Book Reviews

Dynamical Oceanography. J. Proudman. London: Methuen; New York: Wiley, 1953. 409 pp. Illus. $8.50.

When one considers the extensive publicity given oceanographic expeditions by the press, the astonishing success of popular books concerning the marine sciences, the large sums expended in oceanographic research (about $5,000,000 a year), he will be surprised to realize that Professor Proudman has provided us with the *first* text on theoretical oceanography in the English language. It is now possible for any physical scientist to obtain an idea of the theoretical framework of oceanography in terms that he can appreciate. Until the publication of this work, a physicist seeking information about the ocean was without an adequate guide to such theoretical literature as does exist and might easily suffocate in the mass of qualitative reasoning that characterizes so much of the professional literature.

The only prior English language treatise that does exist (*The Oceans,* Sverdrup *et al.,* Prentice-Hall, 1942) is a compendium covering all branches of marine science (biology, chemistry, etc.) in which the physical portions are written in a form more suited for meteorologists and the professional oceanographer than for physical scientists.

The first three chapters of *Dynamical Oceanography* are an introduction to the hydrodynamical equations in a rotating reference frame. Chapter 4 is concerned with the standard gradient current approximation so much used for computing the field of motion from the observed density structure. Chapter 5 treats various examples of stationary accelerated current systems. Chapters 6 and 7 deal with the subject of ocean turbulence and mixing processes. A very original treatment of the role of friction in the dynamics of parallel currents is introduced in Chapter 8. The following chapter begins with an ingenious explanation of the asymmetry of the wind-driven surface circulation, discusses the classical wind-drift current theory of Ekman and the many subsequent studies inspired by Ekman's work. Chapter 10 is unique in the oceanographic literature: it grapples with the difficult thermodynamical circulations in the ocean.

In Chapters 11–14 Professor Proudman enters into the subject of tides, where he is the world's foremost authority. Chapter 15 is an exposition of internal tides and waves. The final chapter is a brief summary of the main results of classical surface wave theory.

The exposition is clear and concise, and the book is so arranged that one may read any chapter at will without having to refer constantly to equations in previous chapters. Many readers will be glad to hear this.

This book should prove particularly useful for teachers of oceanography because each subject is discussed in a series of examples of increasing complexity, and in most cases the proofs and demonstrations are entirely original and novel. There is a short history and bibliography at the end of each chapter. These references contain few works of recent date, but this was perhaps a necessary restriction in order to maintain a well-balanced presentation of the entire subject, many aspects of which are so difficult that little progress has been made for many years. For example, a satisfactory model of the meridianal thermohaline circulation has never been investigated chiefly because of the essentially nonlinear nature of the transfer equations. Or, as another example, it has been impossible to integrate the linear tidal equations for the real oceans because the geometry of the ocean basins is so irregular. There is also a great deal to be said for giving references to original works, rather than to recent elaborations, no matter how old the original works happen to be.

The serious reader will find it desirable to supplement his study of Proudman's book with reading of a more descriptive nature. This reviewer recommends for this purpose the chapter on "water masses" in Sverdrup's *The Oceans.*

For years physical oceanography has been something of an ugly duckling among other prouder, established sciences. To many an academic scientist it seemed a species of geographical exploration, an expensive hobby for amateurs like the Prince of Monaco, or a minor adjunct to marine ecology. This unfortunate impression was largely due to the chaotic state of its theoretical framework. Professor Proudman's book presents this material in an orderly, understandable fashion and ought to do much in attracting the attention of capable mathematicians and physicists to the many perplexing theoretical problems of the ocean. Publication of this splendid volume makes one feel that oceanography has at last come of age.

HENRY STOMMEL
Woods Hole Oceanographic Institution
Woods Hole, Massachusetts

Fundamentals of Limnology. 2nd ed. Franz Ruttner; trans. from German by D. G. Frey and F. E. J. Fry. Toronto: Univ. Toronto Press, 1953. 242 pp. Illus. $6.50.

Usually a foreign text is translated some years after its appearance, by which time it is already beginning to show signs of age. This might have been the fate of this translation had the translators been unable to work from the manuscript of Ruttner's revised edition. The result is an up-to-date English version, published within a year of the new German edition, a circumstance as rare as it is welcome

The virtues of a text are often not apparent until it has been subjected to use by a group of students; the faults, such as major errors and omissions, may be apparent immediately. There are few omissions in