controversy, and to avoid the idiocy of treating opinions on policy as evidence of security risk by shifting to "defects of character," documented in the specularly trivial examples cited by the AEC majority opinion.

Revisiting the affair through Stern's book suggests that the Oppenheimer case poses a true dilemma. There will be occasions again when prudence will dictate some serious screening of highly placed government personnel. And again there may be no way of controlling the paranoia of a loyalty-security quest once it is institutionalized. Eisenhower, Hoover, Strauss, Nichols, Gray, and Borden were not evil or incompetent men. Yet their performance in the Oppenheimer case has left an unnerving record of self-righteousness, insensitivity, and provincialism that should remain a matter of permanent interest and study for students of government.

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Data for Earth Scientists

Handbook of Geochemistry. K. H. WEDEPOHL, executive editor. C. W. Correns, D. M. Shaw, K. K. Turekian, and J. Zemann, editorial board. Springer-Verlag, New York, 1969. Vol. 1, xvi + 444 pp., illus.; vol. 2, part 1, unpaged, illus., in loose-leaf binder. $56.

The literature of environmental science now doubles every five or so years, and the retrieval time of important data can be long. As a remedy to this situation, Wedepohl has assembled a group of about 70 collaborators to extract the existing data of geochemistry from the publications of science. Each chemical element has been accorded a chapter, with the exceptions of the noble gases, platinum metals, and lanthanides, which are treated as groups, and of some short-lived members of the natural radioactive series which will not be considered at all. The following characteristics of the chemical elements in naturally occurring substances are treated: crystal chemistry; isotopic chemistry; behavior in igneous, metamorphic, and sedimentary processes; abundance in extraterrestrial materials, minerals, rocks, the atmosphere, and natural waters; biogeochemistry; and economics.

The first installment appears in volume 2, in which 22 elements are presented. Nearly all the chapters have sections missing; additions will be issued at yearly intervals. A loose-leaf format allows for ready insertion of supplementary pages. Many of the data are set forth in tables and graphs. The use of the narrative style in the chapters also permits critical presentation, and some of the authors perform a most needed service in evaluating and interpreting the material in their sections.

The volume is going to be much used and perhaps will have an impact upon the community of earth scientists similar to that of *Data of Geochemistry* by Frank W. Clarke. The contributors have been appropriately chosen. The magnitude of the venture tends to dwarf the typical inadequacies of the many-authored volume: the unevenness in writing, often resulting from some contributors' using languages other than their native tongues; the time delays of publication (the article on rhenium was received in October 1965); the omissions, errors, and misprints. One hopes that users will point out amendable parts to the executive editor.

Volume 1 contains, according to Wedepohl, the fundamental facts of geochemistry, geophysics, and cosmochemistry. Its 12 chapters by 11 authors cover such topics as crystal chemistry, thermodynamics, meteorite composition, cosmic abundances, geophysics, composition and abundance of different types of rocks, the atmosphere and hydrosphere, and data evaluation. The permanent binding suggests that this volume is expected to survive the results of future investigations more successfully than its loose-leaf counterpart. Its contents indicate that this may not be the case, however. The chapter on geophysics would be markedly enhanced with addition of the recent studies of plate tectonics, magnetic reversals, and sea floor spreading. The chapters on sedimentary rocks and extraterrestrial materials will be in need of alterations as the results of the present intensive studies of deep-sea drillings and of moon samples are published.

There are some curious omissions. The volume lacks chapters on geochronology, stable-isotope geochemistry, and organic geochemistry, clearly most active and basic parts of the discipline.

Most of the chapters reflect the high degree of competence of their authors, yet their utility for reference or as class texts suffers from their brevity. For example, the chapters on crystal chemistry and thermodynamics contain 24 and 40 pages respectively. Although this book may have been conceived as a basic reference in geochemistry, the end result is a rather unsatisfying collection of overly digested material.

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The 1964–65 Solar Minimum

Solar-Terrestrial Physics: Solar Aspects. Proceedings of a Joint IQSY/COSPAR Symposium, London, July 1967, Part 1. A. C. STRICKLAND, Ed. M.I.T. Press, Cambridge, Mass., 1969. x + 414 pp., illus. $19.50. Annals of the IQSY, vol. 4.

Solar-terrestrial physics, a discipline that not long ago consisted principally of studies of sunspot numbers and of sea-level geophysical phenomena, now has matured to encompass all the phenomena relating sun and earth. The circumstance that has brought this about is, of course, the possibility of spacecraft-based *in situ* measurement of the many parameters of the interplanetary medium. That possibility has been exploited in two major undertakings: the International Geophysical Year, devoted to investigation of solar activity in general, and, more recently, the International Years of the Quiet Sun, specializing in the phenomena of the one solar minimum that has occurred since such observations could be made.

This book is one of seven volumes planned by the IQSY Committee to chronicle the initial results of the many scientific investigations of that 1964–65 minimum. It is one of two on solar-terrestrial relations which, along with another devoted to the first widely studied prototype particle flare of the new cycle, that of 7 July 1966, form the scientific-analysis complement. The other volumes are concerned with measurement techniques, list the activity, and catalog the available data and the relevant publications.

In this volume we have 25 papers by an impressive array of the experts. There are several articles each on solar activity, interplanetary space, cosmic rays, the radiation belts, and the aurora and airglow. There is no doubt that anyone concerned with these subjects will find the book useful for some time,

particularly in conjunction with the companion volumes. In spite of any resemblance to the sort of symposium proceedings that can be characterized by rapid obsolescence, this book is not only a review of a historically completed event (of a type which, by definition, cannot be repeated for several years) but is also a summary of phenomena so new and undigested that meaningful inferences and new research ideas may yet result from their further examination.

The distinction is not made in the text, but I shall separate the papers into lengthier reviews and briefer commentaries or topical notes. The first review, by H. W. Dodson and E. R. Hedeman, sets the stage with a detailed discussion of the 1964–65 history of solar activity in the traditional terms of sunspots, plages, flares, and related phenomena. In particular, the development of major centers of activity is followed, and their phenomenology with regard to solar coordinates and the locations of earlier centers is thoroughly presented. This basic study is followed by an informative introduction to solar soft x-ray emission (H. Friedman) and by several classic reviews. One on the solar wind (E. R. Mustel) discusses interplanetary streamers, illuminating the distinction between the R disturbances from active regions and the long-lived M disturbances; one on magnetic fields and plasmas (N. F. Ness) details the measurements and presents a comprehensive picture of the macro- and microstructure of the interplanetary medium.

Papers on cosmic rays review experimental results from sea-level neutron and meson monitors (H. Carmichael) and from space vehicles (F. B. McDonald), and the theory of time variations (L. I. Dorman) follows. In the first one (notwithstanding a mislabeling in figure 7 of the 23 September decrease, found by U. Desai), the ramifications of ground-based synoptic observations are rigorously reviewed. The results are illuminating (it would take extreme confidence to trust one's results with time-varying corrections of over ten times the amplitude of the sought-after effect). The next outlines the advances in the study of low-energy galactic and solar cosmic rays made possible by the continuous time coverage and the great sensitivity to low-energy particle populations that have been attained by spacecraft. A variety of non-flare solar particle emissions that occurred during or near solar minimum are also mentioned. This paper and a companion note discussing solar modulation of cosmic rays (W. R. Webber) both mention the improvement resulting from the use of the *Ap* index (which is directly related to the solar wind and to the interplanetary field), rather than sunspot number, as a coordinate for the description of particle behavior in the solar cycle. The third review, of time variations, is extensive, but one gets the feeling that it is unnecessarily out of date in the choice of parameters it seeks to explain.

In the next review, S. N. Vernov optimistically predicts that the entire problem of the trapped radiation zones will be solved in the very near future. Although the optimism may be unwarranted, the article seems valuable. In a related note, C. E. McIlwain presents the counterpoint that most theories may be speculations having little correspondence with reality, but nonetheless he outlines a possible mechanism of particle acceleration in the magnetosphere. The last review paper is on the phenomenology of auroras (Ya. I. Feldstein, S. I. Isaev, and A. I. Lebedinsky). It appears to be well done and comprehensive, and contains an impressive bibliography.

The book includes several more compact notes by various workers. In many of these the observational sophistication of the last decade is clear, but the lack of detailed theoretical understanding beyond the conjectural or ball-park stage is also evident. In general, the presentations, being mostly self-contained summaries with little cross reference, provide a many-parametered and disjointed picture of solar-terrestrial physics. This is not a failing of the authors but an accurate portrayal of the existing state; the integration of these disciplines into one coherent picture is yet to occur. Many basic phenomena involved, such as the solar-flare and solar quiet-time particle emission processes, the modulation of cosmic rays and the creation of particle populations in the trapped radiation, are yet to be understood. This book presents us with an excellent summary of the last solar minimum—a fragmented phenomenology, but an orders-of-magnitude improvement over the pictures from previous solar cycles.

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Electrons and Electrodes

Tunneling Phenomena in Solids. Lectures presented at a NATO Advanced Study Institute, Risö, Denmark, June 1967. ELIAS BURSTEIN and STIG LUNDQVIST, Eds. Plenum, New York, 1969. x + 582 pp., illus. $35.

The tunneling of electrons or other particles through a potential barrier is a purely quantum-mechanical phenomenon having no classical analogy. Research on tunneling, however, does have a classical analogy: cooking. In most cases the skill of the chef is more important than the quality of the ingredients—every chef has his own secret recipes—and the final result frequently ends up in the garbage. It was with great anticipation that I received this volume, hoping it would be the badly needed "cookbook" of the field. Alas, it is not, although it does contain some interesting recipes.

A glance at the table of contents of this volume suggests that the material covered is as diverse as the title would suggest; topics listed range from atomic tunneling in solids to quantum interferometry using Josephson junctions. Upon more careful examination one discovers that, except for a cursory article or two, most of the book deals with electronic tunneling between two electrodes. The first half contains sections on general tunneling theory and on semiconductor Schottky and *p-n* diodes, with several chapters devoted to phonon-assisted tunneling. The second half is devoted primarily to metal-insulator-metal junctions, with the preponderance of the authors discussing superconducting tunneling of one type or another. There is also an excellent section of related papers, both experimental and theoretical, on the Josephson effect. The organization of material, however, serves to emphasize the diversity of the subject matter rather than its underlying unity.

This is the only published compendium of the developments of the field (up to 1967) in which the developments are described by the original researchers. Many of the chapters present valuable insights, experimental techniques, and a variety of warnings against repeating the mistakes of others. For these reasons alone, this book should be on the shelves of those who are either considering working in the field or seeking applications of tunneling junctions and devices to other problems.