Book Reviews

A Paleohydrology Project

Handbook of Holocene Palaeoecology and Palaeohydrology. B. E. BERGLUND, Ed. Wiley-Interscience, New York, 1986. xxiv, 869 pp., illus., + foldout chart. $114. International Geological Correlation Programme Project 158B.

The International Geological Correlation Programme of the International Union of Geological Sciences sponsored a project called The Paleohydrology of the Temperate Zone during the Last 15,000 Years, and this book is the principal product of the portion of the project dealing with lakes and wetlands. The term "handbook" in the title implies that methods of investigation are emphasized, and indeed they are. But the book contains much more, including broad discussions of various problems in late Quaternary paleoecology. The opening chapter by H. J. B. Birks, for example, is a definitive review of the patterns of late-glacial and postglacial biotic changes in terrestrial and lacustrine environments in northwestern Europe.

The particular long-range goal of the project, as envisioned by Björn Berglund, its leader, was to subdivide the temperate zone into vegetation-landform regions and to establish for each region a primary paleoecological reference site in which all kinds of stratigraphic investigations could be made, in order to reconstruct in detail the environmental history for the region. Appropriate regions have been delineated throughout the Scandinavian countries, but not many reference sites have so far been studied there or elsewhere in the recommended detail, primarily because few Quaternary research groups have the resources or specialists to undertake the broad range of stratigraphic analyses proposed. This volume, however, details what could be done where conditions permit and what considerations should go into site selection, fieldwork, coring, sampling, laboratory procedures, numerical analysis and interpretation of results, and methods of presentation. A preliminary version of the handbook was initially published in 1979 by the Department of Quaternary Geology of Lund University and was widely distributed, but the present volume contains thoroughly revised chapters and several additional contributions.

Because so many students and professionals undertake lake-sediment and peat investigations with casual and imperfect knowledge of field and analytical techniques, results frequently have uncertain validity, and a handbook such as this will improve the quality of all kinds of research on these materials. For example, the lateral variability of sediment stratigraphy from shallow to deep water in a lake indicates the importance of careful selection of coring localities in a lake. Paleomagnetic and other methods of core correlation in transects across lakes are reviewed by J. Dearing. Such transects are necessary in reconstructing the history of lake-level changes, as described by G. Digerfeldt, who also evaluates in another chapter the pros and cons of various coring devices and procedures.

Several chapters in the book deal with dating methods, which are essential in any stratigraphic studies—radiocarbon and lead-210 dating (I. Olsson), paleomagnetic dating (R. Thompson), tephrochronology (Th. Einarsson), varves (M. Saarnisto), and tree rings (A. Munaut and W. Bircher). Among the fossil groups considered in separate chapters are pollen, charcoal, bryophytes, other plant macrofossils, diatoms, other algae, rhizopods, cladocerans, ostracods, beetles, chironomids, and mollusks, all treated by leading investigators. The final section of the book treats the numerical analysis of pollen-stratigraphic data, various methods of multivariate analysis, and problems in vegetational and climatic calibration of analytical data.

Like many other aspects of Quaternary research, studies of lake sediments and peat are highly interdisciplinary. Because of the pervading historical approach and the involvement of earth materials, geologists take the lead, and of the 43 persons listed as contributors to the volume 13 are associated with geological institutes or departments. But departments in 11 other fields are represented, including botany (seven contributors), limnology (five), geography (four), physics (four), ecology (two), biology (two), climatology (two), and archeology, palynology, forestry, and geophysics (one each). Another statistic of interest shows the international flavor of the authorship. Because of the editorship Sweden naturally leads the list with 11 authors, but England has nine, Switzerland and the United States four each, Poland three, Denmark, Scotland, Germany, and Finland two each, and Norway, the Netherlands, Belgium, and Iceland one each. The literature references accordingly provide an entrée to regional publications that American workers do not commonly see, and such exposure should enhance the quality of research in the broad field of Quaternary studies. As a handbook this volume leaves little to be desired, whether for the student who needs guidance in techniques or the professional who wishes the latest word on calibration of radiocarbon dates, the numerical analysis of stratigraphic data, or microscopic analysis of unfamiliar fossils. Each chapter represents the state of the art in the analysis of the numerous physical, chemical, and biological components of lake sediments and peat. The book is nicely produced and easy to handle. Despite the stiff price, it belongs in every library and laboratory concerned with the subject.

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Extracellular Connections

Gap Junctions. MICHAEL V. L. BENNETT and DAVID C. SPRAY, Eds. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY, 1985. xvi, 409 pp., illus. $70. From a conference, Cold Spring Harbor, NY, Oct. 1984.

There have been numerous advances in the study of gap junctions over the last few years, and the resultant accumulation of literature now warrants detailed consideration and assessment, as much to help the initiated sort out the state of the art as to enable those less intimately involved with the subject to discover how the field has progressed.

As the editors note in their introductory remarks, the present book is a progress report rather than the final story. There are in all 32 chapters from a range of workers in the field, producing a relatively comprehensive, rather than idiosyncratic, selection of topics. Among the major issues covered are the structure of gap junctions as studied by a variety of techniques, comparative biochemical analyses in different tissues, the production and use of gap-junctional antibody probes, the control of gap-junctional gating, the response of gap junctions to chemical signals, their importance in the exchange of information during development, and their integrative properties in excitable tissues. The detailed appraisals of the various studies included are in many cases more than will interest the non-expert—this is a tome primarily for the cognoscenti. As is often the case with multi-authored volumes, the editors were unable to impose a common style of presentation on the contributors. One is therefore confronted with a variety of approaches, but many chapters have neat concluding paragraphs that succinctly summarize the salient points of the preceding, often complex, arguments.

It is clear from this volume that controversies still rage round gap junctions and

little is entirely settled. For example, the structure of the channel as revealed by x-ray diffraction differs from images obtained by electron microscopy of negatively stained or frozen gap junctions; hence there is no agreement on the mechanism of channel closing. Equally, the molecular size of the major gap-junctional protein is reported to be 54, 44 to 47, 27, or 16 to 18 kD; which is it, one or all of these? and is lens 26-kD protein actually gap-junctional or not? Questions abound: What factors regulate junctional conductance? Is there a change of structure correlated with uncoupling, and if so can it be resolved with electron microscopy? Is in vitro coupling by liposomes in which gap-junctional channels have been incorporated a useful analogue? How does coupling affect developmental compartmentation? What are the actual messages exchanged in embryonic development? Are gap-junctional connexons reutilized? and what is their mechanism for turnover—internalization, dispersal, or both? Which hormones or second messengers are able to modulate permeability of gap junctions? A range of new physiological and molecular techniques have been brought to bear on these problems, as well as genetic approaches, and this collection provides the reader with detailed information based on these methods. Even if we do not know many of the answers, the questions that can now be asked are, this volume reveals, more specific and searching than before. The book is essential for anyone directly concerned with gap junctions and will be useful for cell biologists, neurobiologists, and developmentalists alike to dip into.

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Cosmic Rays

Cosmic Rays in Interplanetary Magnetic Fields. I. N. TOPTYGIN. Reidel, Dordrecht, 1985 (U.S. distributor, Kluwer, Hingham, MA). xiv, 375 pp., illus. $64.50. Translated from the Russian edition (Moscow, 1983) by D. G. Yakovlev.

Cosmic rays, accelerated in a variety of astrophysical objects including the sun and the galaxy, propagate along extremely convoluted paths. Because the gases through which they pass are generally so rarefied that collisions are negligible, their transport is determined principally by interaction with the irregular ambient magnetic field (the electric field is small and may be determined from the local magnetic and velocity field). This complex process has become much better understood in the past two decades, owing to both theoretical advances and measurements carried out in space. Although early work of Fermi and others suggested that a statistical description of charged-particle motion, assuming a random walk in irregular magnetic fields, could be useful, it took studies of plasma, magnetic field, and cosmic rays from spacecraft in interplanetary space to challenge and sharpen our understanding. Out of this has come a general diffusive transport equation that has manifold applications in many areas of solar-terrestrial research and astrophysics and that accounts for many observed phenomena. The appearance of a monograph covering applications of this theory to the interplanetary medium is welcome.

The author has been an active and respected Soviet researcher in this field for more than 20 years. He presents a very complete discussion of nearly all aspects of the theory of particle transport in interplanetary space, beginning with the solar wind, its magnetic field and structure, and continuing with the detailed theory of particle transport in irregular magnetic fields, application to solar particles, shock acceleration, and modulation of galactic cosmic rays. I can think of no major topic left unmentioned in this generally thorough and complete account. The balance among topics reflects the author's interests. About a third of the book is devoted to acceleration processes in interplanetary space, about 10% to the modulation of galactic cosmic rays, and about 15% to solar particles.

For the most part the discussion is correct, although I noticed one apparent error in the discussion of stationary transport of solar cosmic rays. In the discussion of the small diffusion coefficient limit $(ur/\kappa) >> 1$ at the top of p. 172, the unnumbered equation following equation 12.12 gives a wrong result. In this limit, convection and adiabatic cooling should dominate the transport, and the spectrum should not depend on the diffusion coefficient. This appears to be an isolated lapse, however.

It is regrettable that research in cosmic ray transport theory has had a tendency to advance separately and independently in the Soviet Union and the West, with less interaction between the two sets of workers than would be desirable and much of the research unavailable in translation. This isolation is reflected to some extent in this book, where coverage of Western work is not as complete or up to date as might be desired. As one example, the apparent discrepancy between the mean free path of low-energy solar cosmic rays as determined from flare events and that calculated from the magnetic field is just briefly mentioned, and many relevant papers are not cited. In general, it appears that Western work up to about 1980 is covered reasonably completely. Coverage of shock acceleration is current up to the 1983 publication date of the original Russian edition.

I discovered much that is of use in this book, and it will have an important place on my bookshelf. It should go a long way toward making the extensive Soviet work in this area more accessible to Western scientists and should be consulted frequently by research workers in the field.

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The Sun

Physics of the Sun. PETER A. STURROCK, THOMAS E. HOLZER, DIMITRI M. MIHALAS, and ROGER K. ULRICH, Eds. Reidel, Boston, 1986 (U.S. distributor, Kluwer, Hingham, MA). In three volumes. Vol. 1, The Solar Interior. x, 257 pp., illus. $44.50. Vol. 2, The Solar Atmosphere. xii, 385 pp., illus. $62. Vol. 3, Astrophysics and Solar-Terrestrial Relations. xii, 287 pp., illus. $49. The set, $125. Geophysics and Astrophysics Monographs.

This three-volume work, produced as part of a study commissioned by the National Academy of Sciences at the request of NASA, is monumental in its combination of scope and depth of coverage. Its 22 chapters, prepared by a distinguished group of experts, cover the field of solar physics in a thorough and comprehensive manner, including the formation of the sun and planets, interior nuclear processes, interior structure, dynamics, and magnetic fields, the new and exciting field of helioseismology, the sun's radiation output, various aspects of the solar atmosphere, the physics of solar flares, including nuclear processes, solar radio emission, and the solar neutrino problem. Solar phenomena in other stars and solar effects on the terrestrial environment are also treated.

In nearly all cases it is clear that an enormous amount of effort went into the contributions, most of which read more like monographs or textbooks than reviews. In giving some examples of the contents of these volumes, I must omit mention of important and valuable essays by leaders in their fields.

One of the chapters is a discussion of observational and theoretical aspects of the