ambiguities, Reid deserves praise and thanks for bringing them out. Professional historians may object that she does not make clear the source and reliability of her information and that she has nothing useful to say about the history of mathematics. But Reid has been where historians have not, in the private papers of Courant, which include letters from his student days and his wartime diaries, and she has used them sensibly if not exhaustively. She has done the same with the many interviews she conducted with Courant's friends and colleagues. The result is excellent journalism, informative and engaging if not deep, an appropriate successor to Reid's well-regarded book on Hilbert (reviewed in *Science* **170**, 965 [1970]).

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## Caves

**The Science of Speleology**. T. D. FORD and C. H. D. CULLINGFORD, Eds. Academic Press, New York, 1976. xiv, 594 pp., illus. $29.50.

Once a field for the gentleman naturalist, speleology has been metamorphosed into a legitimate science as a result of the recent emphasis on the environment, pollution, and endangered wildlife. Still, however, the cooperation of the amateur caver with the professional scientist is responsible for many new speleological data. Speleology is also a multidisciplinary field. A plethora of recent volumes have attempted to summarize this new science, but most are either restricted to one subject, such as karst, or technically limited by virtue of being written by a single author.

*The Science of Speleology* attempts to surmount these two limitations. The subject matter is reviewed by about a dozen authorities, most of them British, and it encompasses the entire scope of speleology: geology, biology, and other, less obviously related fields.

Of the geological topics covered, the discussion of the chemistry of cave waters is particularly innovative. The solution reactions involving limestone are summarized along with the pertinent variables controlling them, and the technical level of the discussion is such that any professional would benefit from it. An "advanced discussion" follows this in which the equilibrium reactions are quantified with their respective constants, the values for the constants are evaluated, and tables of applicable values are calculated. Reaction rates and rate-limiting factors are also treated, as are the effects of foreign materials in solution. The final section of the chapter discusses practical techniques of water analysis, describing the various methods and listing the necessary reagents and glassware. Various analytical techniques are compared and evaluated, and the reader is referred to the original publications for details. This latter section is aimed at the amateur scientist or caver: "For studies in limestone areas much useful work can be done using relatively inexpensive equipment and techniques which can be mastered quite readily" (p. 249).

Several of the topics covered in the book are not frequently treated elsewhere. An interesting chapter on the physics of caves discusses both cave meteorology and the geophysical detection of caves. One does not normally think of plants growing in the total darkness of a cave, but a brief chapter on cave flora discusses the bacteria and fungi found in caves, particularly the chemosynthetic autotrophs, bacteria that derive their energy from chemical reactions in the absence of sunlight. The application of the computer to speleology, both in data storage and retrieval and in complex chemical or physical calculations, receives coverage in the concluding chapter.

The need for careful conservation of the unusual biological and mineralogical features of caves is an integral part of the caving ethic around the world. A strong conservation plea is made in the discussion of bats. It is mentioned, for example, that Mexican free-tailed bats in Texas consume about 6600 tons of insects annually and that the handling of bats during their hibernation period may cause them to use up their fat supplies prematurely and die of starvation before spring. "Speleologists and other readers of this chapter may or may not be able to reverse the trend towards a declining bat population, but at least they can refrain from contributing to it" (p. 491). It is unfortunate that only in the chapter on bats and that on paleontology and archeology does a conservational attitude openly manifest itself in this book. Conservation is mentioned fleetingly in the chapter on cave faunas and ignored completely in the chapter on cave minerals, although in both cases flagrant amateur sample collecting is a major problem.

Although the editors have managed to overcome the prevalent drawbacks to a good speleological text, they are restricted in that *The Science of Speleology* is distinctly British. For instance, the biological coverage hinges on British Isles distribution, and orders that are dominant in other areas, such as the tropics, may scarcely be mentioned here. Chemistry escapes this fate by virtue of the basics included, but the coverage of geology, geomorphology, paleontology, and archeology is similarly restricted.

This should not be taken as a criticism of the editors, for this volume was obviously intended primarily for a British audience. Certainly the coverage is broad and the technical detail provided is of high quality, and, for the reader interested in the science of speleology, the excellent discussions of research in another geographical context may stimulate new ideas in his own area.

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