Characteristics of Danxia Landscapes in Northern Shaanxi Province and Comparison with South China

GUO Fusheng1, CHEN Liuqin1, LIU Fujun1, LI Yizhao2 and HUA Chen1

1 State Key Laboratory of Nuclear Resources and Environment, East China University of Technology, Nanchang 330013, China
2 Shaanxi Institute of Geological Survey, Xi’an 710054, China

Abstract: Danxia landscape is a special type of landscapes discovered and named by Chinese geologists in the Mt. Danxiaof Guangdong Province of the humid South China. It generally develops in the terrestrial horizontal-thick-bededded purple-red sandstones and conglomerates of the Mesozoic-Cenozoic age. It is formed by many geological processes including weathering and exfoliation, runoff erosion, and collapse retrogression along vertical joints and faults. Danxia landscape is an important geological relics with high values of geo-tourism and scientific research.

The Danxia landscapes were extensively studied in South China, The Mt. Danxia, Taining, and Mt. Longhu were featured by spectacular landscapes, and they were approved successively to be global geoparks from 2004 to 2007. In August 2010, the “China Danxia” composed of the Chishui of Guizhou, Taining of Fujian, Langshan of Hunan, Mt. Danxiaof Guangdong, Mt. Longhu of Jiangxi, and Mt. Jianglang of Zhejiang Provinces in South China was officially appended in the World Heritage List.

In recent years, a large number of Danxia landscapes have been discovered in arid areas of northwestern China, especially in northern Shaanxi Province. They include cliffs and grottoes in Liushi Village and Heiniuwoof Xunyi County, mesas, stone villages, caves, and sandstones in Zhaojin (Xuejiazhai) of Tongchuan City, stone villages and grottoes in Mt. Yongning of Shaanxi Province. These findings overturn the stereotype of “the Loess Plateau” in northern Shaanxi Province. There are not only Danxia landscapes with scientific and ornamental values, but also a new type of Danxia landscapes different from South China.

Thus, it is interpreted that the Danxia red beds in northern Shaanxi Province are generally deposited in desert environments with temporary river and lake environments. In contrast, the Mt. Danxia and Mt. Longhu in the South China are mainly composed of conglomerates and sandstones formed in the alluvial fan environments, where the mountain summits were usually covered by plants owing to abundant rains.

In contrast, the Danxia landscapes of the arid northern Shaanxi Province are generally covered by thick loose deposits (mainly Quaternary loess and gravel layer). There are weathered crusts between Danxia red beds and overlying loess. The undulating top surfaces of the red clastic rocks under the loess can be observed at the newly excavated road profiles. It shows that the Cretaceous red beds (or later strata) in this area possibly undergone the geomorphological evolution process of Danxia landscapes, which can be confirmed at Zhaojin of Tongchuan City. The Zhaojin National Geoparkshemas, stone villages, caves, which are similar to Danxia landscapes in the South China. Therefore, the Danxia landscapes were formed in the red beds, and then covered by Quaternary loess. The red beds were eroded by flowing water to have valleys to be denuded. Thus, the Danxia landscapes in northern Shaanxi can be named as “Loess-covered Danxia”, which is mainly canyon-type Danxia, indicating that they are in a relatively young stage of evolution.

The characteristics of Danxia landscapes in northern Shaanxi Province are briefly summarized here. (1) The canyons and cliffs are spectacular, and gullies and sedimentary layers combine to form a wave valley landscape. (2) The micro-landforms along the steep cliff surfaces are abundant and develops special forms such as capped silt pillars and mud emulsion pillars (muddy attachment on the pillarsurfaces). This is due to the reduction of lithological requirements in the hardness and thickness of Danxia landscapes in the arid areas in the late stage with intense wind erosion. (3) The red beds are featured by the large cross beddings and uniform granularity which indicates paleo-desert environments. (4) The Danxia and loess landscapes are charmingly combined to form a historical picture that illustrates great changes. (5) The grotto wonders are integrated with religion, ancient residence, and revolutionary red cultures (Fig. 1).

In comparison with South China, the Danxia landscapes in the northwest have fewer marvelous peaks, pictographic stones, and cliffs with abundant natural caves. The cavitiescan only be
observed along the cliffs in Zhaojin and Mt. Yongning, and the beaded cavities can be observed at Bolang Valley in Jingbian County of Yulin City. This difference might be formed by covering of the loess, but they should also reflect the different material basis, external dynamic conditions and formation mechanism, which needs further investigation.

The northern Shaanxi Province is a natural laboratory for the study of red beds and Danxia landscapes in Northwest China, and also an excellent place for the comparative study of Danxia landscapes between North and South China. The following research work needs to be carried out in future. (1) Quantitative survey of Danxia landscape resources by remote sensing, field survey, and borehole data to study the distribution and zoning characteristics of the red beds and Danxia landscapes. (2) The age of weathered crust at the top of the red beds is the key to the determination of geomorphological ages, which is significant for studying the history of landscape evolution. (3) Lithofacies, paleogeography, paleoclimate, and paleoenvironment of the red beds. (4) The landscape types, formation mechanisms and evolution patterns of Danxia, especially the comparative study with the Danxia landscapes in South China. (5) Vegetation characteristics and ecological research. (6) Culture and tourism development research.

**Key words:** Danxia landscape, arid area, landscape origin, Shaanxi Province of China

**References**


**About the first author**

GUO Fusheng, Male, born in 1962 in Ningdu County, Jiangxi Province, professor, Ph.D., mainly engaged in regional geology, sedimentology, and Danxia landscapes. He is the Deputy Director of Geotourism and Geopark Research Branch of China Geological Society. E-mail: fshguo@ecit.cn; Phone: 13879481232.

**About the corresponding author**

HUA Chen, male, born in 1995 in Fuzhou City, Jiangxi Province; a Ms. of geology; graduated from East China University of Technology; research of mineralogy, petrology and ore deposit geology. Email: 1372598878@qq.com; phone: 18870445181.