Analysis of Popular Science Design of Huangpu Shiling Marine Erosion Site Geopark in Guangdong-Hong Kong-Macao Greater Bay Area

Xiuyun Li

School of Architectural Engineering, Guangzhou Nanyang Polytechnic College, Guangzhou, Guangdong, 510925, China

*E-mail: sueone921@163.com

Abstract. Based on the analysis of the current situation of the science popularization system of the Huangpu Marine Erosion Site Park in the Guangdong-Hong Kong-Macao Greater Bay Area, the significance and design concepts of the geological science design of the marine erosion sites in the park are elaborated by means of field investigations, so as to provide reference value for the science popularization planning of Huangpu marine erosion site Geopark.

1. Introduction

Shiling Marine Erosion Site Geopark is located in Huangpu Town, an ancient historical and cultural town in the northern part of Zhongshan City, Guangdong Province. The marine erosion site is one of the largest marine erosion sites discovered along the coast of Guangdong coastal area so far. The ancient marine erosion landform extends over 200 meters (Figure 1-2). The marine erosion landform such as sea erosion, sea cliffs, sea erosion platforms and other sea erosion landforms are still relatively intact and have high scientific and humanistic values[1]. This geopark is based on the standards of "National Geopark Construction Guide of China" and "Technical requirements for planning and compilation of National Geopark", Delphi Method is used to score the landscapes in the park one by one. According to the quantitative evaluation indicators and weights of the geological relic landscape (Table 1), the average value is calculated to obtain the score of the evaluation index. Then, the score of each evaluation index is substituted into formula (1), and then comparing with the evaluation criteria, the final grade of the geopark is determined according to the score. According to the evaluation results, the comprehensive score of Huangpu Shiling Marine Erosion Site Geopark is in the interval [70, 80), which meets the standards of provincial geoparks.

In the formula: A is the comprehensive score of geological heritage; Ci is the weight of evaluation index; Xi is the score of i-item evaluation factor; Fi is the weight of i-item evaluation factor.

\[ A = \sum C_i \cdot \sum X_i \cdot F_i \]  

Table 1. Quantitative evaluation of geological heritage landscape

| Level 1 indicators | Level 2 indicators | Weights | Level 2 indicators | Weights |
|-------------------|-------------------|---------|-------------------|---------|
| Value conditions  | Typicality        | 0.11    | Scientific value  | 0.08    |
|                   | Rarity            | 0.18    | Aesthetic value   | 0.21    |
| Development conditions | Naturalness | Historical and cultural value | Completeness | Economic value | Science popularization value |
|------------------------|-------------|------------------------------|--------------|----------------|-------------------------------|
|                        | 0.09        | 0.10                         | 0.07         | 0.05           | 0.11                          |

| Development conditions | Conservation | Traffic situation | Resource complementarity | Security |
|------------------------|---------------|-------------------|-------------------------|----------|
|                        | 0.12          | 0.21              | 0.21                    | 0.06     |

| Development conditions | Environmental capacity | Protection Foundation | Customer source conditions |
|------------------------|------------------------|-----------------------|---------------------------|
|                        | 0.19                   | 0.15                  | 0.06                      |

The exposed rocks in Shiling mountain are composed of purplish red sandy conglomerate, which were formed in the Cretaceous period more than 100 million years ago. Due to long-term weathering, the rock strata have cracks and spalling, forming various mountain wonders such as flying stones and dripping water rocks and other different shapes. Each cave has its own characteristics, and it has a variety of unique features, such as the largest and longest sea-eroded level cave named “God Dog Rock”. People can climb directly from one end of cave to the top of the mountain and lean over to enjoy the wonders (Figure 3-4). The park is dominated by marine erosion landforms, combined with geological heritage resources such as collapses accumulation, waterfalls, cold springs, lakes, mining sites, regional structures, and integrates natural ecology and human landscapes. It is an important scientific place for studying the changes of the regional sea and land. Geopark is a natural geological museum. It takes geological relics as the carrier and geological landscape as its main feature. The significance of the earth science it carries is the most important attraction factor for science popularization of geopark[2].
2. Analysis on the status quo of popular science system of Huangpu Shiling Marine Erosion Site Geopark

(1) The effect of visual design information is not good, and the number of popular science information display boards urgently needs to be increased. The main road leading to Huangpu Shiling Marine Erosion Site Park is under construction of high-speed rail roads and express roads, and at present the appearance of the surrounding environment needs to be improved. The popular science signs and road signs on the main roads are not displayed on the expressways. Only the third-level village roads are equipped with one or two signs, and the road signs have insufficient directivity. In recent two years, the government has set up a number of stone signs with obvious geographical coordinates, which have been praised by villagers. However, there are many signboards in the geopark, but the signboards are only made of stone panel and stickers, lacking of characteristics. Under the long-term sun and rain, some paper pictures are faded, and the brief introduction of signboards is blurred. This kind of popular science information indicates that the density is unbalanced, the sense of introduction is not strong, and there is a deviation of sudden increase and decrease in the number, which still needs improvement.

(2) The coordination between popular science instruction information and landscape is insufficient. The internal science explanatory signs in the scenic area are closely related to the landscape environment and design elements. In the design, the cultural elements of rural land are not enough, and the effect is dull. The advertising signs in the scenic area are large, so the guide signs are weakened, and some visual elements are submerged in the flowers and weeds, which makes it impossible to obtain the information of the corresponding scenic spots, also unable to keep the pace, could not stimulate the interest and lose the focus of sight.

(3) The propaganda of science popularization is weak, and fails to establish teaching and research base. The marine erosion geological resources in the geological park in this area are very precious material heritage on the earth's surface. Due to the slow construction of the overall large park, there is no cooperation between colleges and universities to carry out field research tourism, and only some small teams of scientific research activities and sporadic individual investigation, and the construction of practice base has not been established as expected.

(4) Efforts to declaration in the early stage, lack of strong financial support in the later stage, and the activities of geoscience popularization were few. Under the guidance of the government, Huangpu Shiling Marine Erosion Site Geopark has been very active and successfully applied for the famous brand of the provincial geopark. However, due to the poor management of the former management unit, it only took a short period of two years to receive more tourists, then stopped opening to the people and entered the slow upgrading of the park. In the process of comprehensive rectification, local villagers generally believed that the business operation and management model of the agency scenic spot company was not good, and the geoscience popularization activities were few, which caused some negative comments on the local landscape and failed to achieve the original goal of economic profits.

3. Significance of popular science design of Huangpu Shiling Marine Erosion Site Geopark

Science popularizes the natural science and social science knowledge accepted by the public. The process of science popularization is not only to unswervingly emphasize the scientific nature, but also full of the humanistic nature of science popularization. This kind of science popularization humanistic characteristics is to improve the scientific and cultural quality of the public and enhance the well-being of mankind. Through disseminating scientific and technological knowledge, scientific methods, scientific thoughts, and scientific spirit in a form that is easy for the public to understand[3], also the rich humanistic connotations are mutually confirmed and complemented by scientific rationality and humanistic spirit, and spread to the public with a more warm world view[4]. Meanwhile, the continuous development of society gives the science popularization work a fresh vitality and a strong sense of the times. After the popular science tour in this area, it can show the geological charm of the Shiling marine erosion site and the civilization of human beings washed by time, which is conducive to stimulate people make in-depth thinking on the frontier dynamics of geological evolution, cultivate
scientific quality, promote the establishment of learning social groups, and regional economic development.

The correct evaluation of the value of geological relics is the prerequisite for development, utilization and protection[5]. The development of the Huangpu Shiling Marine Erosion Site Geopark can be positioned as a “green ecology, low-carbon and environmental protection” marine erosion charm science park, making protection, popular science, management and other work are on the right track, so that the popularity and reputation are improved. In the planning and construction process of Shiling Marine Erosion Site Geopark, we should insist on putting the protection of geological resources in the first place, efforts should be made to build a rural tourism base integrating sightseeing tourism, popular science dissemination and scientific research, and set up a bridge between mass education and geosciences, and strive to achieve three purposes: one is to protect the marine erosion geological sites from being occupied and destroyed for generations; the second is to increase interest in geological mysteries and popular science knowledge; the third is to promote the economic development of beautiful villages through tourism, research, scientific research and other activities.

4. Design principles of science popularization system of Huangpu Shiling Marine Erosion Site Geopark

The popular science system should guide tourists to the destination effectively and reasonably, and the streamline should be clear and simplified. A clear flow line of visits can well avoid interference in popular science explanations when the environmental carrying capacity is large, and improve the continuity of information transmission. The interior of the scenic area, the ticket waiting area, and the entrance and exit distribution area should be equipped with efficient software and hardware to improve the friendliness and comfort of the scenic area. Therefore, in the design process of the popular science system, the following principles can be followed:

4.1 Scientific normative principles
Whether it is a popular science signage in a scenic spot, a large museum or a landscape gallery display, it must pay attention to the scientific nature of the content carried by the science popularization system. From the font, color, graphic symbols, location, specifications, and layout of the interpretation, we require to design and produce them with scientific and rigorous attitude and standards. In the actual project application process, visually uniform and orderly, easy to identify, and information can be quickly communicated, which plays an important role in the occurrence of safety incidents.

4.2 The principle of universality and uniformity
Geotourism development and planning and design should achieve a high degree of consistency between the geological landscape and the ecological environment[6]. The knowledge in graphic elements of the science popularization system need to comply with international general management and be easy to understand, so that tourists from all over the world have a sense of intimacy. Even if visitors do not understand the local text and language, they can also understand the connotation of popular science instructions. The components of the popular science logo system should maintain consistent design concepts and consistent new media communication, and use novel visual effects to characterize, clarify, and simplify information and logos. The style and effect have a sense of integrity, and create a consistent design that can be stored in the communication. The concept of sea eclipse culture and the brand image of visual effects can lead a deep impress on tourists, make the resources of scenic spots and brands quickly connect, so as to improve the popularity of scenic spots.

4.3 The principle of operability
The design of the popular science VI system should focus on the protection and development of scenic spots as the central idea, and give full play to the value of the system. Excellent VI design is inseparable from the creation of architectural aesthetics, differentiation, and national individuality, but the conceptual scheme must be operable and constructable, so that the concept can be implemented.
For example, considering the living habits of groups such as children, the elderly, and the handicapped, the design of the science popularization system should consider improving the accessibility of the public space in the sea erosion sites, so as to ensure that the park can be convenient access and sightseeing.

5. The design concept of popular science system in Huangpu Shiling Marine Erosion Site Geopark

5.1 Construct a high-tech geological museum of sea erosion sites for science interpretation
The indoor museum should have three-dimensional film and television hall, model display corner, forming mineral classroom and exhibition hall for cultural activities. Use physical objects, models, exhibition boards, LED information systems, VR displays and other methods for dissemination. These methods can be used for feasibility studies and investigations. For example, the public has a high and good evaluation of the 5D cinema in Zhuhai Chimelong Ocean Kingdom, so the film and television hall of the geological museum of Shiling Marine Erosion Sites can be constructed by imitating virtual technology. In the film and television hall, introduce comprehensive geological resources, natural landscape, settlement changes and geological development history, and then carry out scientific knowledge and environmental protection awareness to visitors, which could make it a unique place for education and publicity.

5.2 Elaborate design of outdoor science interpretation signs
The geological landscape of Shiling Marine Erosion Site is the core landscape of the whole geopark. Therefore, the design of indoor popular science interpretation signs is an important way to display the silent and imperceptible introduction of marine erosion geology, and an important means to create a good atmosphere for practical learning silently. Interpretation signs can be composed of park guide map, feature introduction, main attraction map, small garden area indicator, geological structure touchable model indicator board and so on. By elaborately designing the display of popular science interpretation signs with regional characteristics, people can enhance their understanding of the earth's marine erosion evolution, raise their awareness of the protection of precious material heritage presented by nature, embody the unique charm of the region, and thus improve the scientific and cultural edification of the park that can be visited and learned.

5.3 Strengthen the promotion of network platforms, media and publications
The Huangpu Shiling Marine Erosion Site Geopark should build a website in both Chinese and English and the official account of WeChat will be opened. The official account or website building of Shiling Marine Erosion Site should consider the placement of ticket reservations and include introductions to cultural and creative shops. The key points in official account WeChat is on recommending the popular science knowledge of the sea erosion sites. The design of the official account can be carried out according to the contents of some successful tourism official accounts. The simple interface such as the Guangzhou metro museum official account WeChat can be used for reference. The construction of the network platform requires technicians to persist in updating in a long time to improve reputation. If the publicity of the park can be strengthened, its popularity will be improved, and the number of tourists for popular science research based on leisure tourism in Guangdong, Hong Kong and Macao Bay area will grow rapidly. At the same time, with the help of the media, the high-definition micro-video of the Shiling Marine Erosion Site was taken to launch a column to introduce the geological structure and humanities and customs, which can also be applied to the regular interest class education in universities, and secondary schools. The CCTV filming team of China also came here to take a short shot on the evolution of sea erosion in the vicissitudes of life, and the local region can continue to increase input of media resources to shoot a more complete video, focusing on the Huangpu Shiling Marine Erosion Site as the central theme, and producing more video frequency, such as a journey to discover the sea erosion site. For paper-based publications, various
forms of guide maps and popular science loose-leaf materials should be compiled and distributed, using interesting and simple language to simplify the profound content and enhance the principle of the earth's sea erosion and regression. Since the Shiling Marine Erosion Site was approved to build a provincial geopark in 2015, many scholars have visited the marine erosion site. Among them, researcher Fangling Guo said: “The Shiling Marine Erosion Site belongs to ancient sea town, and is the largest brand of traditional culture in Huangpu town, and is a unique business card of southern Guangdong province. It is recommended to write books with the theme of Aoshan ancient sea to spread the history of the town[7]”. In addition, for the study of ancient sea geology and geomorphology, it can also compile popular science publicity publications such as children's animation version of sea erosion site changes.

5.4 Strengthen the interpretation ability of popular science personnel
Geo-tourism cannot be imposed on geo-science knowledge. It is necessary to emphasize the attraction of geoparks to tourists from the perspective of viewing and interest[8]. Huangpu Shiling Marine Erosion Site Geopark should pay attention to the cultivation of the ability of geological knowledge interpreters and museum commentators. The interpreters of the park can be: fixed narrators of the park, professional narrators in museums, volunteer narrators in schools, women narrator. Professional knowledge training and assessment mechanisms should be conducted on a regular basis, so that local interpreters can master skilled and professional basic knowledge of geosciences, have a scientific understanding of the formation process and connotation of the sea erosion site landscape, which can provide tourists with appropriate scientific explanations at different levels.

5.5 Carry out science popularization activities continuously and regularly
Relying on special festivals such as China Water Week, World Water Day, Earth Day, World Environment Day, World Museum Day, and Chinese traditional festivals, various forms of popular science publicity activities, distribute relevant publicity materials and promote forward marine erosion geological culture. In addition, as informatization and intelligence are gradually introduced into the daily life of villagers, Huangpu Shiling Marine Erosion Site Geopark can sign school-enterprise cooperation agreements with a number of colleges and universities located in the Guangdong-Hong Kong-Macao Greater Bay Area to conduct regular geological studies for the students. Popular science lectures, considering traffic, time, epidemic and other public health emergencies, online or offline methods can be prepared for communication and learning.

5.6 Establish practice bases to strengthen scientific research
Huangpu Shiling Sea Erosion Site Geopark has a geographical advantage. With the improvement of expressways, intercity expressways, and high-speed rail transportation, the marine erosion site park has strong radiation in the Guangdong-Hong Kong-Macao Greater Bay Area and traffic exchanges within 1-2 hours. There are many universities and colleges in this greater bay area, thus when establishing teaching practice bases based on the unique, the park can make reference on domestic units such as the Hong Kong Tourism Training Center and the school of geosciences of Zhejiang University to build a teaching practice base with Yandang Mountain. According to the uniqueness of geological resources in the region, colleges, research institutes and geological institutes and other units with obvious academic characteristics are selected to build Shiling Sea Erosion Site geology research and teaching practice base. Draw lessons from the successful operation experience of foreign geopark scientific research bases to optimize the management model of marine erosion site bases established in the future, such as the Eifel mountain geopark in Germany[9] the climate evolution research base of Lake Maggie, and the Lesvos Petrified Forest Geopark in Greece[10], which regard the active rock faults in the park as a base for popularizing geological science to promote earthquake knowledge. For some theoretical courses and scientific topics, such as the study of geology, tectonics, and petrology, the lively off-site teaching is not only an experience, but also strengthens the memory of the theory, which is helpful to carry out scientific research.
6. Conclusion
The science popularization system of Huangpu Shiling Sea Erosion Site Geopark should strive to change the current weak attraction. The design of the science popularization system of the marine erosion site geopark needs to build a high-tech geological museum of sea erosion sites to make the science popularization process interpretation vivid and interesting. The outdoor science popularization explanation signs should be carefully designed to enhance the attraction of tourists in the park, and the publicity of promotion of network platform, media and publications also be elevated. In particular, the official account and the English and Chinese websites of the geopark are opened to ensure effective implementation of the funds, and to enhance the ability of commentaries of science popularization personnel. Meanwhile, continue to regularly carry out science popularization activities, build teaching practice bases, and upgrade scientific research so as to achieve a healthy thriving development of the “ecotourism + science popularization interest + marine erosion research” tourism model, which will promote the economic development of the beautiful ancient villages, and make the Huangpu Shiling Sea Erosion Site Geopark sustainable protection.

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