Article

Geoparks and Geotourism in China: a Sustainable Approach to Geoheritage Conservation and Local Development

Kejian Xu[1,*], Wenhui Wu[2]

[1] China Univerisity of Geosciences, Beijing 100083, China; kejian77@foxmail.com
[2] Chengdu University of Technology, Chengdu 610059, China; wuwenhui@cdut.edu.cn
* Correspondence: kejian77@foxmail.com

Abstract: Geoparks, as an innovation for the conservation of geological heritage, play an important role in the development of geotourism. While developing geotourism, the establishment of geoparks can generate new job opportunities, new economic activities and additional sources of income, especially in developing countries. China, with its vast territory and complex geological, geomorphic features has received the designation of UNESCO Global Geopark for 41 areas of significant geological importance and heritage. This paper reviews the geoparks initiative in China, the types and distribution of Chinese geosites and geoparks, as well as geotourism and local development. A geopark is a sustainable approach to advancing geoconservation and promoting local economic development. Implications for geopark management and geotourism development are discussed.

Keywords: geopark, geotourism, geoheritage, geoconservation, sustainable development

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1. Introduction

Within the field of tourism, geotourism and geoparks are two of the most recent concepts. According to Newsome and Dowling (2010), geotourism has developed to address the need to minimize the negative impacts of mass tourism at tourist sites based around geological and geomorphological attractions [1]. They stress that its key goal is an emphasis on sustainable tourism development in primarily rural and natural environments. United Nations Educational, Scientific and Cultural Organization (UNESCO) defined geoparks as nationally protected areas with a number of geoheritage sites of particular importance, rarity or aesthetic appeal [2]. The establishment of geoparks also favours non-traditional economic development based on geotourism and geoproducts [3,4]. The essential purpose of a geopark can be seen as establishing an ecosystem which consists of geoheritage and other local values in its territory, in order to link heritage conservation with educational and economic development, and furthermore back up geoconservation by such educational and other local sustainable development activities. For this reason, both geotourism and geoparks may be seen as attractive tools for rural development.

The idea of geoparks was developed in 1996 but it was in 2000 when representatives of four European territories, which had separately been promoting geological conservation and sustainable development, signed a convention declaring the creation of the European Geoparks Network (EGN) [5,6,7]. In 2004, the EGN was opened to non-European territories including 8 Chinese geoparks and creating the Global Geoparks Network (GGN). The Madonie Declaration was also signed in 2004 re-affirming the previous agreement (2001) of cooperation between the Division of Earth Sciences of UNESCO and the GGN [7,8]. This cooperation was consolidated in 2015 when the 195 member states of UNESCO ratified the creation of the UNESCO Geosciences and Geoparks Programme, with the UNESCO Global Geoparks (UGGps) as a branch of this programme. In April 2022, UNESCO's Executive Board approved the designation of 8 new UGGps in the world. The total number of sites in the GGN is 177 in 46 countries. The distribution of UGGps is variable depending on the continents and countries (Figure 1). The great majority of UGGps are located in Europe (94 UGGps) and in the Asia-Pacific region (66 UGGp). There are 8 UGGps in North America, 7 UGGps in South and Central America and the Caribbean and 2 UGGps in Africa. China has got 41 UGGps and it is the first country when considering the number of UGGps in the world.

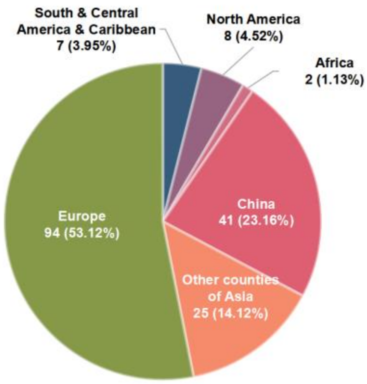

Figure 1. Distribution of the number of UGGps by continent.

The main goals of this paper are (1) to show the main features of geoheritage and geoparks in China, (2) to analyse the geoconservation, management and geotourism in China's geoparks and (3) to discuss the main challenges of the future in China's geoparks.

2. Materials and Methods

Publications related to geopark themes do not appear in many journals. According to the literature review, most geoheritage manuscripts focus on geodiversity and geoconservation, and few papers discuss geoparks in a comprehensive way. Several scholars in China consider related studies on geoheritage and geoparks as important. They have attempted to extend these studies to include the geological backgrounds of national geoparks [11,12,13], geoheritage assessment [14,15], geopark management [16,17], relationship between geoheritage conservation and economic development [18,19,20],the sustainable development of national geoparks [21,22,23], geoheritage development [24,25], the spatial structure of geoparks [26] and geotourism and its products [24,25].

The methodology followed to develop this study is based on the following: (1) compilation of data referring to the historical evolution of the China's UGGps; (2) compilation of cartographic data of the China's UGGps; (3) compilation of information on essential aspects to understand their extension, distribution and geographical, geological, administrative and management characteristics; (4) analysis of the results and diagnosis; and (5) elaboration of the synthesis figures and obtaining conclusions.

3. Geoheritage and Geoparks in China

3.1 Geological and geographical setting of China

China has a unique geology and a dynamic natural landscape which has attracted numerous tourists from home and abroad. Owing to the dynamic processes still shaping China's landscape, combined with the natural environment in the country, China is often referred to as an open laboratory in geosciences. China is located at the convergence of three geological plates: the Pacific Ocean Plate, the Eurasia Plate and the India Plate. In its long geological history, it has undergone the evolution of ancient plates such as Siberia, North China Tarim, South China, Yunnan-Tibet and India (Gondwana), therefore it has a complex and diverse geological tectonic pattern (Figure 2). Many prior studies [28,29,30] have shown that the major fault and fracture systems in the region exert a dominant control on landform development, via differential uplift and widening of fractures and joint sets. The basement structure of most of southern China was established by the Wuling-Xuefeng Orogenic Movement (~1400-850 Ma), and during the Late Triassic Indosinian Movement China underwent a complex process of NW-SE extrusion and EW shearing, producing associated groups of NW-NNW tension-faults and NS and NNW strike-slip faults. The early Yanshanian Movement during the late Jurassic period (around 160-140 Ma), caused EW extrusion of China and formation of NNE-NS folds together with two sets of strike-slip faults in NNW and NEE directions. The late Yanshanian Movement of late Cretaceous age (around 130~68 Ma), displaced south China from SE to NW, with reactivation and enlargement of faults, uplift and tilting [28].

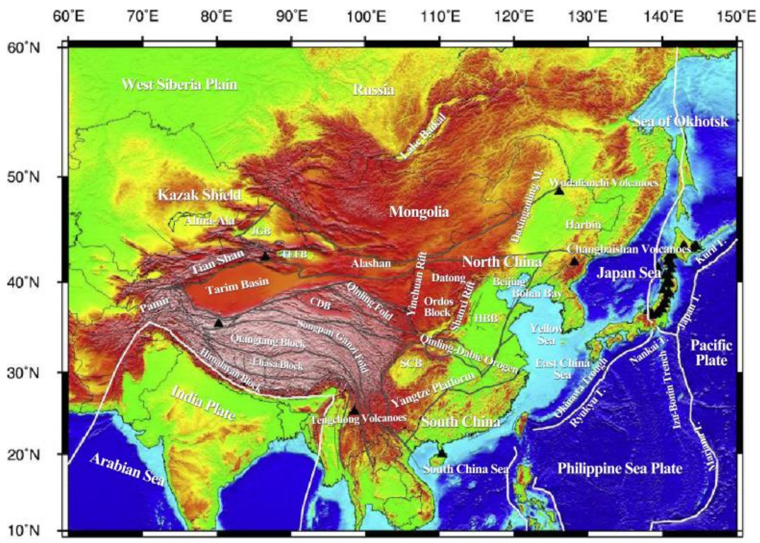

Figure 2. The Geological setting of China (modified from [27])

Colors indicate topographic fluctuations, white lines indicate plate boundaries, gray lines indicate major faults and boundaries of major tectonic plates in the region, and black triangles indicate major volcanoes.

China has well-developed strata (Figure 3), various sedimentary types, complex geological structure, where the active zones and stable zones coexist. It also has frequent magmatic activities, a long evolution history, as well as different metamorphism. Therefore, China is one of the regions with significant geological characteristics in the world, where diverse geoheritage and landscapes have been well preserved.

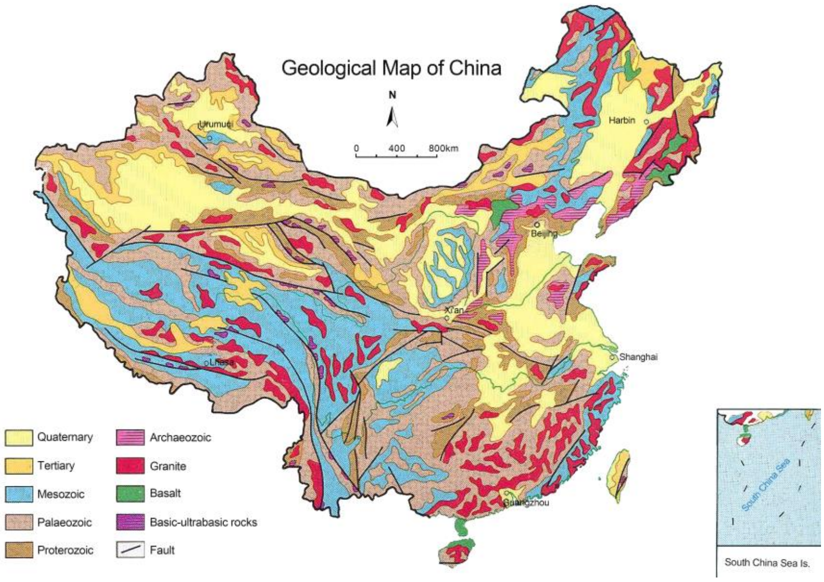

Figure 3. Geological map of China (modified from [31]).

China has an area of 9,600,000 km^2 and a coastline of 18,000 km, and is the world's third largest country, after Russia and Canada. It spans a latitude of about 50 degrees and a longitude of about 62 degrees. 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 results in three tectono-geomorphic steps shown in Figure 4. The average altitude of the first step is more than 4,000m. The highest step is formed by the Qinghai-Tibet Plateau at an average height of over 4,000m, with the Kunlun Mountain Range, the Qilian Mountain Range and the Hengduan Mountain Range as the division between this step and the second one. The highest peak in the world, Everest, at 8844.43m high is known as 'the Roof of the World'. On the second step are large basins and plateaus, most of which are 1,000m - 2,000m high. The Great Khingan, Taihang Mountain, Wu and Xuefeng Mountains divide this step and the next lower one. Plateaus including the Inner Mongolian, Loess, and Yunnan-Guizhou Plateaus, and basins such as Tarim, Junggar, and Sichuan Basins are situated here. The third step, easternmost and lowest, which is abundant in broad plains, is dotted with the hills and lower mountains, with altitudes of over 500m. Here are located famous plains: the Northeast Plain, the North China Plain, and the Middle-Lower Yangtze Plain, neighboring with each other from north to south.

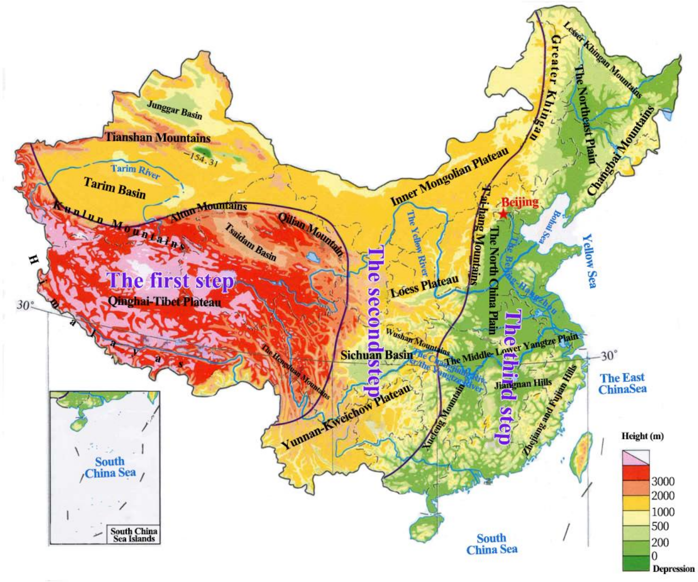

Figure 4. Three Tectono-Geomorphic Steps (modified from [32]).

3.2 Classification of geoheritage in China

Geoparks Secretariat gives a classification scheme, with emphasis on the geoheritage involved in various geoscientific disciplines such as: solid earth sciences, economic geology and mining, engineering geology, geomorphology, glacial geology, physical geography, hydrology, mineralogy, palaeontology, petrology, sedimentology, soil science, speleology, stratigraphy, structural geology, volcanology, etc [33]. To date, there have been few different geoheritage classification schemes developed [10,11,29,34,35,36]. The classifications are similar to each other, mostly from the disciplines of geoheritage or the geological processes formed. Qi et al. (2004) proposed a comprehensive classification method based on 'materials composition and cause of formation' [25]. Xu (2007) divided geoheritage into 10 categories based on the cause of sections, strata, structures, rocks, fossils and topographies [22]. Most existing classification methods are based on 'materials composition and cause of formation'. These methods capture the essential features of geoheritage and are highly scientific in nature. However, geoheritage classification aims to protect heritage with special scientific values. Therefore, according to 'cause of formation-protection' attributes, a new geoheritage classification method is proposed based on previous works [17,18,37] and the programme 'technical requirements of China's national geoparks' released by the MLR.

The authors thus provided a new method for geoheritage classification that is based on both the cause of formation and the factors that support the reason for protection. The geoheritage in China can be classified into 3 different categories, i.e., basic geology, landforms, geohazards (Table 1).

Table 1. The classification of geoheritage in China

Category	Subcategory	Geoheritage
basic geology	stratigraphic section	international stratigraphic section Stratigraphic (typical) section geological events section
	rock section	intrusive rocks section volcanic rocks section metamorphic rocks section sedimentary rocks section
	structural section	plane of unconformity fold and deformation fault
	important fossil site	palaeoanthropolgy fossil site palaeontology fossil site palaeophytology fossil site palaeozoology fossil site ichnofossil site
landforms	loess and rock landform	carbonate rock landform granite landform clastic rock landform loess landform
	dessert landform	desert landform gobi landform
	volcanic landform	volcanic apparatus volcanic lava landform volcaniclastic accumulation landform
	glacier landform	glacier erosion landform glaciers accumulate landform
	ice-marginal landform	ice-marginal deposit ice-marginal structure ice-marginal terrain
	coastal landform	marine-erosion landform marine-deposit landform
	fluvial landform	fluvial erosion landform fluvial deposit landform
	structural landform	tectonic structure landforms mesoscopic structure landform minor-scale structure landform
	water landscape	river landscape lake, pool wetland-marsh waterfall spring
geohazards	earthquake	geosuture ground deformation
	geohazard remains	collapse landslide debris flow surface collapse ground subsidence

3.3 The initiative of geoparks in China

In China, the concept and management of geoparks were introduced in the early 1990s [38,39,40,41]. Encouraged by the UNESCO Geoparks programme, the Ministry of Geology and Mineral Resources officially accepted the idea of the geopark, and subsequently, the Ministry of Land and Resources (MLR) issued a notification to approve national geoparks and outlined the regulations regarding the evaluation criteria, and approval procedures in 2000, opening a way for the central government to manage national geoparks [40]. In 2002, the Chinese Geoparks Network (CGN) responsible for the coordination and management of national geoparks and global geoparks was established [40]. From 2003, in response to the establishment of the GGN, China began to apply for global geoparks. When 25 global geoparks in the world were announced in 2004, 8 of them were located in China, demonstrating that China's geoparks were a success. Due to the Chinese government reform, the newly founded National Forestry and Grassland Administration of PRC was made responsible for the geoparks administration instead of the MLR in 2018. At present, there are 41 UGGps and 281 national geoparks in China, covering an area of over 60,000 km^2 (Figure 5, Figure 6).

Figure 5. Distribution of Geoparks in China.

Figure 6. Map of UNESCO Global Geoparks in China

China has been very active in promoting the concept of geoparks so as to conserve geoheritage and raise public awareness in environmental protection. This can be seen from past occurrences in which China was positively involved and played an important role. The first International Conference on Geoparks that was then held in June 2004 in Beijing, China, is a historical event which conveyed a message to the rest of the world that China has a strong will in the promotion of the concept of geoparks.

The establishment of the GGN was a good sign from the perspective of providing an efficient way for local economic development as well as geological conservation. It encourages many Chinese national geoparks in becoming aspiring UNESCO Global Geoparks, and then UNESCO Global Geoparks. As shown in Figure 7, after the 8 national geoparks' initial joining into the GGN in 2004, 4 other Chinese national geoparks were ratified as GGN members in 2005, 6 new members of the GGN in the year of 2006 are from China. Between the years 2008 - 2015, almost every year the GGN welcomed two new Chinese members, with the exception of the year 2012, in which only one joined the GGN. It is also noticeable that there were two more new Chinese members in each year after 2017. China's continuous contribution to the GGN is certainly derived from the rapid development of UNESCO global geoparks in China.

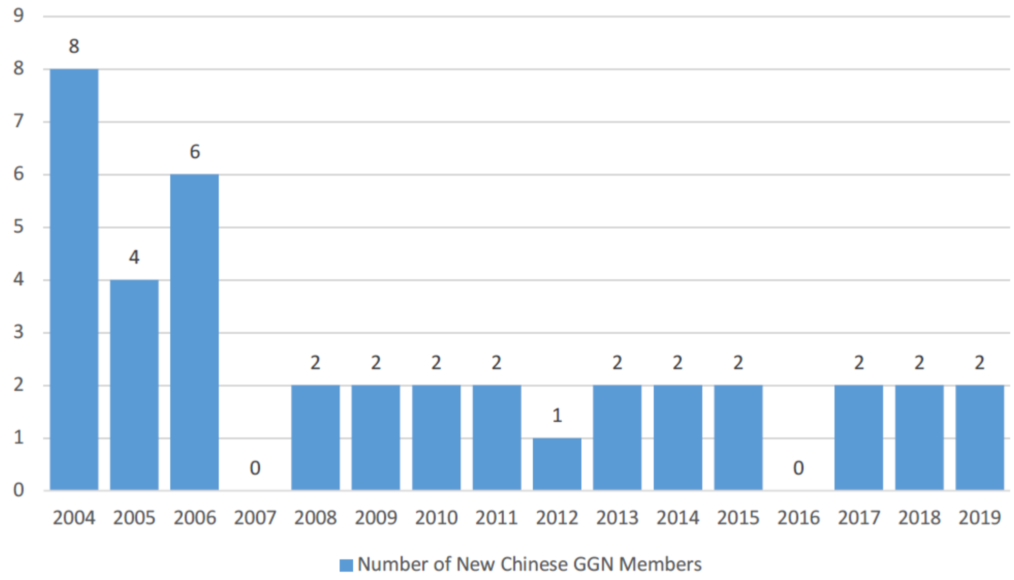

Figure 7. Number of New GGN members from China (2004-2019).

4. Geoconservation, Management and Geotourism in China's Geoparks

4.1 Geoconservation

4.1.1 Conservation legal framework

Geoconservation is currently defined as 'the act of protecting geosites from damage, deterioration, or loss through the implementation of protection and management measures'[42]. China's geoparks are state-owned assets. All national laws and regulations are the legal basis for geoconservation. There are no specific laws on UGGps in China, and drafts of regulations on national geoparks have been completed for many years but have not been issued. However, the State Council has set forth administrative regulations, including Regulations on Scenic and Historic Areas (2016 Revision), Regulations on the Protection of Geoheritage (1995), Regulations of the People's Republic of China on Nature Reserves (2017 Amendment), Regulations on the Protection of Fossils (2010), Forest Law of the People's Republic of China (2009 Amendment), Environmental Protection Law of the People's Republic of China (2014 Revision), and Mineral Resources Law of the People's Republic of China (2009 Amendment). Regarding Regulations on the Protection of Geoheritage, according to the provision of law, the environmental protection department under the State Council should provide assistance, and the geology and mineral resources department under the State Council should supervise the protection of geoheritage nationwide.

4.1.2 Zoning for geoconservation

A three-tier protection zoning system adopted in China's geoparks, i.e., core protected areas, special protected areas, integrated protected areas (Table 2). The core protected areas are places where the geoheritage is of international or national scientific significance which have been preserved in their natural state and are extremely sensitive to human impact. These places have been designated mainly for conservation purposes, where no infrastructure is permitted. Anyone without permission is forbidden to enter. The special protected areas are places where the geoheritage is of regional scientific significance and has medium carrying capacity and sensitivity. Scientific research, educational activities, academic exchanges and geotourism activities are allowed. The integrated protected areas have high carrying capacity. Most tourism facilities are already in place and the areas can serve recreational purposes.

Table 2. The three-tier protection zoning system of China's geoparks

Protection level	Vulnerability	Carrying capacity	Naturalness	Safety level
Core protected area	High	Low	High	Low
Special protected area	Medium	Medium	Medium	Medium
Integrated protected area	Low	High	Medium	High

4.2 Management

4.2.1 Geoparks management structure

China's geoparks are established through a top down process and have a multi-tier administrative structure. The top tier is the National Forestry and Grassland Administration, the second is the provincial department of Forestry and Grassland, the third is the municipal people's government of Forestry and Grassland, the fourth is the geopark administrative committee, the fifth is the geopark management bureau, who is responsible for geoparks (Figure 8). The government has a crucial role in decision-making and management of the geoparks, which is most likely the main difference between Chinese geoparks and any other geoparks in the world.

Figure 8. Chinese Geoparks Management Structure

4.2.2 Geoparks management body

There are three types of geoparks management body in China. The first type is an independent management body. It is responsible for the implementation of government projects; geoheritage survey and assessment; the conservation of the geological heritage and ecological environment; the organization and implementation of scientific research; science education; marketing and promotion, infrastructure construction, and exchange with other geoparks. The second type is a shared management body. It is employed to administer geoparks and other designations and under the leadership of the local government's administration committee (Table 3). It has its own office, which is only responsible for the daily work of the geopark, e.g., Huangshan UGGp, Lushan UGGp, Taishan UGGp, Sanqingshan UGGp, Yandangshan UGGp, Shennongjia UGGp, Dunhuang UGGp, etc. China's geoparks typically cover a broad range of areas and overlap with other protected areas or national brand tourism destinations. Therefore, a shared management body facilitates the planning, conservation, and management of the area. Figure 8 shows that the Dunhuang UGGp overlaps with many other brands but under the leadership of the Dunhuang Municipal Government, which administers other tourism areas in Dunhuang City. The third type is a management organization subordinate to a government department. For example, Xingwen UGGp is subordinate to the local natural resources and planning bureau. The administration of Danxiashan UGGp is subordinate to the local tourist administration. Although subordinate to government departments, the administration is still responsible for the management, geoconservation and geoeducation of geoparks.

Table 3. Other designations in addition to UGGps (modified from [43])

Name	UNESCO designation			National designation				
	UNESCO Global Geopark	World Heitage Site	World Biosphere Reserve	AAAAA National Tourist Attraction	National Park of China	National Forest Park of China	Nature Reserve of China	China Cultural Heritage
Huangshan	√	🔵	√	√	√			√
Lushan	√	🟢		√	√		√	√
Taishan	√	🔵		√	√			√
Sanqingshan	√	🟠		√	√			√
Yangdangshan	√			√	√	√		
Shennongjia	√	🟠	√				√	
Dunhuang	√	🟢		√	√		√	√

Category of World Heritage Site: 🟢 Cultural site, 🟠 Natural site, 🔵 Mixed site

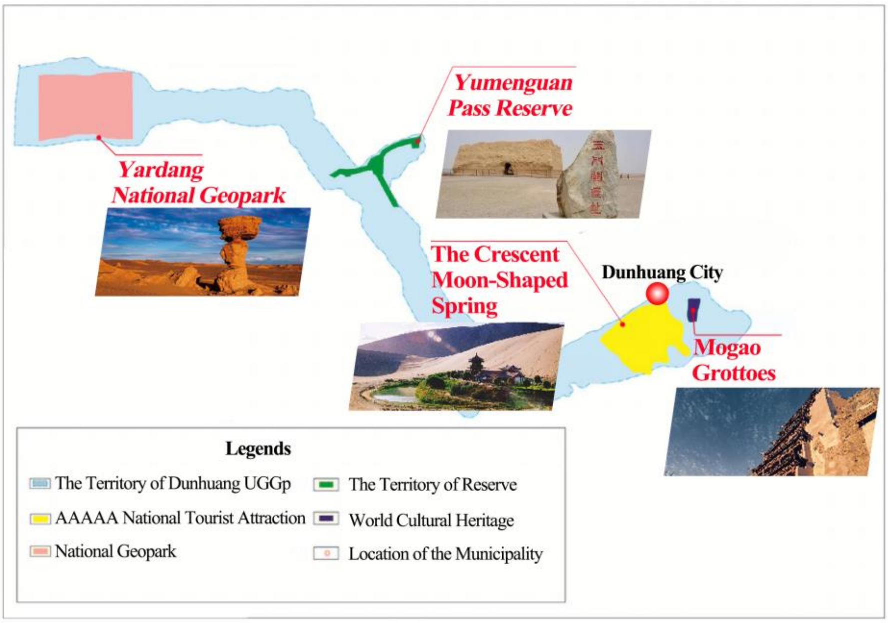

Figure 9. The Dunhuang UGGp overlaps with many other brands (modified from [43]).

4.2.3 Geoparks operating mechanism

Under the supervision of local governments, the main operating mechanism of China's geoparks consists of two types of enterprises, state-owned enterprises and private enterprises.

- State-owned enterprises. Authorized by the local government, the state-owned enterprises manage all resources within the geopark in accordance with a market-oriented approach; most importantly, they are responsible for geoconservation. Ticket income belongs to the administration committee (government); other business income belongs to the enterprise or the administration committee; and the enterprise might share ticket revenue.
- Private enterprises. Entrusted by the government to operate all tourism businesses, including tickets, the private enterprise is the only agency responsible for tourism management in the geopark. Thus, monopolizing the resources in the geopark, the enterprise is required to pay a franchise fee to the geopark administration, which is agreed upon in advance.

4.2.4 Geoparks financial management

The main funding sources of China's geoparks are described as follows:

- Fiscal policy of local governments. For large investments in tourism infrastructure, the geopark administration submits a budget to the financial department of the government one year in advance. After the government examines and approves the budget, appropriation can be allocated as planned in the subsequent year.
- Special funds for geoconservation. Special funds are issued by the Ministry of Finance and the MLR or by the provincial finance department to protect geoheritage at the global and national levels. These funds are utilized for tasks such as project engineering, educational activities, specimen collection, exhibitions.
- Support from the China Geological Survey. Funding is provided for geoscientists in geoheritage surveys and related research. From 2002 to 2017, the central government has invested 4 billion Yuan in the special funds for geoconservation, thereby, it spurred local governments at all levels to invest 4.3 billion yuan and attracted 33.8 billion yuan of social funds [43].
- Operating income. As geoparks are state-owned assets, regardless of the management structure, the geopark administration committees belong to the government; thus, enterprises pay rent or management fees to the administration committee every year. Franchising projects and tickets serve as operating income shared by the administration committee.
- Social investments. Enterprises invest in geoparks with operation projects. From 2002 to 2017, the geoparks received 33.8 billion yuan of social funds [40].

4.3 Geotourism

Geoparks are pioneers in the development of geotourism; they generate new job opportunities and new economic and cultural activities, and they should be sustainable and produce real economic benefits to local populations.

4.3.1 New job and business opportunities

Due to the development of geoparks in China, such new job and business opportunities as travel agents, guides, event organizers and operators, transportation, shops, restaurants & cafes, accommodation, infrastructure construction companies, museum design, printing, local food and souvenir manufacturers, environmental survey, planning and conservation professionals (geoscientists, ecologists, etc.), have been created. The number of direct and indirect employees in geoparks between 464,100 and 25855,000 respectively [40]. The number of hotels, motels, hostels and farm inns within geoparks have reached more than 23,500 [40].

4.3.2 Increasing number of visitors and revenue generation

Geoparks have stimulated socio-economic activities and sustainable development by attracting an increasing number of visitors. By 2015, China's geoparks received 438 million visitors and tourism revenue reached 149.279 billion yuan.

Geoparks are a driving force in some remote areas or places that are experiencing shifts. For instance, the Zhijindong Cave UGGp is located in the western Guizhou Plateau, a remote area of Southwest China. Despite its unique natural charm and high aesthetic value, it remains relatively unknown compared to other karst landforms, although it has offered tourism activities since 1987. In 2015, after it became a member of the GGN, the number of visitors increased by 51% compared with the previous year [43].

Figure 10 shows the number of tourists and tourism income of Sanqingshan UGGp from 2012 to 2020. The Sanqingshan Geopark was approved as a member of the GGN in 2012; the number of tourists was gradually increased and it received 1.89 million tourists and generated 22.038 billion yuan in 2019.

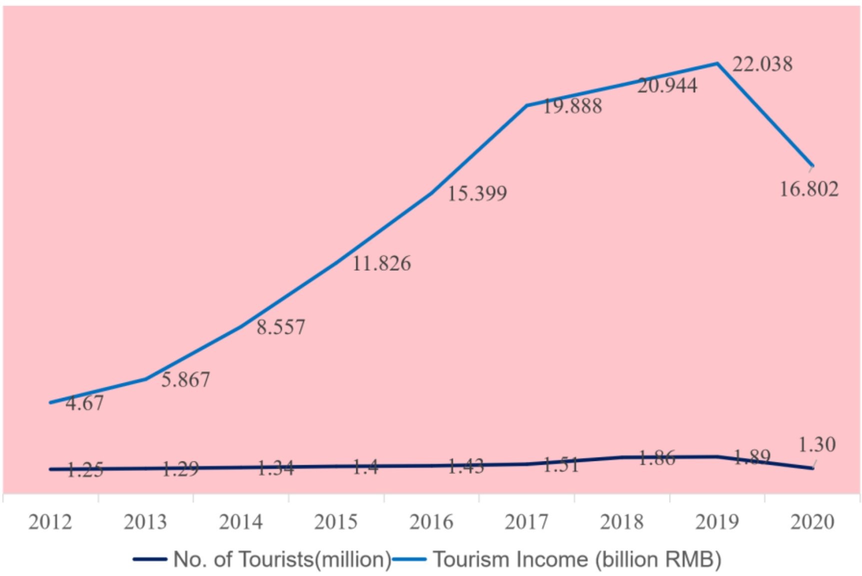

Figure 10. The number of tourists and tourism income of Sanqingshan UGGp (2012-2020)

5. Discussion

5.1 Geotourism and geoparks: a tool for geoconservation and local development?

The establishment of geoparks presents a sound opportunity for China to achieve geoconservation of its resources whilst fostering sustainable development of its regional areas, as China's natural features are very vulnerable and sustainable use is the only option.

Geoconservation is a key element in geotourism development in China. Fundamental to the management of sustainable geotourism is an understanding of the interrelationship between geodiversity, conservation and tourism development, emphasizing the critical importance of research in order to find the ideal balance between these three central components. However, geoparks do not have a positive reputation in the tourism market. In some traditional tourism areas or developed areas, due to overlap with other tourism brands, it is difficult to identify the difference between geotourism activities and traditional tourism activities. From the data of tourism, it is impossible to distinguish the tourists' purpose and the reasons for the destination brand choice.

5.2 Visitor management

In terms of protection, China has the largest population in the world but the worst vacation schedules. Geoparks will receive a large number of tourists during the peak season, which causes crowding. This large influx of tourists will not only place great pressure on the reception but also destroy the original ecological environment. Therefore, restricting the flow of people is a common way to balance tourism and conservation in China.

For example, during the May Day holiday in 2021, Huangshan UGGp received a total of 104,997 tourists. Due to the limited visitor capacity of the geopark, to manage the increase in the number of tourists during the peak tourism season, the visitor flow in the geopark was effectively monitored to prevent accidents. Huangshan UGGp adjusts its tourist threshold according to the climate: the number of visitors in good weather is limited to 50,000, whereas the number of visitors in inclement weather (thunderstorms, strong winds, fog, and hail) is limited to 35,000. When the upper limit is reached, the system will stop selling tickets or encourage visitors who have bought tickets to visit the next day; through scientific calculation, the maximum number of visitors per day in Mogao Grottoes, Dunhuang UGGp, is strictly limited to less than 6,000 [45].

At the same time, China mainly adopts engineering protection, manual inspections, video monitoring, and other means to protect the geoheritage. For instance, visitors to Zhangye UGGp are fully aware that the rainbow hills is not renewable but deliberately climbed over a fence into a protected area and tramped it, which not only violated the law but also caused damage that could take a maximum of 60 years to recover.

6. Conclusions

With its vast territory and diverse geological and geographical settings, China has 289 national geoparks and 41 UGGps so far, currently making it a leading country in the world. The geotourism and geopark approach adopted in China is proven to be economically effective in both geological conservation and rural development, especially in vulnerable environments. During the past two decades, the geoparks in China have made some significant achievements in geoconservation and geotourism. Some geoparks in China are still in the primary stage of development, and there are such problems as inefficient conservation management, the lack of geopark legislation, ineffective interpretation and educational activities, less community involvement, etc.

China's geoparks need to improve in the following ways:

- Enhance the promotion of the sustainable development of geoparks

In terms of benefits, the local governments with jurisdiction over some geoparks attach importance only to declarations or revalidation and achieving status as a global tourism brand, which is regarded as the definition of geopark success. Moreover, after receiving a UNESCO certification, some authorities no longer pay attention to the sustainable development of geoparks as intended by the master plan. The lack of a master plan for sustainable development can easily lead to tourism over-development, emphasizing a short-term economic value over protection. Regardless of the motivations for investing in geoparks in China, from the past to the future, the promotion of the sustainable development of geoparks, especially in terms of sustainable tourism, is a crucial task.

- Increase community participation

Due to the top down approach of China's geoparks, the geoparks administration in China is actually an agency of the government and the government leads the whole process. The community participation is superficial, i.e., only at the economic level in some areas, such as geotourism, georestaurants, geosouvenirs, geofood. Therefore, enthusiasm among residents should be encouraged and opportunities for public opinion should be increased, for example, establishing a council that includes people from different backgrounds so that their opinions can be heard during the decision-making process (Lauren et al., 2014).

- Develop more geo-routes and attract more geo-guides

Despite the increasingly large number of visitors in China, most of them visit as part of tour groups that are limited by time and trip mode with fixed routes and do not distinguish among ages or groups. Therefore, geoparks still focus on sightseeing tours. Although geo-routes and some supplemental activities with extra fees exist, due to the high costs and limited quantities, these activities are not commonly experienced by tourists. Tour guides in China typically major in tourism rather than in geology-related subjects. Similarly, during the peak season, many part time guides who are not familiar with the concepts of geoheritage and geoparks are hired by travel agencies. Therefore, it is crucial for the geoparks in China to develop more geo-routes and attract more geo-guides.

- Pay attention to the negative impact of tourism on the environment

Geoparks with weak ecological conditions and poor carrying capacities are facing a sustainability problem, especially some areas with glaciers or deserts, which have the greatest difficulty building and maintaining the infrastructures that are needed by tour groups. First, due to the limited environmental carrying capacity, too many tourists will have a certain impact on the ecology, which will affect the ecological balance and occupy natural resources in advance. Second, due to the limited reception capacity, a large number of tourists in the peak season, which causes crowding, will not only accelerate damage to infrastructure but can also lead to a poor experience.

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