BOOK REVIEWS

Aspects of Geology

Principles and Applications of Palaeomagnetism. By D. H. Tarling. Pp. 164. (Chapman and Hall: London, February 1972.) £1.75.

The Earth's Age and Geochronology. By D. York and R. M. Farquhar. Pp. viii+178. (Pergamon: Oxford and New York, February 1972.) £2.50.

The Structure and Physical Properties of the Earth's Crust. Edited by J. G. Heacock. Pp. x+348. (American Geophysical Union: Washington DC, December 1971.) \$19.

DURING the past twenty years, the study of the permanent (remanent) magnetism of rocks has developed into a powerful new physical tool for studying the Earth and its history, comparable in importance with the study of radioactive isotopes in rocks. It has been shown that even rocks of early pre-Cambrian age can, under favourable circumstances, retain much of the magnetization they gained at the time of their formation. Rocks can act as fossil magmatic compasses, but the positions of the magnetic poles, except in geologically recent times, have apparently deviated considerably from their present position of approximate coincidence with the geographical poles. Further, there have been episodic reversals of the magnetic polarity, which are now providing a new secondary means of calibrating the geological time scale. Dr Tarling works in one of the leading schools of palaeomagnetism at the University of Newcastle-upon-Tyne. In his book, *Principles and Applications of Palaeomagnetism*, he gives an excellent account of the physics of rock magnetism and of the problems of measuring magnetic properties of rocks and relating them to the geological setting of the rocks. This comprises more than half of the book. The remaining three chapters deal with applications. While these do give overall a fairly complete coverage, the attempt to compress all the topics into fifty-nine pages leads to some sketchiness, which is particularly acute in the short chapter on geological applications. This is partly offset by a useful selected bibliography. All in all, however, the book is very good value for money for any geologist or geophysicist.

It is, of course, the dimension of time that gives geology so much of its fundamental significance. Until the twentieth century, however, the only time scale was the relative, though very important, one provided by stratigraphy. The discovery of radioactivity opened up the possibility of measuring the absolute ages of rocks, minerals and artefacts, and this was given a tremendous boost by the enormous and sophisticated development of atomic physics in the 1940s and 1950s. The past 20 years have seen an exponential rise in the number of radiometric age measurements and corresponding progress in interpretation and application of the data. York and Farquhar devote seven chapters of their book to a critical discussion of the principles and methods of radiometric dating and a further five chapters to the results and their applications. It is slightly surprising to find no references in the book dated later than 1969, which detracts from the value of the short chapter on reversals of the Earth's magnetic field. There is an interesting chapter, "The Pulse of the Earth", concerned with the history of igneous activity; but surprisingly there is no discussion of applications of radiometric measurements in palaeontology. There are also useful chapters on meteorites and the age of the Earth. Through radiometric dating, the time dimension is now becoming increasingly important in geophysics, and, in conjunction with studies of rock magnetism and with studies by the classical geological methods, it is providing the framework for a theory of the evolution of our planet. This book will be a useful addition to the library of any geologist or geophysicist.

Volume 14 of the very useful monograph series of the American Geophysical Union consists of twenty-six papers by research workers in the USA and is based on the proceedings of a symposium held at the University of Colorado in July 1970. The meeting was sponsored by the Office of Naval Research (ONR), the University of Colorado, and the Environmental Research Laboratories of the National Oceanographic and Atmospheric Administration (NOAA). It was initiated by the editor "with a special view toward answering fundamental environmental questions about the nature of

the Earth's crust", although this was linked also with the practical question of the possible use of a part of the crust as an electromagnetic wave guide for radio communications. The book is divided into sections dealing with continental crust, oceanic crust, laboratory measurements, and electromagnetic wave propagation in the crust. The physical properties dealt with are seismic wave propagation, electrical resistivity and heat flow. Half of the papers (and more than half of the books) are devoted to continental crust studies, most of them in the USA. There are useful reviews of a number of topics. These include: reviews of evidence for low seismic velocity crustal layers by M. Landisman, S. Mueller, B. J. Mitchell, and J. H. Healy; a review of evidence on low-resistivity crustal layers by H. Porath; an attempt at the construction of a crustal resistivity model to 40 km depth, based on laboratory studies, by W. F. Brace; and papers on water in the crust by P. J. Wyllie, and on the composition, structure, and evolution of the crust by A. L. Boettcher. A theme which recurs throughout the book is the growing interest in the significant role of any aqueous solutions trapped in pores in rocks at depth. Although, as concluded by the author, long range radio communication through the crust is probably not feasible, the symposium built around the problem has proved to be usefully stimulating. Because of its price and its specialized nature, the symposium volume will probably not be bought by many individual research workers, but it will surely be included in any geology and geophysics reference library.

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Using the Land

Agricultural Geography. By W. B. Morgan and R. J. C. Munton. Pp. xii+175. (Methuen: London, 1971.) £2 cloth; 90p paperback.

GEOGRAPHY, as commonly defined, comprises a blend of physical, human and economic branches, so in agricultural geography a reader might anticipate that all these three aspects would be appropriately covered.