Recent Advances in Group Theory and Their Application to Spectroscopy. John C. Donini, ed. NATO Advanced Study Institutes, Series B: Physics, 43. 692 pp. Plenum, 1979. $59.50.

This proceedings volume suffers from an unevenness in style and quality. Some articles are very clearly written, some are totally unintelligible, and some are even wrong. The articles by Butler, König, and Kremer belong to the first category. They are very well written, self-contained, and illuminating. Among those in the second category, I would mention the essay by Kibler. As an example of papers in the third category I would cite Hollebone's, which is full of vague and sometimes incorrect statements. For instance, on page 623, one reads, "in which the time reversal operators (sometimes called isospin operators in describing nuclear wave functions) are defined." Only the author knows what isospin has to do with time reversal! I would also mention another difficulty that plagues this field, which is evident in this book: the plethora of notations, choices, and conventions. Could not the authors have agreed on a common notation?

The book achieves its purpose of presenting the latest developments in the application of group theory to chemistry. For this reason it will be of interest to researchers working in the field; researchers in other areas, however, will only be confused by it. To them I would suggest waiting for the publication of Butler's forthcoming book, *Point Group Symmetry Applications, Methods and Tables,* which, judging from its author's brief account of it in this book, promises to be very good.—*Franco Iachello, Physics, Yale University*

Statistical Mechanics and the Foundations of Thermodynamics. A. Martin-Löf. Lecture Notes in Physics, 101. 120 pp. Springer-Verlag, 1979. $9 paper.

This monograph presents an introduction to statistical mechanics and its relation to equilibrium thermodynamics and fluctuation theory. The author's purpose is to bridge the gap between the standard treatment of this subject in the usual physics texts and the so-called rigorous approach to statistical mechanics.

The basic idea is to consider the state variables of the microscopic subsystems, defining a thermodynamical system, as random variables whose distribution depends on a small number of parameters, namely the thermodynamical parameters. It is then the goal of this book to show that in the thermodynamic limit the average values of macroscopic observables such as E/V, N/V, ... have a very sharp distribution, to obtain the relations between these average values, and to describe their fluctuations. This program is achieved by the introduction into statistical mechanics of an "entropy function" associated with macroscopic observables and by proving that this function has all the properties required by the principles of thermodynamics.

These derivations are very technical and are conducted with the mathematical care required for rigorous results. However, the author also takes time to illustrate the results obtained by means of elementary examples. I appreciate this very much in a field where concrete examples are often considered unnecessary in a discussion of mathematical theorems. In particular, the equation of state of a gas in an external field, the law of mass-action, the osmotic pressure, and the discussion of work, heat, and Carnot cycles are typical chapters of classical thermodynamics which one wants to understand from a microscopic approach and which are discussed as applications of general results. Another interesting point that follows from the discussion of the entropy function is the fact that it is the sign of the temperature.

The presentation of this work will appeal first to those who are mathematically inclined and who will appreciate this rigorous derivation of thermodynamics from the principles of statistical mechanics. On the other hand, there are enough applications to make these lectures of interest also to anyone concerned with the physical aspects of the foundation of thermodynamics.—*Ch. Gruber, Physics, Ecole Polytechnique Fédérale de Lausanne, Switzerland*

Earth Sciences

Saharan Dust: Mobilization, Transport, Deposition. Christer Morales, ed. SCOPE 14. 297 pp. Wiley, 1979. $33 paper.

We have known of the mobilization of large quantities of dust from the Sahara and its transport out to sea for a very long time. The perils of sandstorms are enthroned in the classical literature. Darwin encountered Saharan dust on the voyage of the *Beagle,* and duly collected it and sent samples back to a Viennese microscopist for examination. Yet systematic study of the phenomenon is virtually a matter of the last few decades.

Given the novelty of the subject, it is not surprising that a workshop specifically on Saharan dust was convened in April 1977; this volume presents the bulk of the papers, as well as the usual summary and recommendations for further research that comprise the inevitable outcome of the workshop format. The organization is logical: a general description of the problem is followed by discussions of mobilization, transport, and deposition. Monitoring is considered as a special case of deposition. There is a modest, somewhat incomplete index. The number of typographical errors appears to be about what is expected in such a volume: significantly larger than zero, with few that actually inhibit understanding the authors' intent.

It is my impression that the two goals of the publication were the dissemination to immediate colleagues of the small body of existing knowledge on the subject and the stimulation of financial support for continued work. If there was any intent to produce a monograph for general consumption, even within the appropriate sectors of the scientific community, it is not in evidence; to cite one trivial example, a great deal of geography is discussed without the inclusion of a single overall map locating the regions of interest by name. There is no concession in vocabulary to the nonspecialist reader. I suspect that the first objective is reasonably well served, while the success of the second can only be evaluated in about a decade's time.

The volume, then, can be best described as an excellent first attempt. Perhaps it is too soon to expect the sort of larger syntheses that I would hope might emerge in due time. For example, there is some evidence that the transatlantic transport of Saharan dust has played a significant role in the building of a number of islands, a process that appears to require continuity in source strength for some millions of years. However, conventional wisdom holds that during the years surrounding the beginning of the Christian era much of the Sahara was vegetated. Is our traditional understanding in error? Is it correct, but representative of an abnormal and temporary climatic aberration? Most important, is the continued transport of Saharan dust to these islands as vital to their stability as the floods of the Nile are to the productivity of the Nile Valley, so that a major effort to push back the desert will be as detrimental to their habitability as the Aswân Dam is to Egypt?

It is apparently not time to answer these questions; perhaps it is not even time to advance them seriously. The present volume marks a beginning, nothing more. It can only be hoped that its success is sufficient to ensure that the final answers will be provided in time.—*James P. Lodge, Consultant in Atmospheric Chemistry, Boulder, CO*

Origin of the Earth and Moon. A. E. Ringwood. 295 pp. Springer-Verlag, 1979. $24.80.

As awesome as our ancestors must have found the Biblical explanation of the Earth's origin, few are likely to have im-

agined anything as spectacular as the scenario for the formation of the Earth and moon described here. The author envisions the Earth accreting from a collection of objects ranging in size from dust particles up to small planets 1,000 km in radius. As the protoearth and its gravitational field grew, so too did the kinetic energy of the incoming objects and the violence of their impacts with the growing Earth. Vaporization of the volatile constituents of the incoming bodies during these impacts led to the growth of a massive primitive atmosphere that interacted with accreting material.

As the Earth neared its present size, melting of an Fe-O-(S) alloy began at depths of 1,500 km or greater, initiating a runaway growth of the core and violent convective overturn of the earth's interior. The gravitational potential energy released as the Fe-O-(S) melt fell toward the center of the Earth raised the temperature of the mantle by up to 2,000° or more. Although the bulk of the Earth's interior remained solid, the outer 400 km or so was molten—a gigantic globe-encircling ocean of liquid silicates, with a surface temperature near 2,000°C.

Impacts of accreting planetesimals into the magma ocean led to vaporization of portions of the magma ocean. As the vapor moved away from the Earth, perhaps aided by a strong early magnetic field, it began to condense. The moon accreted from this condensed material; thus, the moon was essentially blasted from the Earth's magma ocean by impacts in the later stages of accretion after the core had formed.

How one approaches problems as complex and essentially insoluble in their details as the origin of the Earth and moon may be largely a matter of personal taste. Does one build specific models based on detailed observations of those bodies and generalize about planetary formation from these specifics or start with a general model of planet formation and test and modify it with details from the study of individual planets? Ringwood's approach is decidedly nearer the former extreme. He sets forth in detail what he considers to be the boundary conditions that geological, geochemical, and geophysical study have yielded. He then develops what he believes to be an internally consistent model that will satisfy these details.

This model has weaknesses, however: his interpretations and translations of the data into meaningful boundary conditions are highly controversial, and insofar as they can be undermined so too can his model. Nevertheless, the models provide a point of reference—something to test, modify, and, as with most models of this sort, probably ultimately reject—and raise questions that have not previously been raised.—*Edward Stolper, Geological and Planetary Sciences, California Institute of Technology*

Rocks and Rock Minerals. Richard V. Dietrich and Brian J. Skinner. 319 pp. Wiley, 1979. $11.95.

In the venerable series started by Louis V. Pirrson in 1908 and continued by Adolph Knopf in 1946, the early editions were widely used and it was clear that a major revision was long overdue. This new version brings the text up to date, yet presents information in a format that is easy to use either as a text or a reference. A manual of petrology, according to Pirrson, should be designed for use without sophisticated laboratory equipment. Every properly trained geologist should be able to identify rocks in the field, armed only with a hand lens and pen knife. Unfortunately, this seems to be a dying art, as more and more students can no longer identify rocks outside the classroom. The book attempts to remedy this and is tailored for courses where hand specimen petrography is taught and thin sections are only mentioned to illustrate points in theoretical petrology.

The first third of the book is devoted to the rock-forming minerals—their properties and simple tests, the principal silicates and their structural classification, and the most important nonsilicates. The rock sections do not have any "hardrock" bias: sedimentary rocks (30% of the rock sections) receive almost as much treatment as igneous (35%). The metamorphic rocks are adequately covered (21%), and a section on other and pseudo-rocks (13%) includes rocks altered by hydrothermal or weathering processes. The book is liberally illustrated with photos, diagrams, and tables; references and important geographic occurrences are given for all principal rock types.

Some usages in the book will upset a few people, such as "contactite" for rocks formed by contact metamorphism, but these are few and do not detract from its general usefulness. The authors have successfully followed Pirrson's 1908 dictum, to produce a reference "for the geologist, engineer, miner, architect, etc. and for instruction in colleges and schools."—*Norman Herz, Geology, University of Georgia*

Origin and Distribution of the Elements. L. H. Ahrens, ed. Physics and Chemistry of the Earth, 2. 909 pp. Pergamon Press, 1979. $80.

This collection of 79 papers from an international symposium (Paris, 1977) is divided into 9 sections, ranging all the way from cosmochemistry (8 papers and a solar abundance table) to geochemistry and health (6 papers). The largest section consists of 17 papers on the geochemistry of the oceanic and continental crusts. Although the authors are from 18 different countries, the papers are mainly in English; 11 are in French and one in German, with English abstracts.

I find it hard to say anything good about the book, which is truly a smorgasbord. Hardly any of the papers, even within a section, are related to each other except in a very general way. Only 4 of the 79 papers can be described as reviews that summarize significant developments since a similar conference 10 years earlier. Very few papers struck me as breaking new ground.

I cannot, therefore, recommend the book as one that every geochemist should have within reach. Libraries will have a copy for the two or three papers that might be of use to an individual scientist.—*Arthur H. Brownlow, Geology, Boston University*

Agrometeorology. J. Seemann, Y. I. Chirkov, J. Lomas, B. Primault. 324 pp. Springer-Verlag, 1979. $53.90.

This book was prepared at the behest of the Commission for Agricultural Meteorology of the World Meteorological Organization to provide an introduction to current problems of agrometeorology. It was written not as a textbook or a handbook, but as "a series of accounts,