Project Summary Report

Project title: THE EFFECTS OF MN AND FE OXIDATION STATES ON THE COLORATION OF GLASSES

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Project objectives: We proposed to determine Mn oxidation state in the glass mosaic *tesserae* found at Faragola, utilising the unique advantage offered by synchrotron instrumentation for such studies. Moreover, the historical importance of the pieces made the adoption of a completely non-destructive technique mandatory.

Allocated beam-time: BM08 - 08 01 785 – 15 shifts

Dates: 03 October 2007 – 8 October 2007

Performed experiments. The X-ray Absorption Spectroscopy (XAS) measurements were carried out at the Mn-K and at the Fe-K edge, directly on glass fragments having dimension of few mm^2.The monochromator was equipped with Si(111) crystals; a pair of Pd-coated mirrors working in grazing incidence (Θ=3.3 mrad) were used for the rejection of the harmonics. The energy scale was calibrated by comparison with Fe and Mn foil standards. Synthetic olivine and hematite and natural spessartine, pyrolusite, bixbyite, rodocrosite were further used as standards. A total of 47 scans were perfomed on glass materials and reference compounds.

Main achievements. The XAS data showed that different ratios of iron and manganese compounds mixtures are present in the different samples, and indicated a possible way of grouping (ordering) the samples of different type according to the spectral shift caused by the varying ratio of Fe^{2+}/Fe^{3+} and $Mn^{+2/+4}$ composition. Fe is found in the $^{3+}$ valence state in

tetrahedral geometry in green and blue tesserae whereas an appreciable contribution of octahedral Fe^{2+} is found in the black tessera. Fe_2O_3 and MnO are responsible of the blackish colour.

Dissemination. The scientific paper including these results is nearly finished and will be soon submitted to *Archaeometry* Journal. An abstract summarizing all results obtained by the application of XAS sat GILDA have been submitted and accepted for the 37th International Symposium of Archaeometry (Siena, 12-16 May 2008).