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Review of *The Hidden Sea: Ground Water, Springs, and Wells* by Francis H. Chapelle

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The Hidden Sea: Ground Water, Springs, and Wells. Francis H. Chapelle. Tucson: Geosciences Press, 1997. 237 pp. Figures, references. \$18.00 paper (ISBN 0-945005-26-1).

The Hidden Sea is divided into three parts. The first, "Myths and Models," tells "how both mysticism and rationality have been used to understand the puzzling behavior of groundwater." Second is "Bays in the Sea," which reports on "the strikingly different characteristics of ground water systems found in different parts of the country, and how their differences affect the people who use them." The last part, "Evil and the Wells," discusses "how ground water systems can become contaminated by various waste disposal practices, and how perceptions of this contamination are so often different from reality." Francis Chapelle, a research biologist with the U.S. Geological Survey in Columbia, South Carolina, ends his Preface by declaring that "even more this is a book about how human beings go about discovering the hidden secrets of the earth. It is about human imagination."

Chapter one begins with an elderly woman exclaiming, "My well is poisoned." It turns out she has a safe water supply, though a fetid one resulting from proximity to degraded Cretaceous tree trunks, transforming dissolved sulfate in the water into foul-smelling hydrogen sulfide. This story offers a rational answer to a groundwater question. The author points out, however, that there is much folk lore regarding groundwater because "its behavior is not readily observable." He tells many fascinating tales, including the origins of the wishing well, and makes relevant reference to a varied assemblage of groundwater users, such as the Biblical Abraham, Charles Darwin, and Dr. Seuss. All this is enjoyable reading, and one tends to agree with Chapelle that "imagination, it would seem, is a necessary first step in learning the hidden secrets of this world."

The parts dealing with groundwater depletion and contamination contain a series of vignettes, each a brief chapter in length, reporting on a particular geographically based problem. Included are discussions of the overdraft of the Ogallala Aquifer in the High Plains, land subsidence in Arizona, and contamination from disposal of TNT production waste in Weldon Springs, Missouri, during the Second World War. The safety of

current hazardous waste disposal sites is explored, suggesting the great difficulty of attempting to achieve total groundwater protection. The author feels that improved knowledge of groundwater will be its salvation.

The Hidden Sea is a very readable book with many interesting and potentially useful stories and examples. But it is badly flawed. The title conveys a wholly false impression of what groundwater is all about. Not content to use metaphor only in his title, Chapelle insists that "Ground water, that vast body of water underlying the visible world, is a great hidden sea." His discussion of groundwater formations in pages 149-153 is too little too late. The volume's reference value is greatly reduced by the absence of an index. There are errors, as when the drought of the 1930s and center pivot irrigation systems are given as the bases for serious exploitation of the Ogallala Aquifer (more correctly the High Plains aquifer system), overlooking improved pump technologies and available energy. With slightly over 230 textual pages divided into twenty-four chapters, no topic is discussed in much detail and no attempt made to provide a comprehensive understanding of groundwater. Only the chapter on the Ogallala Aquifer deals specifically with a portion of the Great Plains. **David E. Kromm**, *Department of Geography, Kansas State University*.