Book Reviews

Volcanoes: Windows into the Earth's Crust

Volcanoes and Their Activity. A. Rittmann. Translated by E. A. Vincent. Interscience (Wiley), New York, 1962. xiv + 305 pp. Illus. $11.95.

Volcanoes. In history, in theory, in eruption. Fred M. Bullard. University of Texas Press, Austin, 1962. xvi + 441 pp. Illus. $7.50.

The Orion Book of Volcanoes. Haroun Tazieff. Translated by Arthur Tannenbaum. Orion Press, New York, 1962. 104 pp. Illus. $6.95.

Volcanoes in Action. Science and legend. Lynn and Gray Poole. McGraw-Hill, New York, 1962. 79 pp. Illus. $3.

Volcanology is one of the oldest branches of geology; volcanoes provide our only means of studying igneous processes in action; volcanic rocks form a very large part of the geologic record; and ancient volcanoes are intimately related to many of the world's most important ore bodies, especially those of epithermal origin. Nevertheless, volcanology, as a university discipline, has been seriously neglected. The subject, by its dramatic qualities, invites popular and semipopular accounts, but authoritative, scientific presentations are pitifully few. Von Wolff's *Der Vulkanismus* is now almost 50 years old; Sapper's *Vulkankunde* (1927) was the descriptive work of an eminent geographer, with a host of other interests; and Cotton's *Volcanoes as Landscape Forms* (1944), though written by a foremost geomorphologist, contains little about the genesis and mechanisms of volcanoes. It is high time, therefore, that Rittmann's *Vulkane und ihre Tätigkeit*, first published in 1936 and enlarged in 1960, was made available to a wider audience, and this translation, by E. A. Vincent of Oxford University, is excellent. This is, without doubt, by far the best book ever written about volcanoes. It is a thoughtful and provocative study by one of the world's leading authorities, a skilled petrographer and careful field observer, gifted with a bold imagination. It is based almost entirely on Rittmann's own experience, mostly among the volcanoes of Italy and Iceland; had fortune given him the opportunity to travel still more widely, his book would have been even better.

Volcanoes and Their Activity is not "a textbook in which all the important facts are illustrated by examples, and in which all explanations which have been proposed are objectively presented"; it is essentially a summary of Rittmann's own ideas, with hardly a mention of the ideas of others. Therein, perhaps, lies its principal weakness. The advanced student will also regret that Rittmann did not provide a bibliography. And he will regret that more space was not devoted to such topics as the recent discoveries concerning submarine volcanism, the geophysical and geochemical aspects of volcanism, and the origin of calderas, ring complexes, and diatremes, as well as the variations in primary magmas which seem to be related to their depth of origin within the mantle.

The book embodies an extraordinary amount of information and ideas, expertly condensed. Rittmann discusses first the types of volcanic activity and the products of this activity and the forms, structures, and distribution of volcanoes; he then goes on to describe the relations between volcanism and tectonics, the physiochemical properties of the magmas that feed volcanoes, the origin and nature of volcanic reservoirs, and the mechanism of eruptions. Finally, in the last two chapters he presents his views on such highly controversial subjects as the ultimate causes of volcanism and mountain-building, the origin of the earth and its crust and of primary magmas, the hydrosphere and atmosphere, continents, meteorites, and lunar craters. These are weighty subjects, and although many readers will disagree with much of what he says, all should consider his opinions with respect.

Part of the book is descriptive, dealing as it must with the anatomy and products of volcanoes, but most of it is concerned with the genesis and classification of volcanoes and with an explanation of their varied behavior. It is a masterly account.

Just as Rittmann's is the best book on volcanology for advanced students, Bullard's *Volcanoes* is the best for laymen without any background in geology. It is, moreover, well adapted to serve as collateral reading in an introductory course in physical geology. The format is excellent. Bullard writes clearly and without condescension, and his text is greatly strengthened by more than 100 well-chosen illustrations and by a bibliography of 170 titles. But the enquiring reader is likely to feel that his narrative accounts of dramatic eruptions such as those of Mont Pelée and the Soufrière of St. Vincent in 1902, of Krakatoa in 1883, of Vesuvius in 79 A.D., and of Parícutin and Stromboli although fascinating, are too long, and that these accounts occupy a lot of space which might better have been used for fuller explanations. Bullard's classification of eruptive types, borrowed mainly from Lacroix and Mercalli, is much too simple; Rittmann's scheme, though cumbersome, is a marked improvement. Bullard's errors of omission are chiefly the same as those already noted in Rittmann's book, and Bullard places too much significance on supposed volcanic cycles. Strangely enough, he makes virtually no mention of the most voluminous of all volcanic eruptions—those that form ignimbrites by discharging glowing avalanches of siliceous ash and pumice from swarms of narrow fissures. Neither he nor Rittmann refer to the significant eruptions that took place in 1912 in Alaska's Valley of Ten Thousand Smokes, even though these provided the key to our understanding of the immense ignimbrite sheets that have since been recognized in many places throughout the world, among formations of every geologic age.

The dramatic aspects of volcanology are given even more space in *The Orion Book of Volcanoes*, which was

written for laymen by that intrepid explorer and photographer, Haroun Tazieff. As stated on the book's jacket, Tazieff is "probably the most daredevil geologist alive today." He is indeed a modern Empedocles, and he conveys to the reader much of the thrill, esthetic pleasure, and feeling of awe that he himself feels in watching volcanoes erupt. But his narrative is haphazard, more entertaining than instructive, more descriptive than analytical, and the translation does not read as smoothly as it should. There are 64 illustrations, most of them spectacular, including 12 color plates and several reproductions of old engravings; these constitute the most valuable part of the book. Unfortunately, however, the illustrations are not adequately described, and they bear no relation whatever to the adjacent text. Maps and diagrams are conspicuous by their absence.

Volcanoes in Action by Lynn and Gray Poole is intended for youngsters, aged 9 to 13. Among this audience, it will appeal more to those who like exciting stories than to those who look for answers; it dwells too much on accounts of dramatic eruptions and too little on their causes. The illustrations are excellent, but it should be noted that one is wrongly labeled an eruption of Mount Katmai (Alaska), a volcano which, contrary to many published accounts, did not erupt in 1912 and which has not been photographed in eruption since that date! Inaccurate statements and incorrect explanations mar the text. It is wrong, for example, to say that the famous eruption of Krakatoa in 1883 was a steam explosion caused by the heating of downward-seeping seawater, or to say that the glowing avalanches which raced down the Valley of Ten Thousand Smokes in 1912 were caused by fumaroles that "belched forth watery sand" which "trickled across the Valley floor." Bright youngsters will wonder if volcanoes can be simply divided into three types—the "explosive or blast-out" type, the "tame or oozing" type, and the "intermediate" type. And they may ask if volcanic formations built from falling bombs, cinders, and dust are called *cinder cones*, whereas other cones, "made of both cinders and lava flows, are known as *big cones*." They should not be misled by errors of this kind.

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IAEA Symposium, 1961

Tritium in the Physical and Biological Sciences. vols. 1 and 2. Proceedings of the Symposium on the Detection Use of Tritium in the Physical and Biological Sciences. International Atomic Energy Agency, Vienna, 1962 (order from National Agency for International Publications, New York). vol. 1, 369 pp., $7; vol. 2, 438 pp., $8. Paper. Illus.

These volumes suffer, like most symposia, from the common problem of late publication. Many of the papers presented at the symposium, which was held in early May 1961, have been presented, and in some cases published, elsewhere since and are therefore now well known. Exciting experiments, such as those by J. H. Taylor on the timing of DNA synthesis in the chromosome, have already been widely publicized. The value of this symposium, as in all cases of valuable symposia, is two-fold: (i) it brought together scientific personnel from diverse fields to discuss their own work and to hear about that of others, and (ii) publication of the volume places the papers in an unusual and valuable juxtaposition. In these volumes the relationship of the use, distribution, and counting techniques for tritium is related by the actual act of correlating the collection of papers with those on the biological uses and the biomedical effects of tritium. The advantages of such a symposium and of the subsequent publication of its papers are far too often overlooked. Growth of the physical and biological sciences, has at times, been inhibited by their increasingly artificial separation.

Two of the most interesting of the many papers presented at this symposium are (i) the study by Speirs and his associates and (ii) the study by Pelling. The Speirs paper reports the use of tritium to investigate inflammatory cells; the formation of plasma cells by inflammatory mononuclear cells and the migration of inflammatory cells back into the lymphatic and blood vascular systems as the inflammation subsides is discussed. In addition to these interesting findings, Speirs and his associates present most lucidly the techniques used for autoradiography and, in an appendix to their paper, a list of the difficulties commonly encountered in autoradiography as well as remedies for these difficulties. The study by Pelling is on DNA, RNA, and protein synthesis in the giant chromosomes of the midge, *Chironomus*. In this presentation Pelling demonstrates by the simultaneous use of tritiated uridine and thymidine that RNA and DNA synthesis may take place concurrently in the chromosome. Pelling searches for replicating chromosomes, and then, as an index of RNA synthesis, he examines the nucleolus and Balbiani rings which synthesize much more RNA than DNA and which are only slightly labeled with tritiated thymidine. In this work, as in much recent work, asynchronous DNA synthesis in the bands of the giant chromosomes is indicated.

The two volumes include many papers and subsequent discussions which are of interest to anyone now using or considering the use of tritium in physical or biological research.

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Vistas of Science Series

Challenge of the Universe. J. Allen Hynek and Norman D. Anderson. Scholastic Book Services, New York, 1962. 144 pp. Illus. Paper, $0.50.

This attractive, pocket-size paperback is one in the "Vistas of Science" series conceived by the National Science Teachers Association to present current and accurate scientific information to junior and senior high school students and to the general public. Facts and ideas are presented in a stimulating fashion: this is not just another book. For example: "It is virtually impossible . . . that our particular star should be the only one to have planets with physical and chemical conditions able to support life. It would be like saying that out of trillions and trillions of cats, only your pet cat has kittens."

Difficult topics, such as the celestial sphere, orbits, Kepler's laws, and relativity, are presented in easily understood language, and the three-dimensional illustrations by Helmut Wimmer are well done and most helpful. In the final section, "Projects and experiments," Norman Anderson describes building and using simplified versions of a theodolite, a sundial-shadow stick, a globe sundial, and a spectroscope. This section is the best thing of its