

speaker familiar with the subject would have been advantageous and given some justification for the price. At over 6p per page of text, the book is poor value for money and is unlikely to find its way on to the shelves of many mineralogists.

R. C. MACKENZIE

JONES (M. J.), Editor. *Geological, Mining and Metallurgical Sampling*. London (Institution of Mining and Metallurgy), 1974. viii+268 pp., 177 figs. Price £8.00.

The refractory nature of sampling problems, to borrow from Griffiths's opening paper, is nowhere better displayed than in the practices of finding, mining, and refining metalliferous ores that are uniquely blended in the corpus of the publisher of this very reasonably priced high-quality paperback. The accumulated experience of 23 mainly specialized and highly numerate authors will profit readers active in all branches of mineral industry. Conversely the general reader could find himself extended as the papers traverse from geochemical surveys to the sampling of small-scale flotation circuits via a theory of cutoff grades. Six of the papers have appendices of direct use to the statistically minded and the seriousness with which sampling problems are taken by the industry is underlined in the 34 pages of discussion.

The orthogonal grids recommended by Griffiths could be difficult to apply, for example, in regional geochemical surveys where the natural drainage is sampled. In two papers on stream sediment sampling different sub-sampling procedures are utilized prior to optical emission-spectrographic analysis, a procedure involving dry mixing, which is regarded as unsuitable by Nicholls. This author's 100-g 'bulk' sample for geochemical analysis is dwarfed by the samples taken from shipments of iron ore and calcined alumina where large sums of money depend upon accurate analysis.

High-value products such as gold, diamond, uranium, and tin pose special sampling problems, not least in deep borehole sampling of the Witwatersrand gold reefs where a core sample is taken to represent an area of reef ten orders of magnitude larger. Statistical procedures are heavily relied upon by the authors of the six papers in this area. Their pragmatic approach is typified by Phillips's comment in discussion that 'statistical methods are useful in extracting the maximum information from available data and indicating better sampling strategy for the future', and by Applin's acceptance of undervaluation of the grade of African alluvial diamond deposits since it provides a safety margin in production.

Sampling problems associated with the development of an open-pit copper mine in Spain and with the processing of Zambian copper ores receive very detailed attention. Pryor, Rhoden, and Villalón compare copper grades yielded by developmental drilling, subsequent blast-hole sampling, and eventual mining, demonstrating that the loss of friable copper minerals in drilling can lead to underestimation of grade. Armstrong Smith concludes that error is most likely to arise at the grinding stage when sampling copper concentrator products. He shows that little advantage is gained from replicate assaying of the same sample and recommends laboratories 'to pay more attention

to sample preparation (and) to expend more effort on guarding against the covert intrusion of bias'.

The over-all conclusion to be drawn from this excellent volume is that a wide range of statistically based monitoring systems are being evolved by mineral industry to improve the reliability of sampling.

M. J. GALLAGHER

DOHR (G.). *Applied Geophysics: Introduction to Geophysical Prospecting*. Stuttgart (Ferdinand Enke Publ.), 1974. 272 pp., 125 figs. DM 16.80.

A concise textbook on applied geophysics with adequate descriptions of modern techniques in reflection seismic work is badly needed by students of applied geology and geophysics. This book aims to supply this need and devotes more than half its length to seismic methods, including most modern techniques. Many of the field examples are German, which is welcome. Unfortunately there are several serious defects. The translation is so awkward that not only is the book difficult to read but on occasion it is almost impossible to understand. The conventional vocabulary of applied geophysics is not always used, and anyone who learnt to use the terms given in this book would be unable to talk to his professional colleagues. Proof-reading has been poorly done. References are inadequate. Although the mature geophysicist may enjoy flipping through this book it cannot be recommended for use by students. It is described as Volume I in a series on The Geology of Petroleum. One hopes that the succeeding volumes will be translated more carefully.

H. C. P.

LEVINSON (A. A.). *Introduction to Exploration Geochemistry*. Calgary (Appl. Publishing Ltd.), 1974. 612 pp., 198 figs. Price \$25; Students \$16 (purchasable post paid from Appl. Publ. Ltd., P.O. Box 39, Maywood, Illinois 60153, U.S.A.).

DR. LEVINSON can be congratulated in going a considerable way towards achieving the ambitious objectives outlined in his preface, of presenting an up-to-date review of value to students, geologists, those in allied fields such as geophysicists, and serious and experienced prospectors. All of these will find the book useful in different degree, either as a broad survey of the subject or as a reference on particular aspects of exploration geochemistry, for which it has the merits of referring in the text (albeit briefly) to the work of many recent authors in specialist fields and of including an extensive modern bibliography.

Probably the book is of most value to the exploration manager who has not specialized in geochemistry, and the predominance of Canadian examples of exploration practice and case histories is therefore fitting in view of the scale and variety of mineral exploration carried on in that country by the mining industry. This parochial bias does not detract from the value of the book to readers outside Canada, especially those working in high latitudes who can benefit from the sections on geochemical exploration in areas of permafrost, muskeg, bogs, and glacial deposits (the last two presenting problems currently demanding investigation in the U.K.).