

The Restless Sea: Exploring The World Beneath The Waves

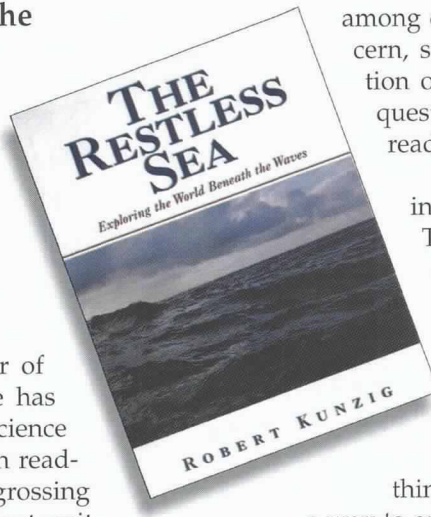
Robert Kunzig,
336 pages. W.W. Norton & Co.
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Robert Kunzig is European editor of *Discover* magazine. The fact that he has received awards for excellence in science journalism is quickly discerned upon reading the first few pages of this engrossing book. Kunzig artfully combines elegant writing with a facility for explaining science in plain English. His approach is to sketch both the very human activity of scientists who helped create an understanding of the ocean, over mainly the last fifty years, and the highlights of that understanding. That he combines both these aspects of science (a human activity and a collection of facts leading to understanding of the world around us) is, in my opinion, the primary value of the book.

We scientists repeatedly hear—and ignore—the call for us to present science to our audiences in the way that science is done, because that is what excites us about science, and excitement can be contagious to learning. *The National Science Education Standards* (National Research Council, 1996) is but one voice asking this of us. This book is an excellent example of a science writer answering that call by interviewing, as he says, “many dozens of researchers” in order to tell the stories in this book.

On learning, to his amazement, that human activity can damage the seemingly unchanging sea, Kunzig set out to discover what oceanographers have learned about the sea that can help counter this damage. He interviewed people, visited their laboratories and ships, read their writings, and limited himself to topics that are not often written about for the lay audience. You will find nothing in this book about beaches, whales, dolphins, tides, or, in spite of the jacket photograph, waves. Rather you will learn about the deep sea, its water, bathymetry, fauna and flora, and thermohaline circulation. You will also realize quickly that this is a book to be read, not only for the subject matter content, but for peeks into how the data on which these ideas are based came to be collected and for eavesdrops on how ideas were half-formed and reformed in order, finally, to inform us all. You will also find yourself wandering



among question marks about issues of broad concern, such as climate change and over-exploitation of natural resources. That the inverse of a question mark is a hook further engages the reader.

As in every good nonfiction book, an index is included, as are selected references. The book is well designed, the type easy to read. The technical vocabulary should not deter a lay reader, but in places he or she may wish for elaboration. There are no photographs and only one drawing, which is not a drawback, in my opinion, and which keep the price of the book relatively low. Of greater value, I think, is the use of analogies to everyday life as a way to enhance understanding, such as by comparing the swimming speed of some amphipods to the sprint of a human.

The shortcomings are those common to a book that is chiefly an oral history. One can always think of someone else who should be telling part of the tale. Kunzig admits that not even all the people he interviewed are given room in the book to play their parts. The compensation for this constraint is that the story line remains clear in each chapter, unlike the story line in history books that are trying to cover all that happened, which, because of the detail, can let the reader drift away into fascinating little historical eddies. The facts in the book seem all but error free to me, with only the misattribution of the design of the box core to biologists rather than geologists being obvious. There is one sentence in the Prologue, however, with which I take exception. Kunzig comments that “Most of us have experienced, in some very ordinary way, the danger of the sea, its power to humble us with a casual shrug.” On the contrary, my experience watching swimmers, small boat users, and other recreational water users, is that too many of them are oblivious to the dangers of the sea.

As I note the content covered in the ten chapters, remember that each chapter also contains the story of how we have come to explain that aspect of the ocean. Chapter 1 seeks to answer the questions why there is an ocean on planet Earth and why it is important to us humans. Chapter 2 presents the changing description of ocean floor topography and changing ideas to explain that topography, ending with plate tectonics. Chapter 3 covers several topics on sea floor topography, including the most recent techniques of measuring it, and laments the lesser understanding we have of sea floor topography on Earth than of the topography on the planet Venus. Chapter 4 deals with our growing understand-

ing of the deep-sea benthos. Chapter 5 turns to the amazing life forms populating the hydrothermal vents at ridge crests, and tracks answers to such questions as: What do they eat for food? How do they populate new vents? Chapter 6 presents some discoveries about gelatinous plankton of the open ocean and notes a lack of funding for exploratory research. Chapter 7 is about phytoplankton. Chapter 8 is an historical summary of the over-exploitation of the cod fishery of eastern Canada and New England. Chapter 9 is about thermohaline circulation. Chapter 10 takes thermohaline circulation into the study of climate change. The Epilogue touches on extraterrestrial oceans and the destruction of the ocean in the geological future.

Let me end this review with a, perhaps audacious, suggestion for teachers of introductory oceanography or marine science courses. This book was written to engage an audience, not, as with most textbooks, to deliver as much subject matter content as technologically possible. I think it can indeed engage students because, in the main, it is about people, not things. And these people experience the same range of emotions and behavior as students: wonder—the people in *Alvin* as they explore the ridge crest vents, disappointing failure of a good idea—the false-start at inventing echosounding, stubborn refusal to give up an erroneous idea—the last gasp adherence to the concept of an azoic zone, high standard of ethics—Thomas Huxley in the Bathybius affair (scientists are not so different from other people as the movies and TV make us out to be). What's more, each chapter contains cameos of scientists at work: fumbling with misconceptions, working their way by fits and starts through new kinds of data that

call upon imagination and intuition for new interpretations, battling contamination of equipment and instruments, competing with one another in their interpretations, making do with whatever is at hand when equipment fails in order to keep the observations going, adapting to the tediousness of sampling in order to reap the reward of interpretation (the hard work of a scientist is normally hidden from the lay person by the scientist's technical skill, but not here). Finally, integral to the story are broad topics that interest many students: the origin of life, public funding of science, exotic species, controlling nature vs. responding to environmental hazards, and over-exploitation of resources. With this book as the "text," one could, I believe, truly engage the students, excite them about the ocean, guide them to necessary additional information that they would want to discover, encourage them to synthesize and evaluate that information, let them judge the role of science in society, and enable them to learn how to learn. You might wish to turn them loose to learn on their own about waves and beaches or some other topic not covered in this book. But of course, you could not cover all the topics covered in a regular textbook. Nor have them memorize 1,200 boldfaced terms. To some of us this would be a trivial price to pay for engaging students to learn ocean science the way ocean science is done.

REFERENCES

National Research Council (NRC), 1996: *National Science Education Standards*. National Academy Press, Washington, D.C., 262 pp.

Books Undergoing Review:

Beaches and Dunes of Developed Coasts

By

Karl F. Nordstrom

Cambridge University Press, Publisher

The Effects of UV Radiation in the Marine Environment

Edited by Stephen de Mora, Serge Demers and Maria Vernet

Cambridge University Press, Publisher

The History of American Deep Submersible Operations

Will Forman

312 pages. Best Publishing Company
ISBN: 0-941332-72-1

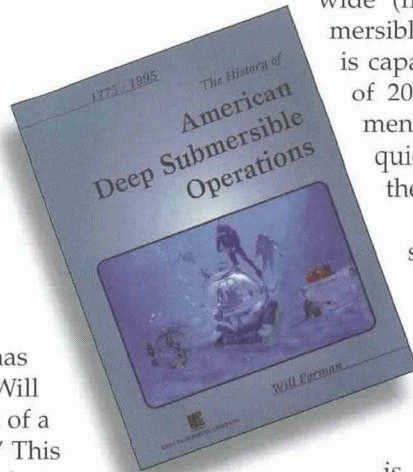
Review by Hal Palmer

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Dr. Don Walsh of Trieste and Marianas Trench fame opens his Foreword to Will Forman's book stating . . . "I cannot think of a more qualified person to write this book." This reviewer certainly concurs in Don's endorsement. I had the privilege of a casual but enlightening association with Will when I too worked at the U.S. Naval Ordnance Test Station (NOTS). I was at the Pasadena Annex and on San Clemente Island while Will was toiling to build the "Deep Jeep" in the middle of the Mojave desert! One of his colleagues, a renowned marine geologist then at NOTS, constantly referred to submersibles as "those backyard death-traps" although he did bump me from a dive in the Cousteau "Soucoupe" when Westinghouse and the Navy contracted it for dives off San Clemente in the early 60s.

Many of us whose careers have spanned the heyday of manned submersibles (1960s and 70s) will be familiar with the people and craft Will presents in his well-researched book. He begins with a fascinating account of the "turtle," a Revolutionary War vintage one-man submarine built to deliver ordnance designed to sink British ships in Boston Harbor. Forman takes the reader on an historic tour of subsequent "submarine" developments, all related to military operations until the initiation of deep diving for science launched by William Beebe and Otis Barton employing their tethered diving spheres, the "Bathysphere" and "Benthoscope".

U.S. Navy interest in deep submergence prompted the purchase of the Swiss-designed, Italian-built "Trieste" in 1958. The Office of Naval Research paid \$200,000 for Trieste and had her shipped to the Naval Electronics Lab in San Diego. From the success and scientific excitement generated by Trieste's exploits U.S. industry, primarily aerospace firms, Westinghouse Electric and several private companies, foresaw enormous promise in deep submergence vehicles and literally plunged into fabrication, testing and research programs employing scores of manned submersibles. According to "Tex" Treadwell (1977), at the beginning of the 1960s there were only 4 deep-sea research vehicles in operation. By 1970 there were 43 and from Don Walsh's count, by the end of 1970 there were 200 world-



wide (from Forman's preface, "a deep submersible shall refer to a manned vehicle which is capable of sustained operations to a depth of 200 meters"). In anticipation of government funding, the concept of a "wet NASA" quickly became a buzz-word throughout the U.S. oceanographic community.

For a variety of reasons, the U.S. submersible fleet dwindled rapidly, and today only a few remain active in industry and marine research. Will Forman's book provides an engaging, first-hand account of the trials, tribulations and lessons learned in taking man to the ocean's depths. It is a stimulating account of American marine engineering and science in the fast-paced world of underwater exploration. Companion books such as Frank Busby's exhaustive and thorough compendium of manned submersibles (Busby, 1976) and Richard Geyer's analysis of applications to science and engineering (Geyer, 1977) can augment Forman's account of U.S. involvement in deep submergence. A recent paper by Peter Rona (2000) will bring interested readers current with the world-wide status of deep-diving manned submersibles.

Numerous photographs, drawings and tables enhance this narrative of the evolution of American undersea activities. The inclusion of a bibliography citing sources, both published materials and personal interviews, provides a valuable resource in itself. A thorough index, sometimes an afterthought in many publications, permits direct access to information on people, events and vehicles. Will has done a masterful job in summarizing an enormous amount of information in a readable, informative and sometimes humorous dialog—often in the first person. He was there, and thank goodness he took the time to capture history that could easily have slipped away.

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- Treadwell, T.K., 1977: The Rationale for Submersibles. In: *Submersibles and their use in Oceanography and Ocean Engineering*. R.A. Geyer, ed., Elsevier Oceanography series, 17, Amsterdam, 14-21.