



## **Mechanism of Corrosion and Color Inconsistency on Gold Foil Surface of Avalokitesvara in Dazu Rock Carvings**

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Dazu Rock Carvings locates in Dazu, ChongQing in the south-west China, which includes over 60,000 carved status of religion in 74 different places and has been listed as a World Cultural Heritage by the UNESCO. As one of the most elegant gold foil painting stone sculptures, Avalokitesvara has near 800 hands and a large number of pigment painted instruments. Avalokitesvara that is mainly made from sandstone, plaster, painting, and gold foil, is suffering from severe irreversible weathering caused by various natural and human factors. This processing is accelerating in recent years.

In addition to the corrosion of gold foils, we observe the color inconsistency on the surface gold foil of Avalokitesvara as well. It is a little surprising since gold in the nature is extremely stable and hard to corrode. Our previous results showed that there are impurities in the gold foils. Since impurities in the gold foil, such as, copper, are much easier to be eroded than gold itself, the corrosion products of impurities should interact with the components and/or their corrosion products of Avalokitesvara sculptures. We believe that the corrosion of gold foils is a result of the complicated synergistic effect among these compositions while the alternating wet and dry environment and frequent acid rain in this area promote these effects. Therefore, it is necessary to carry out the experiments to clarify the mechanism beyond these observations. Firstly, the microscopic appearance, chemical composition and the corrosion product of gold foil should be determined. Secondly, it is necessary to understand the interaction of the corrosion products of impurities in gold foils with other components of Avalokitesvara. Thirdly, the influence of local atmosphere and hydrology environment on the corrosion processing has to be considered.

In this present paper, in a combination with micro-environment monitoring, infrared thermal imaging, X-ray fluorescence, X-ray diffraction, and scanning electron microscopy with EDX, and various on-site and laboratory non-destructive techniques, the macro- and micro- information of composition materials and corrosion products on Avalokitesvara is collected and the mechanism causing this color inconsistency on the gold surface is clarified. Our results show that the fading of the gold foil results from the alternating wet and dry environment in this area while frequent acid rain accelerates this processing. The pitting corrosion on the gold surface caused by acid rain as well can be another factor contributing to the corrosion of gold foil. Additionally, we found that the significant color difference in the east and west side of Avalokitesvara is mainly due to the higher moisture content in the east side since a little surface stream is flowing along the east side.