

Cave and Karst Systems of the World

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Caves and Karst of Turkey— Volume 2

Geology, Hydrogeology and Karst

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Series Editor

James W. LaMoreaux, P.E. LaMoreaux and Associates, Tuscaloosa, AL, USA

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ISSN 2364-4591 ISSN 2364-4605 (electronic)
Cave and Karst Systems of the World
ISBN 978-3-030-95360-7 ISBN 978-3-030-95361-4 (eBook)
<https://doi.org/10.1007/978-3-030-95361-4>

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Dumanli Karst Springs (Underground River)—The Largest Karst Spring in the World—Manavgat River, Antalya, Turkey. The Dumanli Spring in the Mediterranean region of Turkey was already submerged by the year 1982 by about 120 m head produced by the Oymapinar reservoir. Manavgat River will be dammed at Oymapinar. The mean discharge of the spring is estimated at about $50 \text{ m}^3/\text{s}$; in October 1978, the authors measured the spring discharge by the Dye-Dilution technique. The flow rate of about $35.6 \text{ m}^3/\text{s}$ at the very end of the dry period (at the end of spring's discharge recession) motivated the authors to declare the Dumanli, the largest karst spring in the world, issuing from one single orifice (G. Günay, J. Karanjac—*Journal of Hydrology*, 1980).

Foreword

Between 1977 and 2000, a series of six symposiums were convened in Turkey. These symposiums are considered to be the most important reunions of the world's karst society. The main organizer and the initiator of these worldwide known karst conferences was Prof. Dr. Gültekin Günay from Hacettepe University, Ankara, Turkey.

Günay's vast knowledge and experience in geology and particularly in karstology are based on many years of research and field visits in various karst regions of Turkey. His in-depth knowledge in engineering has been an important asset while he was serving as the leading geologist of the General Directorate of State Hydraulic Works of the Republic of Turkey (DSİ). Under the umbrella of the United Nations Development Program (UNDP), Dr. Günay established the International Research and Application Centre for Karst Water Resources (UKAM) at Hacettepe University. In a short period, UKAM has become the leading institution for karstology in Turkey and one of the top-ranking karst research centers in the world. Under the supervision of Dr. Günay, UKAM has progressed toward being one of the leading schools of well-educated and trained young specialists in the field of scientific and applied karstology. For many years, Günay has been a member of an important Commission of the International Association of Hydrogeologists—the Karst Commission. He was the chairman of all six Karst symposiums (1977, 1979, 1985, 1990, 1995, 2000) and editor or co-editor of all symposium proceedings. Based on his extraordinary experiences, he published many scientific papers in various journals and submitted them to symposiums. In a great number of papers, as an author and co-author, he analyzed and presented the geological and hydrogeological features of numerous karst regions of Turkey, particularly the Taurus karst region, which is the largest and the most significant karst region in Turkey.

With more than 40 years of experience in the field, Dr. Günay has been involved in an extensive number of projects in many karst regions in Turkey. In this book, Günay shares the vast experience that he has accumulated during his professional life. The content of the book mainly includes his fieldwork, application of various investigation methods, data analysis, and presentation in the form of diverse professional and scientific papers. It is also based on the undergraduate and master courses in karst hydrogeology taught at Hacettepe University.

This book consists of two volumes. Each volume encompasses distinct topics focused on specific karst phenomena on a regional scale and a detailed explanation of many case studies. In the first part, hydrogeological characteristics of important karst river basins, including specific karst phenomena such as sinkholes (obruks), huge deposits of travertine in the Antalya region, gypsum karst of the Sivas region, and particular groundwater flow systems, are depicted. One of the essential characteristics of Turkish karst is fascinating karstic springs. Attributes of these springs are presented in detail. Some of them are well known to anybody dealing with karst hydrogeology: Dumanlı Spring, one of the largest karst springs in the world; Pamukkale, a captivating geothermal spring; Kirkgözler Spring in Antalya travertine area and a few others. The text includes the results of remarkable studies performed for the protection of water quality of karstic springs and geothermal reservoirs.

This book contains a vast knowledge of the general characteristics of karst regions in Turkey. It is a valuable source for scientists and engineers working in these regions and a significant handbook for other professionals working in numerous karst regions of the world. One of the aims of this book is to assist and encourage students of the earth sciences and engineering to grasp karst aquifer properties from a technical and environmental point of view.

It is an extraordinary book with precious data for planners of regional socio-economic development in such an unfriendly environment as karst landscapes.

Belgrade, Serbia

Prof. Dr. Petar Milanovic
Emeritus Professor

Preface

Karstic limestones in Turkey cover approximately one-third of the country and are primarily located in the Mediterranean sector of the Alpine orogenic belt. This belt lies in between the Russian belt to the north and the African and Arabic belts to the south. The geologic history of the region was influenced by the repetitive opening and closing of several ocean basins, whose tracers are depicted as suture belts. Karst limestone areas in Turkey, covering one-third area, also include very productive aquifers. The karstification in limestone is more common in Paleozoic, Cretaceous, Miocene, and Neogene formations. The carbonate rock units are about 200 km wide along the Taurus Mountains, which attain elevations of 2500 m. These high mountain ranges, sharp peaks, deep valleys, and narrow gorges cause extremely rugged topography. The Taurus Mountains were formed by folding and overthrust faulting during the Alpine orogeny. With uplift, karstification increased and the surface drainage of many lakes and rivers was transformed into subsurface drainage. Turkey has several types of karstic landforms containing lapies, caverns, dolines, uvalas, poljes, and underground river valleys. Karstification is related not only to the thickness and purity of limestone, climate, and height but also to tectonic movements. Well-developed karstic features such as poljes, groundwater, and cave systems are widespread in/on the Mesozoic comprehensive limestone in the Taurus Mountains. The formation of these karstic forms has taken a long time. Karstification has begun to be developed toward the end of the Mesozoic limestones by the uplifting movements of the Taurus Mountains in general. Tectonic movements are considerably responsible for karstification and karstic landforms. Most of the deep and large karstic depressions, especially poljes, are related to vertical tectonic movements. The Taurus Mountain region is characterized by abundant water resources, large hydroelectric potential, some of the world's largest karst aquifers, and the largest karst springs.

These springs of exceedingly large discharge are formed by the channelized flow along with the fractures by water that cannot penetrate the deep formations because of their low permeability.

Turkey has important karst formations that cover wide areas. Economically, karstification and karst hydrogeology/hydrology are very important for Turkey. Six international symposiums have been arranged in the last 20 years in Turkey and have taken important steps in this region. UNDP has given significant support due to the importance of this subject, and DSI (State Hydraulic Works) has supported these studies and projects together with Hacettepe University UKAM (International Karst Research Center). The scope of foreign engineers and hydrogeologists provided educational opportunities, and therefore, the world's largest dams in Turkey and groundwater projects performed.

Ankara, Turkey

Dr. Gültekin Günay
Emeritus Professor

Acknowledgments I would like to acknowledge and thank the following people for their great support and incentives during the preparation of this book. Prof. Dr. Petar Milanovic, Belgrad, Serbia; Dr. Jim La Moreaux, Pela, USA; Dr. Selim Yilmaz, Hacettepe University, Ankara, Turkey.

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