

edition has become available, this time in German. After an historical introduction, the mode of occurrence of the chemical elements in the earth's crust is passed in review, with special reference to their concentrated or dispersed distribution in the successive earth-shells, including that of the biosphere. The succeeding chapters deal in great detail with the geochemistry of manganese; with silicon and silicate minerals, including the parts played by compounds of aluminium and iron and the significance of the colloidal state; with the carbon cycle and the geochemical activities of living organisms; and finally with the distribution of the radioactive elements and their relation to lead and helium and the earth's thermal history. The book concludes with an excellent annotated bibliography and indexes of authors and subjects.

The author is to be congratulated on a work of fascinating interest, imbued throughout with the spirit of research, and touching everywhere on points of great importance to geology and chemistry that are generally passed over in more formal textbooks. As three other languages have already had their turn, we may perhaps be allowed to express the hope that when the fourth edition is prepared it may be published in English. Its welcome is already assured.

*American Mesozoic Mammalia.* By George Gaylord Simpson. (*Memoirs of the Peabody Museum of Yale University*, Vol. 3, Part 1.) (Published on the Othniel Charles Marsh Publication Fund.) Pp. xv + 235 (32 plates). (New Haven: Yale University Press; London: Oxford University Press, 1929.) 5 dollars.

THIS work forms a companion volume to the same author's monograph on the European Mesozoic mammals which was published in 1928 as a catalogue by the Trustees of the British Museum. In the present volume the author has rounded off his investigations by a description of the pre-Tertiary mammals of the American continent. While there are here no faunas at present known quite so early as the Rhætic and Middle Jurassic of the Old World, there are, on the other hand, at least a few places where Cretaceous mammal remains occur. A knowledge of what happened in this period is so essential to our understanding of the evolution of placental and marsupial lines, and the localities and their yield of specimens so scarce that the dozen genera of marsupials and three of placentals here catalogued by Dr. Simpson acquire considerable importance.

A large part of the general description of the six Mesozoic orders of mammals has already been given in the British Museum Catalogue, where also questions as to their reptilian origin and their inter-relationships are fully discussed. To this every reader of the present memoir will have to refer. The two works with their excellent plates and figures, and the sound and workmanlike treatment of the subject, form an admirable and useful treatise.

*Limestones: their Origins, Distribution and Uses.* By Dr. F. J. North. Pp. xxiii + 467. (London: Thomas Murby and Co.; New York: D. Van Nostrand Co., 1930.) 16s. net.

FEW people realise the importance of the part played by limestone in the economic life of the nation. It enters into nearly every phase of human industry, and on its varied uses Dr. North has written a most interesting and readable book. No aspect of the subject appears to have escaped his attention; he deals with the origin of limestones and their distribution in the various geological formations in such a manner as to make the book an excellent introduction to the science of geology, and it may be recommended confidently to the general reader who desires to know something of the history of the earth. The book is profusely illustrated, and to each chapter is appended a list of references which form a useful bibliography of the subject.

As evidence of the care taken by the author, the book is remarkably free from errors. One, however, may be pointed out. On page 242 it is stated that the lower part of the Speeton Clay "is of Jurassic age (corresponding to Portland and Purbeck Beds)". A similar mistake is to be found on page 185. There are no marine representatives of the Portland and Purbeck rocks in Yorkshire; the beds referred to by Dr. North are now placed in the Lower Cretaceous.

### Mathematics.

*Theory of Functionals and of Integral and Integro-Differential Equations.* By Prof. Vito Volterra. Edited by Prof. Luigi Fantappiè. Authorised translation by Miss M. Long. Pp. xiv + 226. (London, Glasgow and Bombay: Blackie and Son, Ltd., 1930.) 25s. net.

THIS translation of lectures, delivered in 1925 before the University of Madrid and since corrected and improved by the author, gives a concise survey of 'functionals', first studied by him in 1887 under the name of "functions depending on other functions", and later called "functions of lines". The first chapter gives definitions, properties of functionals, and operations performed on them. The second chapter treats of problems of the functional calculus and in particular of integral equations. Then follows a chapter on the extension of the concept 'analytic function' to functionals and, more particularly, extensions of the Riemann and Cauchy theories of conjugate functions in the  $xy$  plane to conjugate functions in space. The fourth chapter treats of the composition and permutability of functions, and leads to an extension of the concept 'power-series of a variable' to functionals. The fifth chapter deals with integro-differential equations and functional derivative equations and their relations to the Hamilton-Jacobi theory, the new quantum electro-dynamics, and Green's functions. The last chapter gives a summary of the applications of functionals to a variety of topics; in order to give some idea of the wide range of the subject matter of the lectures we