

constraints of its format, the "task of making clear the historical forces that produced the modern computer" (I. B. Cohen, Introduction, p. 7).

HENRY S. TROPP

*Computer History Project,  
Smithsonian Institution,  
Washington, D. C.*

## Men, Institutions, and Ships

**The Edge of an Unfamiliar World.** A History of Oceanography. SUSAN SCHLEE. Dutton, New York, 1973. 398 pp., illus. \$10.95.

Oceanography, although its beginnings are respectably far back, was long a small community where everybody knew nearly everybody else. Since World War II, it has exploded to vast dimensions and great diversity. This happened first by the drawing in of talent from the outside, and only much later by formal training of oceanographers as such.

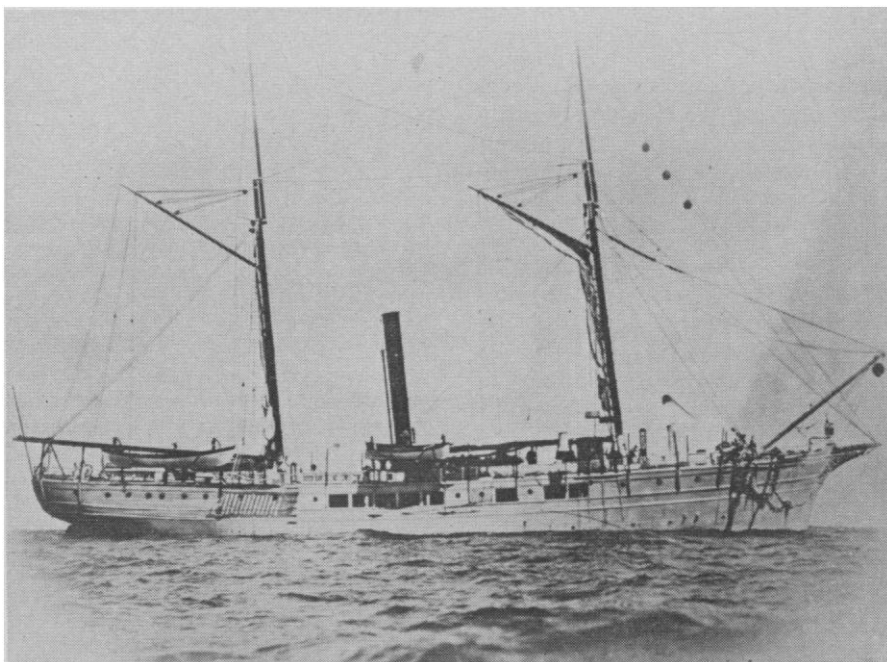
Now the size and wealth of its domain and its impact on human thoughts and affairs make oceanography of interest to those whose task it is to explore the evolution of man's ideas and their interaction with reality. At the same time, the practitioners of the science, finding it increasingly difficult to keep up even with the daily developments in their own specialties, begin to lose contact with the evolution of the field and feel a need to acquaint themselves with its past in a more deliberate and systematic manner than by just listening to the lore provided by the old hands. Thus the time is ripe for historical studies of this suddenly so visible and important field. With the exception of some specialty studies, there are few of these, and Susan Schlee has filled an important gap and filled it well.

This charming book is an introduction that will not so much satisfy the desires of the historians and oceanographers as whet their appetites. In the process, it provides a rich, stimulating, and also entertaining experience, written as it is in an easy, flowing style full of small details that focus on personalities and events. For this reviewer, who has watched the oceanography scene for almost 25 years, it contains a great deal that was new and much more that suddenly made sense out of strings of loose information picked up

here and there. The history of oceanography is filled with men, institutions, and ships. The names are often familiar and suddenly acquire new perspective. To see Sir Charles Wyville Thomson, formerly best known from the oceanic ridge that bears his name, as a human being, to find that R. V. Pillsbury traces its name back to a man who desperately tried to retain a scientific effort in the 19th-century Coast Survey, but failed, are small delights that brighten days normally filled with charts, tables, and administrative memos.

The reading of the history of one's own field leaves many impressions that last. There is the sobering surprise, in some areas, that we have advanced so little. I enjoyed the careful discussion of the contribution of the *Challenger* expedition to our present knowledge of deep-sea sedimentation. To a much larger degree than many of us realize, we have succeeded only in quantifying and geographically expanding Murray and Renard's concepts; it is just in the last very few years that we have solved

some major problems and raised important new ones. Reading this chapter in Schlee's book suggests that we might profitably take the *Challenger* Reports down off the shelf and dump some fairly large number of newer works. Quite in contrast with this, and almost wholly new to me, is the history of the International Council for the Exploration of the Sea in the early part of this century, and its successful organization of what has remained a major and active research program in biological and physical oceanography. Fascinating also, and in a way comforting, is the story of the relations between the U.S. government and academic and private ocean science. Concerned as we are today, or perhaps indignant is a better word, about the official emphasis on immediate returns of benefits to society, there appears to be nothing new in it. On the contrary, it is government support of fundamental research that is the new phenomenon, and if today we see a return to the older, more pragmatic, or perhaps more mercenary, attitudes



"The U.S. Coast and Geodetic Survey steamer *Blake*, which was used by Alexander Agassiz for a series of three cruises from 1877 to 1880." These expeditions of Agassiz's "were no carbon copies of the *Challenger's* voyage, for the engineer-naturalist . . . had new ideas on how to rig a ship for deep-sea exploration. Agassiz had gotten these ideas . . . from the Calumet and Hecla copper mines in northern Michigan. There . . . he acquired much experience in hoisting pieces of heavy machinery and loads of ore up and down mine shafts, and this knowledge he applied to the similar problems of raising loads of deep-sea animals aboard the *Blake*. He worked closely with Charles Sigsbee, the steamer's able and inventive captain, and the two of them rearranged the drums and winches aboard the 139-foot ship, replaced her bulky hemp lines with thinner but stronger wire rope, and equipped the vessel with a double-edged dredge (that could land on either edge and still work), a better trawl, and Sigsbee's own improved version of Lord Kelvin's sounding machine." [Reproduced in *The Edge of an Unfamiliar World*, courtesy National Ocean Survey]

on the part of the government, we are still a long way from the total disdain of the 19th and early 20th centuries. The author's suggestion, made in passing, that the focus in England was different owing to the much stronger position of private scientific organizations with a strong influence in government is intriguing, and I would like to have seen that pursued further.

By the author's own word, this is a book of men and ideas. In fact, and of necessity because of the vastness of the terrain it covers, it is rather more a book of events, with brief spotlights on the people that moved and the concepts that moved them. In an introduction of this kind this is probably inevitable, and the book covers a great deal of ground without giving much cause for quibble. The level, I judge, is more that of the educated layman than of the professional oceanographer, but we are all laymen in each other's specialties. Nevertheless, a somewhat more rigorous treatment of concepts would have been both possible and desirable; an example is the very light touch regarding the development of wave theory and experimentation during and after World War II. Somewhat surprisingly, the introduction disclaims any specific intent to discuss the evolution of oceanographic instrumentation. Fortunately, however—and rightly, because our concepts about the sea are so strongly limited by what we can measure—there is in reality a good deal of discussion of instruments, and the slowness of development of our understanding of oceanic circulation in consequence of the inaccuracy of thermometers and salinity determinations is very nicely sketched. One wonders, as a result, to what extent the evolution of oceanography has been so slow because the investigator, bent on testing his ideas, has often found himself charged first with the duty of outfitting his ship and designing his equipment. Even today, we do not always accord due respect or proper reward to those who invent our instruments—no new phenomenon, apparently.

A rather sizable portion of the book is devoted to a discussion of development of new tectonic concepts of the earth. Admittedly, this is an exciting subject and an exciting time, appearing to us geologists a bit like the days in physics when the atom model was developed or the heady times just behind in genetics. The summary is adequate,

but basically this is a subject of the sciences of the solid earth, and its future lies there, not in oceanography. I would gladly have seen the space devoted to a more watery subject.

The history of science can be traced along many paths, its evolution seen in terms of concepts, of the contributions of outstanding and powerful minds, of changing social and political conditions, of the lagging or racing ahead of technology, or of the growth and decline of famous institutions. In oceanography, we can also tell sea stories (which somebody ought to preserve). This book includes a bit of all, but mostly it is a classical history in the sense that it de-



"The nonmagnetic brigantine *Carnegie* under full sail." The *Carnegie* "was framed of white oak, planked with yellow pine, and held together with locust treenails and bolts of copper and bronze. Her auxiliary engine was built almost entirely of bronze, and her anchors were of bronze and manganese. . . . her lines of hemp were rove through wooden blocks and spliced around copper thimbles. (Her crew even wore nonmagnetic belt buckles . . .)." On her maiden voyage in 1909 the *Carnegie* "followed the route taken some 200 years earlier by . . . Edmund Halley in the *Paramour Pink*. Halley had also been collecting data for a magnetic chart. . . . In the 200 years between the two voyages the magnetic declination . . . had changed so much that had the *Carnegie* followed the *Paramour Pink*'s compass courses she would have made landfall, not near Falmouth on the south coast of England as intended, but somewhere along the northwest coast of Scotland." [Reproduced in *The Edge of an Unfamiliar World*, courtesy Department of Terrestrial Magnetism, Carnegie Institution of Washington]

scribes the temporal sequence of events, although grouped under headings that add a conceptual content. Thus, it leaves me with a taste for a great deal more, for studies of political relationships, so convolutedly described recently by Edward Wenk, Jr., in *The Politics of the Ocean* (University of Washington Press, Seattle, 1972), for the history of great institutions (we only have a small one for Scripps—Helen Raitt and Beatrice Moulton's *Scripps Institution of Oceanography, the First Fifty Years*, Ward Ritchie Press, San Diego, 1967—as far as I know), for the tracing of the migration of concepts between the fundamental disciplines, such as physics and chemistry, which generate them, and oceanography, which uses and modifies them, and particularly for more about people. There is more than one side to the role of men in science, who are not only carriers and shapers of ideas but also personalities who, for better or for worse, have often molded the course of events more through their strength and idiosyncrasies than through their science. This is perhaps less clear in this book than it might have been, and it is now certainly time for some good biographies of the major players of the game. Many of those who have put their mark on the marine sciences, or those who have known them well, are still alive. Perhaps this makes the task a little delicate, but it is also a rare advantage, and one longs to see good biographies of many important men like Harold Sverdrup, H. H. Hess, Columbus O'Donnell Iselin, Alfred Redfield, and Maurice Ewing. Maybe the author will take me up on this suggestion; it should fill the rest of her life and be very nice for all of us.

TJEERD H. VAN ANDEL  
*School of Oceanography,  
Oregon State University,  
Corvallis*

## Hale Memorabilia

**The Legacy of George Ellery Hale.** Evolution of Astronomy and Scientific Institutions, in Pictures and Documents. HELEN WRIGHT, JOAN N. WARNO, and CHARLES WEINER, Eds. M.I.T. Press, Cambridge, Mass., 1972. viii, 294 pp. \$17.50.

George Ellery Hale (1868–1938) was one of the giants in the history of science in the United States. He was a leader in establishing the "new" science