described in a paper by J. W. Winchester and R. A. Duce. Relations of the three halogens show many surprises, and the paper is eloquent testimony to our present lack of detailed knowledge about the geochemical behavior of these elements.

K. K. Turekian and D. F. Schultz present current results in a continuing study of trace-element economy in the oceans. One interesting conclusion from their data is the demonstration that the supply of trace elements to the deep sea by continental runoff is importantly supplemented by underwater volcanism in the Pacific Ocean and by glaciation in Antarctica.

The volume is a useful, if somewhat uneven, survey of current work and thinking in an active area of research. As might be expected, it raises far more questions than it answers. Many of the papers convey a sense of excitement over unexpected results fresh out of the laboratory and not yet assimilated into the main body of scientific thought. Unfortunately, the book contains no record of the discussions that must have enlivened the symposium.

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Introductory Geology Textbook

In response to the need of nonscience students for some contact with the broad spectrum of scientific knowledge, many colleges have condensed physical and historical geology into a one-semester survey course. This book, **Geology—An Introduction** (Heath, Boston, 1966. 367 pp., $7.20), by R. L. Bates and W. C. Sweet, is a suitable textbook for such a course.

The best possible organization of the topics of physical geology has been accomplished. Consideration of weathering, transportation, and deposition processes precedes the chapter on sedimentary rocks. Discussions of rock deformation, metamorphism, and mountain-building are grouped together. Superposition, geologic time, and correlation are introduced early in the book. The weakest sections are those on minerals and igneous rocks. There are no mineral identification tables and no discussion of physical properties of minerals, so the book must be supplemented by a good laboratory manual. Possibly the best chapters in the first half of the book are those on downslope movements and ground water.

Post-Precambrian physical history of North America is presented on the basis of five cycles, each bounded by major marine regressions. Generalized rock types and thicknesses for each Paleozoic and Mesozoic system are presented by means of isopach-lithofacies maps (after Sloss, Dapples, and Krumbein, 1960). The history of animal and plant development is discussed separately, and the emphasis is very strongly on vertebrate animals. Very few invertebrates are illustrated and these mostly by photographs of museum reconstructions.

In covering all major topics of introductory geology and still realistically staying within the limits of a semester course, the authors ran into some problems of misleading oversimplifications and omission of some material that others would consider important (for example, stream piracy, initial dip, and possible causes of ice ages). New terms are placed in heavy type where they are first defined. However, several terms that will not be familiar to nonscience students are introduced without definition (for example, natural glass, ion, angle of repose, and suture). Almost all of the photographs are well chosen, but about 20 percent of them show low contrast or appear to be somewhat out of focus. A brief list of suggested readings follows each chapter.

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The Mathematics of Space Exploration (Holt, Rinehart, and Winston, New York, 1965. 160 pp., $1.96), by Myrl H. Ahrendt, was produced for teachers and nonspecialists who want to know how to use a little mathematics to sketch our activities in space. Fifty-two formulas concerned with mechanics, astronomy, and rocketry are introduced and used in examples designed to demonstrate their utility. There are 185 "Space Flights," imaginative problems for the reader to solve, and the answers are thoughtfully provided. There is a three-page index, a one-page bibliography, four pages of natural logarithms, and 20 pages of powers, roots, and reciprocals of numbers from 1 to 1000, to six significant figures. Nevertheless, all of the examples and problems are expected to involve no more than slide-rule accuracy.

I recommend this book to anyone who can handle mathematical and physical ideas with ease. Neither the mathematics nor the physics is difficult, but there are a few printed errors that may trap the naive or unwary reader. Of course not all of the errors are important—for example, the use of *infers* for *implies* (p. 56) and the amusing instruction: "Fill in the other empty blanks" (p. 94). The half dozen typographical errors will not trouble an experienced reader.

The author seems a little unsure in discussing centrifugal force in connection with orbits and weightlessness. Early in the work, he correctly calls it an inertial reaction to the action of a centripetal force, but this upright stand gradually droops into a balance of the two forces to explain weightlessness. On page 99, he states that the expression for the speed of a body at any point in an elliptical orbit is beyond the scope of the book, and then he introduces it on page 105. This is a very useful expression and may be rearranged to show the relation between kinetic, potential, and total energy throughout an orbit. The needed space could have been made available by deleting Figure 5-1 which contains no information, turning Figure 5-2 the necessary 90° counterclockwise, and deleting the confusion on pages 101 and 102 which exists because Kepler's Third Law was not properly explained and the velocity expression was not used.

In general, the figures exhibiting the earth are stylized and show no relation between coordinates and the sketched maps. A few of them are confused and indicate poor rapport between the author and artist; all of them should have been controlled by a science editor.

A review that points out errors may make the book look worse than it is, and this review should serve only as a caveat to the reader. The grade on this work is almost A$^-$, and the book deserves a place on the desk of teachers and nonspecialists who need such a volume.

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