

# 中国喀斯特石林景观研究

KARST STONE FOREST LANDSCAPES IN CHINA

陈安泽 等著



 科学出版社



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北京

## 内 容 简 介

本书对中国十个省区典型喀斯特石林景观的定义成因、年代分类、分布及其地质地貌特征作了深入的研究和景观评价，是第一部专业研究喀斯特石林的著作。

本书可供从事地质景观研究、喀斯特地貌研究人员和有关大专院校师生，以及地质公园开发人员和科普工作者参考使用。

### 图书在版编目(CIP)数据

中国喀斯特石林景观研究 / 陈安泽等著. —北京: 科学出版社, 2011  
ISBN 978-7-03-032118-3

I. ①中… II. ①陈… III. ①岩溶地貌—研究—中国 IV. ①P931.5

中国版本图书馆 CIP 数据核字 (2011) 第 170492 号

责任编辑: 文 杨 朱海燕 / 责任校对: 包志虹

责任印制: 钱玉芬 / 封面设计: 迷底书装

科学出版社 出版

北京东黄城根北街 16 号

邮政编码: 100717

<http://www.sciencep.com>

北京通州皇家印刷厂印刷

科学出版社发行 各地新华书店经销

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2011 年 9 月第 一 版 开本: A4 (880 × 1230)

2011 年 9 月第一次印刷 印张: 27 1/2 插页: 16

印数: 1—2 200 字数: 780 000

定价: 120.00 元

(如有印装质量问题, 我社负责调换)

# **KARST STONE FOREST LANDSCAPES IN CHINA**

Chen Anze et al.

 **Science Press**  
**Beijing, China**

## 本书主要编著人员名单

陈安泽 钱 方 李兴中 范 晓

池永翔 陈文光 陈伟海 周旦生

朱晶文 张尔匡 张忠慧

# 序

云南省路南县的石林，以其柱石林立、崔巍峥嵘、形态万千的喀斯特景观而闻名于世。正是由于这种具有宝贵的科学研究价值和重要的旅游资源内涵，这片石林地区成为世界地质公园，也列入了中国南方喀斯特世界自然遗产目录。

20 世纪 80 年代，随着改革开放大力发展旅游业的背景，当地想借着石林之声，而将路南县改为了石林县。这是当时的一种思潮，以为这样就可以更好地发挥石林这宝贵资源的价值。实际上是对石林这种喀斯特现象认识有局限，将地名改为同自然景观现象同名，反而是贬低了石林的价值。

这片路南的石林，也是现在石林县的石林，真正的内涵在于：她是这类石林喀斯特景观类型的典型代表。在云南，不仅有这片石林，在全国还有很多好的石林，在世界上也有不少好的石林发育。重要的是，对众多的国内外石林发育地区进行对比研究，才能更深刻地掌握石林发育的机理，更好地体现天公造就的瑰宝价值。

可喜的是，以陈安泽研究员为首的一个研究群体，将中国主要石林地质现象，进行了深入的对比研究，涉及云南、贵州、川渝、湖北、湖南、广西、福建、海南、河北、河南等许多地区发育的石林，并提出了这份非常有价值的成果。这本有关石林这种喀斯特现象的对比研究成果，其创新之处在于：

## 1. 自发组织的对比研究

将路南县改为石林县，其结果不利于广大人民群众对石林的认识，也降低了石林的价值。一花不是春，百花争艳才是春。只有一处石林，显不出其更大的价值，许多地方石林相对比，才能更好地认识其发育的规律及其内涵与价值。在地学上，对某种现象进行对比研究，这是很重要的一个研究方法。而这次对石林的对比研究，却是以陈安泽研究员为首的科技人员，自发组织的对比研究，没有依靠申请专项经费，这是非常难得的，也是一个创举。

## 2. 密切科学研究为当地发展服务

旅游业已是当今经济发展的一个重要方面。通过这次石林的对比研究，使有关科技工作者，能更好地直接与各地有关管理、开发人员密切接触，针对当地情况，借鉴其他石林地区情况而提出科学的依据与建议，更好地将科学研究与当地今后的开发与保护密切联系，有利于更好地对当时石林进行开发与保护，也对当地的旅游业和经济发展，提供相应的建议，促进当地旅游业与经济的发展。

## 3. 低经费而得到好成果


若按以往有关地质方面的全国性对比研究，正规申请的经费，必定数量大，往往也不易得到大量的资助。这次石林对比研究，得到一些地方管理部门与有关事业机构的有限支持。正是这种不多的支持，发挥出了更大的作用。在自愿组合的群体中，使有限的资金发挥出了最大的作用。

## 4. 更好地发挥了新老科技人员的结合协作

参加本项研究的科技人员，有的虽然已经退休，但仍活跃在科技工作岗位上。身体健康的老科技人员，可更好地发挥其经验与认识。参加研究的人员也有年轻人，有的目前担负一定科技研究工作的人员，以其年富力强，可以更好的从事有关对比调查研究工作。这种老中青相结合而完成的石林对比研究成果，显示了其重要创新性。

本项研究成果得以高质量完成，确实令人欣慰。特别是作为一名老喀斯特研究工作者，我曾划分了石林-洼地的喀斯特类型。但我没有在国内就石林这一类型，更好而深入地进行对比研究。因此，这一成果对我而言，也是一个学习的教材。

最后，在此向陈安泽研究员为首的这个研究群体，对他们出色完成的对比研究成果，表示我衷心的感谢和祝贺。他们为中国喀斯特研究，添上了一笔重彩。



2010年6月30日

# Foreword

Shilin of Lunan County, Yunnan Province, is world-famous for a forest of stone pillars towering aloft in a multitude of karst landscapes. It is just due to its great scientific research value and connotation of important tourism resources that this stone forest area becomes a world geopark and is listed into the World Natural Heritage Catalogue of South China Karst.

In the 1980s, with China's reform and opening-up and energetic development of the tourism industry, Lunan County was renamed Shilin County by the local government in attempt to use the fame of Shilin. This was a trend of thoughts then. The local government thought that by doing so the value of this resource could be better brought into play. However, in fact, their understanding of such a karst phenomenon is limited and the change of the place name into the same name as the name of a natural landscape phenomenon depreciates the value of the stone forest instead.

The real connotation of this stretch of stone forest in Lunan, i. e. now the stone forest in Shilin County, lies in that it is a typical representative of this type of stone forest karst landscape. Stone forests are not only found in Yunnan but there are also many good stone forests around the county as well as around the world. What is important is that, only by conducting a comparative study of numerous stone forest areas at home and abroad, can we get a more profound understanding of the mechanism of stone forest development and better reflect the value of this naturally occurring treasure.

It is gratifying that a research team headed by my friend and distinguished colleague, Professor Chen Anze, has performed an intensive comparative study of main stone forest geological phenomena in China, which involved stone forests developed in many areas such as Yunnan, Guizhou, Sichuan, Chongqing, Hubei, Hunan, Guangxi, Fujian, Hainan, Hebei and Henan, and presented this very valuable achievement. This book about the achievement of comparative study of stone forest karst phenomena has the following innovations.

1. Comparative study that was organized spontaneously

The renaming from Lunan County to Shilin County is not favorable to the understanding of stone forests by the broad masses of people and also reduces the value of stone forests. "A single flower does not make a spring; only when flowers compete in splendor, does spring come". If there is only a single stone forest, its value cannot be displayed; only when stone forests in many places are compared, can we better understand their development characteristics, connotation and value. Comparative study of a certain phenomenon in its geoscience context is a very important research method, and this comparative study of stone forests was organized and conducted spontaneously by scientists and engineers headed by Professor Chen without applying for special funds. This case is very rare and also an innovation.

2. Close integration of scientific research with services for local development

The tourism undertaking has been one of the important aspects of current economic development. Through this comparative study of stone forests, relevant scientists and engineers can more directly get in close touch with relevant personnel in charge of management and development in various areas, put forward scientific grounds and suggestions according to the local conditions and by referring to conditions of



other stone forest areas and better combine scientific research with future local development and protection. This comparative study is favorable for better development and protection of local stone forests and also helps advance related good suggestions about the local tourism industry and economic development. It will promote the development of the local tourism industry and economic development.

### 3. High-efficiency results achieved with limited funds

To conduct nationwide comparative studies about geology, considerable funds must be applied for according to the previous practice and usually it is not easy to obtain substantial financial assistance. This comparative study of stone forests got limited support from some local administrative departments and relevant institutions and it was just such limited support that played a greater role. The voluntarily organized team utilized the limited funds to their fullest extent.

### 4. Better giving play to combination and collaboration of younger and older scientists and engineers

Some scientists and engineers who participated in this project were retired but they were still active in scientific and technological work. Healthy veteran scientists and engineers may better bring their experience and knowledge into full play. Those who participated in this study also include young people, some of whom are now charged with certain scientific and technological research. They are in the prime of life and full of vitality and can better undertake related comparative investigation and research. The fulfillment of this comparative study of stone forests by three (the old, the middle-aged and the young) -in-one combination is an important innovation.

It is gratifying indeed to know that this study has been completed with high quality. Especially as an old karst researcher, I have identified the karst types of stone forest-karst depression; however, I have not performed an intensive comparative study of the stone forest type in China. Therefore as far as I am concerned, this book is also a teaching material for learning.

Finally, I would like to express my heartfelt respect and congratulations to the research team headed by Professor Chen Anze for their brilliant achievements obtained in the comparative study. They add a strong color for China's karst study.

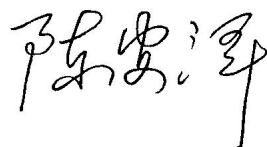
Lu Yaoru  
June 30, 2010

# 前言

喀斯特地貌景观是一种珍贵地质遗产，也是十分重要的风景资源和旅游资源。在喀斯特地貌景观中石林景观又占有十分突出的位置。由石林景观构成的景区众多，特别是自 2000 年地质公园出现之后，以石林景观为主体建立起来的地质公园日益增多，如云南石林世界地质公园、四川宜宾兴文石海世界地质公园、河北涞源白石山（大理岩石柱林）世界地质公园、贵州兴义（泥凼石林）国家地质公园、湖南古丈红石林国家地质公园、福建永安（鳞隐石林）国家地质公园、重庆万盛国家地质公园以及湖南龙山洛塔石林地质公园等，加上含有石林景观的风景区、森林公园、旅游景区等，石林景观在我国旅游资源中的重要地位就很突出了。在国际上，已知马来西亚、菲律宾、巴布亚新几内亚、马达加斯加、西班牙、法国以及古巴等都有石林景观或类似石林景观分布，更说明石林景观是一种具有全球意义的景观资源。石林（Shilin）已成为国际性喀斯特地貌景观术语（但也有很多学者使用 Stone forest）。石林景观作为喀斯特景观的一种独立类型，虽然已被地学界接受，但是总体来看它的研究程度还不够高，许多问题尚待深入研究。如石林景观的定义、景观类型划分、景观形成机理、分布规律、成景年代及成景过程等地学问题尚需探讨；此外，石林景观作为一种重要旅游资源，其美学观赏价值、旅游开发价值、旅游产品打造、特别是如何把石林景观的科学内涵向旅游者传播的方法研究等都待深入研究；再者，石林景观的保护方法，石林景观国内外对比研究也都亟须开展。

基于以上情况，为了提高石林景观的地学研究水平，为了更好地保护这种珍贵的资源，特别是为了更好地为含有石林景观的地质公园、风景区、森林公园及各种旅游景区建设服务，为广大游人服务，笔者于 2005 年策划了“中国喀斯特石林地貌景观综合研究”项目，在有关省区国土资源厅（局）的支持下设立了 11 个子课题：第一子课题，国内外喀斯特石林景观综合对比研究；第二子课题，云南喀斯特石林景观（以石林世界地质公园为例）综合研究；第三子课题，贵州喀斯特石林景观综合研究；第四子课题，川渝地区喀斯特石林景观综合研究；第五子课题，湖南喀斯特石林景观综合研究；第六子课题，湖北喀斯特石林景观综合研究；第七子课题，广西喀斯特石林景观综合研究；第八子课题，福建永安喀斯特石林景观综合研究；第九子课题，海南喀斯特石林景观综合研究；第十子课题，河北碳酸盐岩石柱林地貌景观（以涞源白石山为例）综合研究；第十一子课题，河南关山喀斯特石柱林状地貌景观形成机制研究。在研究方式上，由笔者牵头成立了总项目组，通过有关渠道发动各有关省自愿认领各子课题。在笔者的统一指导下按要求联合进行研究工作。项目于 2005 年 12 月 29 日在北京开题，在开题会上邀请了中国喀斯特著名专家卢耀如院士、张寿越研究员进行了咨询讨论，详细商定了研究计划。2006 年 4 月在石林世界地质公园的支持下集合各子课题成员在云南石林进行了实地考察，以典型的石林景观为范例，统一了研究内容、工作方法和取样要求等。之后，各子课题组对各自列入计划的研究对象进行了深入的野外调查，室内测试分析，综合对比研究。经过两年的艰苦工作，于 2008 年 10 月各子课题分别完成了各自的研究报告，较系统地总结了全国主要喀斯特分布区 11 省（市、区）的 88 处（片、点）石林景观情况，是迄今为止对我国主要石林景观的一次大调查，大总结。在此基础上，项目组于 2008 年 11 月 22 ~ 23 日在长沙举行了结题总结会议，11 个子课题组作了系统汇报，同时举办了石林景观图片展。卢耀如、张寿越、崔之久、《地理学报》、《地质学报》、《地质论评》编辑部负责人出席会议，在卢耀如院士的主持下，对整个项目进行了评审（结论附

后)。为了使各界共享石林景观研究成果,会议建议将报告按出版要求公开出版,本书就是响应专家建议汇编而成的一本专著,全书共分 11 篇,参与执笔编写的人员如下:前言,陈安泽;第一篇,陈安泽、张寿越、钱方、梁永宁、王敏;第二篇,钱方、陈安泽、梁永宁、李玉辉、彭阳、郭克毅;第三篇,李兴中、王立亭、陈跃康;第四篇,范晓;第五篇,陈文光、江涛、贺岳林;第六篇,朱文晶、李正琪;第七篇,陈伟海、朱德浩;第八篇,池永翔、赖树钦、吴小雄、王增银;第九篇,陈颖民、周旦生、傅杨荣、柳长柱;第十篇,张尔匡、陈安泽、郭克毅、李友善、彭阳;第十一篇,张忠慧、苗晋祥;结束语,陈安泽。邢瑞玲、钱方参与了全书编辑工作,张寿越审阅了全书。值得特别提出的是,整个研究工作和本书的出版,得到了以下单位的资助:云南石林世界地质公园、贵州省国土资源厅、四川省国土资源厅、四川省区域地质调查大队、重庆市国土资源和房屋管理局、湖南省国土资源厅、湖南省地质环境监测总站、湖北省地质研究所、广西壮族自治区国土资源厅、中国地质科学院岩溶研究所、福建省国土资源厅、海南省国土资源厅、河北省国土资源厅、河南省地质调查院。在工作过程中还得到了国土资源部地质环境司原司长姜建军博士的支持和鼓励,得到了中国地质科学院国家地质公园研究中心的全力帮助。在本专著付梓之际,特对所有资助单位,对为本项目为本书作出贡献的所有专家、领导表示衷心的感谢。由于中国石林景观研究涉及的范围广领域多,因此,本书一定会存在许多不完善之处,希望读者提出批评指正。



2010 年 3 月于北京

## Preface

Karst geomorphological landscapes are a precious geological heritage as well as very important scenic resources and tourism resources. Among karst geomorphological landscapes, “Shilin” (or stone forest) landscapes occupy a very prominent position. There are numerous scenic spots made up of shilin landscapes; especially since the appearance of geoparks in 2000, geoparks built with the shilin landscape as the main part have increased steadily. The examples are the Shilin World Geopark in Yunnan, Xingwen (Shilin) World Geopark in Sichuan, Baishi Mountain (Marble Pillar Forest) World Geopark in Laiyuan, Hebei, Xingyi (Nidang Shilin) National Geopark in Guizhou, Red Shilin National Geopark in Guzhang, Hunan, Yong’an (Linyin Shilin) National Geopark in Fujian, Wansheng (Shilin) National Geopark in Chongqing and Luota Shilin National Geopark in Longshan, Hunan. If scenic and cultural relics spots, forest parks and tourism scenic spots endowed with shilin landscapes are added, the important position of shilin landscapes in China’s tourism resources will be very prominent. It is known that in the world shilin landscapes or those similar to shilin landscapes are also distributed in Malaysia, the Philippines, Papua New Guinea, Madagascar, Spain, France and Cuba, which further indicates that shilin landscapes are landscape resources of global significance. Shilin has become an international karst landscape term (but there are also many researchers use the term stone forest). Although the shilin landscape as an independent type of karst landscape has been accepted by the geoscience community, its research level is not high and many problems remain to be further studied; for example, the definition of the shilin landscape, landscape type classification, formative mechanism of landscapes, distribution characteristics, ages of landscape formation and process of landscape formation still need discussion. In addition, since the shilin landscape is an important tourism resource, its aesthetic value and value of tourism development, the design of tourist products and particularly the ways of dissemination of the scientific connotation of shilin landscapes remain to be intensively studied. Furthermore, there is an urgent need to look for the protection methods of shilin landscapes and conduct a comparative study of shilin landscapes at home and abroad.

Owing to the aforesaid facts, in order to raise the geoscience research level of shilin landscapes and protect this valuable resource better and especially with a view to render better service to the construction of geoparks, scenic spots, forest parks and various kinds of tourism scenic areas that are endowed with shilin landscape and to broad masses of tourists, Chen Anze formulated the project “Comprehensive Study of Karst Shilin Geomorphological Landscapes in China” in 2005. Under the support of related provincial departments (bureaus) of land and resources, 11 subprojects (subjects) were established: the first subproject, comprehensive comparative study of karst shilin landscapes at home and abroad; the second subproject, comprehensive study of karst shilin landscapes in Yunnan—a case study of the Shilin World Geopark; the third subproject, comprehensive study of karst shilin landscapes in Guizhou; the fourth subproject, comprehensive study of karst shilin landscapes in the Sichuan-Chongqing region; the fifth subproject, comprehensive study of karst shilin landscapes in Hunan; the sixth subproject, comprehensive study of karst shilin landscapes in Hubei; the seventh subproject, comprehensive study of karst shilin

landscapes in Guangxi; the eighth subproject, comprehensive study of karst shilin landscapes in Yong'an, Fujian; the ninth subproject, comprehensive study of karst shilin landscapes in Hainan; the tenth subproject, comprehensive study of carbonate stone pillar forest landscapes in Hebei—a case study of Baishi Mountain, Laiyuan; and the eleventh subproject, study of the formative mechanism of karst stone pillar forest landscapes in Guanshan, Henan. With respect to research ways, a general project team led by Chen Anze was founded, and through related channels, the Project Team mobilized various related provinces to offer to undertake their selected subprojects. Under Chen's unified guidance, research was conducted jointly according to requirements. Opening reports of the project were given in Beijing on December 29, 2005. At the meeting Professor Lu Yaoru, academician of the Chinese Academy of Sciences and China's famous karst expert, and Professor Zhang Shouyue were invited for consultation and discussion and a detailed research plan was decided through consultation. In April 2006, supported by the Shilin World Geopark, members of all the subprojects gathered and made an on-the-spot investigation in Shilin, Yunnan. Take the typical shilin landscape for example, the research content, work methods and sampling requirements were standardized. Then the subproject teams conducted in-depth field investigations, laboratory tests and analyses and comprehensive comparative studies of the research objects included in their respective plans. Through two years of hard work, in August 2008 all the subproject teams finished their own research reports and relatively systematically summarized the shilin landscape conditions of 73 stretches (sites) in 11 provinces (autonomous regions and municipalities directly under the Central Government) of the main karst regions throughout China, which was a great investigation and great summary of main shilin landscapes made so far in China. On that basis, the project team held a concluding summary meeting in Changsha on November 22 ~ 23, 2008. At the meeting 11 subproject teams made systematic reports and meanwhile an exhibition of shilin landscape photographs was held. Lu Yaoru, Zhang Shouyue, Cui Zhijiu and editors in charge of *Acta Geographica Sinica*, *Acta Geologica Sinica* and *Geological Review* attended the meeting. Chaired by Lu Yaoru, the whole project was examined and appraised at the meeting (for the conclusions, see the appendix). In order that all circles could share the research results of shilin landscapes, the meeting suggested that the reports be published openly according to publication requirements. This book is just a monograph compiled in response to the suggestion of the experts, with Chen Anze as the chief editor. The book is divided into 11 parts, and those who participated in the compilation and writing of the book are as follows: Preface, Chen Anze; Part 1, Chen Anze, Zhang Shouyue, Qian Fang and Wang Min; Part 2, Qian Fang, Chen Anze, Liang Yongning, Li Yuhui, Peng Yang and Guo Keyi; Part 3, Li Xingzhong, Wang Liting and Chen Yuekang; Part 4, Fan Xiao; Part 5, Chen Wenguang, Jiang Tao and He Yuelin; Part 6, Zhu Wenjing and Li Zhengqi; Part 7, Chen Weihai and Zhu Dehao; Part 8, Chi Yongxiang, Lai Shuqin, Wu Xiaoxiong and Wang Zengyin; Part 9, Chen Yingmin, Zhou Dansheng; Fu Yangrong and Liu Changzhu; Part 10, Chen Anze, Zhang Erkuang, Guo Keyi, Li Youshan and Peng Yang; Part 11, Zhang Zhonghui and Miao Jinxiang; Concluding Remarks, Chen Anze. Xing Ruiling and Qian Fang participated in compilation of the whole book and Zhang Shouyue went over the whole book. It is worth mentioning particularly that the entire research work and publication of the book were funded by the following organizations: Yunnan Shilin World Geopark, Department of Land and Resources of Guizhou Province, Department of Land and Resources of Sichuan Province, Regional Geological Survey Party of Sichuan Province, Department of Land Resources and Housing Management of Chongqing, Department of Land and Resources of Hunan, Hunan Geological Environmental Monitoring Station, Hubei Institute of Geology, Department of Land and Resources of Guan-

gxi Province, Institute of Karst Geology of the Chinese Academy of Geological Sciences, Department of Land and Resources of Fujian Province, Department of Land and Resources of Hainan, Department of Land and Resources of Hebei and Henan Institute of Geological Survey. In the course of the work, we received support and encouragement from Dr. Jiang Jianjun, former director of the Department of Geological Environment of the Ministry of Land and Resources, and were given full assistance by the State Geopark Research Center of the Chinese Academy of Geological Sciences. On the occasion of sending the manuscript of this monograph to the press, we would like to express our sincere gratitude to all the financial assistance organizations and all the experts and leaders of the project who made contributions to the book. Due to the wide scope and many fields involved in China's shilin landscape research, imperfections are almost unavoidable in the book. We hope that the readers do not hesitate to offer their criticism.

Chen Anze  
March 2010 in Beijing



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