mentioned and mineralogy is often very simplified. However, this book appears to me, as a geologist, to be an invaluable guide to recovery of the precious metals, containing many tricks of the trade, based on practical chemistry, avoiding high tech methods and black boxes. The author makes precious metal recovery look easy.

H. M. PRITCHARD

Eckert, A. W. *The World of Opals*, New York and Chichester (John Wiley & Sons, Inc.), 1997, xiv + 448 pp. Price £60.00 (ISBN 0-471-13397-3).

This is the first comprehensive book on opals for over thirty years and claims to give a complete guide to the science and history of this gem material. After a definition of exactly what constitutes an opal, the author provides a new look at opal formation, and this is followed by chapters describing opalized fossils and pseudomorphs, the mythology of opals (the 'bad luck' popular image being blamed on the one of Sir Walter Scott's Waverly Novels *Anne of Geierstein*), famous and otherwise noteworthy opals, types of opals, the world's major opal occurrences, and a glossary of opal-related terms; there is also an extensive bibliography and an index.

The chapter on the mode of formation of opals is based largely on the thesis that most of what has been taught about opals has been based on theories now proven, in part at least, to he incorrect. The author's style is distinctly idiosyncratic, and it is difficult to unravel the use of such terms as atom migration [metasomatism ?] and the definition of an electrolyte as "a liquid carrying a chemical that generates an electrical pathway through anything". The work of Sanders and Darragh in 1965 using electron microscopy to demonstrate that precious opal consists of aligned lepispheres and voids giving rise to a three-dimensional diffraction grating is acknowledged, but we are told that the refutation of part, if not all, of the other theories on the basic formation of opal must take place because of experiments carried out by a man from Lightning Ridge, New South Wales, who has succeeded in growing opals from 'opal dirt' in a liquid in glass jars in an incredibly short time (a few days to six months, followed by the secret electrolyte being siphoned off through a small hole in the container's cover, allowing air contact to dry the stone). These opals are said to be indistinguishable by sight from natural opal, but have not yet been scientifically analysed; a lot of work has been done, but the experimenter quite reasonably wants to publish the results himself. We are thus left with various statements, but a lot of the author's work reminds one of a current British advertising campaign on the lines of "... I don't know the answer but I know a man who does". Nevertheless, the evidence of fossil pseudomorphs leads one to the conclusion that opalization does not neccessarily require a geological time-scale in which to operate.

Putting aside these reservations, this book does succeed in giving an overall account of the occurrence of opals, not only in Australia, the United States and Mexico, but also in British Columbia, Honduras, Austria, the Czech Republic, Slovakia and Hungary. The descriptions of opal deposits in Opal Butte, Oregon, and the Virgin Valley area of Humboldt County, Nevada, are described in detail, and in the section on noteworthy opals, details are given of the Roebling opal (2560 carats) and the Bonanza opal (25 586 carats) both from Virgin Valley. Opal being what it is, many of the black-and-white photographs in the text are uninspiring, but 22 colour plates demonstrate the amazing variability in play of colour to be, seen in opals even from the same mine. A book that manages to be both provoking and informative, while we await the promised definitive work on the geology and chemistry of opal by the 'man who does'.

R. A. HOWIE

Harlow, G. E. (ed). *The Nature of Diamonds*, Cambridge (Cambridge University Press), 1997, x + 278 pp. Price £55.00 (hardback, ISBN 0-521-62083X); £19.95 (paperback, ISBN 0-521-62935-7).

In this comprehensive, large-format book, published in association with the American Museum of Natural History, a dozen or more experts on the geology, mineralogy, gemmology and social-economic aspects of diamonds cover every facet of this mineral.

After an introductory chapter, the nature of colour in diamonds is discussed (E. Fritsch), and this is followed by a chapter on the origin of diamonds and the involvement of relatively cool harzburgite keels at the base of the thickest, oldest parts of the Earth's crust (M.B. Kirkley), later subduction of basaltic oceanic crust resulting in some portions of it adhering to the bases of the

continental keels and recrystallizing there as eclogite. The basaltic crust contained carbon (some of organic origin) and recrystallized as diamond; heating or fluid infiltration of this continental keel caused kimberlite to form, which under the right conditions ascended rapidly to the Earths's surface.

After a brief chapter (Harlow, Shatsky and Sobolev) outlining the collision and return of ultra-high-pressure terrains, permitting formation and preservation of diamonds in the continental crust, there is a detailed chronological and geographical account of the discovery of diamond sources (Levinson). This chapter presents many fascinating insights into diamond production, firstly in India which was the sole source until around 1730, when diamonds were found in Brazil; then from around 1870 to the present day, with South Africa, Namibia, Botswana and some 10 other African countries, followed by the Russian kimberlite sources mainly in Siberia (mining started in 1957), the Australian development in the lamproite of the Argyle mine (from 1979), China, and currently the active exploration in the Lac de Gras region of the Northwest Territories of Canada. This account is accompanied by numerous production statistics, but it is not always easy to compare production in terms of weight of carats produced with the value of diamonds mined, there being wide variations in the proportions of gem-quality diamonds in the different deposits: thus in 1995 the Argyle mine produced about 38% of the world's diamonds on a weight basis, but only about 6% on a value basis.

Sandwiched in the middle of the book is a chapter on the world's great diamonds, but here unfortunately two colour plates have been transposed relative to their legends, making the Koh-i-Noor appear in the Imperial State Crown! This is followed by various chapters outlining the history of diamonds as gemstones, their place as regal ornaments through the centuries, their value in English literature, diamond jewellery in Russia, Hollywood and the rest of the world, and into the twentieth century.

The final three chapters are likely to be of greater interest to geologists and mineralogists, dealing as they do with the processing of diamonds from the Earth to fashioned objects (Harlow), diamonds as gemstones (Shigley and Moses) and the synthesis of diamonds and their applications in modem technology (Collins). The production figures are interesting, being 100 tons per year (500 million carats) of which 80% is represented by the production of synthetic diamond grit for industrial use; mined natural diamonds amount to 100 million carats per year of which 25 million carats are used in the gem trade.

Altogether, this is a fascinating book, covering almost all aspects of diamonds from the aesthetic to their possible use in supercomputers, and from their discovery in the frozen wastes of Siberia to their synthesis by chemical-vapour deposition. The presentation is excellent, with many clear diagrams and sketch-maps. Almost my only regret (apart from the mislabelling of plates mentioned above) is that surprisingly there is no mention, either in the chapter on famous diamonds or in those concerned with colour in diamonds,of the wonderful Williamson 54.5 carat pink diamond (23.60 ct after cutting) presented to H.M. Queen Elizabeth II to celebrate her Coronation.

R. A. HOWIE

O'Donoghue, M. *Synthetic, Imitation and Treated Gemstones*. Oxford (Butterworth/Heinenmm), 1997, x + 203 pp. Price £35.00. ISBN 0-7506-3173-2.

This book sets out to describe a range of gem and ornamental materials, species by species, covering synthesis, simulation and both permanent or short-term colour enhancement. That 'nothing is quite what it seems' is a guiding principle – and then there is the problem as to what to call it, in attempts to avoid the weasel words or grandiose names seen in many advertisments .

After a summary of the various methods employed for the growth of gem-quality crystals, and an introduction to the techniques used in gem testing, there is a brief exposition on the major natural gemstones (taken by the author as diamond, corundum, spinel, beryl, quartz, opal, alexandrite and topaz) which includes a useful warning about the somewhat fanciful language often used to describe inclusions, e.g. 'silk', 'feathers' and 'fingerprints'. The meat of this book lies in the chapters concerned with the individual gemstones and methods of simulating them, ranging from glass to synthetic materials such as cubic zirconia, YAG, GGG and spinel, and including the many refinements such as carefully crafted doublets and triplets, the filling of fractures and the enhancement of colour. Even gem-quality diamonds have now been success-