



## Caves and Karst of the Upper Midwest, USA: Minnesota, Iowa, Illinois, Wisconsin

Greg A. Brick and E. Calvin Alexander Jr., editors, 2021. Springer Nature Switzerland AG, Cave and Karst Systems of the World series; 314 p., 8.3 × 11 inches; ISBN 978-3-030-54632-8 (hardcover), ISBN 978-3-030-54633-5 (e-book). Hardcover \$137.99 retail, USA. Kindle version \$119.99 from Amazon.

A recent addition to Springer's extensive series on *Cave and Karst Systems of the World*, this is the first comprehensive book that covers the karst of the Upper Midwest, including the caves and karst of Minnesota, Iowa, Illinois and Wisconsin. This is a low-relief region, most of which has undergone serious glaciation, and it receives relatively little attention in the karst literature. However, it contains hundreds of significant caves, including several that are open to visitors. Some have been the focus of significant historical and scientific studies. The well-known geologist J Harlen Bretz (no period after the "J") lived in the area and in 1961 co-authored a book on Illinois caves, published by the Illinois Geological Survey, which contained some innovative hypotheses about their origin. David Morehouse, who made many studies of Iowa caves in the 1960s, was one of the earliest to document cave origin by sulfuric acid derived from the oxidation of local sulfide minerals.

The major caves of these four states are described and interpreted in this book, along with their human histories, some of

which are quite odd. The longest in the area is Iowa's Coldwater Cave, with a surveyed length of 17 miles. Much of its length has been mapped beyond upstream sumps. Mystery Cave, Minnesota, contains at least 12.8 miles of maze-like passages between meanders in the Root River. Much of the cave requires climbing through slippery, muddy fissures in cold, wet conditions. However, easily accessible dry sections are open to tours as part of the Forestville/Mystery Cave State Park. Fogelpole Cave, in Illinois, is a significant biological refuge containing at least 12 miles of passages.

The first chapter covers the regional geology with a map and geologic column for all four states that identify the Paleozoic bedrock stratigraphy which host the karst. Significant aspects of each stratigraphic system are described. Some unique paleokarst features are introduced, as well as Mississippi Valley Type lead and zinc ore deposits that are associated with the carbonates and considered an integral part of the karst. Carbonate and evaporite karst are clearly distinguished, as are the relation of the karst to patterns of glaciation. A general summary of Pleistocene glacial history is provided. Caves and karst in each state are covered in detail, along with their history of exploration, interpretation of potential hypogenic processes, and the impact of glaciation on karst.

Chapter 2 deals with the long, complex, and at times rather unusual history of cave exploration and the development of commercial tours. Some of the smallest caves have had the most unusual histories.

Chapters 3–6 describe the karst and caves of the four states in the area, each presented by appropriate specialists, including both editors and other well-recognized speleologists (Michael Lace, Raymond Anderson, Patricia Kambesis, Samuel Panno, Donald Luhman, Joseph Devera, and Michael Day).

Chapter 7 concerns lead-zinc ores and their relation to karst (James Dockal). Because the Mississippi Valley Type ore deposits are so important economically and historically for the area, there is a chapter dealing with the fissures created by the oxidation of sulfide-related ore minerals to produce sulfuric acid. Some of the resulting crevices are several kilometers long. A detailed discussion of the formation of the ore and then its oxidation to form the fissures is given.

Chapter 8 considers "paradigmatic studies in Midwestern cave science" by co-editor Greg Brick. Several basic concepts are examined (e.g., *karst* and *speleogenesis*) that are ordinarily taken for granted. This chapter shows how these concepts have changed with time.

Chapter 9 examines the cave fauna of the region, with a contribution by Stewart Peck, a speleobiologist who has been active since the 1950s, and Julian Lewis, and John Whitaker. This chapter covers invertebrates, such as amphipods, spiders, and crickets; as well as vertebrates such as bats, packrats, fish and salamanders. Their distribution and origins are discussed, including their fate during the Pleistocene.

Chapter 10, by Kevin Erb and Benjamin Maas, considers the interaction between agriculture and karst, including the impact of karst on this important agricultural area – and vice versa. Case studies are given that relate to the susceptibility of the karst to contamination by fecal waste and fertilizer, and how to limit their effects.

Chapter 11, by Jeffrey Dorale, describes paleoclimate studies based on caves of the upper Midwest. Many important paleoclimate studies have been made in Midwestern caves - dating speleothems, especially stalagmites and then determining their carbon isotopes, which data can be used to interpret past climate conditions. Early paleoclimate studies in the U.S. included analyses of speleothems from Iowa's Coldwater Cave. Methods of studying speleothems are described, along with significant findings. A reminder is made that speleothems are fragile and non-replaceable, and collections should be very conservative and kept to a minimum.

The book is well illustrated with a map or photo on almost every page. Most images and maps are in color. The printing (at least in the review copy) is on non-glossy paper, so that color images lack sharpness, although they still convey the appropriate information. The many diverse topics in the book are well organized. All authors are specialists in their topics, and their work is carefully written. It covers an important, but often overlooked, karst area, and introduces thought-provoking topics that apply to all karst areas. It will be of special interest to those who are concerned about the overall character of karst in the United States. Knowledgeable authors and depth of coverage make it a strong addition to any speleological library.

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