Planning and Design of Geological Landscape Popular Science Exhibition in Urban Geopark: A Case Study of Zhengzhou Yellow River National Geopark

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Abstract Urban geopark is the backyard garden of urban residents' life. Geological landscape popular science exhibition enables people to receive geological popular science knowledge easily and happily while playing, which will virtually strengthen people's protection awareness of urban geological landscape. Urban geopark landscape is featured by unique typical geological characteristics. It is a realistic problem that troubles the planning and design of geological landscape popular science exhibition in urban geopark by effectively protecting these geological landscapes and upgrading them into urban popular science leisure tourism resources. Taking Zhengzhou Yellow River National Geopark as an example, this paper systematically studies the planning and design of geological landscape popular science exhibition in urban geopark.

Keywords Urban geopark, Geological landscape, Popular science exhibition, Planning and design
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Geological landscape mainly refers to various types of nonrenewable geological relics with high historical value, which are formed, developed and preserved due to special geological processes of internal-external force fields of the universe during the geological period of the earth's natural evolution and development[1]. Geological landscape has many characteristics such as spatial complexity and diversity. According to the technical design requirements of the National Geological Park Planning and Design Committee, geological landscape is initially divided into 7 classes, 25 sections and 56 geological subclasses[2]. Geological landscapes generally have higher scientific value and lower aesthetic value, but geomorphic relic landscape and water relic landscape have higher scientific and aesthetic value[3].

Urban geopark is generally located in the suburbs of cities and is one of the components of urban leisure green space[4]. Urban geopark has a certain scale of geological landscapes with aesthetic and historical value, and fully integrates natural and humanistic landscape of other cities, thus constituting a unique geological landscape popular science publicity place, and providing people with an ideal environment for recreation and fitness[5].

1 Significance of planning and design of geological landscape popular science exhibition

Urban geopark is usually close to the central city, with a large flow of people, but it is difficult for ordinary tourists to have a deep understanding of geological landscape and a strong sense of protection like geological experts. Only through reasonable planning and design of geological landscape popular science exhibition in urban geopark to create a good geopark atmosphere and popularize the geological landscape of high scientific value to people, can it be loved and accepted by the vast audience, and then better protect the geological landscape of urban geopark, which is of great significance to comprehensively improve the scientific connotation of geological landscape, increase a variety of sightseeing and viewing projects, and improve the urban tourism income of local government[6].

2 Status quo of planning and design of geological landscape popular science exhibition in urban geopark

2.1 Geological landscape popular science exhibition only pays attention to the scientific value of geological landscape and neglects its aesthetic performance

In the planning and design process of geological landscape popular science exhibition in some urban geoparks, it only emphasizes the scientific nature of geological landscape while ignoring its aesthetic appreciation value, and over-emphasizes the scientific education function of geological landscape while ignoring the excavation of geological culture and the creation of cultural tourism products.

2.2 Geological landscape popular science exhibition lacks the performance of scientificity and interestingness

In the planning and design process of geological landscape popular science exhibition in some urban geoparks, the marking, interpretation and publicity of urban geopark lack scientificity and interestingness, and the designers did not integrate the scientificity and interestingness of geological landscape popular science exhibition well to provide visitors with distinctive space environment through popular science design since they did not fully understand the scientific connotation of geological landscape.

2.3 Geological landscape popular science exhibition lacks wider participation of urban residents

At present, geological landscape popular science exhibition in urban geopark has relatively simple publicity means, which is mostly supported by the national government and economic investment, and lacks the participation of local residents. It is difficult to understand the interpretation of geological popular science in some urban geoparks because they can not simplify the profound geological landscape scientific knowledge. Ordinary people can not understand the scientific value of geological landscape, and the science popularization of geological landscape in urban geopark can not be generalized. As a result, some urban residents lose their interest in geological popular science exhibition and participation in publicity.

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2.4 Geological landscape popular science exhibition lacks the integration with other tourism product display

The planning and design of geological landscape popular science exhibition neglects the connection between geological landscape content and other types of tourist attractions, resulting in the isolation of geological landscape popular science exhibition. Other types of tourist attractions are separated from the display content of geological landscape attractions, leading to the lack of integration of park landscape points.

3 Coping strategy of planning and design of geological landscape popular science exhibition in urban geopark

3.1 Geological landscape popular science exhibition should give consideration to the expression of geological landscape science and aesthetic value

The planning and design of geological landscape popular science exhibition should pay attention to the aesthetic and scientific value of geological landscape. Only in this way can the scientific and aesthetic value of geological landscape be fully understood by the vast audience, thus protecting and utilizing geological landscape scientifically and reasonably, fully exploring the connotation of geological culture, and creating geological tourism products and effectively transforming them into tourism product benefits.

3.2 Geological landscape popular science exhibition should pay attention to its performance of scientificity and interestingness

Some urban geoparks should pay attention to their scientificity and interestingness when planning and designing geological landscape popular science exhibition. Particularly, the focus on scientificity of markup language in the design of the park's signage system will lead to monotonous and boring expression of the content of signage system. It is necessary to make the language of signage system more scientific and interesting, and create a space environment with more geological characteristics for people, thus arousing people's interest in the geological landscape popular science exhibition to accept geological landscape science knowledge subtly in leisure and entertainment[7].

3.3 Geological landscape popular science exhibition should attract the participation of residents

Geological landscape popular science exhibition in urban geopark not only depends on the support and economic investment of the government, but also needs to join the market operation and mobilize the majority of residents to participate in the maintenance and management of geoparks. More people can understand the historical and scientific value of geological landscapes and participate in the publicity of geological landscape popular science knowledge and the maintenance and management of geopark by strengthening the universality of geological landscape popular science exhibition in geopark and expressing the profound geological landscape popular science knowledge in plain and understandable language[8].

3.4 Geological landscape popular science exhibition should strengthen the integration with other tourism product display

Urban geopark is rich in landscape resources, which has not only precious geological landscapes, but also a wealth of forests, animals, humanities and other landscape resources. In the planning and design of geological landscape popular science exhibition[9], geological landscape and other landscape resources should be considered as a whole to organically connect geological landscape resources of the park with other types of tourist attractions and naturally integrate geological landscape into other landscape resources of the park, thus enhancing the integrity of geological park landscape resources. As a result, the geological landscape in the geopark not only has distinctive display, but also can be integrated with other landscape resources[10].

4 Planning and design practical cases of geological landscape popular science exhibition of Zhengzhou Yellow River National Geopark

4.1 Overview of Zhengzhou Yellow River National Geopark

4.1.1 Regional location. Zhengzhou Yellow River National Geopark is located on the bank of the Yellow River in the north of Zhengzhou City, with the loess geological landscape as the tourism theme characteristics. It is the backyard garden of Zhengzhou City with superior geographical position, reaching Huayuankou Town in the south, Guying Town in the west, and Guangwu Town in the east, with the main geological landscape area of nearly100 km^2.

4.1.2 Scientific and aesthetic value of loess geological landscape. Zhengzhou Yellow River National Geopark has all types of loess, and the main geological landscapes include Wucheng loess, Malan loess, etc., being the representatives of loess geological landscape in North China. The average thickness of Malan loess is higher than that of the contemporaneous strata in the Loess Plateau. It is difficult to see the paleosol layer and paleosolification contained therein in the Loess Plateau area of China, which reflects the whole process of the Chinese nation and the world's global paleoclimate, paleoenvironmental geological evolution and its process and synchronous evolution and development history, and has high scientific research value. In addition, the geological landscape of Zhengzhou Yellow River National Geopark in Mangshan region has various loess landforms, which is a miniature of landform landscape types of the Loess Plateau in China, with extremely high aesthetic value.

4.2 Planning and design of geological landscape popular science exhibition of Zhengzhou Yellow River National Geopark

Yellow River National Geopark has rich geological culture and humanistic resources of the Yellow River. The planning of the Yellow River National Geopark is based on the popular science exhibition of loess geological landscape.

4.2.1 Popular science exhibition of geological landscape tourism route. Mangshan Wulong Peak loess popular science route serves as the main line of popular science of Yellow River National Geopark. According to the characteristics of loess geological landscape, the geological museum with unique characteristics is the starting point of the exhibition route, and the bare loess geological landscape along the popular science route is planned and designed as the content of popular science exhibition. Mangshan Wulong Peak loess popular science route is about 1 km long. The exposed loess is 80 m thick from the Geological Square Loess Cave Museum at the entrance of the geopark to the Jimu Pavilion at Mangshantou with the height of 100 m, which preserves major geological event information of paleoclimate, paleenvironment, martian fossil life and the evolution of the Yellow River, and is an ideal geological carrier to reveal the mysteries of the earth's quaternary period. Through a series of popular science exhibitions of paleosoil, Malan loess, snail fossils and so on, people have a deeper understanding of the value of loess geological landscape and better protect geological landscape.

4.2.2 Popular science exhibition of cave style geological museum. The geological museum is located in the core scenic area of Wulong Peak,

and it is designed on the basis of the original abandoned cave dwelling. The characteristic cave dwelling structure in the loess area is combined with modern novel high-tech materials to fully embody the characteristics of loess geological landscape. The geological museum is composed of preface hall, mapparium, loess hall, Yellow River culture exhibition hall, Huanghuai plain hall, Yellow River hall, sightseeing elevator hall, multimedia hall, time and space tunnel, quaternary glacial relics ecological park, grand river square hall area, VIP hall, restaurant area, etc., covering an area of 4,114 km^2. The museum displays the complex geological phenomena and the evolution mechanism of loess geological landscape completely and vividly.

4.2.3 Interpretive panel design for popular science of loess geological landscape.

(1) Cartoonish design. Some geological landscapes with storylines are interpreted scientifically in the form of cartoonish comic strips. There are many snail fossils buried in the loess, which generally do not attract people's attention because of their small volume. Cartoonish design is adopted to show the formation process of snail fossils buried in the loess, and explain that most snail fossils are buried when they are alive, making people understand the formation of huge thick loess in Mangshan and the Yellow River.

(2) Graphical design. Some of the data that people are interested in are designed into beautiful diagrams, such as mountain height, formation time of mountain, rock age, river length, material composition, etc. The paleosoil of Mangshan formed 150,000 years ago is not just a red strip in the loess that easily attracts people's attention, and it is exactly the age when the Yellow River was formed. These knowledge points are linked to the graph of scientific data, and popular science is endowed with vitality and excitement.

4.2.4 Planning and design of loess geological landscape popular science platform (small popular science field). Five geological popular science platforms with significance of popular science and easy maintenance are designed and planned in Yellow River and loess geological landscape exhibition, and small popular science fields are set up for scientific display along the concentrated distribution area of important landmark geological landscapes.

(1) Governance landscape design. There are some safe areas in Zhengzhou Yellow River National Geopark that need to be treated with slope protection. Starting from the long-term display of the paleosoil layer, the shapes of ancient trees, elephants and ostriches are designed in the loess protection slope, and paleontological reliefs are carved in the protection slope, exposing loess section in the surrounding part for visiting. A small anti-corrosion wood sign plate is set up next to it to mark the popular science information here, which not only avoids the monotonicity of the landscape, but also protects the weathering of the loess section, showing the scientific connotation of the loess. The park extends from the west side of the ecological garden to the entrance of the feeding square, with a slope protection length of 85 m. Anchor bolt metal net guniting is used for slope protection, and the surface of ginger rock is inlaid with paleontological sculptures found in the quaternary strata such as elephants, rhinos and ostriches.

(2) Four seasons landscape display design. The geological landscape of Zhengzhou Yellow River National Geopark is seasonal, to let visitors experience the landscape changes in different seasons. For example, the viewing and popular science platform set up in the southwest of Jimu Pavilion can overlook the Yellow River, loess hill, loess ridge and other loess landform landscapes to the north, and a science popularization wall is set up in the south to show the loess scenery in the four seasons with photos.

(3) Restoration display design. According to the scientific research results, the paleontological fossils in the stratum can be restored and displayed. The paleosoil layer represents a relatively hot and humid geological environment, and a science popularization platform set to reflect this environment can plant tropical plants and create a tropical natural ecological environment. In the place where there are more snail fossils, a small cave is cleared, and fossils of snails and myospalax are displayed in the loess layer on the cave wall. The cave is illuminated by colored lights of solar energy.

(4) Distant view display design. Some landscapes along the geological landscape popular science route can only be viewed far away and are not allowed to appreciate nearby, and some of the intuitive geological landscape phenomena observed are reasonably connected with scientific connotations on some of the best viewing and science popularization platforms. For example, as for Qinhe Delta on the north bank of the Yellow River and Wuzhi palaeohigh belt in Mangshan, the palaeohigh belt can not be seen intuitively, but people can see the beautiful entrance estuary. The geological landscape phenomena observed can be connected with the detailed popular science interpretive panel at the observation platform, making people understand the value of loess geological landscape more deeply.

(5) Extemporal view design. The differences between geological landscapes are used to remind visitors of their attention and enable them to enter the mysterious geological relic knowledge space. For example, the paleosoil layer in the loess is manifested as distinct red stripes with distinctive characteristics, and has become the object of popular science. In the distribution of paleosoil layer and loess cave dwelling, people opened courtyards and dug caves on the gully cliff. However, these caves are not randomly dug, but make clever use of loess and paleosoil characteristics. The loess has high sandy content and soft texture, and is easy to dig holes and build houses. The paleosol has high content of clay and is solid and firm, which can form a stable "roof". Therefore, cave dwellings are mostly distributed in or under the paleosoil layer and distributed along the layer.

5 Conclusions

The geological landscape popular science planning and design of urban geopark is different from that of ordinary urban park. More abundant geological landscapes are provided to attract more people for leisure and recreation and cultivating sentiments, and they will accept the concept of geological landscape environmental protection imsubtly when playing. Meantime, it also brings vitality to the local tourism economy.

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(To be continued in P16)

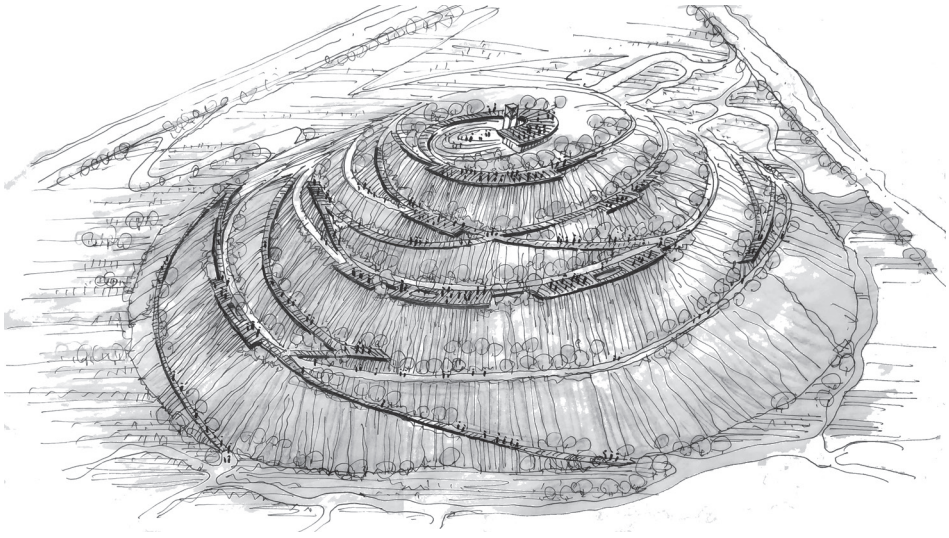

Fig.13 Conceptual sketch

so as to form an integrated mining landscape system at the urban level. Based on the interactive concept of "scenery" and "view", the best landscape construction point in the gangue hill is analyzed via GIS viewshed analysis, and the viewing route is designed and guided, so that the designed pedestrian path and viewing platform can play a practical role. This method makes the design rational and can be extended to the design and landscape construction of more gangue hills, and provides more rational and meaningful references for design.

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