BOOK REVIEWS

MEDIAEVAL MINERALOGY

Book of Minerals

By Albertus Magnus. Translated by Dorothy Wyckoff. Pp. xlii + 309 + 2 plates. (Oxford: Clarendon Press; London: Oxford University Press, 1967.) 84*s*. net.

ALBERTUS MAGNUS, whose dates are usually given as 1206–1280, was the most learned man of his day, taking all knowledge for his province. He was a Dominican, and famous in his own time not only for his scholarship but for his piety. Even in his lifetime he became the centre of legend. In some quarters his knowledge of alchemy caused him to be regarded as a magician skilled in the black arts; by others he was looked upon as a saint who could perform miracles. As early as 1484, the date of his death (November 15) became officially recognized by the Pope as "Albert's Day", and in 1931 he was canonized.

Albert was a scholar through and through, and a devout follower, translator and commentator of the works of Aristotle, the shadow of whose doctrine extended over two millennia, effectively preventing true scientific advance based on observation and experiment. But yet in Albert's works there are many signs that, almost alone among mediaeval thinkers and writers, he was a shrewd observer of animal and mineral nature. His written treatises cover an enormous range, and even their sheer bulk is sufficiently impressive. The new Cologne edition of his works, for example, is in forty volumes, of which nine comprise his works on natural science. Most of these are based on works of Aristotle, in which case the original text is paraphrased and interwoven with expositions of Albert's own, or refutations of the opinions of earlier commentators. In the *Book of Minerals*, there was no basic text, which left more scope for development of his own ideas, though his model is still Aristotle, with his doctrine that concrete particulars obtained by direct observation of nature are often confused and difficult to understand and that science should apply itself to analysing these data in order to arrive at the underlying general principles or causes. And for Aristotle, and therefore for Albert, the four causes of minerals come under the headings "Material", "Efficient", "Formal" and "Final".

For the material cause, the composition of minerals, Albert had to juggle with the accepted four "elements", fire, air, water and earth. On this unpromising basis, Albert divides minerals into three groups—stones, which are mixtures of earth and water; metals, which are made up of sulphur and quicksilver, which are themselves mixtures; and intermediates, which have certain characteristics of both stones and metals.

For the efficient cause, or the processes by which minerals are made, Albert relies on the reactions of exhalations such as "dry smoke", or sulphur, and "moist vapour" or quicksilver, which are converted by a mineralizing power acting through the instruments of heat and cold. The formal cause is that which determines the nature of the mineral, and this formative power comes to us from the heavens through the influence of the planets and stars. Lastly, the final cause, which is concerned with why a thing exists, is not stressed by Albert, because inanimate mineral matter was not considered by Aristotle or by Albert to have a significant purpose of its own.

With such a scheme as this, an author cannot be expected to produce a work on mineralogy which has a recognizable affinity with any tract written on the same subject in the nineteenth or twentieth century. The sort of qualities of a mineral which we consider to be valuable indications of its nature and identity—texture, colour, hardness, cleavage, density—are here regarded as "accidental", not essential, and thus unimportant. Even crude figures for density, for example (and certain Arabs had by this time arrived at quite fair values, using Archimedes' principle), would have helped us greatly in identifying correctly the species with which Albert deals: but none at all is given.

The first book having dealt with the general properties of stones, the second concerns itself with precious stones and their powers, which, rather curiously, are considered in alphabetical order, from asbeston, admas, absinthus, agathes . . . to zemech (lapis lazuli) and zigrites (probably fabulous). There is a section ("tractate") on images and sigils in stones in which Albert shows a curious ignorance of the art of gem-cutting or cameo carving, and accepts so highly finished a work of art as the "Ptolemy" cameo as a product of nature.

The third book concerns "Metals in General", the fourth book deals with "Individual Metals", and the fifth book with "Minerals that seem to be intermediate between stones and metals".

The translation of the *Book of Minerals* itself takes up 250 pages of the present volume, and incorporates ample notes on the text and cross references to, for example, Albert's possible sources and other comparable works. In addition there are some twenty-five pages of introduction, sketching Albert's life and the circumstances in which the *Book of Minerals* was written; the book ends with some valuable appendices and an index.

The translator and editor, Dr Dorothy Wyckoff, was until recently professor of geology at Bryn Mawr College, and had spent many years in her study of the *Book of Minerals*. She is to be congratulated on a fine piece of scholarship, which will not only reward and delight students of mediaeval science, but will serve for others who are not familiar with the period as an accurate yet very readable introduction to those strange times, when superstition and learning were intimately mixed, when astrology was indistinguishable from astronomy, alchemy from chemistry, and hearsay from hard fact.

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FUNCTION THEORY APPLIED

New Methods for Solving Elliptic Equations

By I. N. Vekua. Translated from the Russian by D. E. Brown. Translation edited by A. B. Tayler. (North-Holland Series in Applied Mathematics and Mechanics, Vol. 1.) Pp. xii + 385. (Amsterdam: North-Holland Publishing Company; New York: John Wiley and Sons, Inc., 1967.) 100*s*.

THE original Russian edition of this book appeared in 1948, so that since then a knowledge of the methods used has had time to spread. Vekua himself published a very large number of papers in this field during the 1940s. Many of these papers related to plane problems in anisotropic elastic media, part of the notable contribution to the mathematical theory of elasticity made in recent years by Soviet scientists; much of Vekua's work shows the influence of Muskhelishvili. Related material has also been made available in Vekua's book on generalized analytic functions (1959; with an English translation, published by the Pergamon Press in 1962); this again gave many applications to elasticity.

The familiar simplification of many two-dimensional problems obtained by the use of a complex variable z can be widely generalized by a transformation $z = x + iy$, $\zeta = x - iy$, where if x and y are restricted to be real, ζ specializes to the conjugate of z. The differential operators associated with these variables permit an application of complex function-theory to the general representation of solutions of second order partial differ-