

account that requires no background beyond trigonometry and analytic geometry. While some demands may be put on the neophyte's mathematical maturity, the rewards to be gained are great. Among the topics included are: (i) development of the real numbers from the naturals; (ii) existence and uniqueness of decimal, Cantor, and continued-fraction expansions, with rationality tests; (iii) the Hurwitz-Borel theorem; (iv) Liouville's theorem on algebraic numbers; (v) Dirichlet's theorem on diophantine approximations; (vi) the theorem on uniform distribution; and (vii) an elegant introduction to cardinality.

Although the author's tone is informal, his proofs are well motivated and rigorous. More advanced readers will probably regret omissions forced by limitations of space, as I regretted the absence of a more thorough treatment of the integers and the rationals. The scope of the book is, however, remarkably broad. Unfortunately the book suffers from a large number of misprints which will force the less advanced reader to proceed with caution. For example, the displayed equation on page 6 should read $a_1 + a_2' = a_1' + a_2$, and the fraction $\frac{1}{4}n$, on page 36, line 9, should be replaced by $2\frac{1}{4}n$.

In general, however, this book is well suited to serve as an introduction to the real numbers as well as to some of the ideas of analytic number theory. Used in this way it will undoubtedly stimulate many students to explore further the fascinations of the real number system.

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The Pleistocene Epoch

The Deep and the Past. David B. Ericson and Goesta Wollin. Knopf, New York, 1964. xxiii + 292 pp. Illus. \$6.95.

The Deep and the Past is intended as a popular account of 17 years of oceanographic research carried out at the Lamont Geological Observatory. The book circulates around the way to and the methods used to discover the "first complete record of the Pleistocene." Therefore, the validity of the use of the words "first" and "complete" must be discussed.

Deep-sea cores penetrating the whole

Pleistocene were collected by Kullenberg in 1947. Dutch studies (Zagwijn) have resulted in a curve of the same epoch, which also is in agreement with that obtained from the Swedish cores. The record now offered by Ericson and Wollin deviates markedly from the others.

Foraminiferal analyses, which are their methods of tracing glacial and interglacial ages in the sequences, are complex methods, and the authors have apparently been misguided by them. Two examples will be offered.

The authors stress the necessity of discovering the interstadial in the Würm stage of core sequences (why not also within the Riss?). An interstadial is traced approximately 50,000 to 31,000 years ago by other students and with other methods, but it is not discernible by the way these authors "read" the cores. Therefore they suppose a period at 95,000 to 65,000 years ago as an interstadial and date the last glaciation to 340,000 to 115,000 years ago; it is more likely that Riss-Würm ended about 80,000 (± 7000) years ago, Riss about 100,000 years ago, and that Mindel-Riss falls at about 300,000 to 200,000 years ago.

The absence of the foraminifer *Globorotalia menardii* in some Atlantic cores at approximately 6 to 8 meters indicates, according to Ericson and Wollin, glacial condition (Riss). However, everything seems to suggest that the section was formed during the warmest period of the Pleistocene, which I have correlated with the Upper Mindel-Riss. Their method of tracing the climatic development is therefore questionable.

The authors refer to some potassium-argon datings. An additional one, Lipolt's dating volcanic ash to about 375,000 years, Uppermost Cromerian or Lower Mindelian in age, could have been quoted. This dating suggests an age of the Mindel glaciation of one third of that given by Ericson and Wollin.

One chapter is devoted to the discovery of a horizon with a faunal change and where the Discoasteridae had become extinct. This horizon is suggested as a new Plio-Pleistocene boundary. They believe that this change mirrors a sudden and drastic climatic deterioration. A different interpretation may also be possible.

On the basis of these considerations, Ericson and Wollin's climatic curve for the Pleistocene must be considered incorrect for most of the Pleistocene.

Their time scale for ages greater than 200,000 is only a guess. The correlation with the conventional time-stratigraphic units is unlikely, except for the last 65,000 years. In two chapters they then apply this unlikely time scale to Pleistocene cultures, Mammalian succession, and human evolution.

Several other discussions and statements in the book are inconsistent, others are incorrect. But, owing to limited space, examples cannot be given.

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Hydrology

Advances in Hydrosience. vol. 1. Ven Te Chow, Ed. Academic Press, New York, 1964. x + 442 pp. Illus. \$15.

With this first volume of *Advances in Hydrosience*, Ven Te Chow, the editor, has initiated a much-needed new means for satisfactorily collecting and disseminating new knowledge resulting from scientific research on water. Volume 1 is a collection of timely articles prepared by authorities in the fields of sonar, hydroelasticity, the statistical hydrodynamics in porous media, hydroballistics, and the hydraulics of wells. The information, with emphasis on physical theories and mathematical analyses, will be most useful to advanced scientific workers.

The article "Sonar," by Bradford A. Becken, describes the field in relation to the gathering of scientific information from the ocean through the use of underwater acoustics. Recent scientific and engineering advances in signal enhancement, transducer design, and receiving-beam formation are illustrated.

In his article "Hydroelasticity," S. R. Heller, Jr., defines hydroelasticity and outlines its scope, largely by analogy to aeroelasticity, to denote its naval counterpart. Heller's article is concerned with differences between aeroelasticity and hydroelasticity, typical static and dynamic hydroelastic phenomena, control-surface flutter, and vortex-induced vibrations.

In "New contributions to hydroballistics," F. S. Burt points out that there is need for considerable improvement in the performance of all types of underwater weapons. Burt gives a brief review of the various aspects of