

MACKENZIE (R. C.), editor. *Differential Thermal Analysis*. Vol. I. London and New York (Academic Press), 1970. xv+775 pp., 313 figs., 58 tables. Price £12.00.

Although not an unexpected development, it is, nevertheless, highly creditable that R. C. Mackenzie, who edited the monograph 'The Differential Thermal Investigation of Clays' published by the Mineralogical Society in 1957, should follow up this earlier success with a more up-to-date text covering a much wider scope. This first volume, to be succeeded by a second dealing with practical applications of the technique, is a fairly massive compilation of fundamental data occupying 775 pages and grouped into 25 chapters, five of which deal with general instrumentation and techniques and twenty with the thermal characteristics of individual substances.

Because of the nature of the method, considerable variations in operator technique, and, in the mineralogical field, vagaries in composition and physical properties, one's initial enthusiasm for the book is tempered by the realization that information on mineral species is less definitive than one would otherwise have hoped. For this reason much of the text is written in the manner of a review of published data, which, although of considerable practical value, is often presented uncritically or with too little informed comment. Also, there tends to be an uneasy relationship, and often separate identities, between information derived from artificial compounds and that obtained from naturally-occurring minerals.

As a reference book for mineral species it is immediately apparent that some radical groups are treated in much greater detail or are given undue prominence at the expense of others. This arises partly from a lack of published information for certain categories of minerals, but also because of the differing backgrounds and experience of the contributors and the relative importance of mineral species in an industrial sense (to be pursued further in the second volume).

In a chapter dealing with silicates other than clays (which are covered in three other sections) and zeolites (discussed briefly in a chapter on 'inclusion compounds') most of the space is devoted to a fairly detailed and informative description of thermal data for alkali and calcium silicates derived from the study of glass melts and cements. In comparison, the natural silicates—feldspar, feldspathoids, amphiboles, epidote, tourmaline, and zircon—are dealt with in a cursory manner.

A whole chapter on the silica minerals is no doubt justified by their importance in the manufacture of glass and ceramics. This is concerned largely with structure and structural changes—surprisingly making no reference to the 3rd volume of Dana's *System of Mineralogy* (7th edn) dealing specifically with this information—and with attempts, with varying success, at estimations of quartz contents.

The first of three chapters on clays and the mica minerals deals with simple phyllosilicates, succinctly and, with the exception of quantitative determinations, perhaps adequately, but contains surprisingly little new information when compared to the earlier monograph on the DTA of clays. A few minerals often found in association with clays are mentioned here but are rather out of context. Reference is thus made to the alunite group, although gypsum and other sulphates are covered elsewhere, and a brief mention of wavellite is virtually the only coverage of phosphate minerals in

the whole book. A separate chapter on interstratified clays reviews the problems associated with their identification but does not show convincingly how DTA can help. A section on the sepiolite-attapulgite clays provides a comprehensive summary of their thermal reactions.

Of other mineral groups, the carbonates are given extensive and perhaps rather excessive coverage, especially with respect to minor details of individual investigations, when the group is well covered by other publications and the treatment largely follows that employed in the earlier Mineralogical Society monograph. In complete contrast is a chapter on salt minerals, which contains much information, not easily available to English readers, condensed into a few pages. Data concerning the reactions of chlorides and sulphates given in lists and tables are valuable, but cry out for illustrative curves (at least of a formalized sort), and require further details of thermal affects such as solid-state reactions. Information on borates is merely tabulated. To a certain extent these brief details are amplified by an earlier chapter on simple salts (chemical compounds), which discusses many of the important characteristics such as melting points and the sharply-delineated polymorphic transitions.

The examination of oxides and hydroxides of mono- and di-valent metals is given a comprehensive treatment, although the range of compounds is limited almost to those of the alkalis and alkaline earths. The iron, aluminium, and manganese oxide and hydroxide minerals, described in a subsequent chapter, were already well covered by the same author in the Mineralogical Society monograph, so here the information is presented in concise form incorporating some more recent references.

Of other chapters in the book the one of greatest interest for the mineralogist is undoubtedly that on the chalcogenides, which contains a considerable amount of original and recent information on the investigation of sulphide ore minerals. In the study of sulphides, long avoided by the mineralogist in view of their reactivity and the evolution of corrosive gases at higher temperatures, the importance of rigid experimental control is emphasized with respect to atmospheric and pressure conditions, and details of special techniques, such as the use of evacuated vial specimen holders, are outlined.

Other sections of the book include a chapter on metals and alloys and four on organic materials. Mention should be made of the useful introductory section on instrumentation and techniques, which includes a chapter on theoretical considerations and derives formulae that are of importance in equipment design. Some space is also devoted to brief descriptions of complementary thermal techniques, which makes it all the more surprising that a book of this scope should virtually confine its attention to DTA. With the oft-admitted misgivings about the reliability of DTA for many quantitative determinations, it would have seemed sensible to have included information from thermogravimetric and evolved gas analyses—especially in view of the industrial emphasis of the second volume. For this reason, the writer would have preferred to have seen (publishing economics apart) a series of smaller monographs dealing with specific groups of materials but covering all inter-related thermal investigations.

Nevertheless, although the references are seldom more recent than the mid-60s,

the practising analyst will wish to have a copy of this book at hand as a primary reference source. The second volume, with the more novel approach of tackling materials under their appropriate headings as industrial commodities, could well prove to be the more important as a working guide to the application of DTA. J. A. BAIN

ENERGLYN (Lord) and BREALEY (L.): *Analytical Geochemistry* (Methods in Geochemistry and Geophysics, Vol. 5). Amsterdam, London, New York (Elsevier Publishing Company), 1971. xv+426 pp., 114 figs., colour frontispiece. Price £9.25.

The Preface to this work states that it sets out to be an introductory manual to the techniques required for the analysis of rocks and minerals, and is aimed at geologists who did not study chemistry as undergraduates. While such a reader will find matters to interest him, the book as a whole cannot seriously be recommended as a guide for the audience at which it is aimed.

In a work attempting to cover a very wide range of geochemical methods, questions of the level of treatment and of balance between the various topics have to be faced, and may legitimately be solved in a variety of ways. The reviewer none the less finds it surprising that this book—designed for a wide geological readership—while devoting for example a chapter over 60 pages in length to chromatography, dismisses the electron microprobe in a page and a half and ignores atomic absorption spectrophotometry altogether. Neither are the reasons for the unusual balance to be found in the fact that the work is a volume in Elsevier's series on geochemical and geophysical methods: other volumes fill some of the gaps, but still others duplicate topics treated here (including chromatography and X-ray spectrography).

The standard of treatment varies, but the opening chapter of the book—a 47-page Introduction to Geochemistry—is so idiosyncratic in its approach as to inspire little confidence in the remainder. It is difficult to follow the authors' purpose in this chapter, which begins with a vague and slightly misleading introductory section, mostly on crystal chemistry, followed by a section on the calculation of CIPW norms and Niggli values. Here, one begins to encounter the inaccuracies and inconsistencies with which the work abounds: except for MgO, K₂O, and TiO₂, for example, the molecular weights quoted on p. 4 all disagree with those used in Table III on p. 10. The opening chapter, among other topics, includes a section on fluidization and a description of the senior author's scale model of the Eakring anticline, followed by a longer section on organic geochemistry (for which the running titles incidentally read 'Organic Chemistry').

The following chapters are: 2. Qualitative Analysis (pp. 48–88); 3. Quantitative Chemical Analysis (pp. 89–142: only 'rapid' methods are treated in the main); 4. Chemical Analysis of the Minor Elements (pp. 143–212); 5. Emission Spectrography (pp. 213–43); 6. Flame Photometry (pp. 244–73); 7. X-ray Spectrography (pp. 274–303); 8. X-ray Diffraction (pp. 304–26); 9. Fluorimetry (pp. 327–39); 10. Chromatography (pp. 340–402); References (pp. 403–12); Index (pp. 413–26).

Apart from arguable eccentricities in choice and treatment of subject matter, the