

should be on the shelves of all workers in the field, and in all Materials Science and Mineralogy libraries.

G. D. PRICE

Annels, A. E. *Mineral Deposit Evaluation: a Practical Approach*. London (Chapman and Hall), 1991. 451 pp. Price £49.95.

This is going to be very useful book for geologists and other professionals in the mining and mineral extractive industries and a good text for students in those (regrettably few) educational establishments which teach mineral evaluation. As the sub-title says, the book deals in a very practical way with the process of quantifying resources and reserves of minerals including some very welcome material about the evaluation of coal, gravel, sand and other non-metalliferous deposits. It is very much written from a geologist's point of view (none the worse for that) but does include a great deal of the engineering and economic aspects that are vital to understanding this multi-disciplinary subject.

The book is organized into eight chapters dealing with the representation of data (maps, plans, sections, projections etc.), sampling, 'classical' and 'geostatistical' reserve estimation, grade control. There is a long chapter devoted to design and evaluation of open-pit operations recognising the importance of low-cost mining in the present economic climate. There is a whole chapter devoted to case histories, ten of them covering several metal mines, two limestone quarries, a gravel pit, opencast coal, a potash mine, chosen from five different countries.

In addition to this chapter, the whole of the rest of the book contains case history material and illustrative examples from a wide variety of contrasting deposits. The chapter on financial evaluation was written by a different author, E. G. Hellewell. Although the chapter covers adequately the subject it is not well integrated into the rest of the book. As a consequence, the book does not deal with the use of econometric techniques (internal rate of return etc.) in sensitivity analysis, risk analysis, grade optimization, in which mine geologists inevitably become involved as part of the planning process.

At every point in the book, computer-based methods are discussed and many of the illustrations are taken from computer output. There are a lot of references to proprietary software packages which are perhaps essential but are liable to become dated fairly quickly.

It is very easy for a reviewer to say that this or that subject deserves more coverage, which begs the question of what should be left out in order to prevent the book becoming too long; everything in this book is relevant. What I do feel is lacking in some ways is discussion of the mineralogical nature of deposits in relationship to the processing and marketing of the products; a bed of gravel containing one per cent alkali-reactive clasts has a very different value to one that does not.

The book is very well illustrated with numerous clear line drawings and photographs. The design is a little annoying in places and the index could have been longer with advantage. But none the less, this is a good book, and very welcome. Every mine should have a copy and one can only say to the geology graduate who has never heard of a mineral deposit but can only find a job as a trainee mine geologist in an Australian gold mine; read it on the plane, you won't regret it.

C. DIXON

Van Loon, J. C. and Barefoot, R. R. *Determination of Precious Metals: Selected Instrumental Methods*. Chichester and New York (John Wiley and Sons), 1991. x + 276 pp. Price £45.00.

The precious metals (Pt, Pd, Rh, Ru, Ir, Os, together with Au) are strategic elements that continue to command importance in industrial processes, medicine as well as the jewelry trade, investment and bullion markets. In consequence, much of the expertise in the determination of these elements has resided traditionally in industrial and commercial service laboratories. A book that covers methods for the determination of these elements, mainly in range of geological applications is to be welcomed in filling a gap in the current market.

The strengths and weaknesses of this book are set in the introduction. The authors consider that the determination of these elements remains the ultimate challenge to the inorganic analytical chemist, but propose that despite well documented advances in instrumentation for traces element analysis, there have been few real breakthroughs in the determination of the precious elements. They also endorse a statement by Beamish that fire assay is the preferred method for the determination of gold in complex rocks and that the classical lead method never failed to find a paying ore. Thus, although the book encompasses a range of 'recommended' methods, these can largely be classified as 'established', rather than innovative with a preference to methods based on the 'classical' lead fire assay

procedure. Thus, I could find no reference to recent developments in nickel sulphide fire assay involving low mass (e.g. 1 g) buttons, nor to the innovations in the determination of Os relevant to recent interest in the Os/Re geochronometer.

There are ten chapters in this book. Following the introduction (Chapter 1, 8 pp), the principles of instrumental methods are reviewed in Chapter 2 (40 pp.). The techniques considered include AAS (flame and electrothermal atomisers) ICP-AES, ICP-MS and NAA, though not XRF despite the use of XRF methods later in the book. The style is a little uneven since the AAS (flame and electrothermal atomisers), ICP-AES, ICP-MS and NAA, though not XRF despite the use of XRF methods later in the book. The style is a little uneven since the AAS section includes details of instrumental features relevant when considering a purchase from manufacturers, whilst the ICP-MS section outlines the theory (of quadrupole mass spectrometry) in some mathematical detail, neither topics being covered in this detail when considering other techniques. Chapter 3 (12 pp.) reviews some physical and chemical properties of the precious metals. Chapter 4 (33 pp.), is entitled 'Reference Materials' and although this subject is considered with some perception, more coverage is given to blanks, the preparation of standard solutions and safety. The latter section includes X-ray spectrometry hazards (despite the absence of this technique from Chapter 2!). Although SI units are defined, it is disappointing to see the working discussion in the old radiation units of the curie, rad and rem.

In Chapter 5 (13 pp.) sampling and sample preparation are reviewed in respect to the following samples: geological; mineral; ore; concentrate; metals and alloys; metal scrap; catalysts; organics; botanical and water. Chapter 6 is devoted to fire assay (46 pp). Much of this chapter is devoted to the classical lead method. Alternative fire assay collectors, including the ubiquitous nickel sulphide procedure, merit 11 lines at the beginning of the chapter since although these techniques are claimed to be particularly useful for the determination of Os, Ir and Ru, in general there is little advantage in these approaches for the other precious metals—a statement with which some analytical colleagues may not agree. However, the nickel sulphide technique *is* then taken up again later in the chapter since the technique has found 'widespread application'. Much of the lead fire assay details given in this chapter reproduce procedures used by the USGS that were first published by Haffty and co-workers in 1977.

Chapter 7 (23 pp.) covers the analysis of ores, minerals and concentrates, summarising six procedures published previously in the literature. Chapter 8 (46 pp) covers rocks, water and biogeochemical materials. Following a brief introduction to each section, details are given of individual methods (about 15 in all) published previously in the literature, many of which are reproduced by permission of the original publisher. Chapter 9 (19 pp.) is devoted to biological materials describing about seven previously published methods. Industrial samples are covered in Chapter 10 (32 pp.) following the same format.

As is apparent from the above commentary, there are a number of inconsistencies in this book. Perhaps the most disappointing aspect is that the contents appear to this reviewer to lack an in-depth critical evaluation of the procedures presented in this work. Thus, some sections of the book appear, at a superficial level at least, to comprise a series of procedures presented as re-edited versions of the original paper. In one sense, this is useful in giving an overview of the analytical methodologies currently available. However, any reader new to the subject would benefit considerably by expansion of the commentary that generally introduces each of these procedures. In summary, this book presents a useful overview of techniques for the determination of the precious metals biased towards established methods.

P. J. POTTS

Hashimoto, M. (Ed.). *The Geology of Japan*. Tokyo (Terra Scientific Publishing Co.) and Dordrecht and Boston (Kluwer Academic Publishers), 1991. x + 249 pp., 52 maps. Price £67.00 (Dfl. 195.00, \$125.00).

English language readers are generally starved of authoritative texts on the geology of the Japanese islands. Yoshida's *Outline of the Geology of Japan* (1977) was very much an outline; Minato, Gorai and Hunahashi's *The Geological Development of the Japanese Islands* (1965) was a weightier volume but pre-plate tectonics in its approach. Your reviewer was, however, somewhat disappointed by Hashimoto's 'new' (1991) work for essentially it is a translation of a 1980 Japanese-language publication. Though it claims to have been 'considerably abridged and rewritten to make it suitable for non-Japanese readers' this reviewer found very few references dated later than 1979 and no indication as to whether those references are written in the Japanese or the English language.