

# Geodiversity in China

Kejian Xu

China University of Geosciences, Beijing

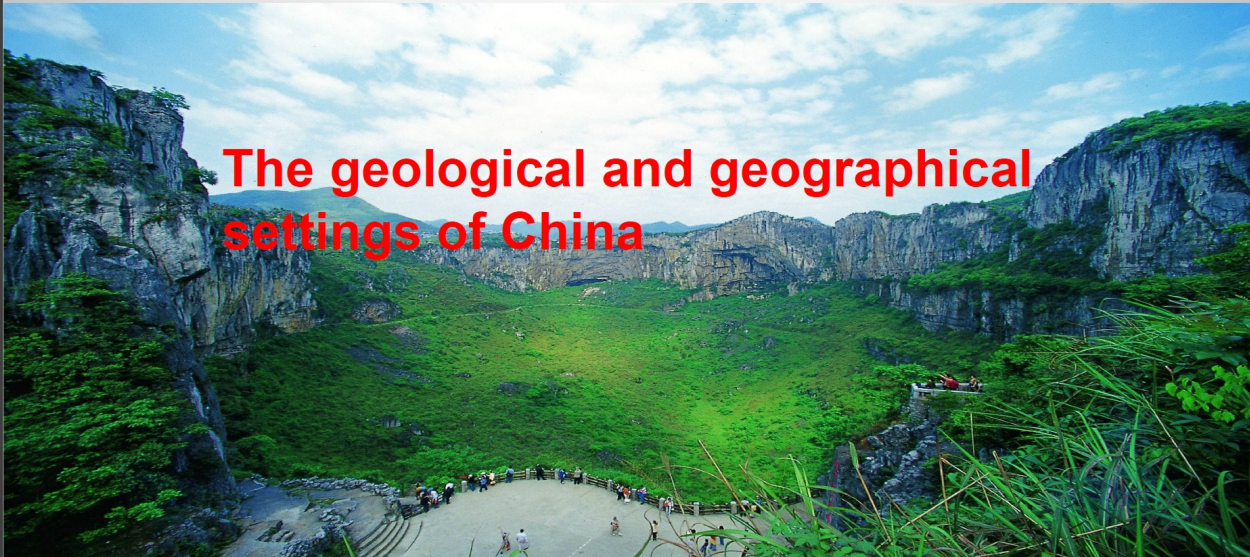
26 Jan 2022

## Introduction



- China has a remarkably rich geodiversity and some geological features can even be considered as world-class.
- Because geodiversity has a wide ranging of values and is threatened by human activities and urbanization, geoconservation is essential for the well being of present and future generations.
- Geodiversity has garnered considerable attention in China during the last decade.
- The main objective is to introduce the geological and geographical setting of China, review the status of the geodiversity and geoparks in China.

## The geological and geographical settings of China



## The territory of China



the world's third largest country, after Russia and Canada

With an area of 9.6 million square kilometers and a coastline of 18,000 km, its shape on the map is like a rooster.

northern end: Mohe in Heilongjiang Province

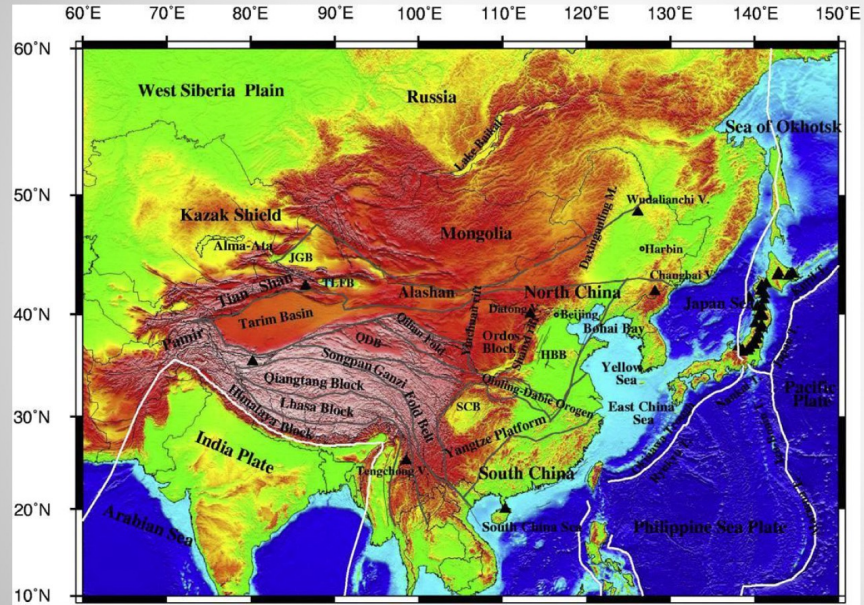
southern end: Zengmu Ansha

western end: Pamirs

eastern border: the conjunction of the Heilongjiang River and the Wusuli River

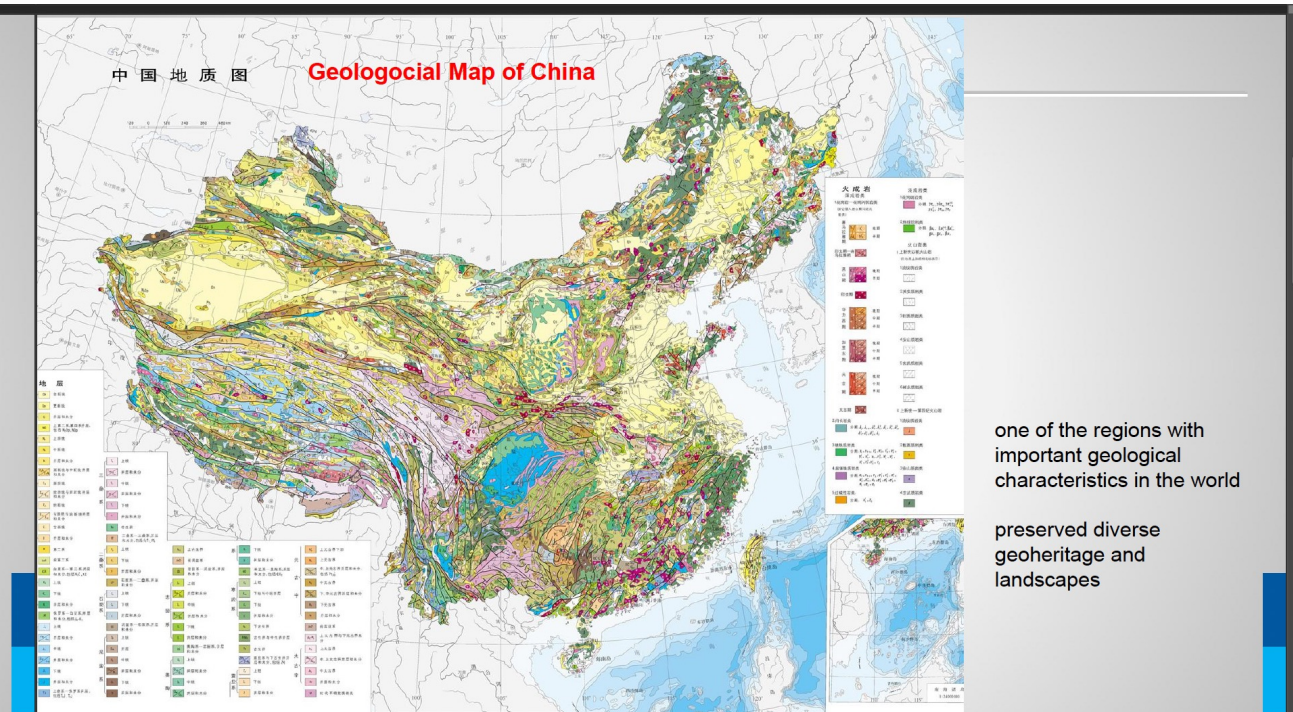
spanning a latitude of about 50 degrees and a longitude of about 62 degrees

## The tectonic setting



located at the convergence of three geological plates: the Pacific Ocean Plate, the Eurasia Plate and the India Plate.

a complex and diverse geological tectonic pattern



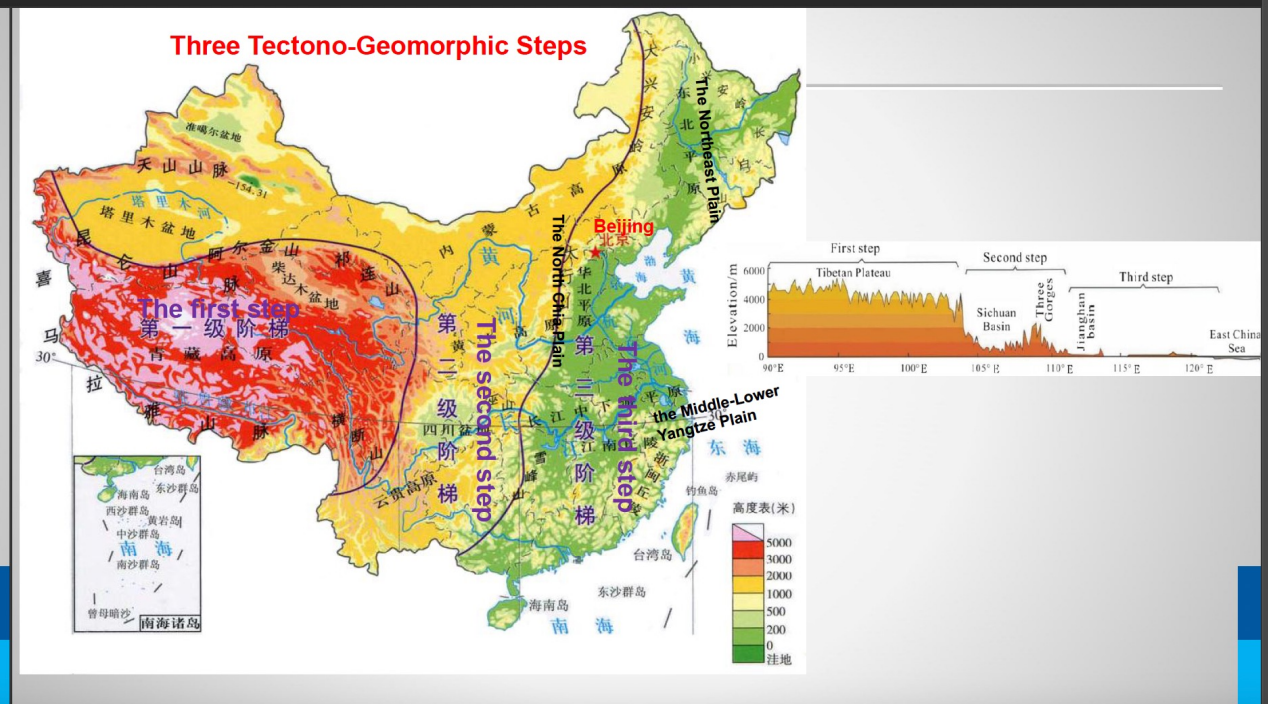
one of the regions with important geological characteristics in the world

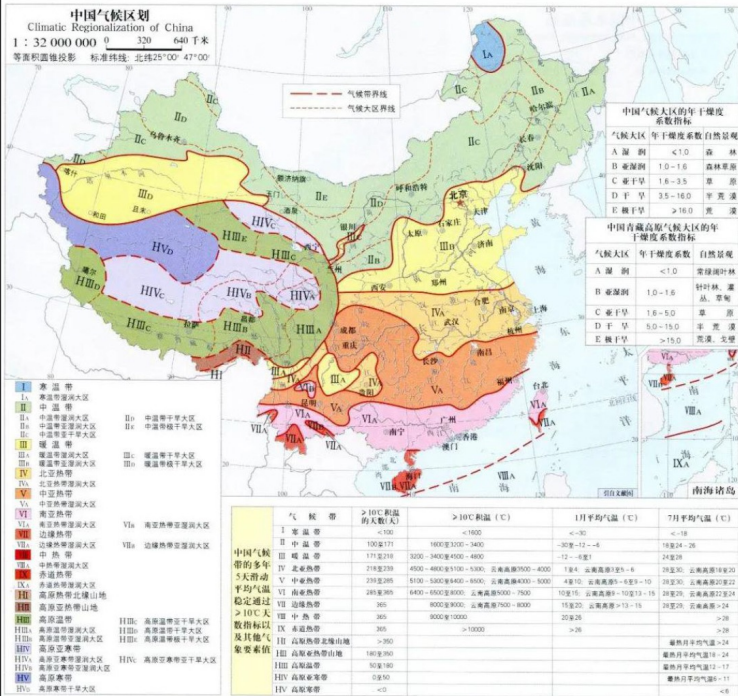
preserved diverse geoheritage and landscapes



The vast land expanses of China include plateaus, plains, basins, hills, and mountains.

They occupy nearly two-thirds of the land, higher in the West and lower in the East, which resulted in three tectono-geomorphic steps.





13 temperature zones from the plateau frigid zone to the equatorial tropical zone

27 climatic sub-regions



China is featured with plenty of geological landscapes.

## The geological landscape regionalization of China

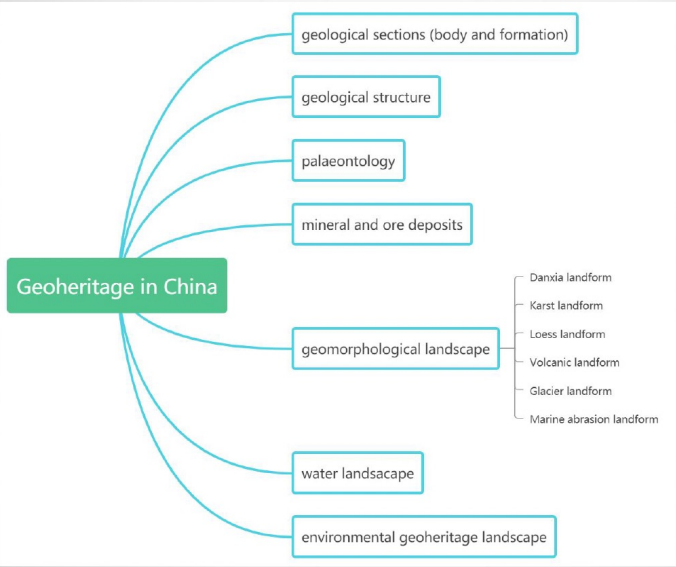
Zone	Scope	Feature
The Qinghai-Tibet Zone	The Qinghai-Tibet Plateau	Glacial landform, alpine- extremely alpine landform, salt lake, plateau lake & wetland, geothermal landscape, etc
The Northwest Zone	Kunlun Mountains - Altun Mountains - Qilian Mountains - north of the Yellow River loop and west of the Daxinganling, including Tarim Basin, Tianshan, Junggar Basin and the Altai Mountains in Xinjiang, Hexi Corridor in Gansu and the Inner Mongolia Plateau	Desert - Gobi aeolian landform, sandstone landform in northwest arid area, granite landform in arid-cold areas, oasis - inland river - lake landform, glacier landform, alpine - extremely alpine landform, etc
The Northeast China-North China Zone	East of Great Khingan, Qinling - Tongbaishan - North of Dabieshan	Cenozoic volcanic landform, loess landform, granite mountain landform in the North China, fault block mountain tectonic landform in the North China, exorheic river - lake & wetland landform, coast - island landform in the North China, etc
The South China Zone	East of Qinghai-Tibet Plateau, Qinling - Tongbaishan - South of Dabieshan	Danxia landform, karst landform of the South China, granite mountains landform of the South China, Cenozoic volcanic landform along the southeast coast, sandstone peak forest landform, horst & graben basin & ridge landform of the Yunnan Plateau, and coast - island landform of the South China

## Geodiversity in China





# The classification of geological heritage in China

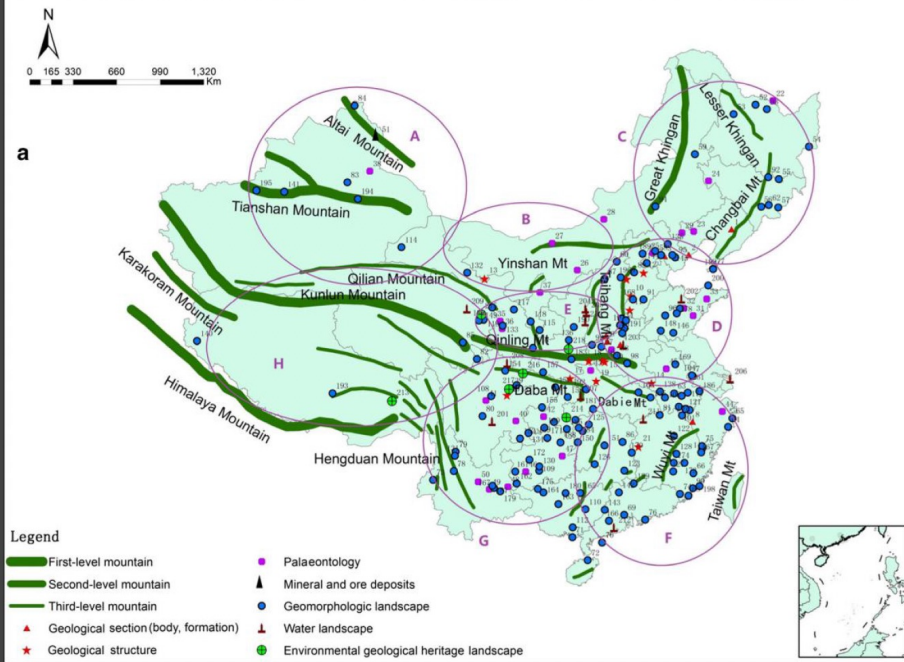


Map of National Geoparks in China



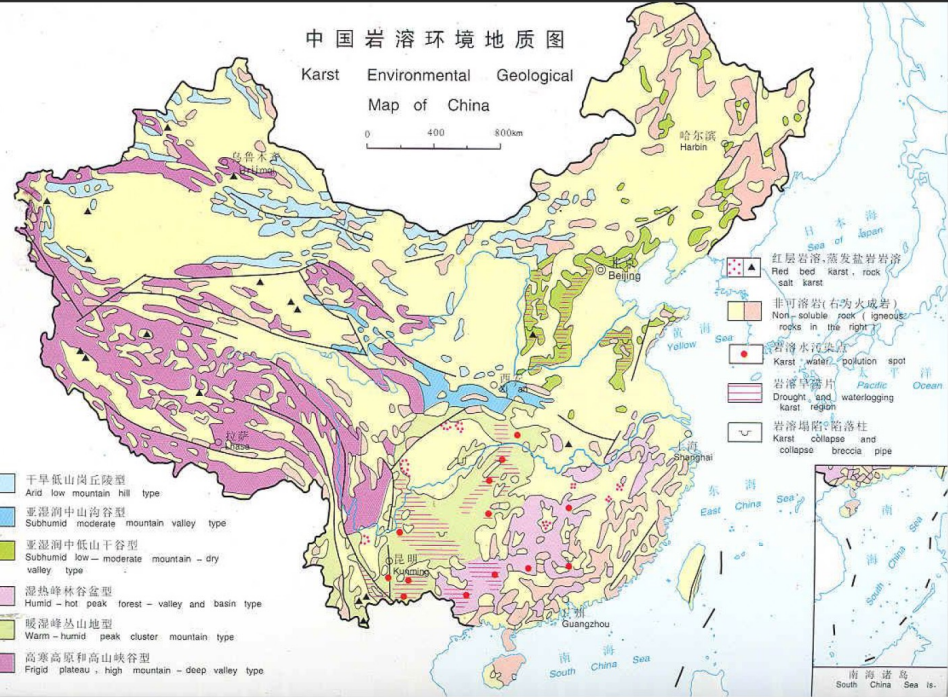
281  
National Geoparks

41  
UNESCO Global  
Geoparks



The spatial distribution of national geoparks is extensive, and geopark distribution coincides with the tectonic zone of geological structure features.

Coupling relationships are obvious between spatial distributional patterns and natural and geological conditions.



The area containing carbonate rock strata in China reaches 3.44 million kilometers, accounting for more than one-third of the land area.

## Distribution area of carbonate rocks in China (km<sup>2</sup>)

Zone	Pure	Interlayer	Interbedding	Interlayer	Total
The Northeast Zone	-	52,560	3,600	14,760	70,920
The North China Zone	55,440	89,280	16,200	-	160,920
The China Zone	2,220	19,080	3,240	8,280	32,820
The Central China Zone	27,720	48,600	58,320	9,000	143,640
The Southwest Zone	197,640	117,000	40,680	70,920	426,240
The Tibet Zone	-	23,760	73,800	133,560	231,120
The Northwest Zone	-	-	276,120	24,480	300,600
Total	283,020	350,280	471,960	261,000	1,366,260

## Regionalization of Karst Landscape and Karst Geoparks in China

Zone	Climate zone	Landform	Geopark
The South China Zone	North subtropical climate zone - Central subtropical climate zone - South subtropical climate zone - Tropical climate zone	Hills, peak clusters, stone forests and caves in the Yunnan-Guizhou Plateau	Shilin UGGp, Zhijindong Cave UGGp, Jiuxiang Canyon & Cave Geopark, Luoping Geopark, Luxi Alu Geopark, Shuanghedong Cave Geopark, Xingyi Geopark, Pingtang Geopark, Wumengshan Geopark, Yanbian Gesala Geopark
		Tiankengs, caves and canyons in the transition zone from the Yunnan-Guizhou Plateau to Guangdong-Guangxi Hills to Xiangjiang River to Jiangnan Plain to Sichuan Basin	Xingwen UGGp, Leye-Fengshan UGGp, Wulong Geopark, Youyang Geopark, Wansheng Geopark, Shizhu Qiyaoshan Geopark, Guzhang Red Stone Forest Geopark, Fenghuang Geopark, Wulongshan Geopark, Xuefenghu Geopark, Miaoling Geopark, Sinan Wujiang Karst Geopark, Ziyun Getuhe Geopark, Tenglongdong-Grand Canyon Geopark
		Peak clusters, peak forests and isolated peaks in the Guangdong and Guangxi Hills	Xiangqiao Karst Geopark, Dahua Qibainong Geopark, Yizhou Water Stone Forest Geopark, Du'an Underground River Geopark, Luocheng Geopark, Donglan Geopark, Jiubujiang Geopark, Yangshan Geopark
		Caves, peak clusters and stone forests in Longmenshan - Micangshan - Dabashan - Wushan	Guangwushan - Nuoshuihe UGGp, Anxian Geopark, Jiangyou Geopark, Huayingshan Geopark, Yuniang Longgan Geopark, Liping Geopark
The Qinghai-Tibet Zone	Plateau sub temperate climate zone - plateau temperate climate zone	The alpine karst in the east of the Qinghai Tibet Plateau - the Hengduan Mountains, the surface travertine pools - travertine beaches - travertine waterfalls - travertine barrier lakes	Jiuzhaigou - Shenxianchi Geopark, Huanglong - Muniou Geopark, Kalonggou Geopark, Gonggashan Yaguan - Yulongxi Geopark, Shangri-La Baishuitai Geopark
The North China Zone	Warm temperate climate zone - Middle temperate climate zone	Caves in Taihangshan - Yanshan - Xing'anling - Changbaishan	Fangshan UGGp, Benxi Geopark

### The South China Zone

#### -The Yunnan-Guizhou Plateau



Hills, peak clusters, stone forests and caves

Xingyi National Geopark



Shilin UGGp

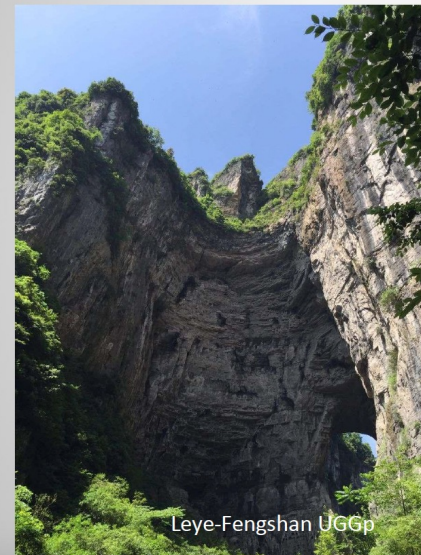


Zhijindong Cave UGGp

### The South China Zone

#### -The transition zone from the Yunnan-Guizhou Plateau to Guangdong-Guangxi Hills to Xiangjiang River to Jiangnan Plain to Sichuan Basin

#### Tiankengs, caves and canyons



Leye-Fengshan UGGp



Tenglongdong-Grand Canyon National Geopark



Xingwen UGGp



## The South China Zone

-The Guangdong and Guangxi Hills

Peak clusters, peak forests and isolated peaks



Leye-Fengshan UGGp  
畅游凤山



Xiangqiao Karst National Geopark



## The South China Zone

-Longmenshan - Micangshan - Dabashan - Wushan

Caves, peak clusters and stone forests



Guangwushan-Nuoshuihe UGGp



Liping National Geopark



## The Qinghai-Tibet Zone

The alpine karst in the east of the Qinghai Tibet Plateau - the Hengduanshan, the surface travertine pools - travertine beaches - travertine waterfalls - travertine barrier lakes



Jiuzhaigou National Geopark



Huanglong National Geopark



## North China Region

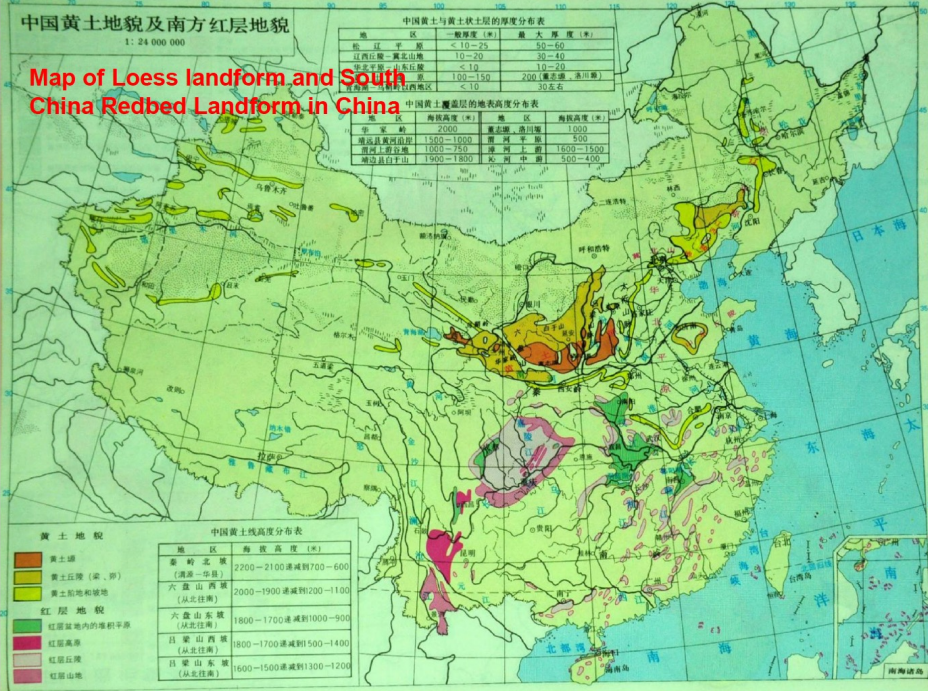
Caves



stalactite in Fangshan UGGp



Benxi National Geopark



## Loess landform Geoparks in China



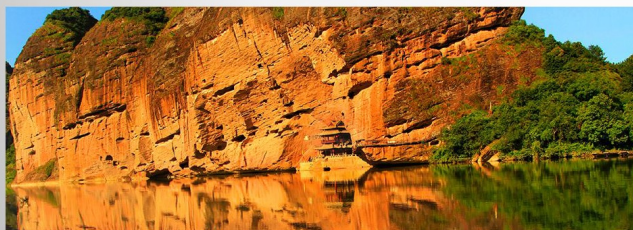
Luochuan Loess National Geopark



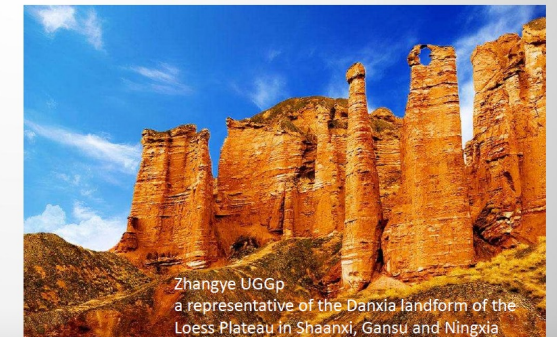
Mahuangliang Loess Geopark

## Regionalization of Danxia Landform and Danxia Geoparks in China

Zone	Climate zone	Landform	Geopark
The South China Zone	Central subtropical climate zone - south subtropical climate zone	Nanling - Southeast coastal mountains - Hills	Danxiashan UGGp, Longhushan UGGp, Taining Geopark, Shicheng Geopark, Langshan Geopark, Feitianshan Geopark, Wanfoshan, Swan Caves Geopark, Yong'an Geopark, Guanzhaishan, Qiyunshan Geopark, Ziyuan Geopark
The Southern Margin of Sichuan Basin	Central subtropical climate zone	Ladder shaped long cliffs, urn valleys and waterfalls in the transition zone from Guizhou Plateau to Sichuan Basin	Chishui Geopark, Hejiang Geopark, Simianshan Geopark
The Loess Plateau in Shaanxi, Gansu and Ningxia	Warm temperate climate zone	-	Zhangye UGGp, Kongtongshan Geopark, Maijishan Geopark, Huoshizhai Geopark, Zhaojin Geopark



## 中国主要丹霞景观分布示意 Map of Danxia Landforms in China







## Cretaceous volcanic landscapes and volcanic geoparks along the southeast coast of China

Peaks, mountain depressions and mountain streams in the mountains and hills along the Southeast Coast

**Yandangshan UGGp**, Xiandu Geopark, Fushan Geopark, Shiniushan Geopark, Baishuiyang Geopark, Lingtongshan Geopark, Fozishan Geopark, Sanqing Country National Geopark



Yandangshan UGGp



Baishuiyang National Geopark



## Late Cenozoic volcanic landscapes and Volcanic Geoparks in China

Leiqiong UGGp



Southeast coastal area

**The hills and platforms of Coast - Islands of Jiangsu-Fujian- Guangdong-Guangxi-Hainan**

Leiqiong UGGp, Liuhe Geopark, Zhangzhou Coast Volcano Geopark, Weizhoudao Geopark

Wudalianchi UGGp



Northeast - North China area

**Volcanic cones, craters and barrier lakes** in Greater Khingan Range -Lesser Khingan Range- Changbaishan - central Inner Mongolia - northern Shanxi

Wudalianchi UGGp, Jingpohu UGGp, Arxan UGGp, Changbaishan Geopark, Datong Volcanoes Geopark

Tengchong National Geopark



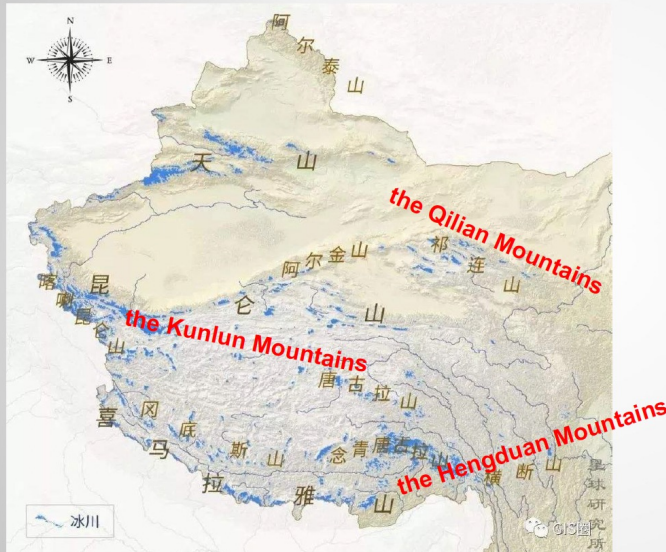
Southwest area

**Volcanic cones and craters** at the southern end of Hengduan Mountains

Tengchong Geopark



## The Distribution of Glaciers in China



Extremely high mountains in the Kunlun Mountains - the Qilian Mountains - the Hengduan Mountains



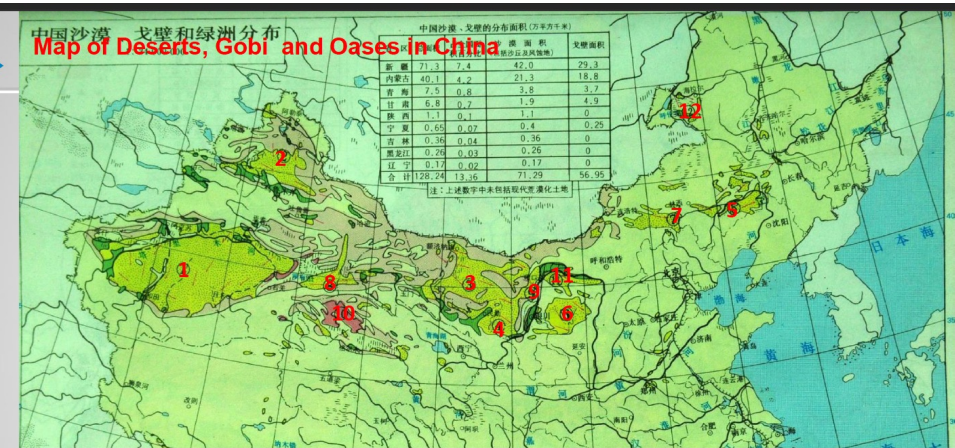
### Statistics of modern glaciers in main mountains of China

Mountain	No.	Area (km <sup>2</sup> )
Altai Mountains (in China)	457	271
Tianshan Mountains (in China)	6,895	9,548
Qilian Mountains	3,306	2,063
West section of Kunlun Mountains	3,180	4,331
Animaqing Mountain	50	139
Hengduan Mountains	386	750
East section of Kunlun Mountains	2,756	4,880
Nanshan in Lhasa	248	161
North slope of Mount Qomolangma	217	772

### The Comparison of the altitude of modern snowline in main mountains of China

Mountain	The altitude of Modern snowline (m)
Altai Mountains	3,000-3,200
Bogda Shan	3,900 (North slope)
Hantengri Peak	4,100-4,200 (South slope)
Qilian Mountains	400-5,200
West section of Kunlun Mountains	5,400-6,200
Tanggula Mountains	5,400-5,500
Hengduanshan	4,600-4,700
Chayu region	4,600-5,200
North slope of Mount Qomolangma	5,800-6,200

### Map of Deserts, Gobi and Oases in China



### The area of key deserts in China (1,000km²)

No.	1	2	3	4	5	6	7	8	9	10	11	12
Name	Taklimakan Desert	Gurbantunggut Desert	Badain Jaran Desert	Tengger Desert	Horqin Sandy Land	Mu Us Sandy Land	Hunshandake Sandy Land	Kumtag Desert	Ulan Buhe Desert	Qaidam Desert and Wind Erosion Land	Hobq Desert	Hulunbuir Sandy Land
Area	337.6	48.8	44.3	42.7	42.3	32.1	21.4	22.8	9.9	34.9	16.1	7.2

## Desert Landform and Desert Geoparks in China



01

### The Northwest arid area

Junggar Tarim Turpan Hami Alxa, Gurbantunggut, Taklimakan, Kumutak, Badain Jaran, Yamarek, Tengger, Kubuqi and Maowusu deserts in Ordos



02

### The Semi arid area of central eastern Inner Mongolia

Hunshandak Sandy Land, Horqin sandy land and Hulunbuir sandy land

## Important paleontological fossil sites and paleontological Geoparks in China



01

### Important dinosaur fossil sites

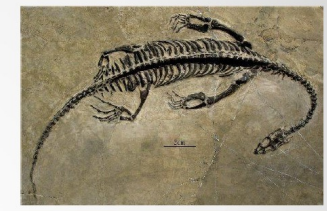
South Area: Dinosaur bones, eggs and footprints dominated by Jurassic and followed by Cretaceous  
North Area: Dinosaur bones, eggs and footprints dominated by Cretaceous and followed by Jurassic



02

### Important petrified wood fossil sites

The East Junggar Qitai-Jimसार-Mulei-Qinghe-Fuyun-Balikun-Yiwu petrified wood enrichment area (The world's rare)



03

### Important paleontological communities fossil sites

Mammoth- Rhinoceros fauna fossils, Mammalian fossils, Rehe biota fossils



## Conclusions

- China has remarkably rich geodiversity. The geoheritage can be divided into 7 categories and the geomorphological landscape is the largest category, accounting for about 70%.
- The spatial distribution of national geoparks of China is extensive, and the distribution of geoparks coincides with the tectonic zone of geological structure features.
- The rich geodiversity in China can be an asset for the development of geotourism. and geotourism may generate benefits beyond monetary terms. Concepts of geodiversity and geoconservation, and their contribution to sustainable development deserve more attention in China.



**Happy  
Chinese  
New Year**