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New finding of raw material and colorants in the copper red glaze in China

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High-temperature copper red glaze is a unique color glaze variety in ancient Chinese ceramics, which was valued by the court in the Ming Dynasty (AD 1368–1644). and the Qing Dynasty(AD 1644–1912)., and has always belonged to the imperial porcelain. Because copper element is very sensitive to the firing atmosphere, it is very difficult to prepare pure copper red glaze, so there were small number of high-temperature copper red glazes and relatively few related studies.

There has been an unsolved mystery about the reason for the color of copper red glaze in ancient China, and the reason for the sudden interruption of copper red glaze firing in the middle of the Ming Dynasty(AD 1522–1566). This article aims to unravel the mystery of copper red glaze through the study of samples of the Ming and Qing dynasties unearthed in the Forbidden City. In particular, synchrotron radiation microfocused X-ray fluorescence and X-ray diffraction with high spatial resolution and high detection sensitivity were used to detect copper particles in different areas of the glaze layer, and it was preliminarily determined that the main coloring role in high-temperature copper red glaze was nanoscale spherical metal copper particles. At the same time, micron-sized irregular cuprous sulfide particles were found in the bottom layer of Hongwu underglaze in the Ming Dynasty, which provided important evidence for inferring the raw materials of copper red glaze in the early Ming Dynasty. In addition, this project uses a variety of analysis methods to conduct a comprehensive study, compare the research results of Hongwu underglaze red (Ming dynasty) and sacrificial red glaze (Qing dynasty) , and explain the differences in glaze composition, glazing process and copper raw material source of copper red glaze in the Ming and Qing dynasty.

Keywords: copper red glaze ; SR- μ -XRF; SR- μ -XRF ; Ming Dynasty ; Qing Dynasty

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