

thought' expressing what have often appeared to be conflicting views on feldspars. A clear message of general importance that emerges from the history of feldspar researches is that successive concepts are seldom completely right or completely wrong.

A large amount of energy and print has been devoted over the years to questions of feldspar classification and nomenclature. The subject is dealt with fully here, giving the various systems employed by different investigators, and also a judgement as to their relative merits and a unifying scheme suggested by J. V. Smith. It is made clear that, while for many feldspars (e.g. albite, anorthite) assignment to a name on the basis of observations is fairly straightforward, for some others (e.g. orthoclase) it would depend very much on the method, and in particular, the scale of the observations. This point is emphasized strongly. Thus, observations by light microscope necessarily 'average' over dimensions of several μm , X-ray diffraction over perhaps a thousand \AA , while electron microscopy can give information relating to a few unit cells or even one unit cell. This leads, for example, to some specimens being correctly described as simultaneously optically monoclinic and 'X-ray triclinic'. The author appreciates well that the geologist in the field has only his eyes for observation, and that not all geologists have access to electron microscopes, and he offers naming procedures suitable at varying levels of investigation.

By using a work of this kind, researchers are usually able to see, more clearly and readily than by perusing the journals, where there are gaps in present knowledge and good scope for further research. Joe Smith does not leave much to chance, emphasizing explicitly for the benefit of his readers where there are likely to be fruitful fields. One should not assume that because of the colossal task of producing and updating these volumes, Joe Smith will not be there among the future fruit pickers!

Since the book achieves so much, it would be almost churlish to offer criticisms. However, I do feel that the author has succumbed to giving a little too expansive a treatment in places, and perhaps to using a little too conversational a style, leading to a greater length of text than is really desirable. Extra space could have been used to more effect in order to give more and larger figures, many of which suffer from overcrowding with information.

The book is well produced, and contains a subject index, author index, locality index, and rock-type index. Each chapter has its own list of references. Page numbers of figures and tables are usefully listed at the end of the book.

J. V. Smith is to be congratulated on the prodigious feat of producing these volumes, which I am sure constitute a landmark in the subject of mineralogy.

J. ZUSSMAN

SMYKATZ-KLOSS (W.). *Differential Thermal Analysis: Application and Results in Mineralogy* (Minerals and Rocks, vol. 11). Berlin, Heidelberg, and New York (Springer-Verlag), 1974. xiv+185 pp., 82 figs., 36 Tables. Price £9.86.

In the past, differential thermal analysis (DTA) was rejected by many mineralogists because its value in qualitative and quantitative studies did not come up to the expectations raised by published results obtained under ideal conditions. That this was tantamount to throwing out the baby with the bath water is clear from recent studies in chemistry and polymer science, which have shown how valuable the technique can be when used responsibly and with due appreciation of its limitations. It is to be hoped that this book, a detailed account of the author's own experiments, will not lead the uninitiated again to attempt the impossible. As mentioned in the Preface, remarkably precise details can be obtained by one operator using a standard procedure with one instrument and one specimen holder, but the general value of such an approach is questionable. A change in operator would necessitate tedious recalibration, since it is almost certain that the determinative diagrams and Tables would require alteration even under apparently similar conditions. The reproduction of all this material therefore seems unnecessary.

In describing technique and equipment the author does not identify his specimen holders adequately, although he does give—in abbreviated form and in translation of the German translation of the original English version—most of the recommendations for reporting DTA results made by the Standardization Committee of the International Confederation for Thermal Analysis. Since the furnace atmosphere was static air and 'loose' packing was used, another operator would have difficulty in replicating the curves exactly. A preparative treatment of ball-milling for three hours, described in the chapter on identification and semi-quantitative estimation of minerals, seems somewhat drastic for certain species to which it was applied. The section on clay minerals is weak and no reference is made to abnormal species (for which the determinative curves would be unsuitable). Useful information is, however, given on zeolites. Much stress is laid on the use of peak temperature/peak height and peak temperature/sample weight relationships in qualitative and semi-quantitative studies, respectively—but the caution given above that these apply only to the author's experiments must be reiterated. The final chapter, which discusses the value of DTA in assessing chemical composition, degree of order, and genesis of minerals, has a useful section on quartz and describes a promising technique for determining whether all the titanium in magnetite samples is in the magnetite lattice. However, much of the material dealing with isomorphous substitution, degree of order, and particle size is over-simplified: for example, the effect of admixture on high-temperature exothermic effects is not considered, nor is sufficient stress laid on the disrupting effect of particle size and shape on degree-of-disorder determinations on kaolinite minerals from the characteristics of their dehydroxylation peaks.

The index is good and a lengthy reference list is given, although some comments, such as the misattribution of some peaks on the bayerite curve (p. 39), make one wonder whether the author is completely familiar with all references cited. Neither thermoanalytical nor clay mineral nomenclature conforms entirely to international standards. The text is understandable but the English is quaint: *resp.* instead of *or* becomes monotonous, as do the numerous exclamation marks. The book is magnificently produced, in true Springer style, but correction of the text by a native English

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