustal tectonics—Gondwana, and (5) crustal tectonics—Laurasia. The majority of contributions fall into the last two sections [M.A. 92M/4720–4767].

As befits the product of an international conference, authors from 16 different countries are represented. Papers are by workers from every inhabited continent, as well as Iceland. However, more than 60% are by people from the U.K., India, Canada and Australia. Canadian workers appear to hold a near monopoly on palaeomagnetic research. Denmark and the U.K. are the only E.C. countries represented.

Most of the papers are about basaltic and lamprophyric dykes, but there is at least one piece of work on syn-plutonic mafic dykes in a granitoid batholith. Very few papers are theoretical in nature, only two, and these are both by Australian authors. Most of the rest are case studies. Not having read the 1987 book spawned by the previous international dyke conference, I should probably shrink from pronouncing on the degree to which progress has indeed been made in the five-year period. Undaunted by awareness of my own ignorance, I will comment, however, that, to me, the most important breakthroughs seem to have come in the understanding of emplacement mechanisms.

The book is printed on reasonably good white paper. Diagrams and half-tones are nearly all well produced and clear. One or two tables are a little faint. Being a compilation of camera-ready work, the typeface is, inevitably, variable. It ranges