Book Reviews

A Voluminous Eruption

The Great Tolbachik Fissure Eruption. Geological and Geophysical Data 1975–1976. S. A. FEDOTOV and YE. K. MARKHININ, Eds. Cambridge University Press, New York, 1983. xii, 341 pp., illus. $69.95. Cambridge Earth Science Series. Translated from the Russian edition (Moscow, 1978) by the Cambridge Arctic Shelf Programme translation team.

The most voluminous eruption of basaltic lava and tephra since the 1783–84 eruption of Lakagigar, Iceland, took place in Kamchatka, U.S.S.R., between 6 July 1975 and 10 December 1976. About 2 cubic kilometers of material (more than four times the volume of the largest historic eruption of Mauna Loa) were erupted from two major vent areas in the Tolbachik regional zone of cinder cones, a fissure system extending more than 38 kilometers south-southwest of Ploskiy Tolbachik volcano. The initial activity—from the northern breakthrough about 17.5 kilometers south of Ploskiy Tolbachik, which itself had been erupting tephra mildly since 28 June—was correctly predicted several days in advance on the basis of seismic studies. The prediction enabled the early establishment of monitoring networks that formed the nucleus for intensive geologic, geodetic, and geochemical studies conducted throughout the eruption. Activity at the northern breakthrough was unusually violent for a basaltic eruption, generating a tephra-laden column 8 to 13 kilometers high that persisted throughout the development of three large cinder cones as well as voluminous flows. This activity continued until mid-September 1975, when the locus of eruption shifted about 12 kilometers southward to the southern breakthrough, where it continued until the end of the eruption. The shift was preceded by collapse of the summit of Ploskiy Tolbachik, a month-long event culminating in the second half of August with a caldera 1.7 kilometers in diameter, 0.5 kilometer in depth, and 0.3 cubic kilometer in volume. This is less than half the volume of the later eruption products, so that even if all the magma withdrawn from Ploskiy Tolbachik had been erupted additional magma either stored within the fissure system or supplied from depth was involved. Most of the lava erupted from the northern breakthrough is relatively mafic basalt, and most from the southern breakthrough is relatively alkaline high-alumina basalt. Small volumes of lava of intermediate compositions were erupted just before and just after the shift in vent locations and are interpreted to reflect mixing of relatively mafic magma supplied from depths of perhaps 30 kilometers with relatively alkalic magma withdrawn from Ploskiy Tolbachik. This interpretation is supported by seismic data, which show focal depths of as much as 30 kilometers before the eruption from the northern breakthrough and generally less than 5 kilometers before the activity in the southern breakthrough. In addition, earthquakes were distributed between Ploskiy Tolbachik and the site of the southern breakthrough during the shift in vent locations, seemingly tracing the lateral movement of magma. The general similarity of this behavior to that of Kilauea is remarkable, especially when the vastly different tectonic settings—above a subduction zone for Ploskiy Tolbachik and in the interior of a plate for Kilauea—are considered.

As a consequence of cold war politics, the Kamchatka volcanic area is closed to Western scientists. Most of us who cannot read Russian or who have not spoken directly with Soviet colleagues know little about this remarkable eruption. No book can take the place of direct field observations, but the one under review goes a long way toward making the great Tolbachik fissure eruption an integral part of Western volcanologic literature. The book consists of 25 separate papers dealing with many different aspects of the eruption, from the regional geologic setting to chronologies of many events to detailed analyses of volcanic tremor and gases. An additional paper traces the development of the Kamchatka Volcanological Station, one of the leading volcano observatories in the world. The collection of papers gives a comprehensive overview of the eruption, although the absence of a large-scale map showing all place names makes some sections hard to follow (page-size maps are abundant). I think that a necessary complement to the book is the 1976 paper by Fedotov, Khrenov, and Chirkov (*Dok. Acad. Sci. USSR, Earth Sci. Sect.* **228** 1193), which traces the course of events at the northern breakthrough much more thoroughly than is done in the book. The book is well illustrated, particularly with regard to line drawings, and the translation is adequate, although synonyms or even approximations are used for some technical terms used only by specialists. Inevitably, *The Great Tolbachik Fissure Eruption* will be compared with the U.S. Geological Survey's Professional Paper 1250, which deals with the eruption of Mount St. Helens. Both provide a wealth of information about an important volcanic event, have broad but somewhat uneven coverage, contain differences of opinion (perhaps less obvious in the Tolbachik book), and should be owned by every volcanologist.

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Quantum Biology

Structure and Dynamics. Nucleic Acids and Proteins. ENRICO CLEMENTI and RAMASWAMY H. SARMA, Eds. Adenine Press, Guilderland, N.Y., 1983. xii, 488 pp., illus. $49. From a symposium, La Jolla, Calif., Sept. 1982.

This collection of papers from a meeting of the International Society of Quantum Biology attempts to bring together theory and experiment in elucidating the nature of structure and dynamics in biopolymers. Some authors also try to reconcile experimental results with theoretical calculations designed to illuminate the origin of the experimental phenomena. Although not all aspects of the subject are covered in the volume, several interesting topics are discussed.

The editors have ordered the papers so that the subject is developed more logically than in most proceedings. Conceptual and didactic material is included as well as the latest calculations and experimental results.

The book is divided into three parts. In the first part the physical bases (often couched in mathematical terms) of molecular structure and dynamics are developed; in the second part the structure and dynamics of nucleic acids are explored experimentally and theoretically, with an emphasis on theory; and in the third part the structure and dynamics of proteins are examined theoretically and experimentally.