

# STONE FOREST

## A TREASURE OF NATURAL HERITAGE

(石林, 自然遗产中的珍宝)

Proceedings of International Symposium  
for Lunan Shilin to Apply for World Natural Heritage Status

SONG Linhua Tony WALTHAM CAO Nanyan WANG Fuchang

宋林华 T. 沃尔什姆 曹南燕 王富昌

石林

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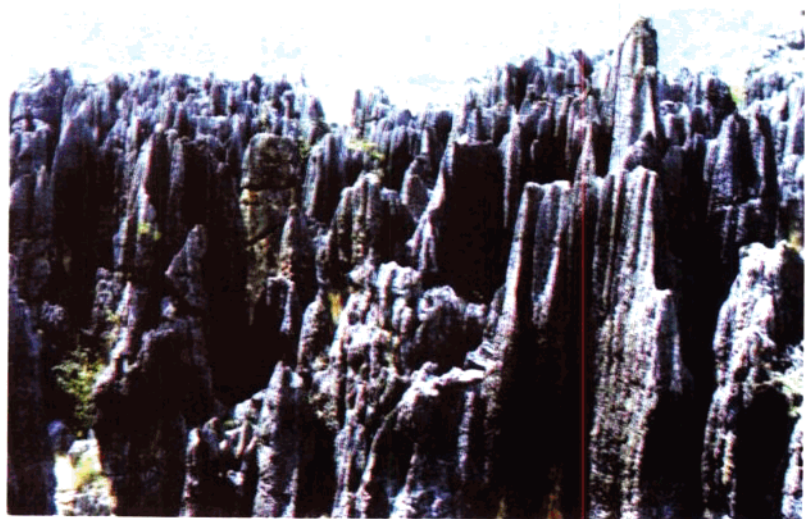
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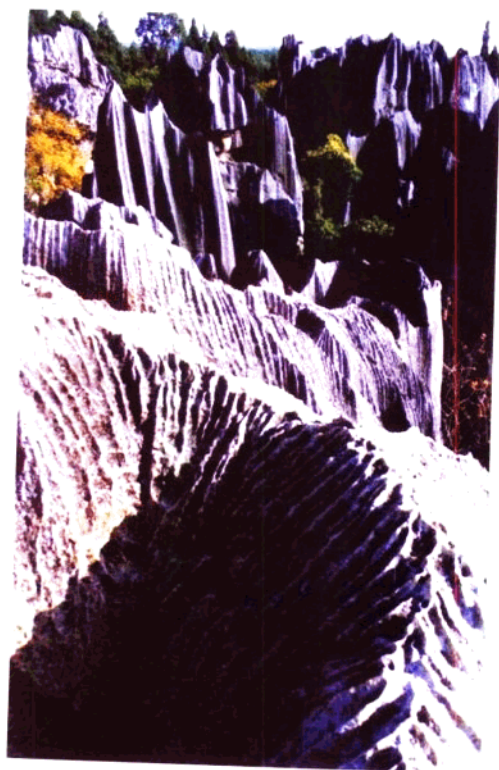
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柱状石林 Column Stone Forest  
(By Yang Xinmin)



剑状喀斯特石林  
Pinnacle Karst Stone Forest  
(By Yang Xinmin)



剑状喀斯特与溶痕

Pinnacle Karst and Karrens (By Song Linhua)





石林 Stone Forest (By Yang Xinmin)



石牙 Stone Teeth (By Yang Xinmin)



石蜡烛 Stone Candle  
(Photo by Yang Xinmin)

石蘑菇 Stone Mushroom  
(Photoed by Yang Xinmin)



石龟爬行 Walking of Stone Tortoise  
(By Yang Xinmin)

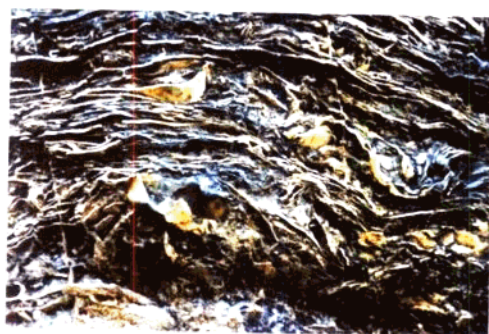


双墨珠 Twin Black Pearls (By Yang Xinmin)



充填在石牙间的P<sub>2</sub>玄武岩和玄武岩覆盖的  
石柱的基部

P<sub>2</sub> Basalt covers on the stone column base  
and filled in the fissures between stone teeth  
(By Song Linhua)



烘烤过的石牙基部

The base of stone teeth was baked by basalt  
(By Song Linhua)



覆盖在石牙上的老第三系砾石层

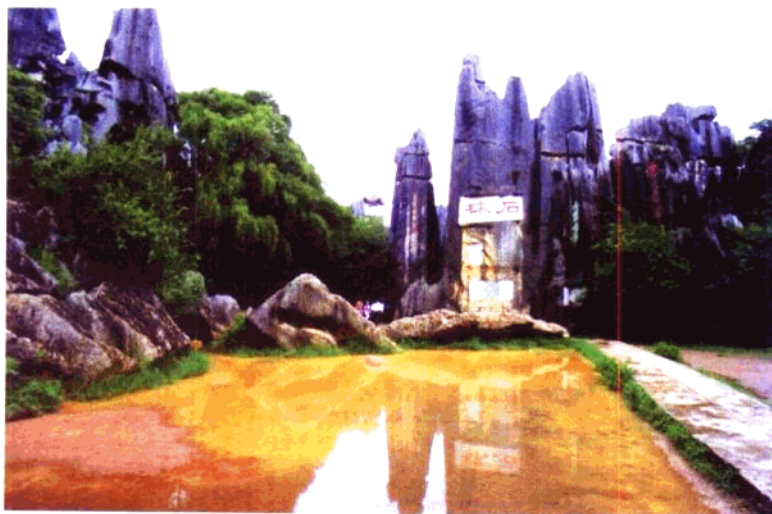
The Eocene conglomerate rock covered on  
stone teeth of lower Permian limestone  
(By Song Linhua)



残留在石灰岩地面上的铁石岩

The ferrohydrite rock is remained on the  
limestone surface  
(by Song Linhua)





1991 年 7 月 23 日被淹过的石林洼地  
 The Shilin depression was flooded on July 23, 1991  
 (by Yang Xinmin)



剑池——天然的喀斯特湖  
 Sword Pond —— A nature Karst lake  
 (By Yang Xinmin)



撒尼姑娘纺线

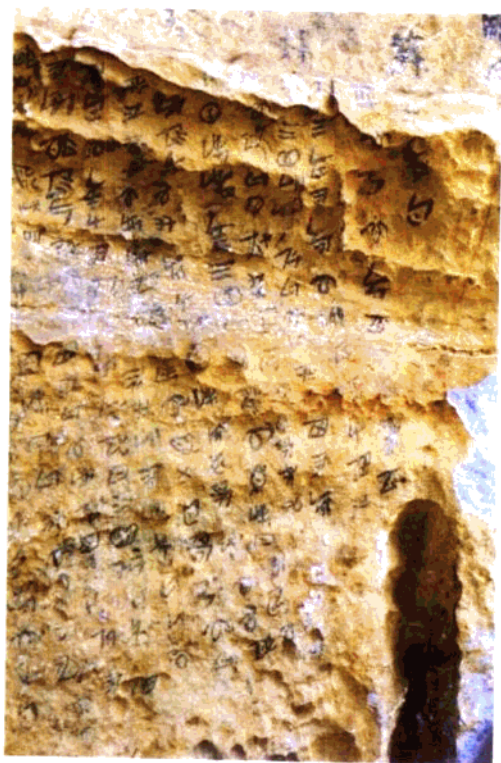
Sani girl is prinning By hands

(By Yang Xinmin)



撒尼姑娘手绣花

Sani girl is embroi dering (By Yang Xinmin)



古老的撒尼象形文化  
The old Sani pictorial character culture  
(By Yang Xinmin)



欢乐的撒尼舞  
Joyous Sani dancing  
(By Yang Xinmin)



白云洞  
White Cloud Cave  
(By Yang Xinmin)



跳起了三弦舞的火把节之夜  
At the night of Torch Festival  
young people are dancing  
with the 3 string instrument  
(By Yang Xinmin)

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# STONE FOREST, A TREASURE OF NATURAL HERITAGE

## PREFACE

As Mecca is to the devout Muslim so is China to the lover of karst landscapes. It is immensely rich and varied. There is limestone karst at the highest, coldest summits in Qinghai and along the tropical seashores of Hainan. In the north of the country, it is present in subtle doline topographies, at world-renowned archeological sites such as Zhoukoudian and displayed among the cultural icons in the Winter Palace. In central China, caves, springs and dolines are to be found everywhere amongst the great gorges of the Yangtze and its tributaries. But it is in the south that the karst becomes truly astonishing. Limestone and dolomite formations are exceptionally thick there and collision with the Indian Subcontinent has elevated them vigorously while heavy monsoonal rain seek to reduce them by dissolution. Amongst the immense diversity of landforms are the greatest examples in the world of three particular types of karst, the feng cong ("peak cluster" or "egg box" topography) and feng lin ("tower karst") in the provinces of Guangxi and Guizhou, and the stone forests (pinnacle karst) of Yunnan.

Lunan Stone Forest National Park Preserves the finest examples in Yunnan. It was created in 1982 in the first group of national parks approved by the government of China. It is within Lunan County and has a total area of 350 square kms. Two of the most outstanding clusters of pinnacles, Shilin (11 sq. km) and Naigu (8 sq. km) are fully developed with hotels, trails, etc. and are now attracting 1,500,000 visitors each year. There are several thousand permanent residents in the Park, principally Sani people of the Yi autonomous nationality, whose cultural traditions are recorded as early as 1200 B.C in this region. From the perspective of a professional karst scientist like me, the Lunan stone forests are unrivalled for two principal reasons; (1) they preserve and display much greater evolutionary complexity than the other celebrated pinnacle karsts; at Lunan historical geologists and geomorphologists get three landscapes for the price of one, so to speak! The first was created in the Permian Epoch, 250 million years ago, when the young limestones were uplifted, indented by karst, then invaded and submerged by basalts. At Shilin itself one can see dramatic examples where lavas flowed into epikarst, roasting the surfaces. Two hundred million years later most basalts were eroded and deeper karst with laterites and yellow soils formed in tropical wet-and-dry seasonal climates. This foundered in its turn, buried by debris from adjoining mountains. Now, in a third cycle, these old landscapes are being exhumed and re-worked in a cooler montane environment, and progressively exposed by the deforestation and soil erosion brought by human occupation. (2) the Modern Pinnacles display greater morphological variety as individual features than elsewhere. There are needles, fins, fluted spires, ruiniform blocks, emergent stone teeth and many other forms. Subaerial and subsoil weathering forms are intimately mingled. There is equal variety in the groupings that occur, lone individuals, small clusters ("coppices", if you will) and true forests of pinnacles are seen. They may be set alone on hilltops, or march along ridges; they may crowd the broad flanks of the hills and in the floors of dolines they often stand like reeds in the seasonal lakes. Such richness of form and distribution is to be attributed to the combination of a varied limestone and dolomite lithology and a complex genetic history.

It is the aesthetic appeal of the stone forests that attracts most of the visitors, however. Poets

and painters have celebrated it for centuries. It generates its own fanciful vocabulary. The countless small stone tops just peeping above the soil are "dragon's teeth", growing in size and number as erosion exposes them over the years. Many larger pinnacles are known individually to the local people, some named for their immediate association with form ("Sword Peak", "stone Mushroom"), others interpreted more exotically ("Cap leaping up the Dragon Gate", "Sadly Parting"). Many are incorporated into legends or have inspired them ("A-Shi-Ma", a heroine of the Sani people).

The forest landscapes are very appealing to foreign visitors. Those from the European cultural background that I share will find plenty of imaginative associations. In caves below the vivid black and orange pillars of Naigu, Italian visitors might see St. George fighting the Dragon; the setting has the structure and colour of many Renaissance paintings on this theme. Germans will imagine a baronial castle at every hilltop crag. For me (from England) the stone forests conjure up the fantasy realms of "Lord of the Rings", a famous fairy story of the contest between good and evil; in particular, they are the Barrow Downs, where questing travellers must do battle with ghosts haunting the ruined tombs of long-dead heroes. A day's walk from the traditional Sani village of Qing Shui Tang through open pine woods, corn patches and grasslands to Shilin is a pure delight of castellated vistas unfolding in sunshine and mist.

This volume is dedicated to scientific description and analysis of the Lunan stone forests, their comparison with other pinnacle karsts around the world, and to assessing the case for their recognition as a U.N.E.S.C.O. World Heritage natural site. The book is a fine example of international co-operation. Half of its authors are from China, including scientists and administrators from Yunnan Province and from the leading national research institute and universities, who speak to their own expertise and place Lunan in its regional and national context. The other half are foreign experts representing Australasia, Europe and North America, with wide experience of karst and caves in other nations, from the "classical" regions of Western study around the Adriatic Sea to the newest discoveries in the rain forests of Madagascar, New Guinea and Sarawak. All are united in their appreciation of the exceptional appeal of the stone forests of Yunnan.

It is a pleasure to thank our Chinese colleagues for their warm hospitality in Lunan. On my most recent visit with Professor Jean-Noel Salomon and Professor Paul Williams in February 1996, our hosts were Mrs. Cao Nanyan, National Park Division, Beijing; Mr. Zhang Faming and Senior Engineer Peng Yirong, for Yunnan Province; Mr. Wang Guanghua, Mr. Jin Zhiwei and Mr. Wang Fuchang for Lunan County. Our dear friend and colleague in international karst studies, Professor Song Linhua, Chinese Academy of Sciences, Beijing, initiated our visit and highlighted it with his continual good humour. What an excellent ambassador he is! I hope that his efforts and those of all contributors to this volume will help to ensure that Lunan Stone Forest National Park is granted the World Heritage status that is so richly merits.

**Derek Ford, M. A., D. Phil., F.R.S.C.,**  
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# 石林，自然遗产中的珍宝

## 序

喀斯特景观爱好者心目中的中国就像虔诚的穆斯林心目中的麦加。中国的喀斯特景观类型是如此的丰富繁多，从最高最冷的青海山峰到热带海南岛沿海，均存在着石灰岩喀斯特。在中国北部，如世界著名的考古点周口店附近显现了稀疏的斗淋地形，甚至在故宫的文化画廊中有所体现。在华中，洞穴、泉水和大型斗淋在长江三峡及其支流流域内随处可见。华南的喀斯特更令人惊叹，这里的石灰岩和白云岩地层特别厚实，与印度次大陆的碰撞使其强烈抬升，而暴烈的季风雨通过溶解作用又使其高度降低。中国三种特殊的地貌类型广西和贵州的峰丛和峰林及云南的石林是世界上地貌多样性最好的范例。

云南省路南石林国家公园是保护最好的样板，是中国政府于1982年公布的第一批国家公园。在路南县境内的石林，总面积达350km<sup>2</sup>。其中两个最著名的剑状喀斯特群：大石林(11km<sup>2</sup>)和乃古石林(8km<sup>2</sup>)，得到了充分的开发，并建有旅馆、旅游道等旅游设施，每年吸引150万游客。公园内还有几千居民，以彝族撒尼人为主。据记载，他们的文化传统始于公元前1200年。

像我这样的专业喀斯特科学家都持有这种观点，路南石林具有举世无双的两大特点：(1)它们保存和显示了比其它闻名于世的剑状喀斯特复杂得多的演化：在路南，历史地质学家和地貌学家找到的三种景观，可以说价值居世界之冠！第一种景观产生于2.5亿年前的二迭纪，当年年轻的石灰岩开始抬升时，被喀斯特蚀成齿状，随即被玄武岩侵入和覆盖。就在石林，人们就能看到岩浆流入浅层喀斯特，并烘烤其表面的这种神奇的例证。第二，2亿年后大部分玄武岩被剥蚀掉，在热带湿—旱季节交替气候条件下，深层喀斯特与红土和黄土同时发育。最初形成的景观被来自邻近山区的碎屑所掩埋。第三，现在这些老地形在凉爽的山区环境中被揭露出来和重新得到发育，并随着人类活动导致森林破坏和土壤侵蚀使其不断被裸露。(2)现代的剑状喀斯特在个体特征上比其它任何地方显示出更多的形态类型，有针状、鳍状、箔状石塔、残破岩块、出露的石牙和许多其它形态。空气中风化和上下风化的形态相互混合，使许多同类景观以群种出现，可以见到单独的个体、小型石柱群和真正的剑状石林。有的以单个分布在山顶上，有的沿着山脊排列；它们可聚集在宽阔的山坡上或像季节性湖中的芦苇那样矗立在洼地里。如此丰富的形态和分布类型应归结于不同石灰岩和白云岩与复杂的成因历史的结合。

正是石林的美学景观吸引了绝大多数的游客。诗人和画家对它赞美了几个世纪。由此产生了它自己的奇特的语汇。无数刚刚从土中出露的小石尖是“龙牙”，经过长年累月的剥蚀，其出露的体积和数量都会增加。许多大型尖柱在当地已人人皆知，家喻户晓。有一些根据它们的形态进行了命名(“剑峰”、“石蘑菇”)，另一些则给予更吸引人的名字(“鲤鱼跳龙门”、“悲伤离别”)，许多被编入了神话故事或赋予它们以灵感(“阿诗玛”，一位撒尼女英雄)。

对于外国游客来说石林景观动人心弦。那些像我一样的来自欧洲文化背景的人也会浮想联翩。在乃古石林亮黑色和桔黄色石柱下面的洞中，意大利游客可能看作圣·乔治在与巨龙搏斗；类似于许多文艺复兴时期油画的结构和颜色的乃古石林构成了这个主题的背景。德国人会想到在每个山顶的岩崖上有一个堂皇的城堡。对我来说(来自英国)石林可以想像成“Lord of Rings”(众神之国)里的虚幻王国，这是一个著名的善与恶相斗的神话故事；尤其是，那里是古墓岗(Barrow Downs)，在这里探索旅行者们必须要与在死了很长时间的英雄的已毁墓地周围游荡的鬼怪进行搏斗。从传统的撒尼人村庄清水塘穿过开阔的松树林、玉米地和草地到石林的一天步行，看着在阳光和云雾中显露出像城堡一样的峡谷风光，是一种纯粹的享受。