

Application of a portable XRF analyzer to investigate the medieval wall paintings of Yemrehanna Krestos Church, Ethiopia

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X-RAY SPECTROMETRY

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Abstract

Despite the large body of ancient Ethiopian works of art in the form of murals, icons, and illuminated manuscripts, the physicochemical examinations carried out on them are few. This study is an *in situ* investigation of the wall paintings in the early 12th century Yemrehanna Krestos Church, Ethiopia. Fast, onsite, nondestructive analysis of the painting materials was carried out using a portable X-ray energy fluorescence dispersive spectrometer. It is believed to be the first *onsite* technical examination of Ethiopian mural paintings. This work resulted in information about the painting materials and the existence of different painting programs. The analysis revealed that the main pigments were red and yellow ochre, minium, cinnabar, orpiment, gypsum, lead, and white and carbon black; those typically employed in medieval times with no indication of later conservation–restoration intervention. Correlation between concentration of elements and multivariate statistical analysis was used to identify the most probable compounds and to classify sets of pigments used in two painting programs. The portable X-ray energy dispersive fluorescence spectrometer analyzer is found valuable to guide the *in situ* analysis and assess potential sites for microsampling for further investigations with complementary analytical techniques. However, in this expedition, we were unable to collect sufficient microsamples to warrant adequate complementary analyses. Characterization and documentation of the materials of the church murals support art historical studies and eventually conservation intervention plans. Copyright © 2013 John Wiley & Sons, Ltd.

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