up some of Radin's larger ideas. He shows (pages 363–379), in a tough-minded critique of Radin's writings on primitive monotheism and economic exploitation of religious gullibility, that Radin vacillated and reversed his thinking several times over half a century. He was not himself too certain of the objective content of some of his more stimulating ideas.

Anthropologists will all cherish this volume for its intrinsic worth. They will also sentimentally value it. Radin died shortly before the 75th birthday it was intended to celebrate, and in it are posthumously published articles by four other great men of anthropology—Kroeber, Lowie, Redfield, and Kluckhohn—who wrote to honor their friend but, like him, did not live to see the book become a reality. Nonanthropologists whose scholarly interests find enjoyment in occasional forays into fertile fields outside their own will find it to be well worth sampling.

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Tides and Currents

Physical Oceanography. Albert Defant. Pergamon, New York, 1961. vol. 1, xvi + 729 pp.; vol. 2, viii + 598 pp. Illus. + maps. $35.

This two-volume work is a textbook about that part of physical oceanography which comprised the whole prior to 1939. Its two volumes are each divided into two parts; volume one contains material on distribution of physical and chemical properties of the oceans (part 1) and dynamical oceanography (ocean currents) (part 2). Volume 2 is devoted to surface and long waves (part 1) and to tides and tidal currents, including internal waves, (part 2).

The book is arranged as a textbook (without problems), and each new subject is introduced with a lucid, and readable, elementary description which will be most helpful to new students and experienced oceanographers alike. In the theoretical parts, mostly volume 1, part 2, and volume 2, fundamental theory is also presented clearly, and the special vocabulary of oceanography and meteorology (they are very similar) is introduced term by term, so that you are left with the feeling that you have been led simply by the hand, and by a master.

The author is one of the older members of the group of German oceanographers who sailed the *Meteor* extensively in the North and South Atlantic between World Wars I and II. These scientists were prolific contributors to the literature produced by the larger group of European oceanographers who dominated this branch of science prior to 1930. Hence it is not surprising that Defant's references are largely to the work of German oceanographers and that his illustrative examples come mostly from the Atlantic Ocean. Nevertheless, his outlook is international in that he includes, with due credit, contributions from scientists of many nations.

The present book (published only in English) is a second revision of a manuscript (in German) originally written before and during World War II. The revisions bring it up to date, as of May 1957, in the fields of special interest to the author. Unfortunately, in other fields, such as bathymetry and optics, his material is not at all up to date, and he has not included in his summary of the structure of the ocean basins any impression of the wealth of geophysical material published during the early 1950's. The book would be a better textbook had these matters been attended to, but I am content to see the result as it is; Defant has kept abreast of his own interests, and as a result, we have an immensely valuable book.

Both descriptive and theoretical parts are profusely illustrated with examples taken from nature. Thus one is left with a feeling that difficult or abstract-sounding mathematics has been used successfully to account for the rather complex results of observation. Furthermore, when such is not the case, the author skillfully defines the shortcomings of both theory and observation.

Though he makes no commitment to do so, Defant summarizes in tables and charts the distribution, usually on a world-wide scale, of many oceanographic variables. While his summaries will scarcely satisfy a specialist, they should prove very helpful to students.

No attempt is made to describe instruments, except a few of the older types—for example, the Nansen bottle and reversing thermometer—which have a venerable history in oceanography. Instruments are an important expression of the state of understanding in any observational science, and an instrumental revolution which is completely missing in this book was underway in oceanography long before 1957. I believe this to be the book's greatest lack.

The composition is so well worked out that only rarely does one have to turn the page to consult a figure referred to in text. This is a considerable achievement which compositors often seem to try to avoid. Although the figures are generally clear, a magnifying glass is sometimes needed for identifying the coordinates of graphs. The bibliographies (at the end of each part) form an important part of the text, since Defant, in the course of a few sentences, frequently leaves the student a considerable assignment of outside reading. I am least well equipped to comment on this part of the book, since I am almost totally ignorant of European oceanographic literature. However, I hope that before future printings are made the large number of obvious editorial mistakes in the bibliographic references can be corrected. I think it likely that these errors are more characteristic of the parts of the literature I know than of the whole bibliography, but they will prove confusing and should be repaired.

I had great pleasure in reading this book, and I except to have a great deal more. It should be useful to a wide professional readership as a detailed and yet grand exposition of man's understanding, just past mid-century, of water motion of the oceans.

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Gram Determinant

The Theory of Crystal Structure Analysis. A. I. Kitaigorodskii. Translated from the Russian by David and Katherine Harker. Consultants Bureau, New York, 1961. xi + 275 pp. Illus. $12.50.

The title of this book is a fair representation of its content. The book deals with the theoretical background useful in finding the location of atoms in a crystal, using as data a set of the absolute values of the amplitudes of the x-ray diffraction spectra. It is directed, therefore, to the crystal-structure analyst who already has a considerable background in the theoretical and practical experimental aspects of x-ray dif-

fraction by single crystals. Most readers of this review will not find themselves in this category, so I offer this much abbreviated background:

Our present-day understanding of the solid state comes fundamentally from our knowledge of the arrangements of atoms in crystals, and this is provided chiefly from studies of crystals by their diffraction of x-rays. There is a straightforward relation between the characteristics of the diffraction and the arrangement of atoms producing it, so that, if the first is known, the second can be routinely deduced. Unfortunately, the only part of the diffraction of crystals which is observable is the amplitudes of the reflections; the phases are not observable. If a crystal structure is to be deduced from diffraction data, the phases of these reflections (or their equivalent) must be supplied. This book is concerned with the theory of how to do this. For crystals having a center of symmetry the phases reduce to 0 or π, and this is equivalent to attributing a sign + or − to the amplitude of the reflection.

Fortunately, in 1947 David Harker (one of the translators of this book) and J. S. Kasper showed that relations exist between the set of diffraction amplitudes and their signs. Many contributors have added to this initial discovery, notable among them the author of this volume, Kitaigorodskii. His book is a systematic and integrated treatment of the whole subject, from his own point of view. This occupies six chapters and covers some 270 pages.

After developing the general background of the subject, the author comes, in chapter 4, to his favorite treatment, the application of the Gram determinant. This has useful properties for the problem of sign determination, because this determinant cannot be negative. From this determinant another, whose elements are the amplitudes, may be derived, which must have a value greater than, or equal to, zero. Inequalities useful in sign determination can be deduced from this. Chapter 4 really represents the core of the book, and it gives the reader an insight into the author's point of view in crystal-structure analysis.

Chapter 5 deals with the Patterson synthesis. This is treated in an illuminating analytical fashion. Nevertheless, since the subject is really concerned with geometry, the analytical treatment leaves a good deal which must be geometrically imagined.

This book is a valuable addition to the literature of crystal-structure analysis; those who work in this field will be glad to have this integrated treatment of phase determination. The translators are to be congratulated for making this difficult subject available in easily read English. The printing is by photography from typescript, so that there are places where the equations appear a little awkward and a few other places where the typescript appears to have been smudged.

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Climates of the Past

Descriptive Palaeoclimatology. A. E. M. Nairn, Ed. Interscience, New York, 1961. xi + 380 pp. Illus. $11.

The contents of this important volume include an essay on the scope of paleoclimatology (by Nairn, who is also the editor), an article on the fundamentals of climate (by H. H. Lamb), eight articles (by G. Y. Craig, R. F. Flint, Robert Green, R. Kräusel, Nairn, N. D. Opdyke, A. S. Roemer, N. Thorley, and F. B. Van Houten) appraising the various kinds of evidence (desert sandstones, evaporites, evidences of cold climates, geophysics, vertebrates, invertebrates, and plants) that can be used in attempting paleoclimatological interpretations, and four articles (by E. D. Gill, L. C. King, T. Kobayashi and T. Shikama, and M. Schwarzbach) on the sequence and kinds of past climates for various areas.

The volume is well documented and has a list of references for each article (in all there are nearly 1250 references). These will be of immeasurable value as guides to more detailed information, while the appraisals will be significant guides for future studies.

Nairn unsucessfully attempts to establish and maintain an attitude of critical and impartial evaluation of all possible evidence and interpretations. In the interpretive section the consideration of the southern continents and India under the Gondwanaland concept, and the unit treatment accorded North America and Europe, introduce, in the first case, a bias towards continental drift, and in the second, a bias towards permanency of relative position.

With respect to the controversy over the permanency of the continents and ocean basins, four articles favor "drift," two are opposed, and two favor "polar wandering." A truly impartial attitude is maintained in only five of the articles.

The article on the fundamentals of climate is well written and is a "must" for one who desires to consider the causes and effects of past climates. However, in view of the controversy over "continental drift," it would appear that an examination of the probable changes in atmospheric and oceanic circulation resulting from the "drift" and "polar wandering" concepts would have been a profitable addition. No matter what his philosophy, each reader will disagree with some of the contributions describing the paleoclimates of different parts of the earth, for each author represents a different viewpoint.

One final comment: the title of the volume is *Descriptive Palaeoclimatology*. In my opinion only the last four contributions, occupying just slightly over one-fourth of the book, fit the title. A simple "Palaeoclimatology" would have been better.

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Aircraft Materials

Metallic Fatigue. W. J. Harris. Pergamon, New York, 1961. xi + 331 pp. Illus. $12.50.

This is an excellent engineering review of fatigue in commercial metals and alloys with very special emphasis on aircraft materials. The author borrows very heavily from his experiences at the de Haviland Aircraft Company of Great Britain, as evidenced by the fact that by far the majority of data quoted and illustrated appear to have originated from the de Haviland laboratories.

The author covers, in a lucid manner, the problems of stress concentration in fatigue and considers the various ways of improving the fatigue life, such as by shot peening, tensile prestretching, and other novel techniques. A special chapter is devoted to the role of frequency on fatigue. The role of corrosion on fatigue is briefly covered, and a well-documented chapter is devoted to fretting ("rubbing") fatigue.

Crack propagation and the philosophy of "safe-life" and "fail-safe" design are