Book Reviews

Chondrites

Carbonaceous Meteorites. BARTHOLOMEW NAGY. Elsevier, New York, 1975. xiv, 748 pp., illus. $80.95. Developments in Solar System and Space Science, 1.

Early in 1961, when I was curator of the meteorite collection at the American Museum of Natural History, I was visited by Bartholomew Nagy, then of Fordham University. He described his researches in petroleum geochemistry, and his desire to apply this expertise to the investigation of the poorly known organic compounds in carbonaceous meteorites. I supplied him with material from the Orgueil meteorite, hence the present book.

The initial results of Nagy's investigation were presented at a meeting of the New York Academy of Sciences on 16 March 1961, and published under the title "Mass spectroscopic analysis of the Orgueil meteorite: evidence for biogenic hydrocarbons," by B. Nagy, W. G. Meinschein, and D. J. Hennessy. Wider circulation was provided by an article in *Life* by D. Bergamini entitled "Wax and wigglers: life in space?" At that point Edward Anders of the University of Chicago remarked that, in his opinion, "the only connection between meteorites and life is that an article on meteorites appeared in a magazine called *Life*." It might be said that the fat (or wax) was now in the fire. The articles and the reply ignited a hot controversy that has been fueled by contributions and polemics from chemists, physicists, astronomers, geologists, biologists, and mineralogists and has elicited the active participation of two Nobel laureates, Harold Urey (who has contributed a foreword to this book) and Melvin Calvin. The controversy resulted in an enormous increase in our knowledge of these remarkable meteorites. All this is reported in exhaustive (and sometimes exhausting) detail in Nagy's book.

The book has five chapters—"Meteorites: classification, composition, ages, falls and origin" (42 pp.); "Historical information regarding carbonaceous meteorites" (35 pp.); "Chemical composition, mineralogy and petrology of carbonaceous meteorites" (201 pp.); "The carbon compounds in carbonaceous meteorites" (329 pp.); and "Microstructures in carbonaceous meteorites (organized elements)" (81 pp.). Each chapter is accompanied by a glossary and a list of references, each very comprehensive; for example, for chapter 4 the glossary occupies 79 pages and the references 17 pages (approximately 400 entries). The literature is thoroughly documented up to the date of the preface (March 1973). Subject and reference indexes are excellent.

In his preface Nagy writes, "The purpose of this book is simply to document available data which until now were scattered in articles published in a great variety of journals. It is *not* the purpose of this book to evaluate the validity of reported findings and theories—the reader will have to do this to his own satisfaction." Judged by this statement the book succeeds admirably; Nagy has covered all the literature I am aware of and much that I have not read. I think he has presented this material, much of it controversial, fairly and objectively. I noted a number of errors and possible misstatements; most of these are innocuous, but some can be seriously misleading (for example, on p. 96 the concentration of iodine in the Murray meteorite is reported in parts per million whereas it should be parts per billion). A major difficulty in writing a book like this is making it appropriate for the diverse readership it is hoped to serve. For the student, the elementary information is most useful but the extensive detail may be wearisome, whereas for the specialist the elementary information is unneeded but the thorough documentation most welcome. I regret Nagy's decision not to provide some evaluation of theories and findings and deplore his statement that "the reader will have to decide for himself how to interpret the results of the organic analyses" (p. 281). Since this field is Nagy's specialty, one might reasonably expect some guidance from him. Nevertheless, in spite of these shortcomings, the book is a valuable contribution. It fittingly summarizes an enormous mass of information on these remarkable meteorites and provides a solid platform on which to base future research.

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The Mott Transition

Metal-Insulator Transitions. N. F. MOTT. Taylor and Francis, London, and Barnes and Noble, New York, 1974, xvi, 278 pp., illus. $22.50.

A large variety of systems in the condensed state, mostly solids but also some liquids, undergo, as a function of temperature, pressure, concentration, degree of ordering, or other parameters, transitions from a nonconducting or poorly conducting state to a strongly conducting or metallic state. A spectacular example of this behavior occurs in vanadium sesquioxide, which, at atmospheric pressure and as a function of temperature, undergoes at about 168°K a transition in which the conductivity changes by more than six orders of magnitude, from that of a fairly good conductor at high temperatures to that of a fairly good insulator below the transition temperature.

The systems that exhibit these properties are diverse, and the conditions in which the transition takes place are many and very different. To name a few, metal-insulator transitions are exhibited by transition-metal compounds, rare-earth compounds, doped semiconductors, alloys and metals, and metal-ammonia solutions. These systems also include antiferromagnets, ferrimagnets, and ferromagnets, as well as ordinary diamagnets and paramagnets.

In the 1975 jargon of the solid state physicist, the generic name for metal-insulator transition is the Mott transition. This is due to the important contributions that the author of the book under review has made to understanding its mechanisms. Mott's original publications span 40 years of theoretical research, and his ideas have dominated the field and influenced and stimulated a large number of researchers. The field is not, however, a very coherent one. The variety of substances that exhibit the phenomenon, as well as the many different contributions made to the basic theory and the very many mechanisms proposed to explain the various aspects of the transition, do not constitute a closely knit and tidy subject.

As a consequence, the present monograph lacks the coherence and finality that could make it the fundamental and definitive contribution to the literature of the field. It should be considered an extensive and well-researched review article. As such, it describes in a clear way a very large amount of experimental information on the many aspects, properties, and details of the phenomena related to the main subject. Most of this information is included in figures and graphs, and the absence of data in tabular form is more than compensated for by the extensive list of

references to the original papers given at the end.

The author has also attempted to describe in his own language and from his own point of view the various theoretical contributions to the understanding of the many aspects of the metal-insulator transition. The various theories are here presented with a rather personal approach, characterized by the absence of complicated mathematics, an emphasis on physical ideas, and a rather broad scope and perspective. This translation into "Mott language" goes in a very uneven way: it improves the presentation in some cases, it destroys the internal mathematical beauty in others. In a few instances, it leads to conceptual inconsistencies and errors.

Considered as a state-of-the-art review, the book is very successful. It is not, however, the final word on a field which is still developing at a very rapid rate and in which many ideas as well as experimental data are still in a rather unsettled state.

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Quantum Physics

Renormalization and Invariance in Quantum Field Theory. Papers from a NATO Advanced Study Institute, Capri, Italy, July 1973. EDUARDO R. CAIANIELLO, Ed. Plenum, New York, 1974. vii, 404 pp. $28.

Renormalization theory is one of the hard parts of the quantum theory of fields. Decades of work by a large number of talented people have provided some intellectual order for the subject, but there is still much to be done. By the same standards, invariance looks much easier. However, nature seems to be a bit reluctant to divulge which invariance group she is using, so things are not so easy there either. These two subjects in various forms are the themes of this book. Among its 20-some authors are both seasoned veterans and younger colleagues.

Readers with a little preparation in the subject will find quite a few useful nuggets in the volume. Here is a selection.

At the most elementary level is a discussion by B. W. Lee of the quantization of Hamiltonian systems using the Feynman path integral formulation of quantum mechanics. This leads up to the quantization of gauge theories. That subject is itself treated in a variety of forms. J. Lowenstein, A. Rouet, R. Stora, and W. Zimmermann write about the renormalization of models with broken symmetries, a class including a variety of gauge theories. The basic problem here is the working out of a renormalization procedure that is compatible with the surviving symmetries. B. Zumino offers two subjects, one super gauges and the quantization of relativistic strings, the other the application of gauge theories to the weak and electromagnetic interactions. G. 't Hooft treats quantum gravity as a gauge field theory.

The theory of renormalization is treated by several authors. Dimensional renormalization, one of the most important recent technical developments, is discussed by one of its originators, 't Hooft, as well as by P. Butera, G. Cicuta, and E. Montaldi. More conventional problems of renormalization theory treated from somewhat novel points of view are to be found in papers by E. Caianiello and M. Marinaro and by M. Marinaro, L. Mercaldo, and G. Vilasi.

If one were asked to assess the state of the subjects represented in this volume on the basis of the volume's contents, I think one would have to say that there is much complication and confusion accompanied by fascinating regularities, extraordinary insights, and baffling problems, a normal state of affairs for a hard subject still not under mathematical and physical control.

Graduate students starting work in the subject will probably find the book a suitable place to start reading before plunging into the periodical literature. Others who want an idea of the state of the art as of 1973 will probably also find it useful.

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Arctic Geology

Marine Geology and Oceanography of the Arctic Seas. YVONNE HERMAN, Ed. Springer-Verlag, New York, 1974. x, 398 pp., illus. $34.80.

This book is a compilation of 15 articles having to do with the Arctic region. The subjects included are physical oceanography, topography, tectonic fabric (two articles), shelf and slope sedimentation (six articles), the Pleistocene molluscan fauna, the Neogene of the subarctic section of the Pacific, deep-sea sediments of the Arctic basin, atmospheric circulation during the Wisconsin, and the possible causes of glaciation.

The chapter on physical oceanography, by Coachman and Aagaard, in which the physical features, advection boundaries, precipitation, water masses, circulation, and waves of the Arctic and subarctic seas are discussed, is probably the best in the book. Included in it is a short section describing the results of research in the region in the last two years. The topography chapter is disappointing because it does not include a topographic chart of the region, and the physiographic province map included is the one compiled by Dietz and Shumway over a decade ago. Discussion of the tectonic history of the region in a chapter by Vogt and Avery is based solely on deep-sea geophysical measurements, mainly magnetics. There is no discussion of the tectonic fabric of the surrounding land masses or whether this tectonic fabric verifies the evolutionary history described by the authors. Description of the shallow structure of the region as determined by continuous seismic profiles is limited to the Bering Sea. The discussion of shelf sedimentation is limited to the Bering shelf, the shelf off northern Alaska, and the shelves of the East Siberian and Laptev seas. No data are presented from the Barents Sea shelf, the widest segment in the region.

On the basis of examination of cores, Herman, in the chapter on deep-sea sedimentation, demonstrates that the onset of glaciation in the region occurred prior to 3 million years ago. She recognizes three sediment units in the region. Unit I was deposited in the last 700,000 years during the Donau-to-Würm glacial and interglacials; unit II was deposited 2.4 to 2.7 million years ago when the Arctic was free of permanent pack ice; unit III was deposited earlier than 2.4 million years ago under conditions similar to those under which unit I was deposited. These climatic changes during the last 3 million years appear to correlate with geomagnetic polarity periods, unit I with the Brunhes normal polarity period, unit II with Natuyama reversed period, and unit III with the Gauss normal polarity period. In the chapter on the possible causes of glaciation van den Heuvel and Buurman suggest that glaciation in the region began 7 million years ago (in the Pliocene) and was due to continental uplift and thermal isolation, as has been suggested by Ewing and Donn. Variations in mid-latitudes they ascribe to insolation variations.

As a whole I found the book disappointing, not for what is included but for what is left out. This is not the book for the reader interested in a comprehensive book on the Arctic Sea. It is a book limited in scope for a limited audience.

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