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Geo-environment characteristics of weathering deterioration of Tongtianyan Carved Stone Relics, China

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Tongtianyan Carved Stone Relics, Ganzhou City, Jiangxi Province, China, is a famous Cultural Heritage site constructed between the Tang and Song Dynasties (the oldest carving is about 900 years old), known as the first Grotto in the South of China. There are 359 stone niche statues, and 128 stone carvings. It is the largest Buddhist Cave Temple, and is located in the lowest latitude in China. It has been listed as important cultural relic sites under state-level protection by the State Council.

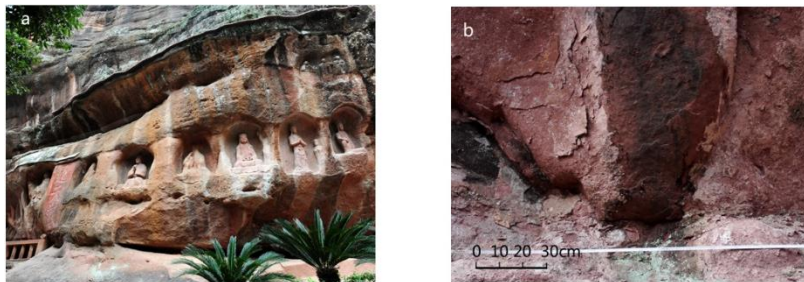


Figure 1: a. Part of Tongtianyan Carved Stone Relics; b. Weathering damage of carved sandstone

The unique monument is located in the intersection area among Wuyi Mountain, Nanling Mountain and Luoxiao Mountain, where the southern fringe is subtropical. The area has adequate illumination and four distinctive seasons: warm and windy spring, hot summer, cool autumn and cold winter. According to historic records, the air temperature has significant variation. The mean temperature is 18.8°C, the maximum temperature reaches 41.2°C and the minimum temperature is -8°C. The rainfall mainly occurs from April to June with the mean precipitation of 1 576 mm. The geological strata within the site are thick or massive red sandstone, conglomerate and their interbedded strata deposited in the Cretaceous. The landform is called Danxia Landform in China, a special landform type characterized by red sandstone cliffs. The attitude of the layer is nearly horizontal.

However, the monuments have suffered various weathering deterioration. Detail investigation has been conducted, and weathering deterioration forms have been classified. Some are gravity-driven collapses controlled by bedding and joints. Severe chemical weathering of the stone is ongoing due to the constituent minerals, porosity and water supply. Bio-weathering deterioration is also found.

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