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Archaeometric analysis of painted tombstones (IV century BC) from Paestum (Italy) / Ferrari, Giorgia; Baraldi, Pietro; Cipriani, Marina; Nannini, Matteo; Zannini, Paolo. - (2014). (Intervento presentato al convegno ICORS 2014 - XXIV International Congress on Raman Spectroscopy tenutosi a Jena - Germany nel 10-15 agosto 2014).

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19/04/2024 21:49

(Article begins on next page)

# Archaeometric analysis of tombstones (IV century BC) from Paestum (Italy)

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## 1. Introduction and aims of the study

Paestum, or Poseidonia, was founded at the end of the VII century BC<sup>[1]</sup>.

The necropolis has been revealed by several archaeological excavations, from XIX century to date. Studies on these graves showed a remarkable change of style during the V century BC, in conjunction with the Lucani's occupation, as we can see in the growing percentage of painted tombstones in that period<sup>[1]</sup>.

The importance of these paintings, characterized by recurring scenes (as the warrior returns, the funeral procession, heroic hunts, etc) lies in their representation of values coming from the dominant class of that period<sup>[1]</sup>. That is why these tombs have been studied for long time from the iconographic point of view, and more data, above all on materials and painting techniques, are necessary for a more comprehensive understanding.

## 2. Sampling and Analysis

Previous *in situ* XRF analyses (Bruker, ARTAX 200, Mo tube, 50KV, 700  $\mu$ A) on the tombstones specified by conservators gave us a first indication on pigments present and, above all, on the points to be sampled. Then, 112 micro -samples were collected from all colours on each grave (Green, Blue, Red, Yellow and Black), in order to compare materials coming from different tombs and to find a method to discriminate possible ancient workshops.

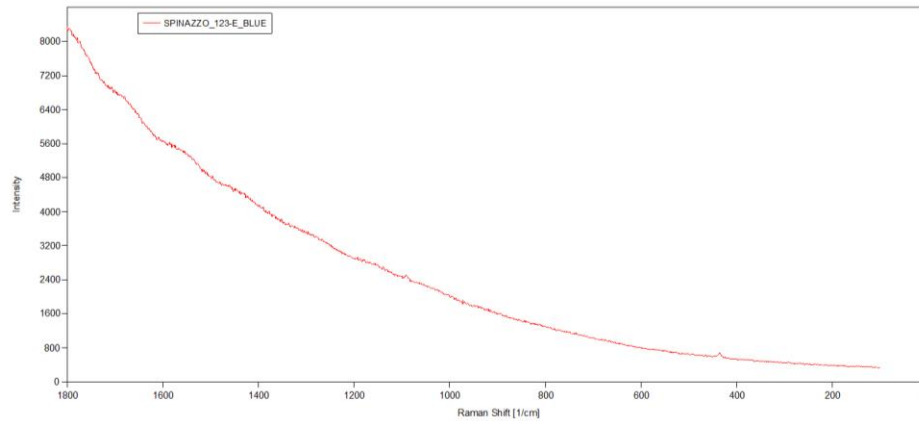
Samples were analyzed by micro-Raman Spectroscopy in the laboratory (Jobin-Yvon-Horiba, LABRAM, He-Ne Laser, 632 nm).

## 3. Results

Data show a uniform composition for Reds and Yellows, in almost every sampled grave. Red was obtained from Red Ochre (with Hematite as principal component), sometimes mixed with Magnetite or Carbon to get a darker tone. Yellow was obtained from Yellow Ochre (Raman spectra always signs the presence of Goethite).

Black is not so homogeneous: we found Carbon or Magnetite (the latter occasionally mixed with Black Hematite), and sometimes their mixture.

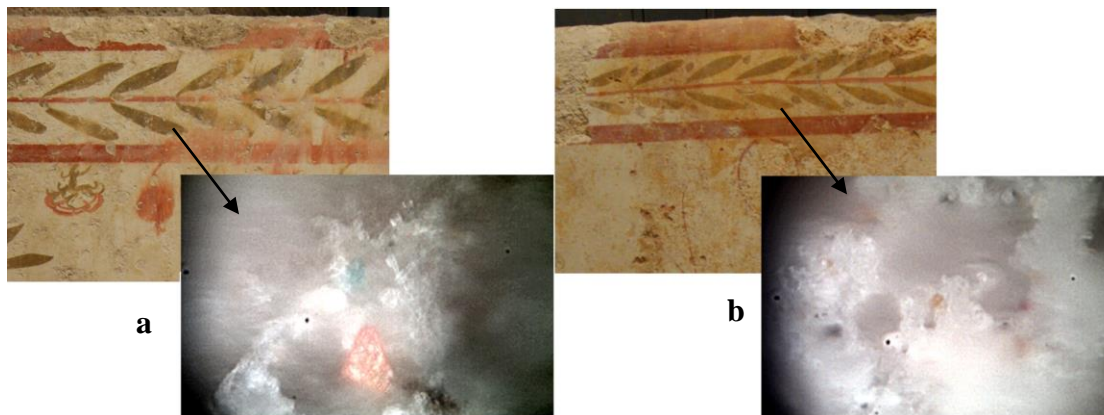
Blue, found in a relatively small number of tombs, is always Egyptian Blue: Raman spectra clearly show the signature of this pigment, with a weak peak at 430  $\text{cm}^{-1}$  (Fig. 1)).



**Figure 1** Raman spectrum of sample SPINAZZO\_123-E, acquired on a blue grain

Interesting information came from Green. This colour, never characterized by a single component, was obtained by mixing Egyptian Blue and Yellow Ochre, or Yellow Ochre and Carbon, or Yellow Ochre and Magnetite (Figure 2).

All data were then put together with historical and iconographic information, from archaeologists, restorers and conservators, in a rich database that will help conservators to draw conclusions. A deeper and systematic study of Green could be useful to try a first differentiation of the ancient workshops.



**Fig. 2a.** Sample ARCIÓNI1\_003 (sampling point and magnification 50x) **b.** Sample A3-N\_001 (sampling point and magnification 50x)

## ACKNOWLEDGMENTS

We thank the equipe of the Archaeological Museum of Paestum for their help and cooperation during every step of this study.

## REFERENCES

1. Pontrandolfo A, Rouveret A., Cipriani M., *Le tombe dipinte di Paestum*, 2004, Pandemos edition.