

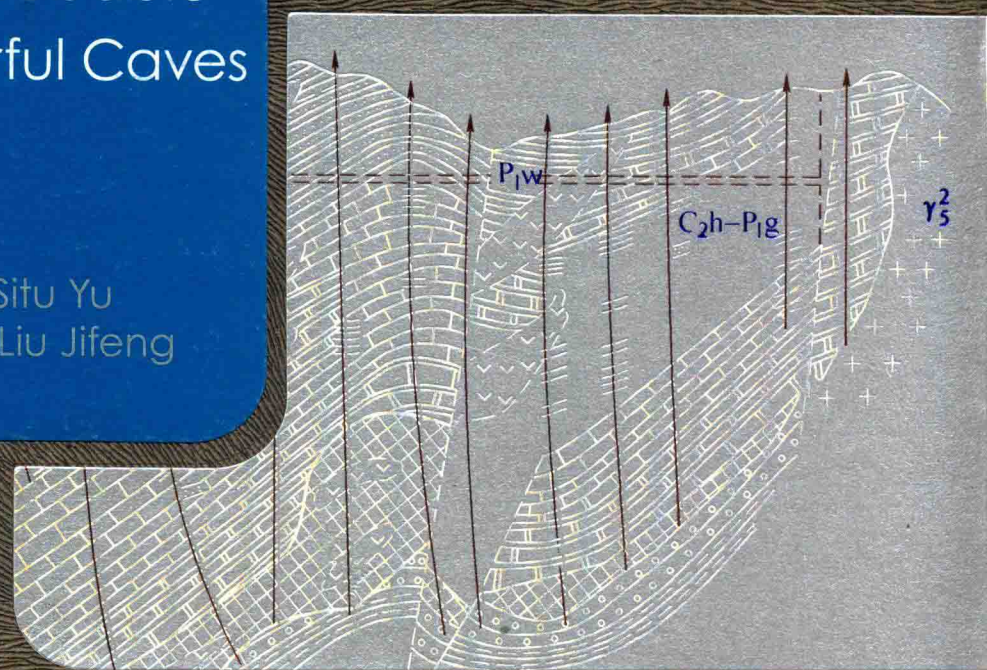
# Karst in China

— A World of Improbable  
Peaks and Wonderful Caves

Lu Yaoru

Translators Li Wei, Situ Yu

Referees Derek Ford, Liu Jifeng





# Karst in China

— A World of Improbable Peaks and Wonderful Caves

ZHONGGUO  
KASITE

中国喀斯特——奇峰异洞的世界（英文版）

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## Author Profile

### Academic Posts

Senior research fellow of the Chinese Academy of Geological Sciences

Professor of Department of Geotechnical Engineering, School of Civil Engineering, Tongji University, Shanghai

Member of the Chinese Academy of Engineering

Honorary President of Guizhou Normal University

Member of the Expert Committee of the National Commission for Hazard Reduction, China

Member of the National Environmental Consultative Committee, China

### Research Interests

Karst and hydro-engineering and environmental geology

### Education

1950-1952, department of Geology, Tsinghua University.

1952-1953, transferred to study at the department of hydrogeology and engineering, Beijing Institute of Geology (due to the adjustment of colleges and departments in 1953), and graduated ahead of time with a bachelor's degree.

### Professional Experiences

For more than fifty years, Professor Lu Yaoru has been undertaking the research and surveying for a series of water conservation and water power construction projects including hundreds of water control projects on the Yangtze River, Yellow River, Zhujiang River, Huaihe River, etc., such as the Sanxia (Three Gorges), Wujiangdu and Xin'an Jiang projects. He has directed the investigations and research for construction of railways, cities and towns etc, contributed to the economic development of karst regions by studying karst geo-ecology and the prevention and treatment of geo-hazards, first put forward the concept of rocky desertification and related understanding of geological and ecological environment, and has developed a set of theories on the

controls of karst exvironmental and hydrogeologic evolution and their impacts on engineering projects in karst terrains.

In the early 1960s, Prof Lu was in charge of the first karst research team in China and participated in the establishment of the Institute of Karst Geology. For his remarkable contributions to karst research and engineering construction, Professor Lu Yaoru has long been dubbed "Karst Lu"!

### Honors and Awards

1978, National Scientific Conference Award

2<sup>nd</sup> prize of Science and Technology Progress, Ministry of Geology and Mineral Resources

1988, 2<sup>nd</sup> prize of National Excellent Science and Technology Books

1999, Honorary Award of Li Siguang Geological Science Prize

2005, 2<sup>nd</sup> Prize of National Science and Technology Progress

2007, 3<sup>rd</sup> Prize of Science of Hebei Province

2008, Prize for Special contribution to tre Construction and Development, Hebei Province

### Selected Publications

Published ten monographs, an atlas and nearly one hundred papers, including:

Karst in China

Basic Development Laws of Karst in China and their Hydrogeological and Engineering Geological Features

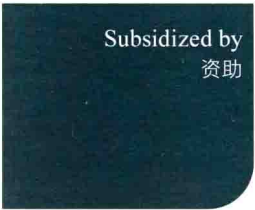
Karst in China — Landscapes · Types · Rules

Atlas of the Geo-ecological Environment in Southern China (karst-based)

Research on the Evolution of Karst Hydro-geological Environments and their Engineering Impacts

Geo-ecology and Sustainable Development — Development Proposals for karst areas of Southwest China and Neighboring Regions





Ministry of Land and Resources, P.R.C.  
国土资源部  
China Geological Survey  
中国地质调查局



Institute of Hydrogeology and Engineering Geology, Chinese Academy of Geological Sciences  
中国地质科学院水文地质环境地质研究所  
Guizhou Normal University  
贵州师范大学  
Tongji University  
同济大学  
Chinese University of Mining and Technology  
中国矿业大学



'Karst' is the technical name describing the geological processes and phenomena of the dissolution of soluble rocks (chiefly the carbonate, sulphate and halide rocks) by natural waters. It is transliterated into "ka'-si-'te'" in Chinese, or paraphrased into "Yanrong" (rock that can be dissolved), and both are in general use.

Karst topography is very widespread in China, being found in many provinces, municipalities and autonomous regions. In particular, large numbers of improbably steep and shapely rock towers and wonderful caves have been created where the carbonate rocks (limestone and dolostone) have been corroded by water enriched in CO<sub>2</sub>. Unrivalled in terms of their abundance, diversity and richness, many Chinese karst areas have become world-renowned tourist spots and ideal fields for geoscientific research.

Karst in China is of great social significance. Not only is it closely involved in many aspects of people's daily life and national economic construction projects such as water conservation, hydropower, railways, expressways, seaports, airports, mines and municipal and urban construction etc, but it is also intimately interactive with agriculture, eco-systems and the geo-environment.

*Karst in China --- A World of Improbable Peaks and Wonderful Caves* is a remarkable scientific monograph. With a host of photos and figures as well as vivid writing, it reveals the features and rules of karst development in China, reflects upon construction achievements, and summarizes a lifetime's experience of geological studies in these great karst lands.

This monograph has four principal emphases:

Firstly, it comprehensively analyzes the development rules and characteristics of karst terrains, and their dual impacts on human life - the often positive abundance of resources and often negative hazards of flood, drought,

and catastrophic collapse. Secondly, based on scientific research, it explores the evolution of these natural phenomena and, to better prevent disasters, it pays special attention to the impacts of human activity. Thirdly, it combines scientific research with engineering practice and points out the important role such collaboration should play in future sustainable development. Fourthly, presented in an accessible and engaging way, this book provides substantial reference information for both geological and non-geological majors, and is a good example of popularization of science for general readers. Real and vivid photos, together with rigorous and abundant text, maps and figures, enhance the scientific value and readability of this book.

In 1954, young geologist Lu Yaoru started his earliest karst research by working for the construction of the Xin'an'jiang (Xin'an River) Hydropower Station. Since then, diligent, meticulous and dedicated, he has worked in this field for nearly 55 years and contributed to a number of large national engineering constructions in the karst areas. His research is noted for its close integration of karst problems with national construction goals that is based on profound study of the characteristics and laws of karst development. Also, it provides valuable knowledge and the scientific basis for engineering construction tasks, enriches the experience with pertinent practical examples and hence raises the public awareness of karst. Due to his remarkable contributions to karst research and engineering construction, Academician Lu Yaoru has long been dubbed "Karst Lu."

I'm delighted at this scientific achievement and very pleased to write this preface.

Vice Chairman of the 10<sup>th</sup> Chinese People's Political Consultative Conference

President of Chinese Academy of Engineering

Xu Kuangdi

Sept 28<sup>th</sup>, 2009

徐匡迪







## Preface 2

Karst, 'Yanrong' in Chinese, is the technical name describing the processes and phenomena of water acting upon soluble rocks. Karst phenomena in China, especially those of the carbonate rocks, are now well known throughout the world for their great extent and rich variety of form.

In China the results of karst development not only create wonderful landscapes, quite a few of which have become global or national geoparks or included in the *World Natural Heritage list*, but are also closely related to people's daily life and to our national economic construction.

Being among the earliest experts on karst following the foundation of new China, Academician Lu Yaoru has been undertaking in-depth research based on the needs of national economic development for many years. His work provides the scientific basis for much engineering construction and economic development, and enriches our knowledge of this natural mystery by providing further insight into its rules of development and evolutionary mechanisms.

*Karst in China --- A World of Improbable Peaks and Wonderful Caves* is an important piece of work by Academician Lu Yaoru. With a great number of real and objective photos, vivid figures and writing, this monograph summarizes domestic understanding of karst research in China and reflects his comprehensive achievement during 55 years of work.

This book is characterized by the following features:

First, it explores the duality of karst with the guidance of a clear scientific perspective on the nature of the development. Equal emphasis is paid to the favorable and to the negative conditions in karst terrains, and hence dual impacts of karst development on different construction projects are recognized.

Second, it combines the macrocosmic with the microcosmic by exploring solution mechanisms at microscopic scales while explaining the laws of karst development at the scale of all China. Therefore, it sets out the impacts of geological evolution on karst development, and demonstrates them through macro-micro phenomena in eco-systems and the geo-environment.

Third, it is a remarkable combination of theoretical research with 'hands on' engineering construction practice. The author has reviewed his years of achievements in large water conservation and hydropower construction, railway construction, mine exploitation, rocky desertification treatment and agricultural development in karst areas.

Fourth, it studies geological conditions at all scales with karst water as its core. Karst water differs a lot from other groundwaters such as pore water and fissure water in terms of its complexity and variety. Consistent with what he did in his previous books, the author once again underlines the distinctive behavior of karst groundwater in this book. From five features of unity and opposites, to hydrodynamic conditions and three-phase flow, he presents in-depth research on fundamental problems of karst water mechanisms, to better assess the engineering and environmental geological problems that they pose.

In addition, in writing this scientific monograph based on his long-term and profound research, Lu Yaoru has managed to present it in lucid language which makes it accessible and beneficial to readers of all backgrounds. Hence, this precious geological achievement should also play a major role in the popularization of science.

In 1999, Lu Yaoru's *Research on the Evolution of Karst Hydro-geological Environments and Their Engineering Impacts (in Chinese)* was published by Science Press and proved to be well-received. I prefaced it then and pointed out that "Academician Lu Yaoru is knowledgeable, experienced and innovative". I am convinced that this new book will be more widely received and applied, and will play a positive role for construction in karst areas in the future.

I'm glad to preface the new achievement of "Karst Lu".

Senior Academician of Chinese Academy of Sciences

Chen Mengxiong

Oct 14<sup>th</sup>, 2009









It is a great honour to be invited to write a preface for Professor Lu Yaoru's major new review of the karst lands of China. He occupies a unique place in the history of international karst science in the 20th Century. In the 1950s and 1960s researchers coming of age in the European scientific traditions and languages (including those in Africa, the Americas, Australasia, etc) knew little or nothing about Chinese karst. For example, there was a major volume published in Europe in 1972 entitled 'Karst: Important Karst Regions of the Northern Hemisphere' that contained lengthy studies by specialists from 13 different nations on both sides of the Iron Curtain (including the USA and USSR), but made no mention of China except one passing reference to it with Indochina in the introductory pages. Lu Yaoru changed all that forever with his publication of an intentionally popular 'coffee table style' volume, 'Karst in China', that appeared in an excellent English translation in 1976. Its many colour photographs showed us breathtaking karst landscapes of a magnitude and extent we had not imagined before, great river caves with beautiful decorations, and vistas of ancient rice cultures cunningly exploiting the rugged terrains and their water resources that were contrasted with ultra-modern hydro power dams, road and rail corridors under construction.

Justly, the 1976 book received rave reviews in the West. This was a land we all had to see for ourselves. The first delegations of foreign karst scientists came to China in the next few years and received the warmest of welcomes, as did sporting cavers looking for the thrill of their lives in these exotic places. When in 1986 Lu Yaoru published a first revised edition 'Karst in China – Landscapes, Types, Rules', it confirmed the position of his country in this science – the karst lands of South China are simply the finest on Earth. The pace of visiting increased, and has become pleasingly reciprocal with many Chinese

karstologists travelling abroad to exchange knowledge and experience.

"Karst Lu" is now world-renowned for his immense experience in karst science and especially in its practical application to solve problems in water supplies, desertification, hydropower generation, transportation routes and hazard management. He has written many technical publications and instructed many students. This new volume '*Karst in China – World of Improbable Peaks and Wonderful Caves*' is the third edition of his popularising masterwork. In it he summarises the basic science, introduces the great variety of the karst landforms at the surface and representative caves and their deposits underground, appraises them at scales from the microcosmic to the cosmological, systematically reviews the problems of economic development and natural conservation that arise, and concludes with geographic review of the many different regions with their distinctive charms. Lu Yaoru and I have been friends and colleagues since 1984. We share a passion not only for the science of karst but for the adventure that it offers and for its profound aesthetic appeal. That aesthetic guides this book and its message, supported by the highest quality printing, photo plate and map reproduction. It is a delight to own and appreciate.

Derek Ford, PGeo., PhD (Oxford), FRSC.  
Emeritus Professor of Geography and Earth Sciences,  
McMaster University, Canada.  
Feb 18<sup>th</sup>, 2012







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