

the text such regional addresses as the Central Wales Mining District are used.

But this is an inspiring book and the inclusion of very full references to some four hundred publications, together with a comprehensive index, should make it an essential item on mineralogists' bookshelves.

R. A. HOWIE

Davies, G., ed. *Properties and Growth of Diamond*. London (The Institution of Electrical Engineers), 1994. xvi + 438 pp. Price £135.00. ISBN 0 85296 875 2.

This book, in the Institution's Datareviews Series, aims to list and discuss all the important properties which characterize diamond. There are contributions from 30 authors, assembled in 12 main chapters, ranging from the bulk properties of natural-isotope diamond, through the surface properties of diamond, the properties of nitrogen in diamond, the properties of nickel, silicon, hydrogen and oxygen in diamond, radiation damage, ion implantation and diffusion, decay times of luminescence and laser action in diamond, carbon isotope effects, donors, acceptors and electrical conductivity in diamond, the technology of diamond surfaces, metastable growth of diamond, and the high-temperature, high-pressure synthesis of diamond.

Most of the individual sections are extremely brief (one or two pages), but the mere fact that there are sections headed 'Optical constants of diamond' or 'The type terminology for diamond' makes reference easy. The literature on the properties of diamond is dispersed between physics, mineralogy, crystallography, materials science and electrical engineering, and the Editor is to be congratulated on drawing together the world expertise on diamond and presenting the results in one internationally authored, highly structured, fully indexed volume. At first glance the reader may be surprised by the relative paucity of diagrams, but the aim is to review a diversity of research results and to present brief summaries of current thinking on the topics covered — and we are given diagrams in the somewhat more expansive chapter on the metastable growth of diamond. The process of making polycrystalline diamond films by chemical vapour deposition (CVD) is a rapidly emerging technology which offers diamond at a relatively low cost, in large areas and in a variety of surface morphologies. In this chapter, reports and views are offered on a variety of burgeoning CVD techniques, ranging from hot-filament assisted growth to plasma synthesis, combustion flame methods and the laser-assisted growth of diamond. The flame characteristics for the combustion growth of diamond are discussed, and

this is followed by a section on the physics and chemistry of combustion flames. The final chapter is concerned with the high-pressure synthesis of diamond and in particular with diamond grown with metal catalysts.

There are extensive references at the end of each section, and these will be essential to gain familiarity with the data scattered throughout the literature of many disciplines and most continents. Both the typeface used and the format and cost of the volume are large, but this is clearly a work that must be available to all interested in the properties and use of diamonds. Its careful study will surely justify the expense of obtaining a copy.

R. A. HOWIE

Regional Geochemistry of the Lake District and adjacent areas. Geochemistry Group of the British Geological Survey, Keyworth, Nottingham (British Geological Survey), 1993. viii + 98 pp, 46 coloured maps + 1:250 000 geological map. Price £50.00. ISBN 0 85272 2257.

This is the ninth publication in the series providing a systematic survey of the regional geochemistry of Great Britain. As the results are being presented starting with Shetland and working southwards, this is the first area to be dealt with in England covering not only the Lake District with its copper lead-zinc, baryte and tungsten mineralization but also west Cumbria and Furness areas with hematite and the western part of the North Pennines lead-zinc-fluorite-baryte orefield. The principal aim of the project, started in 1975 and continuing to the present day, was to identify new occurrences of metalliferous minerals but it also provides quantitative data on natural element levels in the environment against which to assess contamination and to supplement geological information in the investigation of the geological evolution of Great Britain.

The procedures for sampling, sample treatment, analysis and error control are described in detail. The stream sediment sampling for this region took place in the summers of 1978-80 from some 6200 sites covering the area at an average sampling density of one sample per 1.6 km². The conductivity, pH and fluoride content of 2585 stream-water samples were measured and the bicarbonate content at a smaller number of sites. The stream sediments were analysed for 28 elements by direct reading emission spectrometry, arsenic and antimony were determined by atomic absorption spectrometry and uranium in stream sediments and water samples by delayed neutron activation analysis.

The geology of the area is described in rather variable detail, covering the stratigraphic sequence intrusive igneous rocks, metamorphism structure and superficial deposits. Mineralizations of the area are fully reviewed as these represent a major influence on the geochemical patterns obtained.

The publication follows the pattern of the eighth atlas, *Regional Geochemistry of the East Grampians Area*, including the 42 × 30 cm bound format which though still comparatively unwieldy is much more ergonomic than the previous, larger, loose-leaf format. The style of the presentation of the results is based on digital geochemical imagery. The point data have been gridded using the Interactive Surface Modeling package to generate a smooth surface passing close to each data point and the surface has been processed to create colour classified digital maps.

The result is a series of superbly coloured maps for the elements based on percentile divisions of concentrations which show clearly the distribution and the locations of enrichments. Very usefully the simplified outline geological map is superimposed. In addition the statistics are given for the data set of each element and the data distribution is shown on frequency diagrams coloured with the percentile divisions. On the facing page the results are discussed with a synopsis describing concisely the levels and anomalies associated with the major rock divisions followed by short reviews of the geochemistry of the element and its behaviour in the surface environment. Detailed descriptions of the patterns of each element related to the main rock units and to known mineralization are given and an attempt is made to account for individual anomalies.

The innovation in this atlas is the presentation of combined element anomaly maps with four combining the anomalies of two elements: Ba and Sr, Cd and Zn, Fe and Mn, and Mn and Co, and four combining three elements: Ag-Pb-Zn, Ba-Pb-Zn, As-Bi-Sb and Cr-Mg-Ni. The presentation is by the elegant optical method of using primary colours for each element and coincident anomalies are shown by the colours produced by addition. The two element maps are particularly striking with red and green giving the single anomalies and yellow the coincident ones. The three element anomaly maps show clearly the coincidence of the anomalies of all three elements as white spots but the magenta and cyan overlaps are not so striking.

Regional Geochemistry of the Lake District and adjacent areas provides a wealth of information not just on the geochemical dispersion patterns in the stream sediments of the area but also a concise account of the geology of the Lake District and a summary of the geochemistry of the elements in the surface environment and five pages of references

make it an invaluable source book for the area. It also shows how the concept of the regional geochemical survey has evolved, broadening from the original idea of finding mineral concentrations to the relationship of geochemistry to the environment and to disease. It also continues the improvement and innovation in the interpretation and presentation of the results where it would have been very easy for the B.G.S. to churn out the series of reports in a standard, static formula. The result is a valuable and welcome addition to our knowledge of the Lake District.
R. J. L. COLVINE

Miyashiro, A. *Metamorphic Petrology*. London (UCL Press), 1994. xii + 404 pp. Price £24.95 paperback (£60.00 hardback).

Given the relative dearth of comprehensive textbooks on metamorphic petrology and petrogenesis, any new addition to the literature must be welcomed with optimism. This book is new, and in several respects different from Miyashiro's previous work, *Metamorphism and Metamorphic Belts*. It is divided broadly into three sections beginning with the principles behind approaches to describing and understanding metamorphism, followed by two sections that deal with metamorphic facies, *P/T* facies series or baric types, progressive assemblage changes in metapelites and tectonic contexts. An appendix on historical perspectives of metamorphic petrology, including a philosophical discussion of the development of paradigms, is a very valuable and important contribution which should be read in particular by those of today's researchers who seem to forget that metamorphic literature existed before the advent of computerised citation databases and the CD-ROM. It is well-produced with a clear text structure, reasonable index and neat figures complemented by a comprehensive glossary which correlates with terms introduced in bold face within the text. Overall, this is an accessible text with a good blend of scope and depth which should provide students with a good introduction to many, but not all, aspects of the study of metamorphism.

The general principles section (Part I) introduces the subject from a general background of equilibrium pressure-temperature controls and broad types of metamorphism in relation to simple settings, with a brief summary of Barrow's zones as an idealised case of regional metamorphism. Spatial variations in metamorphic grade are discussed, with the significance of relations between 'thermal peak' isotherms and isobars dwelt upon in detail. The phase rule and its applications are described and types of reactions defined, leading into a concise treatment of selected reactions, *T*-composition sections and fluid and