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Use of integrated non-invasive analyses for pigment characterization and indirect dating of old restorations on one Egyptian coffin of the XXI Dynasty

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Abstract

The Royal Museums of Art and History of Brussels holds six coffins of the 21st Dynasty coming from a single discovery, the Second Cachette of Deir el-Bahari (Bab el-Gasus) (*L. Delvaux & I. Therasse, Sarcophages. Sous les étoiles de Nout, Bruxelles 2015, p. 83-111*). Since their discovery in 1891, their rich decorations have been subjected to deep manipulations during the years. In 2014, six coffins and four mummy-covers, the entire collection of the 21st Dynasty, were entrusted to the European Institute of Restoration for their diagnosis and restoration. In 2015, one complete coffin (composed by the external coffin, the internal one and the mummy cover) were the subject of a first targeted diagnostic campaign at the European Institute of Restoration laboratories.

On this occasion, non-invasive in situ analyses have been performed on more than one hundred measuring points of the complete object, considering the five decorated parts (the two wooden anthropoid coffins composed by lid and base and the mummy-cover) showing both different technical features and pictorial materials.

After a preliminary phase of analysis by imaging techniques such as Infrared Reflectography and Visible Fluorescence induced by UV, the pigments and binders were examined exploiting the synergy between four complementary techniques, namely EDXRF (energy dispersive X-ray fluorescence), FORS (fibre optics reflectance spectroscopy), reflection FTIR (Fourier transform infrared spectroscopy) and micro-Raman spectroscopy. The application of techniques with different penetration depths on more than one hundred points allowed to detect the stratigraphic sequences without sampling, opening to the interesting application to off-limits masterpieces.

Based on imaging techniques, the painted surfaces showed areas with different features: dark areas with no UV fluorescence and low reflectance in IR, bright UV fluorescence and high IR reflectance (wavelength >700 nm) and low-intensity UV fluorescence again with high reflectance in the infrared region. Such zones can be linked to the presence or absence of marker chemical elements (for instance Ba or Ti) or compounds that give hints about the presence and the period of the restorations. In these areas, an overlapping of a modern layer on the ancient and original one is the most probable current status of the pictorial stratigraphy.

Original identified pigments include Egyptian blue, copper-based green, calcium carbonate and Red Ochre on an underlying Orpiment yellow layer. In the areas considered as already restored in the past on the bases of the analytical results, we find Azurite, Prussian blue, Egyptian Blue, Vermillion, Red Ochre, Chrome Red, Chrome Green, copper-based green, Zinc Yellow and Lead White. A layer

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