CRISIS UNDER WATER

THE rare aquatic phenomenon described by Mr. David Tomlinson in the November 1 issue of SCIENCE should be of considerable interest, if our interpretation of it is correct. We have seen at intervals precisely the same thing happen in a small indoor concrete aquarium which we keep supplied with rain water because of the high sodium carbonate content of our tap water. From time to time the water in this aquarium assumes a curiously dead appearance due to the sinking of the algae and the accumulation of organic stain; vascular plants look unthrifty, and the fish gather at the top gasping for air. When this condition occurs it can be remedied almost immediately by dumping a small amount of crushed and powdered limestone into the water. It is even possible to predict the arrival of critical conditions some time in advance, and no doubt this could be done in large reservoirs, thus forestalling the destruction of fish. Our surmise is that the phenomenon represents, in miniature, what happens during the transition of a dying lake from the eutrophic or rich mineral condition to the oligotrophic or depauperate mineral condition, which leads to the formation of an acid bog. In the case reported by Mr. Tomlinson, it would be very interesting to know whether the cumulative development of aquatic life had not sequestered most of the soluble alkaline minerals by the time the unsettled weather conditions of which he speaks made their appearance.

If this explanation is correct the real trouble was due to the inability of the algae to remain alive and release oxygen and only in a secondary sense to the mass decay of organic matter. Although the concept of mineral nutrition as a governing factor in bog formation is well understood in this country to-day, it is absent from so much of our literature on peat that it seems proper to emphasize what appears to be a vivid example of it.

P. B. SEARS

UNIVERSITY OF OKLAHOMA

SCIENTIFIC BOOKS

HISTORICAL GEOLOGY OF THE ANTILLEAN-CARIBBEAN REGION

Historical Geology of the Antillean-Caribbean Region or The Lands Bordering the Gulf of Mexico and the Caribbean Sea. By CHARLES SCHUCHERT, D.Sc., LL.D., professor emeritus of paleontology in Yale University. Published by John Wiley and Sons, 1935. 811 pages, 16 plates, 107 figures.

VERILY as time goes by and brings before us new scenes of ancient life and earth development our primal interests change—hobbies become occupations; avocations become vocations.

We have before us a monumental work by one primarily interested in brachiopod classification and structure. Interest in environmental relations, origin, routes of migration, geographic distribution of life forms led the author into paleogeographic studies of the North American continent. Since fossil faunas seemed frequently to have been derived from the South, through what portals did these immigrants pass, how wide, how deep, and what restriction to such immigration did nature impose? With the zeal of the Renaissance enthusiast unearthing the literature of ancient Greece and Rome, examining and translating every newly found document and interviewing every traveler returning from these classic lands, this author has spared no pains in gathering up all relevant literature, be it the printed page, map, section, diagram or chart or even the portrait of each noted worker. He has corresponded at length with those now living and has solicited many a personal interview. Data so obtained have been carefully credited to their proper sources; analyzed for their bearing on the various phases of the work in hand, and finally assembled for proper deductions.

Naturally, no review in a few paragraphs can give anything like an adequate conception of the contents of this work. One might quite as well attempt to review the contents of a new edition of a large encyclopedia or dictionary. The scope of the work seems to have enlarged from an attempt to indicate the provenance of North American fossil faunas through a "Geological History of the Antillean Region" (1929) to this "Historical Geology of the Antillean-Caribbean Region, or Land Bordering the Gulf of Mexico and the Caribbean Sea." But even this extended title does not adequately convey an idea of the contents of this great volume (xxvi–811 pp., 16 pls., 107 figs.). From the title one would naturally expect to find the work given over to a statement of what is known of the systematic or historic geology of the areas concerned, somewhat after the style of the Correlation Bulletins of the U. S. Geological Survey some forty years ago. Instead, we find, for example, half of the "Summary" devoted to paleogeography and diastrophism—the latter containing such topics as "Late Cenozoic Epeirogeny (Antillean Revolution)," and "Probable Causation of Diastrophism." Neumayr and Lapparent might be surprised at the new uses being made of paleogeography, and Suess and Willis find their work meticulously checked and rechecked in this critical region. Historic geology has clearly become a far more embracing branch of science since the days of correlation bulletins.

Perhaps something of the details of this work may be gained from a glance at the table of contents, with supplementary annotations. The whole work is divided into four "Sections" (1, Introductory and Summary; 2, The Three Middle American Basins; 3, Biogeography; 4, The Lands) of which the last section is six times as large as all others combined. This is quite proper, as it contains the detailed data on which the general conclusions are based.

Section I is the "Introduction and Summary." One half of this, as already noted, is devoted to diastrophism and paleogeography. Elsewhere the section contains discussions of "The Antillean Geanticline or Protaxis"; "The Caribbee Volcanic Arc"; "The Panama Bridge," and the "Panama-Costa Rica, Tehuantepec Portals." Humboldt's primary concept of a mountain chain extending continuously from Alaska to Cape Horn was proven erroneous, so far as Central America is concerned, by the painstaking work of Karl Sapper and likewise in the Antillean region by Hill near the close of the past century. Structural features of Central America run mainly east-west but are often obscured by more recent deformations and volcanic phenomena. The Caribbean trough, the author regards as very old, probably pre-Paleozoic. Volcanic islands in Cretaceous times first partially or wholly closed the east and west ends of this trough.

"It is not alone because the Caribbean has oceanic depths that it is considered to be of very ancient origin. The main basis for this assumption is the fact that such a water-way is necessary to explain the distribution of the faunas since Silurian times, from Europe and North America into South America and in the reverse direction."

Regarding the origin of the Gulf of Mexico we read:

> One of the striking results of the present study is the confirmation of Suess's conclusion that the now very deeply sunken Gulf of Mexico, along with Florida and the Bahama Banks, is but part of an ancient "flat plate." . . . The subsiding of the Gulf of Mexico plate began as early as the middle Silurian, but was of a gentle, intermittent nature throughout the Paleozoic time. The effect of these subsidences is not apparent in the immediate area of the Gulf, but is clearly revealed in the marine faunas of the Mississippian depression. . . . The actual downbreaking of the Gulf of Mexico plate and the formation of the Gulf basin are believed to have begun with the gentle subsidence of late Jurassic time in western Cuba. . . ."

Section II, on the "Three Middle American Basins," treats in somewhat detail of the "Caribbean Mediterranean," the "Young Gulf of Mexico" and the "Antillean Sea" between these two.

Section III, "Biogeography," besides dealing with the distribution and relationships of fossil faunas, treats mainly of the occurrence and interrelationships of modern faunas and floras of the various land areas considered. Plants, snails, crayfish, reptiles, fishes, birds, mammals, etc., lead the author to conclude:

> With one exception, all the fourteen students of the life of the Greater Antilles whose work has been mentioned see in both the faunal and floral biotas unmistakable evidence for more or less migration via land from South America. These migrations took place, according to the present writer, at two widely separate times, the first during the Eocene, and the second, in a much more limited way, during the Miocene and early Pliocene. Nearly all biographers are agreed that the Antillean life (except birds) is predominantly Central American in character and that Central American life in turn is very largely of South American origin. . . . What the present work shows especially is that back of the Miocene, and more certainly back of the late Eocene, Central America was continued eastward into a very long, rugged Antillean peninsula, which appears to have been terminated with the Virgin Islands and Banks.

Section IV, the bulk of the work, is devoted to "The Lands." These are divided into seven regions: (1) Mexico; (2) Gulf Coast Plain; (3) Nuclear Central America; (4) The Antilles and Their Foreland; (5) Young Isthmian Link Connecting Central and South America; (6) Northern South America; (7) Oceanic Islands. To each of these regions are devoted from three to seven chapters. Samples of the contents of these chapters, chosen at random, are herewith outlined:

Chapter 11, Mexico. Seven primary structural features: Mexican geosyncline, Occidental geanticline, Llanoria, Southern Pacific geosyncline, Sonoran borderland, Balsas portal, Del Sur borderland. Physiographic and structural provinces: Sierra Madre Occidental province, Anahuac Desert plateau province, Sonora Desert province, Gulf Coastal plain province, Sierra Del Sur province, Volcanic province, Tehuantepecan province. Diastrophism: Paleozoic, Triassic, Late Jurassic, Lower Cretaceous, Upper Cretaceous Laramid Revolution. Late Pliocene-Pleistocene epeirogeny.

Chapter 21, Texas. Physiography, Structure: Fault zones, Barton syncline, Salt domes, whence the salt? Stratigraphic sequence.

Chapter 29, Larger structural features of the Antilles. General structure of the Antilles. Cenozoic crustal unrest. Direction of compression. The major faulting. Structure of the individual islands: Jamaica, Hispaniola, Puerto Rico, Virgin Islands—St. Croix, Cuba. Conclusion on Antillean structure.

Chapter 37, Panama. Notes on the geologic map by R. H. Terry. Volcanoes. Origin of the Panama land bridge: Physical evidence, Biogeographic evidence. Stratigraphic sequence, mainly along the line of the Panama Canal.

The large number of geologic, physiographic and paleographic maps, together with many well-chosen sections and diagrams, aid materially in making clear the author's conception of the development of this great sub-tropical belt of our Western Hemisphere. No attempt has been made to illustrate the faunas and floras upon which the greater part of geologic chronology and correlation is naturally based. Here as elsewhere, in using the vast amount of material assembled from others the author has accepted their work "at its face value" unless "contradicted by later work or not borne out by interregional correlation." The aid Dr. Schuchert has given us in interpreting American geology is clearly that of a Lyell, of whom Ramsay once remarked "We collect the data and Lyell teaches us to comprehend the meaning of them."

This work will at once assume an outstanding place in geological literature, and its value as a work of reference for decades to come can scarcely be overestimated.

G. D. HARRIS

PALEONTOLOGICAL RESEARCH INSTITUTION
ITHACA N. Y.

SPECIAL ARTICLES

NATURAL GLASSES OF THE INSOLUBLE RESIDUES OF THE PENNSYLVANIAN LIMESTONES OF TEXAS

DURING the course of some preliminary investigations of the insoluble residues of certain Pennsylvanian limestones of central Texas it was found that some of the formations contain a relatively conspicuous amount of fragments of natural glasses. This statement should not be construed, however, to mean that any large amount of the fragments may be found in these formations.

The method of investigation, during the progress of which such fragments were noted, was essentially that developed by McQueen[1] for the study of insoluble residues. In this method the rock is first crushed in a mortar and screened. Twenty-five to thirty grams of the material passed through the 8-mesh screen and retained on the 16-mesh are successively digested with 50 cc of 6 M hydrochloric acid until the sample ceases to show any effervescence. The residue remaining is then separated from the acid by decantation and washing or by means of an elutriator. It is then dried and is ready for examination under the microscope.

If the residue is small, which was generally the case with the rocks in question, a constituent may appear to be conspicuous, although in reality it composes only a small part of the original rock. This is the case with the natural glass fragments, which, because of their peculiar properties, are very easily noticed in such residues.

Appreciable amounts of natural glass fragments were noted in samples from a number of formations but particularly from the Marble Falls formation, Adams Branch limestone member of the Graford formation, and the Gunsight limestone member of the Graham formation.

Occurring in different formations with fairly wide separation in the geologic column these natural glasses are, therefore, manifestly of no value in geologic correlation, but it is thought that their presence is worthy of note, even though no practical application can be made.

The fragments vary in size from pieces measuring 0.736 mm × 0.480 mm and 0.928 mm × 0.352 mm to the very smallest of fragments.

Some pieces examined showed perlitic cracks and globulites. Conchoidal fracture is a conspicuous character. The isotropic nature of the material as shown under crossed Nichols is of course a conspicuous characteristic.

All the fragments studied for their refractive indices by means of immersion oils showed indices between 1.515 and 1.520.

George[2] has made a study of the relation of refractive indices of natural glasses to their chemical composition. Reference to George's curve of the indices of refraction and chemical composition indicates that these fragments have a chemical composition of approximately 65 per cent. silica.

No generalization from this study is attempted, except the notation that it probably indicates a more wide-spread distribution of natural glasses in such sediments than may generally be thought to be the case.

Fragments of natural glasses are more or less resistant to destruction during transportation and deposition so that their wide-spread distribution might be expected.

In sediments like sandstone a few fragments included among many pieces of insoluble material would not be noticed during an ordinary examination, while an equal distribution in limestone would be easily noted because of the greatly reduced residue.

The occurrence of the fragments in the formations noted is probably more related to the wide-spread distribution of this kind of material than to any fact of

[1] H. S. McQueen, "Insoluble Residues as a Guide in Stratigraphic Studies," Missouri Bureau of Geology and Mines, 56th Biennial Report, 1931.

[2] William O. George, *Jour. Geol.*, 32: 5, 353–372, July–August, 1924.