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## **A non-destructive spectroscopic study of the decoration of archaeological pottery: from matt-painted bichrome ceramic sherds (southern Italy, VIII-VII B.C.) to an intact Etruscan cinerary urn**

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### **ABSTRACT**

A study is presented based on the use of entirely non-destructive spectroscopic techniques to analyze the chemical composition of the painted surface layer of archaeological pottery. This study aims to define both the raw materials and the working technology of ancient potters. Energy-dispersive X-ray analysis, micro-Raman spectroscopy, visible and near infrared (NIR) diffuse reflection spectroscopy and external reflection Fourier-transform infrared (FTIR) spectroscopy were applied to matt-painted bichrome pottery sherds (VIII-VII century B.C.) from the site of Incoronata near Metaponto in southern Italy. Two different raw materials, ochre and iron-rich clay, were recognized for the red decoration, while the dark areas resulted to have been obtained by the so-called manganese black technique. In any case, it was demonstrated that the decoration was applied before firing, in spite of its sometimes grainy aspect that could suggest a post-firing application. For the samples with a more sophisticated decorative pattern a red/black/white polychromy was recognized, as the lighter areas correspond to an “intentional white” obtained by the firing of a calcium-rich clay. Reflection spectroscopy in the visible-NIR and mid-IR as well as micro-Raman spectroscopy were then employed to characterize the decoration of an intact ceramic urn from the Etruscan town of Chiusi, evidencing a post-firing painting based on the use of red ochre, carbon black and lime, possibly imitating the “fresco” technique used in wall paintings.

**Keywords:** ancient pottery decoration, energy-dispersive X-ray analysis, micro-Raman spectroscopy, reflection visible-NIR spectroscopy, reflection Fourier-transform infrared spectroscopy

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