Research on the Application of Space Information Technology in Geoheritages for Land-use Planning Purposes

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Abstract. The application status of space information technology in geoheritage resources survey and evaluation, digital construction and environmental monitoring in China is reviewed. For improvement of the Land-use planning purposes will be used selected information. The application of spatial information technology in the acquisition of spatial and temporal data, dynamic management, image data processing, analysis and simulation prediction, and visualization of various kinds of information of geoheritage resources is increasing. With the development, planning and protection of geoheritage resources, this technological advantage will become more prominent.

1. Introduction
Geoheritage refers to precious and non-renewable geological heritages formed, developed and left over due to the geological action of internal and external forces during the long geological historical period of earth evolution [1]. As natural resources, geoheritages are non-renewable, non-recoverable and non-removable. Once damaged, huge losses are incurred. Therefore, the protection of geoheritage must always be put in the first place [2]. Establishing geoparks is one of the most effective ways to protect geoheritage. Since most of geoheritage resources have significant spatial characteristics, their protection and development are inseparable from the acquisition, management, excavation and utilization of relevant spatial data [3]. The spatial information technology represented by GPS, GIS and RS has a strong advantage in the collection, processing, management and display of spatial information. The purpose of this paper is to discuss the application of space information technology in geoheritage resources and to provide reference for the protection of geoheritage resources and the planning of geological parks.

There are a vast territory and complicated geological conditions in China. After a long and complicated geological process, the unique geoheritage are formed. Many mountains, such as Mt. Tai, Mt. Huangshan, Mt.Lushan, Mt.Tianshan, Mt. Wulingyuan and Mt. Emei, enjoy a good reputation among the natural treasures in the world. There are 41 UNESCO Global Geoparks and 220 National Geoparks up to August, 2020 in China.
2. Main Research Progress

More and more geoheritage are investigated, evaluated, planned, managed and displayed by spatial information technology. GPS is a modern tool for fast and precise positioning of space entities. RS is the most rapid and effective means to collect current spatial information with the largest coverage. GIS is a powerful weapon to organize and analyze a large amount of spatial information [4].

2.1. Application and research of geoheritage resources investigation and evaluation

It is a prerequisite to establish a geological park to make a systematic and comprehensive survey of the geoheritage and find out the quantity and characteristics of the geoheritage. Spatial information technology can be used to comprehensively understand the distribution of regional geological traces, explore and expand new geological traces, and evaluate the geological traces resources [5].

Liao Min took Junlian Geopark and Zizhong Geopark as examples, making a survey and study of ecological type distribution and its coverage by using RS technology, making a remote sensing image map and 3D visualization of landscape in the geoparks [6].

GIS technology was used to establish the spatial database of the research area, including geological, geographical, mineral, cultural, landscape, tourism and other elements. GPS technology was used to observe and record the data, extract the terrain data after GPS correction, and establish the relevant layer. Zhang Xiaoli et al. took the Longjing National Geopark in Yunyang, Chongqing as the research area, and made a comprehensive evaluation of the geoheritage in the rock area by combining qualitative and quantitative evaluation methods [7].

Taking south Sichuan region as an example, Li Pengju et al. introduced the application of remote sensing technology in geoheritage investigation specifically [8]. Wang Yongli et al. used remote sensing data of Resource No.1 02C satellite to establish formation interpretation signs, extract and analyze typical geology, and generate 3D images of landforms and scenic spots, so as to reduce the workload of field investigation and shorten working cycle to a limited degree [5]. Tan Minglei was focusing on the evaluation of geoheritage landscape resources in Dagu Iceberg Park, identified and interpreted the geoheritage landscape resources in the park by using RS technology and real-time investigation [9].

GIS technology was used to establish the database of geological heritage landscape resource points, and the relevant information of landscape resource points in the park was counted and managed. The terrain and landform, vegetation and traffic in the park were analyzed by means of spatial analysis. This paper evaluates the landscape resources of geoheritage in the park, and discusses the tourism strategy and positioning of Dagu Iceberg according to its actual situation.

2.2. Application in digital construction of geoheritage resources

With the development of more and more geoheritage resources into geoparks, the information requirements for resource management are getting higher and higher, and it is developing towards the direction of networking and intelligence. Through the application of space information technology, the construction of the corresponding management information system for geoparks has become a new trend of tourism development. Bai Chaofan et al. [10], taking Yuntaishan World Geopark in Nantai as an example, used RS and GIS to carry out regional planning, park selection and remote sensing interpretation, and took remote sensing image as the carrier for map compilation, and used GIS to carry out tourism route design and the formation process of virtual geoheritage landscape. Dong Qian
et al. took Shennongjia Geopark in Hubei province as an example and used GIS technology to divide the protection area, providing new ideas and methods for park planning [11]. Li Hailong took Yuntai Mountain Scenic Area as his research area, mainly studying the intelligent tourism situation in Yuntai Mountain Scenic Area [12].

2.3. Application in environmental monitoring of geoheritage resources
In the process of the development of geoheritage resources, some geomorphic landscapes have been damaged to varying degrees, resulting in the decrease of their scientific research value and natural ornamental value, and some even disappear forever, such as the numerous karst cave groups in Guangxi province and the volcanic geological and geomorphic landscapes in Wulianchi, Heilongjiang, etc. [13]. Spatial information technology can be used to monitor the dynamic changes of geoheritage resources and their surrounding environment, to find out the changed areas in time and take remedial measures. He Chao et al. applied RS and GIS technology to draw vegetation map of Shilin Scenic Spot, providing ideas for future scenic spot construction [14]. Zhao Chuan applied space information technology to detect the ecological environment of the geological landscape of Gongga Mountain, which greatly improved the protection efficiency of the geological environment in Gongga Mountain area, and also provided examples for other nature reserves and geological parks to use for reference for intelligent environmental monitoring [15].

3. Conclusions
In this paper, it is reviewed that the application status of space information technology in geoheritage resources investigation and evaluation, digital construction and environmental monitoring in China. RS, GPS and GIS technologies have their own characteristics, and they have their unique advantages in terms of monitoring and locating regional geoheritage resources on the spatial scale, or in terms of investigation, statistics, management and maintenance of geoheritage resources. The application of spatial information technology in the acquisition of spatial and temporal data, dynamic management, image data processing, analysis and simulation prediction, and visualization of various kinds of information of geoheritage resources is increasing.

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