Book Reviews

Geological Changes

Implications of Continental Drift to the Earth Sciences. Proceedings of a NATO Advanced Study Institute, Newcastle upon Tyne, England, April 1972. D. H. TARLING and S. K. RUNCORN, Eds. Two volumes. Academic Press, New York, 1973. Vol. 1, xvi pp. + pp. 1–624, illus. $38. Vol. 2, xvi pp. + pp. 625–1184, illus. $36.50.

These volumes are important as being the first collection discussing many implications of the plate tectonic revolution of 1967.

As almost everyone knows by now, the plate tectonic revolution was the general acceptance of the hypothesis that nearly all the lithosphere (the cold, stiff outer 80 kilometers) is divided into plates a few hundred to several thousand kilometers in extent, moving horizontally with respect to each other at velocities up to about 10 centimeters a year. The main tensile boundaries are ocean rises, so that "continental drift" is mainly the rafting along of the continents on plates spreading from the Atlantic and Indian Ocean rises. Remanent magnetic stations on the sea floor indicate that spreading and continental drift have prevailed since the Triassic, about 200 million years ago. Prior to this time, the continents were clustered in one great "Pangaea." The extent of earlier sea-floor spreading is quite uncertain.

Under the heading of "implications to earth sciences" one could list four categories of problems: (i) the causes (mantle convection, for example); (ii) the effects on currently observable activity of the solid earth (such as earthquakes heat flow); (iii) the nature of past geologic activity (orogeny, geosyncline accumulation, and so on); and (iv) the effects on the biosphere, the hydrosphere, and the atmosphere. The volumes reviewed here are confined to the last two categories, and can be divided into three main parts: reviews of the paleomagnetic and sea-floor spreading evidence; biological and climatic effects; and geological implications. These three parts comprise 17, 22, and 48 papers respectively.

The sections on paleomagnetism and sea-floor spreading come closest to constituting coherent presentations. The gradual trend from the tentative inferences of Precambrian paleomagnetism to the elaborate detail now inferred for the North Atlantic opening over the last 200 million years is most impressive. The most systematic discussion is by Creer on Phanerozoic paleomagnetism, which now appears to agree reasonably well with the sea-floor spreading evidence for the Mesozoic and Cenozoic. A complicated problem is the Mediterranean, discussed by Zijderveld and Van Der Voo: various rotations of parts of this area appear to have occurred back to the Triassic, but not in the Paleozoic. Most disappointing is the discussion of Pacific spreading, which lacks any maps of past configurations to keep the reader oriented with the dearth of familiar continental features.

Biological relationships to continental drift are explored in a variety of papers, ranging from discussions of single genera to systematic analyses of many taxa. In the former category is a paper by Melville about the phylogeny of various tree genera which now have members on widely separated continents, such as the southern beeches. In the latter category is a paper by Flessa and Imbrie, who determine "diversity associations"—correlated waxings and wanings in the numbers of orders and families—among 59 marine taxa for 71 stratigraphic stages, and 20 terrestrial taxa for 60 stages. The computer has evidently come to paleontology in a big way. Significant correlations of the rate of taxonomic change with major plate tectonic events were found, but the reasons for those correlations are obscure. One difficulty for the nonbiologist is that most of the taxa contributing to the correlations appear to be small marine organisms whose ecological preferences are not as easily appreciated as those of the reptiles and other groups discussed in most of the more qualitative papers. Discussion of variations in marine conditions is limited. The effects of cycles of trangressions and regressions on shallow-water organisms are discussed interestingly by Douglas *et al.* Ocean circulation patterns in the Tertiary are conjectured from oxygen isotope and continental climatic data by Frakes and Kemp. Ingenious inferences of bottom currents between Australia and Antarctica from core sediments are made by Watkins and Kennett. One gets the impression that, to paraphrase Newton, there are many more smoother pebbles to be found on this shore.

In the geologic papers, two questions appear to dominate. (i) How are continents split apart? (ii) How did the tectonic pattern differ in Paleozoic and Precambrian from more recent times? Attacks on question (i) vary from discussions of currently rifting zones, such as the Red Sea, to analyses of the lithology of quite ancient units, such as the North Greenland fold belt. Apparently most uplifts and rifts which occur subside before they develop into spreading centers which lead to oceans. Burke and Whiteman identify and discuss 29 such rifts of Mesozoic and Tertiary age; they suggest rift junctions become spreading center junctions only if accommodated by the global tectonic system. In regard to question (ii), the most systematic discussions are by Burke and Dewey and by Sutton. Prior to 2.7×10^9 years ago, the world was distinctly different: considerable crustal rocks similar to those of recent times, both sialic and basaltic, were produced, but in isolated patches, apparently owing to the vigor of early convection. From 2.7×10^9 to 2.0×10^9 years ago the cratons which form the cores of the continents stabilized, volcanism decreased, and the first rifts appeared. Since 2.0×10^9 years ago, the full variety of geologic activity (other than biotic) characteristic of Phanerozoic times has occurred: ophiolite sequences, geosynclinal deposits, continental collision orogenies, and so on. However, the more continental character of the rocks emplaced during this period and the alignment of some very ancient belts in the Pangaea construction suggest to some that any sea-floor spreading was limited compared to that which has occurred since the Triassic.

Also included are six papers on the economic implications: four on metallogenesis, one on petroleum, and one on coal.

These volumes contain some fascinating reading, but they hardly constitute

an organized coverage. Perhaps it is too early to expect such, but at least there could have been more synthesizing commentary for these 1184 pages than a 1½-page introduction: ideally, about four pages for each group of ten papers or so, to place them in context for the nonspecialist.

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Protozoology as Cell Biology

Protozoology. KARL G. GRELL. Third (first English) edition. Springer-Verlag, New York, 1973. viii, 554 pp., illus. $43.90.

For well over 100 years, German authorities dominated the field of protozoology, from such early monographers as Ehrenberg through such leaders as Bütschli, Haeckel, R. Hertwig, and Stein to Doflein, Hartmann, Jollos, and Schaudinn at the turn of the century (followed later by Kahl, Reichenow, and others). This dominance was reflected in the outstanding textbook, *Lehrbuch der Protozoenkunde* by Doflein and Reichenow, which held sway —seldom contested—from the time of its first appearance in 1901 until its sixth and last edition in 1949–53. This sturdy, many-paged work stood off such occasional rivals as the generally slimmer volumes of Calkins, Minchin, Wenyon, Hegner, and Kudo and was much copied and imitated. With the advent of World War II, however, and the tremendous postwar surge of interest in protozoological research—especially among American and other English-speaking protozoologists, parasitologists, and cell biologists—the German grip on the field weakened rapidly.

Once again, leadership in the field was reflected in textbook production. Witness the appearance, in the period from 1948 to 1973, of some 20 general treatments, six by American authors, six by Englishmen, the others by Russian, French, Czech, Polish, or Mexican workers. In the same 25 years, over two dozen substantial monographs or books appeared on special protozoan groups or even individual genera (*Amoeba, Blepharisma, Eimeria, Euglena, Paramecium, Plasmodium, Stentor, Tetrahymena,* and *Trypanosoma*); numerous invertebrate zoology texts were published (not to mention parasitological treatises heavily stressing protozoan species and a scattering of taxonomic and ecological booklets on ciliates and flagellates); several review volumes in cell biology and protozoology appeared; and four International Congresses of Protozoology were convened. German leaders in these enterprises have practically been countable on the fingers of one thumb.

Although high-class research in various important aspects of protozoology was being carried on in scattered laboratories in Germany during the postwar period and was published in the best of journals, it remained for Karl Grell to lead the revival of protozoology in his country in the most visible way—by publication of his outstanding, thoroughly modern textbook, first in two German editions (1956, 1968) and now in English.

Grell initially saw his volume as having limited, essentially European, usage, and early demands for an English translation surprised him. By the time he managed to get away from the research bench and the administrator's desk long enough to supervise a translation, he realized that the English version would have to be more than that: it would have to be updated and revised. The result is a pronounced success, in the opinion of this reviewer (and user) of the new edition.

An internationalist well aware of advances in biological research in the major laboratories of the world, Grell was one of the first to sense that protozoology is becoming increasingly wedded to cell biology, especially at the molecular and genetic levels. His innovative book treats the subject in large measure from a cellular approach, emphasizing areas in which he himself has a special interest and firsthand research experience. The outstanding features are easily identifiable: numerous clear and precise drawings and beautiful light and electron micrographs; scholarly and detailed exposition of a variety of cytological and genetic problems closely related to modern cell biology; neat presentation of "developmental cycles" of selected species (mainly parasitic forms); a thorough bibliography, a unique list of protozoological films, and well-prepared subject and generic (including treated species) indexes.

Of a total of 554 pages, Grell devotes 120 to cytology (including nuclear studies), ultrastructure, and selected biochemical-biophysical subjects and 155 to genetics, sexuality in general, cell cycles, and morphogenesis. References and indexes occupy some 87 pages. On the other hand, only 103 pages are allotted to matters pertaining to taxonomy and classification, including comparative morphology, evolution, phylogeny, and treatment of the dozens of representative groups comprising the major classes; only 73 pages are given to physiology and biochemistry and only 15 to parasitism per se; and there is no exclusive consideration of modern ecological problems. Furthermore, some of the information given on the slighted subjects, such as systematics, is quite dated (though there are scattered excellent exceptions to this) or overweighted in favor of a few select groups, such as the foraminiferans or radiolarians.

But much of the wealth, the usefulness, and the uniqueness of this authoritative textbook of protozoology also derives from the conscious selectivity and fine discrimination of the author. He realizes the goal he set for himself, as both the critic and the user should keep in mind when perusing this handsomely produced volume which restores a leadership role to the country that dominated the field in decades past.

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Protein Anomalies

Alpha-Fetoprotein and Hepatoma. Papers from a symposium, Tokyo, Dec. 1971. HIDEMATSU HIRAI and TORU MIYAJI, Eds. University Park Press, Baltimore, 1973. viii, 320 pp., illus. $29.50. GANN Monographs on Cancer Research, No. 4.

In a word, this volume is a "must" for anyone interested in developmental biology, genic control of protein synthesis, protein purification and immunochemical assays, or clinical pathology and clinical medicine. An exaggeration? Not really, since such is the nature of the subject: serum α-fetoprotein. Normal synthesis of α-fetoprotein occurs primarily in the embryo or fetus. In the human conceptus, the sites of synthesis are the liver, yolk sac, and gastrointestinal tract, and the rate of synthesis reaches a peak at 10 to 14 weeks of fetal development. At or near birth, synthesis of α-fetoprotein is sharply repressed, and the serum concentration of the protein falls rapidly. Repression is not complete, however, as several papers in this monograph reveal: