

insufficiently emphasized and it seems that the significance of Ramberg's experiments in providing explanations of many structural phenomena of migmatites is not fully realized. Further, the account of the migration of elements is confusing and that of sampling methods, although perhaps suitable for intrusive plutons, is inadequate and unrealistic in dealing with migmatite complexes.

Despite these reservations I liked this book with its wide coverage, abundant references, and discussion of most of the main lines of research on migmatite terrains: the general reader might be discouraged but the specialist will not.

W. S. PITCHER

SALMANG (H.) and SCHOLZE (H.). *Die physikalischen und chemischen Grundlagen der Keramik*. 5th ed. Berlin, Heidelberg, and New York (Springer-Verlag), 1968, viii+450 pp., 197 figs., 56 tables. Price DM 66 (U.S. \$16.50).

The fifth edition of the late Professor Salmang's comprehensive textbook has been revised and re-arranged by Professor H. Scholze whose researches into ceramics are well known. Ceramics are essentially defined by a common process of manufacture in which the powdered material is first shaped and then consolidated by firing. It now includes a very wide range of products, from those based on clay to special ceramics based on pure oxides and other chemicals. The book presents the most recent generally accepted views on structural compositions, types of bonding, surface properties, and thermochemistry, and covers raw materials, manufacturing processes, and properties of finished products together with methods of investigation. In order to cover such a wide field the information is often necessarily condensed, but a large number of references are given to the latest work to facilitate a more comprehensive study of particular topics. The book is well illustrated with diagrams and tables.

P. S. KEELING

MURCHISON (DUNCAN M.) and WESTOLL (THOMAS S.). *Coal and Coal-bearing Strata*. Edinburgh and London (Oliver and Boyd) 1968, xii+418 pp., 124 figs., 21 tables, 41 plates. Price 168s.

This book contains the printed versions of fifteen papers read to the 13th Inter-University Geological Congress appropriately held at the University of Newcastle in January 1965. The papers are assembled under five headings. Part I deals with coal as a rock and contains five papers; Part II, concerned with the sedimentary environment of coal formation, has three papers. Part III has three papers on the biological environment of coal formation. Geochemistry and metamorphism are dealt with in four papers in Part IV, while Part V has two papers on coal basins, including Gondwana coalfields and German Mesozoic and Cainozoic coalfields.

In Part I the uses of the terms 'macerals' and 'microlithotypes' are clarified and their development in coal in relation to the process of coalification described, as well

as the changes induced by natural and 'artificial' radioactivity. The role of organisms in the production of carbonaceous material of various kinds is also dealt with in this section.

In Part II early diagenesis and the development of concretions—in particular those of ironstone—are fully described. The vexed question of sedimentary rhythms is discussed at length and a new term 'fascicule' proposed instead of 'cyclothem'. Although the discussion is very broad, no conclusions as to the cause or causes of cyclic deposition are advanced, in fact there is a paragraph on the 'reality' of rhythms. This Part goes on to describe the nature and environment of formation of tonsteins and seatearths in detail.

The mineralogist and petrologist will find most general interest in Part IV where the biochemical and geological factors influencing coal formation are covered. The decomposition of plant material and the various biochemical and chemical reactions involved are shown to lead to a decrease of cellulose and a modification of lignin and humic acids in the stages of development of peat to brown coal. While the changes from vegetable matter to brown coal can be conveniently regarded as diagenetic processes, it is shown that further increases in coal rank ultimately leading to meta-anthracite and graphite are metamorphic. Depth of burial, the local geothermal gradient, and the thermal conductivity of associated rocks are convincingly shown to be important metamorphic factors influencing the degree of coalification. However, the two most important factors are shown to be maximum temperature and its duration and it is further shown that normal coalification temperatures were probably much lower than previously proposed. For example, while temperatures of 150–200 °C acting over 20–100 m.y. are regarded as sufficient for the formation of high rank bituminous coals and anthracites, only 5 m.y. is regarded as sufficient to form anthracite with 5 % volatiles at temperatures above 340 °C. The various authors come down firmly against any over-all tectonic mechanism for coalification, and an impressive array of facts is marshalled against the effects of compression as major causes of increase in coal rank. It is shown that, even in conditions of extreme stress and shearing, high temperatures are needed to form the end product of the metamorphism of coal, i.e. graphite.

The enrichment of coal and associated strata in many elements is impressively dealt with in section 11. As primary biogenic concentration, precipitation or sorption during or prior to coal formation, concentration by selective leaching, etc. can operate singly or together, it is concluded that enrichment of the many elements listed as occurring in coal varies from coal to coal. A cautionary note is introduced in a survey and discussion on the use of geochemical indicators of palaeosalinity; the results of many investigators vary considerably and it is considered much more work needs to be done before the distribution and concentration of elements such as boron can be regarded as safe guides to former environmental conditions. Nevertheless, there is some optimism in the conclusion that if all geochemical criteria including isotope ratios are taken together 'an improved diagnosis of past sedimentary environments is possible'.

The occurrence of syngenetic and epigenetic mineral matter in coal is also covered in Part IV as well as its influence upon the economic utilization of coal.

In Part V the account of European Carboniferous and Permian coalfields is comprehensive, and deals with the depositional environmental contrasts of paralic and limnic coal basins. Further, interesting contrasts occur in the heat supply, which affects the rank of coal in these coalfields. In the European coalfields the heat supply was from below; in South Africa it was often from above, i.e. from thick intrusive sheets and dykes of dolerite. Finally, to show that widespread coal formation was by no means a Carboniferous or Permian phenomenon, the book ends with an account of German Mesozoic and Cainozoic brown coal basins. Although these brown coal basins show some differences from the Carboniferous due to formation in somewhat dissimilar environments the causes of increase in coal rank are the same as those described for the earlier coals, and even anthracite occurs in areas close to igneous intrusions.

The book contains a wealth of new information and admirably summarizes recent advances in many fields. It is well produced, illustrated, and edited; only one error of reference was noted, i.e. on p. 146 where the initial W. occurs for S. E. Hollingworth. It will be long used as a general reference work but its price is probably somewhat prohibitive for all but those with specific interests in the subjects covered.

D. G. JONES

SIDDQUI (M. K. HASNUDDIN). *Bleaching Earths*. Oxford and New York (Pergamon Press), 1968, 86 pp. Price 42s.

Although the industrial exploitation of clays has assumed great economic importance in many countries during the last fifty years or so, books on various aspects of clay technology are not very common, and a small volume summarizing the subject of bleaching earths in less than eighty pages can expect to have wide appeal among young scientists entering the field, to whom the volume is dedicated. Siddiqui's little book seems, at first glance, to fill the gap admirably: the layout is good, the style is simple, and the chapters are well chosen, going gradually from the general and academic to the specific and practical. The faults of the book become apparent only when one reads the text in detail. It seems a great pity that an apparently well-planned project should fall down on account of the inaccuracy of much of its scientific material.

The first chapters introduce the main clay minerals used as bleaching earths, montmorillonite and attapulgite (palygorskite), including theories of their formation. These are followed by two chapters dealing with the crystal structure, the physical and chemical properties, and the methods used for laboratory examination of these clays. The activation processes used for improving bleaching capacity and the bleaching mechanism itself are described in the next chapters, and the book ends with an account of the world-wide distribution of bleaching earth with particular emphasis, understandably, on India.

It would take up much space to list the small errors, incorrect factual statements, and confused or unacceptable theoretical explanations; only a few examples are quoted: The use of the terms meta or sub-bentonite for the non-swelling forms of montmorillonite, e.g. calcium montmorillonite, is incorrect. The range of pH for these