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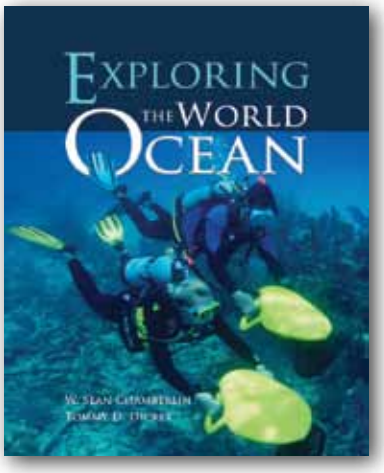
Exploring the World Ocean



By W. Sean Chamberlin and Tommy D. Dickey, McGraw-Hill Higher Education, 2008, 394 pages, ISBN 0073016543, Paperback, $117.90 US

REVIEWED BY CYNTHIA CUDABACK

A college-level introductory science textbook should have three purposes, two of which are often underserved. First, it should present large quantities of information, which results in a text that is bulky and expensive. Second, it should help students understand the nature and process of science, and allow them to practice scientific techniques such as critical thinking and inquiry-guided learning. Third, in the case of an oceanography text, it should help students understand the complex interdependence of humans and the ocean. The new text by Chamberlin and Dickey is the first I have seen that promotes all three purposes equally.

The interdependence of humans and the ocean is at the heart of ocean literacy, as defined by a national consensus of marine scientists and educators (see *Ocean Literacy* pamphlet available online at http://www.coexploration.org/oceanliteracy). The ocean literacy definition includes lists of topics that students should understand, and also describes what students should do with that understanding. An ocean-literate person is one who (1) understands the science of the ocean, (2) is able to communicate clearly about the ocean, and (3) can make informed decisions about policy and behaviors that affect the ocean. The consensus was made in the context of elementary and high school education, but the concept of ocean literacy is starting to gain more attention at the college level.

College-level oceanography instructors now stand at a crossroads—shall we teach only the science of the ocean, or shall we promote ocean literacy? Some universities, concerned only about oceanography majors and future graduate students, seem to have an implicit policy that only scientific understanding matters in these introductory courses. But I believe we have a duty to the many nonmajors in our courses, to help them become well-informed citizens of this ocean planet. Furthermore, study of human impacts helps students understand the relevance of science to their own lives.

If we are to teach ocean literacy and not just ocean science, we need a textbook that integrates human impacts with the more traditional scientific content. My top bookshelf is crammed with texts, each offered by an earnest publisher's representative, each described as the best and latest thing. But in fact, the texts seem pretty similar. They are all written by men in southern California, and they all present the same topics in the same order, from the origins of the solar system to marine biology. Although most authors express a deep concern for the ocean's wellbeing, issues related to human impacts are not well integrated in the older texts. Many texts, on the last page of the last chapter, point out that the ocean is in trouble, and make a stirring call to action. Most students never see that last chapter. One popular text discusses human impacts in Chapter 18, but many of my colleagues teach one chapter per week in a 15-week semester.

By contrast with the earlier texts, Chamberlain and Dickey start out with a discussion of ocean science and human impacts on the ocean. In the first chapter, they provide a table listing the types of human impacts, and encourage students to research one impact more thoroughly (an exercise I have used with great success in my own classes). This inquiry-guided learning experience promotes ocean literacy and gives students a reason to care about oceanography.

The themes of human impacts and inquiry-guided learning appear repeatedly throughout the text. Each chapter starts with an attractively presented list of "Questions to Consider," and ends with an extended "Exploration Activity." The success of these aids to inquiry-guided learning will depend on students' willingness to consider the questions and teachers' willingness to grade the exploration assignments, but having these ideas in the text is a good start. The Questions could be used to start discussions either in class or via some electronic medium, such as a wiki or bulletin board.

The bulk of the information in the

text is similar to that in other texts, but many figures are a bit better than usual. I especially appreciate the conceptual sketches that promote a more intuitive understanding of ocean science. For example, one classic figure shows the different amounts of sunlight intercepted by one square meter of Earth's surface at the equator and at the poles. Chamberlain and Dickey added thought bubbles indicating that the sun is high in the sky at the equator and low at the pole—this concept is more intuitive for students. Similarly, they provide a nice analogy between counting cars and measuring wave period, and a set of thermometers in different units marked with the temperature of the human body as well as the freezing and boiling points of water.

I have a few pet peeves about older textbooks. First, some texts present an obsolete taxonomy. Chamberlain and Dickey have an up-to-date taxonomy with a good discussion of the three domains and a nice comparison of relationships inferred from morphology and genetics (the brittle star gets reclassified). Second, the pervasive myth about toilets flushing backwards in Australia indicates a fundamental misunderstanding about the nature of the Coriolis force. Chamberlain and Dickey do mention the importance of scale in the Coriolis force, but do not specifically debunk the myth.

There is still some undue emphasis on California. Their conceptual sketch of tidal circulation, in which tides propagate along the coast (amphidromic circulation), is accurate for the West Coast of the United States; however, on the East Coast, the tide has a constant phase. My students on the East Coast deserve a more balanced treatment.

My students, and all students, deserve a chance to learn about how their lives touch the ocean, and they deserve a course that promotes critical thinking and inquiry-guided learning. It may be time for me to switch to a new text—by Chamberlain and Dickey.

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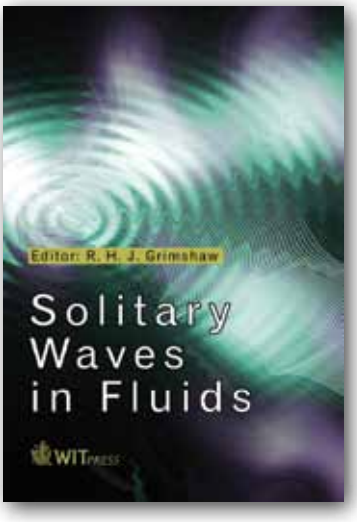
Solitary Waves in Fluids

Edited by R.H.J. Grimshaw, WIT Press, 2007, 208 pages, ISBN 9781845641573, Hardback, $130 US

REVIEWED BY QUANAN ZHENG AND R. DWI SUSANTO



It has been 160 years since the first recorded observation of a solitary water wave in a canal, which British scientist John Scott Russell saw while riding on horseback. Since then, many beautiful and applicable results of the physics and mathematics of solitary waves have appeared. Among them, several are noteworthy: the single soliton solution to the Korteweg-de Vries (KdV) equation (Korteweg and de Vries, 1895), the dnoidal solution (solitary wave packet) to the KdV equation (Gurevich and Pitaevskii, 1973), and analytical and numerical solutions to the perturbed and forced KdV (PKdV and fKdV) equations (Newell, 1985; Wu, 1987; Shen, 1993). Continuous emergence of fresh results in recent years suggests that it is still a brisk field.

The book *Solitary Waves in Fluids* edited by R.H.J. Grimshaw summarizes recent advances in the field. The book concentrates on describing the basic theories of solitary waves beginning with the earliest KdV equation, from which a single soliton solution is solved, to the latest nonlinear Schrödinger equation, from which an envelope solitary wave solution is solved. The book is divided into seven chapters; each chapter has its own references for readers who want to learn more about the topic. After Chapters 1 and 2 provide a historical introduction and the details behind the basic theory of the KdV equation, the subsequent five chapters explain its applications. Chapter 3 describes free-surface solitary waves in water and numerical methods to compute solitary waves. Chapters 4 and 5