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Application of Portable X-ray Radiography instrument to assess the weathering condition of the Avalokitesvara Sculpture in Dazu Rock Cavings, China

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Abstract:
Dazu Rock carvings located in Chongqin, China. It was firstly built in the Tang Dynasty (8th century A.D.), and named as a cultural heritage in World Heritage List in 1999. The Avalokitesvara Sculpture is one of the essence statues of the Dazu Rock Carvings. The area of sculpture caved on cliff is about 88 square meters. The Avalokitesvara Sculpture was caved on sandstone and decorated with gold foil and paintings. Now, the sandstone is suffering powdering, fracture, and other serious diseases, which caused by micro-environmental condition.
Generally, internal conditions could be tested by X-ray Radiography, ultrasonic and CT, but these techniques were mainly used for mobile relics. The case detecting internal conditions of the large stone Sculptures on situ is few.
The present paper provides a method for effectively and roundly assessing the weathering conditions of the Avalokitesvara sculpture based on X-ray radiography technology. More than 200 photos were taken on situ by Portable X-ray Radiography instrument. Due to the different density of weathering and un-weathering sandstone, the penetration of radiation is different. So weathering condition was clearly showed on these photos. Some historic restoration signs were found from the test.
Statistical results show the percent of fracture occurred on the sculpture is as follows: top area 27.0%, central area 36.5% and lower area 12.13%(the sculpture is divided into top, central and lower area); furthermore, the west, middle and east area has the percent of 34.9%, 32.7% and 26.4% (the sculpture is divided into west, middle and east area).
The powdering condition was also assessed. The percent of powdering occurred on top area is 54.7%. The percent on central and lower area is 43.7% and 12% respectively (the sculpture is divided into top, central and lower area), and the west, middle and east area has the percent of 46.7%, 31.7% and 40%(the sculpture is divided into west, middle and east area).
The result fitted the gold foil condition that comes from another investigation. The condition on sandstone that covered by gold foil is better than the one gold foil is off or partly off.
In this paper, we also present the discovery of the micro-bolt via X-ray radiography. The micro-bolt was used for the repairing of the incomplete fingers during restoration in Ming and Qing Dynasty.