



Alfred Bögli

Karst Hydrology and Physical Speleology

Translated by June C. Schmid

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Preface to the German Edition

The present publication on karst hydrology and physical speleology combines two subjects which have up to now been treated separately. The two fields of knowledge have gone their separate ways, less as a result of differences in subject matter than of varying approaches. The focal point in karst hydrology lies in the description of subterranean water with its physical and chemical properties, whereas physical speleology describes subterranean cavities with their contents (air, water, and sediments), which generally have been created by water. Such cavities can be correctly interpreted only by means of a knowledge of karst hydrology, yet they in turn yield indications of the properties of karst water. Karst hydrology and physical speleology are thus two aspects of the subterranean karst phenomenon and should be viewed congruently.

This book addresses geologists, hydrologists, geomorphologists, geographers, and karstologists, above all speleologists, as well as all friends of caves, especially the cavers among them. Its contents must therefore appeal to two groups: on one hand to the academically trained, whether university faculty, graduates, or students, who as a rule have the necessary basic knowledge to be able to understand the theoretical comments; on the other hand to the laymen, who have first-hand experience from their own observations in caves, but who often do not dispose over the scientific foundation necessary for an understanding of the phenomena. Therefore occasionally more attention will be given to problems of a simpler nature and to questions of technical terminology.

During geomorphological studies in the Muota Valley in 1946 it became necessary to investigate the effects of limestone corrosion underground. I then penetrated the Hölloch Cave for the first time. (The Hölloch, Hell Hole, is located in the Muota Valley in Central Switzerland.) Very soon a contrast became apparent between the then predominant notion about subterranean water in karst areas as founded by O. Lehmann and the facts in the Hölloch. Especially the passages which also showed up on the bedding planes in the commercial cave section matched the theory very poorly, and this weighed even more heavily, as Lehmann's hypothesis was founded on accepted physical principles. Furthermore there were additional observations which put his hypothesis equally in question. These contrasts between theory and reality challenged me increasingly into the underground of the karst. There I had to recognize, even though after long resistance, that nature had gone ways which could by no means be explained by the then accepted hypothesis. The goal of solving this problem enticed me to intensify my work and soon the idea of a book arose. The book was to grow out of the natural facts of karst hydrography and to do justice to the evolution of subterranean water passages and thereby to speleology. The necessity of having also to learn about the karst underground in differently structured landscapes took me into

many other caves, above all in table-land and arid zones. For both types the USA offered excellent and easily accessible examples, the exploration of which is in full swing, giving rise to valuable publications.

The Hölloch, which happens to lie in my personal geomorphological area of study, became an important element of this book. In 1946 4280 m of this cave system had been surveyed and were well known. Today, 1980, there are 140000 m. Between 1904 and 1946 all research on it was suspended and all known facts were based on a dissertation by Egli (1904). The new thrust into virgin areas occurred first in 1948/49 by a research group from the Swiss Society of Speleologists (SSS) and by a precursor of the Association for the Exploration of the Hölloch (AGH) which I joined. In August 1952 three collaborators and I were trapped in the cave by rising water. This brought me into especially intensive contact with karst hydrology and gave further impetus to my study of this phenomenon.

In 1974 *Karsthydrogeologie* by J. Zötl was published. It brought substantial progress to the understanding of karst water. For the first time it was shown with all desirability that the hypothesis of O. Lehmann was untenable. Thus the spell was broken which had blocked progress for a long time, but which, however, had also stirred up contradiction and thus encouraged new research.

It is in the nature of karst hydrology and of speleology that they comprise a broad spectrum of supporting sciences. Apart from the geosciences, among them mineralogy, geology, and geomorphology, particularly hydromechanics and the chemistry of the $\text{CaCO}_3\text{-CO}_2\text{-H}_2\text{O}$ system are of central significance. The necessity of a unified approach to subterranean karst prompted me to risk the disadvantages against the advantages of a presentation of the whole scope of material by one single author. Prof. M. Frey, to whom I am indebted, assisted me with hydrodynamics.

Research in subterranean karst is always teamwork. The scientist depends on the assistance of the cavers, whether this is in a purely physical sense or in research by means of surveying, gathering material and observations, or of contributions to discussions. For this reason I owe gratitude to the AGH and its members, my colleagues and friends. The few who are mentioned here stand for the more than 100 collaborators who have helped in the course of three decades: H. Nünlist, the man of the first thrusts, technical director of the AGH during the first decade of exploration; B. Bärtschi, untiring helper and organiser since 1960; D. Krämer, who lost his young life in the exploration. I should like to thank the many friends all over the world, east and west, for reprints, for their permission to use sketches and findings from their field of work, for inspiring and fruitful discussions and for numerous guided trips through "their" caves. Of these I should especially like to mention the members of the Cave Research Foundation, CRF, most particularly R. Brucker. They always received me in the USA with open arms and I am grateful to them for new knowledge and deep insight into North American karst hydrology. My thanks go also to the authorities of Mammoth Cave and Carlsbad Caverns National Parks for always granting me permission to enter the great caves and thereby actively supporting my undertaking. Assistants at the Geographical Institute of the University of Zürich helped in the last phase of the realization of this book by copying, sketching, and proof-reading, among them U. Groner and P. Frehner.

To conclude this preface I should like to express my thanks to the publishers, especially to Dr. K.F. Springer for the good layout and presentation of the book, and to Mrs. A. Seeliger for her agreeable co-operation.

November 1978

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