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