# XAS Investigations of the Painting Layers which Covered a Wooden Statuette of the God Ptah-Sokar -Osiris and are Dating Back to 26<sup>th</sup> Pharaonic Dynasty

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#### Abstract

The God Path – Sokar – Osiris are models appeared at the end of the New Kingdom, and became a very common feature of elites' burials through late period until the Roman one. A unique polychrome wooden statuette of the God Path – Sokar – Osiris (dates back to 26th dynasty (664 –525 BC)) was studied using XAS. The dimensions of the statuette are 85 cm length and 23 cm shoulder width it was based on a rectangular wooden base (77 cm W, 27 cm L, 10 cm H). A mummified falcon was preserved in a rectangular cavity covered by a lid, in the base of the was studied using SR-  $\mu$ FTIR. The arrows in figure (1) point to the position of the measured samples.



#### Introduction

In ancient-colored samples, we are facing the problem of the chemical transformation with time, as in case of transform the blue color to green; therefore, it was difficult to differentiate them because they both contain Cu. The black might be a carbon-based pigment which couldn't be identified too. The analysis of preparation layer and the white color indicates the presence of Ca that may be interpreted as calcite (CaCO3) or gypsum (CaSO4 .2H2O). Another urgent problem has been the identification of the red and yellow colors which we already know they were mainly composed by Fe oxides, but we could not indicate which type those oxides. Such chemical and structural information can be provided by means of promising XAS technique. The work has been carried in order to study ancient Egyptian polychrome wooden statue, in attempts to identify the original colors materials used by the ancient makers, explain the deterioration processes and establish the strategy of conservation and museum display.

#### **Experimental Work**

In an attempt to identify the chemical composition of the abovementioned colors we analyzed (14) irregular samples classified in to two groups as reported in table number (1). The measurements were performed at XAFS and XRF beamline. of Elettra Synchrotron, Trieste, Italy

Group	Samples type	# of samples	Samples descriptions	Size of Samples
А	Colors	7	1 Blue, 1 red, 1 yellow, 1 green, 1 black, 1 off-white and 1 from (preparation layer)	Fallen parts from statuette, the size of each sample in the range of 10 x 15 mm2.
В	Colors	7	1 Blue, 1 red, 1 yellow, 1 green, 1 black, 1 off-white and 1 from (preparation layer)	Fallen parts from the rectangular base. the size of each sample in the range of 10 x 15 mm2.

XAS was applied to study the oxidation state and chemical speciation of the transition metals in the colored samples in fluorescence mode.

#### **Results and Discussion**

In order to study the composition of the black color., we used the collected XRF emission spectra on samples B1, B2, and B4. As we can see in Figure 2, B2 and B4 are rather similar. On the other hand, B1 has no traces of S, Cl does not present any Cu and presents a peak which could be attributed to Ge. The only constant among the three samples is the high content of Fe. We collected also Fe XANES on sample B4 in order to evaluate the phases we find in it, show Figure 3. The figure has a look at all the XANES collected on black samples, some differences can be seen but it's nothing dramatic. It will be more studied when the Linear Combination Analysis is done.



### References

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