MS45 O3

Micro scanning XRF, XANES and XRD studies of the decorated surface of Roman Terra Sigillata ceramics

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The red glaze (slip) that characterizes the *Terra Sigillata* potteries (see fig. 1), has greatly contributed to their success during the Roman period. The colour of the slip can in fact be partially explained by the microstructure (crystalline phases, grain sizes) and the physico-chemistry (compositions) of the ceramics, but the precise process of production and the origin of the process are still not fully known. In this work, we used a combination of different micro scanning synchrotron techniques to get a better understanding of the elaboration process and origins of these ceramics. The small (micron) size of the x-ray beam available at SSRL and ALS synchrotron sources, coupled with the use of a sample scanning stage allows to spatially resolve the distribution of the constitutive mineral phases related to the chemical composition and valence state of iron. A representative selection of slips including Italic, standard Gallic and mixture Gallic at the sample surface and for sample cross-sections has been studied. Sample surfaces were cleaned prior to chemical analysis and cross sections were obtained thanks to Focused Ion Beam apparatus available at CEMES, Toulouse (France). Thin slides will be also prepared for transmission experiments. This work has been supported by a France – Stanford center Grant for the 2006–2007 academic year.

Figure 1. Example of a table-ware in red-fired clay with a bright-red slip made in standard shapes

[1] Ph. Sciau, Ph. Goudeau, N. Tamura, E. Dooryhee, *Appl. Phys. A*, 2006, 83, 219.

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SR-XRD Studies on Neolithic Ceramics Pigments

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Using conventional XRD in pottery analysis major phases can be identified. Minor phases are at the level of the background noise or are unresolved from. However, these minerals are significant for the characterization of the source of the clay (bulk) and of the pigments. The Synchrotron Radiation X-Ray Diffraction (SR-XRD) is a powerful tool for detailed structural determination and mineral phase studies. We used it in order to distinguish the diferent clays and glosses of various pottery-producing centres in the case of some Romanian neolithical ceramics, Cucuteni-type especially. The measurements were performed using the Huber G670 imaging-plate Guiner camera installed on cristalography beamline I7114 at the MAX II synchrotron (Lund, Sweden), and using the station 14.1 of the Synchrotron Radiation Source (SRS) from Daresbury Laboratory (DL), UK. The obtained information help us for the identification of black pigment composition from various Cucuteni sherds (Northern Moldavia) – 5000-3500 BC – as jacobsite and manganite, having their origin in Iacobeni deposit (approx 100 km away from the prehistoric sites). The white pigment appears as a combination between calcite and calcium silicates mixed with illite. The measurements shown the presence of hematite as main component for red pigments. The clay examined for all the sherds was identified to have a local provenance. Some considerations on the technology used to produce such painted ceramics and on possible trade routes for black pigments minerals are presented.

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Powder Diffraction Studies and Raman Analysis of two XVIthcentury Altarpieces

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João de Ruão was one of the most influent artists of XVIth century in Portugal, being a member of "The School of Coimbra", his works are mainly seen in cathedrals and churches in the center of Portugal. The importance of his work to the Portuguese Arts History justifies a thorough study and characterization of the pigments and materials used in the original paintings and over paintings. Once the characterization of the pigments is done, the authorship of other works can be done with scientific arguments other than stylistic criterions. Two polychrome altarpieces credited to João de Ruão were analyzed. Tiny samples of the strongly damaged painted surface of the altarpieces were collected and used both for X-ray diffraction (XRD) and Raman spectroscopic analysis. Powder XRD was used, employing finely grinded samples in glass capillaries (when possible) or in difficult cases the small sample were glued to a glass fiber, always in Debye-Scherrer transmission geometry, with a rotating sample. Cu radiation diffraction peaks were collected in a curved position sensitive detector 120º, and compared to powder diffraction databases. Micro-Raman spectra were collected using a Jobin-Yvon T64000 spectrometer with an Ar+ laser operating at 514,5 nm as an excitation source. The existence of different layers of paintings were observed and the presence of rich products such as gold and lapis-

lazuli was verified. Also, other more common pigments such as lead white (used as undercover), lead red and vermilion, chalcopyrite, lamp black and chromium yellow could be identified. Detailed results on the composition of each color are going to be presented. A portion of one of the altarpieces is shown below.