

groups of carcinogens are waiting to be discovered and should give fresh impetus to the study of the variety of chemical carcinogens.

Most cancer research workers will wish to have access to this volume, for it contains up-to-date accounts of many important aspects of carcinogenesis, of which only a few have been mentioned in this review. It is well produced and free from errors.

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## Geology of the Solar System

**Mantles of the Earth and Terrestrial Planets.** A NATO Advanced Study Institute, Newcastle upon Tyne, England, March–April 1966. S. K. RUNCORN, Ed. Interscience (Wiley), New York, 1967. xii + 584 pp., illus. \$25.

This is an unusually good interdisciplinary book which contains the 50 papers (unfortunately a few of them only in abstract form) presented at a conference held two years ago at the University of Newcastle upon Tyne. The many fields discussed are progressing so rapidly today that one reads the book with a sense of history in the making, and occasionally with excitement.

Perhaps the best way to review the book is to summarize some of the conclusions of several authors whose papers seem of unusual interest. In the first of the nine sections the authors have concentrated on the early history of the solar system. Cooling rates of the parent bodies of the meteorites range from about 1° to 40°C every 10<sup>6</sup> years, indicating diameters of 60 to 200 kilometers for the slower-cooling objects and perhaps 30 to 60 kilometers for the faster.

The authors conclude that meteorites did result from the breaking up of several bodies of asteroidal size. Wilkins appears to have resolved a disturbing problem when he found that Phobos does not show the previously suggested acceleration which has led to so many weird interpretations. Bullen's paper on internal density distribution in the terrestrial planets is concise and valuable.

The section Physical Evidence for Non-Hydrostatic Conditions in the Planets is very important. Neither the earth nor the moon is in hydrostatic equilibrium. Anderle's paper, in particular, discusses the reduction of observa-

tions of satellites by worldwide networks of Baker-Nunn cameras and Doppler tracking stations, and he offers a geoid height map which demands interpretation. Runcorn and Gray, using new data from the Aeronautical Chart and Information Center, have confirmed earlier demonstrations that the moon does possess a bulge aligned with the earth. Runcorn's interpretation is that the moon possesses a convection pattern of the second degree.

In the last few years improved radar observations of the planets have been made, and one section covers this fascinating subject. Mercury has been shown to rotate in about 58.65 days and Venus to rotate in a retrograde fashion in about 247±5 days. A very important detailed paper, "Theory of the axial rotations of Mercury and Venus," is presented by Bellomo, Colombo, and Shapiro.

Years ago H. N. Russell commented that the moon might be an optical illusion because no one could determine how it was formed. Section 6 contains six papers concerned with the problem of lunar origin. In general, the theories presented are not compatible, but they nevertheless are important because of the limiting conditions they give to the solution of this important problem.

Sections 8 and 9 are in many ways the heart of this volume. In them are papers which seem clearly to indicate that the continents have moved over the surface of the earth throughout geologic time and that the cause of such motions is convection in the mantle. Evidence has now been accumulated which points so strongly in this direction that most, though not all, scientists in these fields have accepted the basic model of a convecting mantle. Details of the model and the history of continental drift are still hotly debated, as the papers of Hospers and Creer show. Girdler's discussion of the world rift system and Coode's spherical harmonic analysis of major tectonic features tie in well with the convecting model.

It is clear from the papers in this volume that this is a very young field of study, and one in a period of flux. The importance of a conference such as this one is that it brings together in one place the accumulated knowledge of a field of investigation. The proceedings volume is a status report from which the specialist and nonspecialist may profit.

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## Arctic Explorations

**The Greenland Ice Cap.** BØRGE FRISTRUP. Translated from the Danish edition (1963) by David Stoner. University of Washington Press, Seattle, 1967. 312 pp., illus. \$20.

This is an informative, readable, and splendidly illustrated book on the world's second-largest and best-known ice sheet; it should do much to bring some of the mysteries and delights of Greenland to the notice of the layman. The English book is a slightly expanded version of that which appeared in Danish in 1963, and it incorporates some more recent material. After an introductory section which includes a description of Greenland and the character of its ice sheet, Fristrup devotes the greater part of the book to the history of exploration and research. There are chapters on five major periods of discovery, followed by about a hundred pages on expeditions and investigations since 1940. Considerable space is devoted to American research on the ice sheet, much of it prompted by strategic interests. The work of the International Glaciological Expedition is also described in some detail. The last part of the book is devoted to a systematic survey of the glaciology of the ice sheet, with chapters on its climate, thickness, age, and regimen. There is a comprehensive index, an adequate bibliography, and a useful chronological list of expeditions and major scientific discoveries on the ice sheet.

The text is always interesting and easy to follow, and Fristrup does not deviate from his topic for a moment. There are, however, several irritating pieces of repetition (some of them on the same page), and there is an occasional lack of balance in the treatment of individual expeditions in the first part of the book. The quality of the photographs cannot compare with those in Ernst Hofer's *Arctic Riviera*, but many of them (especially those in color) are very beautiful. They give an exciting insight into life and landscape on the Greenland ice sheet. The photographs are, however, too profuse; several of them would have been better omitted. For example, it is a pity that the fine color prints on pages 111 and 233 should have almost identical black-and-white equivalents on pages 226 and 290, respectively. Throughout the book there is an almost complete lack of coordination between text and illustrative material. This is most marked in the case of maps and diagrams. These are informative and well drawn, but their