Book Reviews

Marine Geology

Papers in Marine Geology: Shepard Commemorative Volume. Robert L. Miller, Ed. Macmillan, New York, 1964. xx + 531 pp. Illus. $20.

In 1923 Francis Parker Shepard became the first geologist openly to question the theory of periodic disastrophism. By 1927 his search for better geological explanations had led him to the study of modern marine environments. In 1942 he began to spend part of each year at Scripps Institution. And in 1946 he emigrated there from Illinois to devote full time to the study and teaching of marine geology. *Papers in Marine Geology*, prepared by 30 authors from 21 institutions, nearly all of them his former students, is a measure of his influence on the field.

Here is not the "comprehensive view" promised by the publishers, but an impressive compendium nevertheless. Two-thirds of the 24 papers deal with the continental shelves and coasts, four concern the continental slope, two are general, one is archeological, and one deals with the deep sea. Geographically 19 papers describe the seas adjoining North America, two involve Japan, and one the northern Red Sea. Strong emphasis is thus placed on shallow seas contiguous to North America, particularly on their sedimentary aspects.

R. S. Dietz introduces the book with a provocative paper, "The third surface." Sea floor geology, says Dietz, is mantle geology, and the differentiation of continents and ocean basins is the grand problem. Sea floor spreading is the current bandwagon, and he hops on it with vigor. According to this now widely championed mechanism, the oceans are the tops of convection cells and the continents are rafts of sial over convergences. Tectonism is accounted for with neither shrinkage nor dilation of the earth—continental compression produces fold mountains, the ocean floors are domains of tension. Continents drift or rift with convectional overturn and remain high by sialization. The ocean basins are ancient features, but they are floored by young rocks, for as the sima slips beneath the continents the older oceanic sediments go under with it. At such places we find island arcs and trenches, or abrupt structural breaks.

"Economic oceanography," by Butcher, is in similarly imaginative vein. Both mineral and biological resources will be garnered from the sea in ever greater mass and with increasing efficiency. Fish will be herded and pumped aboard ship. Water will be desalted in large volumes. Weather will be controlled.

Then comes a pair of factual papers by R. F. Dill and T. K. Chamberlain, in which they describe the head of Scripps Canyon on the basis of scuba diving, sounding, and photography. Both emphasize the mat of intertwined marine plant detritus and sediment that plugs the canyon base between flushouts. This mat creeps down slope, eroding, decomposing, and generating gas. Catastrophic movement is triggered by earthquakes or by abrupt loss of support for upslope sediments as a result of decomposition. Both authors carefully discriminate between turbidity currents and other forms of mass movement. They were unable to find any evidence that the former affected the canyon head.

Other papers in the volume, however, emphasize the importance of turbidity currents in sedimentology. R. J. Hurley applies a modified Chézy equation to estimate velocities of 10 to 15 knots for inferred, low-density, turbidity flow in Cascadia channel, possibly as high as 80 to 110 knots for very dense flows. G. A. Rusnak and W. D. Nesteroff conclude that 70 to 90 percent of the sediments in the Bahama's Tongue of the Ocean are the work of turbidity currents. In contrast to those of abyssal plains, however, these deposits are less well sorted and graded, coarser, and in less extensive sheets.

Cape Cod and Georges Bank draw related studies by R. L. Miller and J. M. Ziegler and by H. B. Stewart and G. F. Jordan. Cornaglia's null-point theory is found to apply to sediment movement and sorting, in the relatively simple environment of Falmouth beach and in the complicated longshore topography of outermost Cape Cod. Sand ridges on Georges Shoal have migrated approximately 1000 feet westward in 25 years, probably because predominantly west-moving waves produce net transport westward of sediment entrained by tidal currents over shoaling crests.

In an interesting note on the interrelation between environments, R. M. Norris points out that long-term maintenance of Southern California beaches depends on stream-delivered supplies now being intercepted by dams. This poses a spectrum of sociological and engineering problems.

J. C. Ludwick needles the stratigrapher in pointing out that seemingly intergrading sedimentary facies in the northeastern Gulf of Mexico really have slightly different ages and are not strictly contemporaneous. He also emphasizes the continental affinities of the deposits of shelves and stable platforms, which are marine only in the sense of ultimate burial. With the exception of local channels, turbidity currents do not appear to be important on the continental shelves.

Two papers deal with the East Bering-Chukchi Sea, a shallow, slightly irregular 700,000 square mile rock platform blanketed with 3 to 10 feet of sandy sediments—one of the worlds great modern epicontinental seas. Dietz and his associates emphasize the low calcite content of the sediments, the prevalence of arenaceous forams, and the local abundance (in the Chukchi Sea) of ice-rafted pebbles. Acoustic subbottom reflections are interpreted by D. G. Moore to imply that most of the sediments were prograded from delta fronts of major rivers, with little redistribution by wave action.

In contrast to the Bering-Chukchi Sea, K. O. Emery's study of the subtropical Gulf of Aqaba shows a high concentration of calcite (average 58 percent) in the sediments, mainly of skeletal origin. The Red Sea proper (with 81 percent) and Persian Gulf (with 75 percent) have even more. This contrasts also with the topographically and structurally similar Gulf of California, an area of upwelling cold currents where the sediments are dominated by detrital clays and diatom oozes. Another paper, by W. R. Walton, shows that (biogenic) calcite is also but a minor component of the subtropical Tampa and Mobile Bay sediments, a function probably of river discharge and reduced salinity. The use of calcite as a climatic indicator is clearly of great subtlety.

D. C. Krause fills in the semidetailed study of the Southern California continental borderland begun by Shepard and Emery a quarter century ago. Most interesting are his excellent underwater photographs, showing tracked surfaces, at 1935 and 3550 meters, which palichnologists would probably classify as most likely shelf features.

No one would expect all papers in such a volume to be of equal quality or verbal parsimony, and they are not. It is an organizational defect that they do not have abstracts or summaries to help in sorting them out. Of the typographical errors noted, only one is important—the photograph, Fig. 24.4B, was taken in 1918, not 1910, and looks north, not south.

Leaving quibbles aside, Fran Shepard can well be proud of his book, his boys, and himself. Many who were not his former students join in wishing him well in retirement.

PRESTON E. CLOUD, JR.
School of Earth Sciences,
University of Minnesota, Minneapolis

Inorganic Chemistry

Non-Stoichiometric Compounds. L. Mandelcorn, Ed. Academic Press, New York, 1964. xiv + 674 pp. Illus. $22.50.

At the end of the 18th century, the general discussion between Berthollet and Proust led to the conception that chemical compounds have a constant composition, and on this basis the general development of chemistry has proceeded. But at the end of the 19th century, when investigations concerning the mutual behavior of metals were carried out, many examples of intermetallic phases with broad "homogeneity ranges" were stated. In the meantime we have discovered "nonstoichiometric" compounds—solid substances of very different character. How manifold the fields concerned are is demonstrated in this book, edited by L. Mandelcorn. The volume contains the following chapters: (i) "X-ray structural analysis" (J. M. Robertson, 46 pages); (ii) "Statistical thermodynamics and reaction rate theory" (D. Henderson and H. Eyring, 46 pages); (iii) "Inorganic non-stoichiometric compounds" (A. D. Wadsley, 103 pages); (iv) "Occluded gases in transition metals" (O. M. Katz and E. A. Gulbransen, 51 pages); (v) "Physical properties of nonstoichiometric inorganic compounds" (C. Subbarao, 38 pages); (vi) "Inorganic inclusion complexes" (R. M. Barrer, 121 pages); (vii) "Clathrates" (H. M. Powell, 52 pages); (viii) "Organic adducts" (L. C. Fetterly, 73 pages); (ix) "Carbohydrates" (F. R. Senti and S. R. Erlander, 35 pages); and (x) "Physics and chemistry of inclusion complexes" (L. A. K. Staveley, 29 pages).

In general, the different chapters are well written and provide a good introduction to the different fields. Predominant emphasis is given to structural questions; indeed, the existence of many nonstoichiometric compounds is understandable only on the basis of structural pecularities. On the other hand, more detailed structural investigations have demonstrated that in some cases the assumed nonstoichiometry does not exist, but that a great number of stoichiometric compounds of very similar, although complicated, structures are present. The discussion of the properties of the substances is a bit brief. And some other chapters should have been enlarged. Why is the otherwise well-written chapter 3 restricted to oxides and other chalcogenides? A treatment of halogenides, phosphides, and the like, and especially of nonstoichiometric intermetallic compounds, would be most interesting. The same is true with respect to chapter 5, and in chapter 4 one is disappointed to read only of hydrides. In a second edition, chapters 3, 4, and 5 should be enlarged.

In general this book is very useful and can be recommended.

W. KLEMM
Anorganisch-chemisches Institut
der Universität, Munster

Optical Methods of Analysis

Treatise on Analytical Chemistry. Part 1, Theory and Practice. vol. 5, *Optical Methods of Analysis.* I. M. Kolthoff and Philip J. Elving, Eds. Interscience (Wiley), New York, 1964. xx + 640 pp. Illus. $16.

This fifth volume in part 1 of the *Treatise on Analytical Chemistry* represents the first of two volumes that will be devoted to optical methods of analysis. Edward J. Meehan assisted the editors as section adviser. Individual chapters include "Optical methods: Emission and absorption of radiant energy," "Fundamentals of spectrophotometry," and "Spectroscopic Apparatus and Measurements," all by Meehan; "Principles of light scattering" by Fred W. Billmeyer, Jr.; "Specification and designation of color" by D. B. Judd and I. Nimeroff; "Ultraviolet and visible spectrophotometry" by Alfred A. Schilt and Bruno Jaselskis; "Fluorometry" by Anne L. Conrad; "X-ray methods: Absorption diffraction and emission" by H. A. Liebhafsky, H. G. Pfeiffer, and E. H. Winslow; "X-ray microanalysis by means of electron probes" by David B. Wittry; "Microwave spectrophotometry" by J. H. Goldstein, and "Nephelometry and turbidimetry" by Frank P. Hochgesang. Generally, the chapters are well written and contain a minimum number of typographical errors. This volume follows the format of earlier volumes of the *Treatise.*

Although it is a difficult task for an editor to integrate a collection of chapters written by different individuals into a coherent presentation, I feel that the volume could have been better organized. For example, optical components of instrumentation (prisms, gratings, and so forth) are discussed in chapter 55, but light sources and detectors are dealt with in the second part of chapter 58. Interposition of chapters on light scattering (chapter 56) and specification of color (chapter 57) between fundamentals of spectrophotometry (chapter 54) and ultraviolet visible spectrophotometry (chapter 58) hardly seems desirable. Also, there appears to be undue repetition and fragmentation of topics between chapters. For example, Tables 53.I and 58.I are essentially identical. Atomic transitions, the Beer-Lambert law and derivations from it, precision spectrophotometry, and spectrophotometric analysis of mixtures are all treated, to varying degrees, in more than one place.

The volume is not without serious technical errors and omissions. In the consideration of environmental effects on ultraviolet absorption spectra (p. 2955 *et seq.*), no mention is made of the *p*H-dependency of spectra for molecules containing acidic or basic groups. The statement is made that ". . . a double monochromator cannot be used with a single vacuum phototube" (p. 3006), even though several