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.

DAVID B. CLAYSON
Algernon Firth Institute of Pathology, University of Leeds, Leeds, England

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 10^6 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 observations 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.

RALPH B. BALDWIN
Oliver Machinery Company, Grand Rapids, Michigan

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

value is lost because they are never referred to and because they appear to have been scattered at random throughout the text. Surely it would not have been too difficult to locate these alongside the relevant paragraphs. Again, the value of the photographs would have been much increased if they had been incorporated into the text with a little more imagination. Why, for example, are the chapters on the heroic days of exploration before 1920 illustrated by photographs of technological devices such as tractor convoys and helicopters?

But these are small criticisms when set against the superb appearance of the book and the simple yet authoritative tone of Fristrup's text. There is a great deal to absorb the attention of both the scientist and the layman in this, "the first book to describe the exploration of the ice cap in Greenland." Not least, there will be many who will appreciate his succinct summaries of past and present glaciological thought in the last 80 pages of the book.

B. S. JOHN
Department of Geography,
University of Durham,
Durham, England

Fish Paleontology

Fossil Vertebrates. Papers Presented to Dr. Errol I. White. COLIN PATTERSON and P. H. GREENWOOD, Eds. Published for the Linnaean Society by Academic Press, New York, 1967. viii + 260 pp., illus. $11.50. *Journal of the Linnean Society of London (Zoology)*, vol. 47, No. 311.

This festschrift, presented to Errol I. White on the occasion of his retirement from the keepership of the Paleontology Department, British Museum (Natural History), should be very useful as a general summary of the paleontology of fishes up to the date of its publication. Only three of the papers do not concern fishes, and the volume presents, in addition to the latest ideas of specialists, an up-to-date bibliography aggregating about 200 entries, as well as White's own bibliography of 116 entries.

The abundant illustrations are of uniformly high quality. They are especially useful to workers who, like the reviewer, retain an interest in the "funny fishes" but who often have difficulty in remembering which are which; the illustrations help one keep track of the various Paleozoic "fish" both for teaching purposes and for general orientation.

The hazards of diffuseness and variety of style chronic to festschriften leave their mark on this volume also, because of the number of authors or pairs of authors (19) and the number of points of view (19). However, what emerges most clearly is an impression of dynamic progress in fish paleontology since World War II.

NICHOLAS HOTTON
Division of Vertebrate Paleontology,
Smithsonian Institution,
Washington, D.C.

Progress Reports in Genetics

Cold Spring Harbor Symposia on Quantitative Biology. Vol. 31, The Genetic Code. Cold Spring Harbor Laboratory of Quantitative Biology, Cold Spring Harbor, N.Y., 1966. xxii + 762 pp., illus. $15.

This book contains the written versions of the talks delivered at the 31st Cold Spring Harbor Symposium, held in June 1966. Considering the progress made in our understanding of the genetic code since 1961 (when it was discovered that polyuridylate specified polyphenylalanine in an in vitro system), "it seemed," says the foreword, "to be the right moment to hold a meeting and draw together, once and for all [*sic*], the many contributions to this solution"—referring to the fact that, in 1966, it was possible to show, as Crick does on page 1 of the volume, the "best allocations" of the 64 possible triplet codons in *Escherichia coli*. "Progress," in the sense of "many contributions," is certainly indicated by the 87 papers (with an average of 3 or 4 authors on each). But the designation of a "right moment" to "draw together" reports on such a heterogeneity of independent ongoing research enterprises may be regarded as enthusiastic poetic license, although seconded by Crick's statement—in the only essay attempting a historical survey (1944–196?)—that "this . . . is the first important [meeting about the genetic code] since the code became known."

The contents of the book, as of the meeting, may be regarded as progress reports from each of the many laboratories represented by the authors, and —as with the meeting itself—will be of (already somewhat dated) value to those actively engaged in research in the field. The 87 papers are grouped into 12 sections (Codons In Vitro; Directions of Reading; In Vivo Code and Polarity; Polarity; Punctuation; Control of Gene Expression; Chemistry, Function, and Interactions of tRNA; tRNA and Ribosomes; Infidelity of Information Transfer; Origins of the Code), and none of these is individually summarized. Some of the individual papers include summaries; many do not. Most are concerned with the most intimate details of experimental procedures, few with anything approaching wide-ranging discussion or speculation. In sum, the book is a source of experimental detail and of references for those already active in fields represented; it is not a book to be read sequentially or completely, nor one that will give the uninitiated a broad view of this or of any large area of contemporary molecular biology.

The expression of individual egos and lack of cohesion that characterize the literature are apparent here as well. Cross-references to pertinent work of others tend to be brief and pro forma, not searching or synthetic. Heterogeneity is furthered by rugged independence in such matters as terminology and symbolism (relatively unhindered, probably because of the physical impossibility of bringing editorial pressure to bear upon such a diversity of authors within the time allotted for preparation of the volume).

Although the volume has some reference value to the cognoscenti as noted above, the delay and expense of producing it give rise to serious questions as to the value of the effort, and to the thought that—as with the highly regarded Gordon Conferences—perhaps "work conferences" limited to those active in the field (about 300 attended the symposium, overall) are best either not reported at all or reported by a single person in a few pages rather than by simply binding together individual papers, each constructed at the home laboratory and not necessarily giving the content, the flavor, or the significance of the actual oral presentation. Added to these concerns is the thought that, with the rapidity of progress in this large area, such reports as are included in this volume are almost like news or like radioisotopes, of temporary rather than lasting value, and should perhaps, as was semi-seriously suggested for a similar compendium, be printed in vanishing ink with a well-chosen half-life, and with little attention to the details that attend an archival destiny.

W. E. COHN
Biology Division,
Oak Ridge National Laboratory,
Oak Ridge, Tennessee