

FCT Fundação para a Ciência e a Tecnologia

MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR



Programa Operacional Ciência e Inovação 2010

MINISTÉRIO DA CIÊNCIA, INOVAÇÃO E ENSINO SUPERIOR

PROJECTOS DE INVESTIGAÇÃO CIENTÍFICA E DESENVOLVIMENTO TECNOLÓGICO

RELATÓRIO DE PROGRESSO

ANEXO ao Relatório de Execução Material

REFERÊNCIA DO PROJECTO N.º POCI/CTM/60685/2004 .

RELATÓRIO REFERENTE AO 3.º ANO DE EXECUÇÃO



União Europeia – Fundos Estruturais



Governo da República Portuguesa

RELATÓRIO DE EXECUÇÃO MATERIAL – ANEXOS

ANEXO 1: equipamento adquirido no âmbito do projecto



Fig. 1



Fig. 2

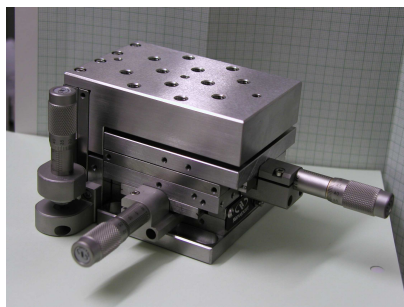


Fig. 3

Fig.1 – Caudalímetro de ar Ki – Key Instruments, mod. MR3000.

Fig.2 – Mini-câmara de captura de imagem com iluminação ARTRAY, mod. ARTCAM-34MC

Fig.3 – Mesa Newport, mod. M-562-XYZ, com deslocação XYZ micrométrica por parafusos SM-13



TECHNART 2007

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Certificate

This is to certify that

Rodrigues, Alexandra

presented the oral presentation entitled

EXTERNAL MICRO PIXE/RBS ANALYSIS AT ITN

on the Non-destructive and Microanalytical **Techniques** in **Art** and Cultural Heritage Research (Technart 2007), held in Lisboa, Portugal, from the 25 to 28 April, 2007.

Organizing Committee

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External Beam Analysis of Roman Glasses



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³ MMAR, Municipal Museum of Archaeology of Amadora, Av. Eduardo Jorge 43 r/c, 2700-306 Amadora, Portugal

Introduction

Implementation of an external beam analysis system at ITN microprobe beam line allows studying art and archaeological objects, non-destructively and without requiring sampling. Using the OM 50 triplet quadrupole system and an extraction nozzle equipped with ultra-thin Si₃N₄ membranes, the objects are analysed resorting to PIXE and RBS.

Preliminary results regarding the study of a group of archaeological Roman glasses are presented here.

Spatial Resolution

Experimental Conditions

- 2 MeV H⁺ beam, 2.5 MV Van de Graaff accelerator
- Oxford Microbeams type microprobe with OM-DAQ
- Object slits: 500x500 μm²
- Collimation slits: 1x1 mm²
- Typical beam current: ~1 nA

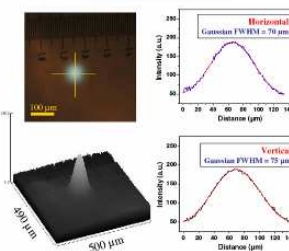
Setup

- Exit nozzle: 15 cm tube from end of vacuum chamber; 43 cm from the last quadrupole
- Exit window: 1x1 mm², 100 nm thick Si₃N₄ membrane (SPI)
- Microscope in front viewing position to the exit nozzle
- Glass window for initial alignment and focusing
- Microscope glass slide with engraved scale (10 μm/div.) at 3 mm from exit window
- Controlled helium flow

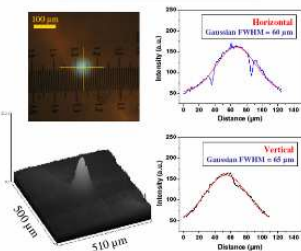


- 1 - exit nozzle
- 2 - 30 mm² SDD Röntec
- 3 - RBS detector
- 4 - microscope
- 5 - vacuum chamber

Irradiation in air



Irradiation with He flow



Helium flow improves the spatial resolution. Implementation of He flooded volume will further enhance the quality of PIXE and RBS spectra. In this configuration an external proton beam with 1-3 nA current, and 70-100 μm spatial resolution, is currently obtained.

The Roman Glasses from Quinta da Bolacha

A group of glasses was recovered from an excavation site of a Roman villa, in Quinta da Bolacha, Amadora, Portugal, that is believed to have had two different occupations between the 3rd and 4th centuries AD [1]. Fragments from two contexts (nr. 17 – 2nd occupation and nr. 19 – 1st occupation) were analysed, in order to materially define each of these moments.

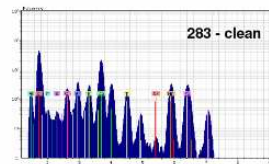
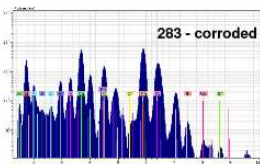
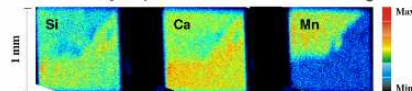
Characterisation

The poor state of conservation of the fragments, namely delaminating of the glass surfaces, was determinant for using external beam analysis.



Results and Discussion

Point analysis performed after beam scanning



- Corroded areas show increased concentrations in Mn and Fe.
- The presence of Sb and Pb in the blue tile 193/03, indicates use of opacifying agents (e.g. Ca₂Sb₂O₇, Ca₂Sb₂O₆ and/or Pb₂Sb₂O₇) [2].
- The presence of Cu and absence of Zn and Sr in 92/01-smaller fragment, contrarily to 92/01-larger fragment, indicate that these two fragments do not belong to the same original object, as initially supposed.
- There is evidence that glasses from context 19 do not have Cr in their composition.

Conclusions

- Improving system performance by He flooding the region of analysis and focusing optimization, makes 50 μm resolution an attainable goal.
- Area analysis by automatic raster scan is still possible under external microbeam conditions.
- The referred opacifying agents were in use until the 4th century AD, which confirms the time interval of the villa's occupation.
- The presence of Cr may be useful as a fingerprint for context identification

References:

- [1] - MIRANDA, Jorge Augusto; ENCARNAÇÃO, Gisela, Vila Romana da Quinta da Bolacha, Campanha de Arqueologia de 1967, Relatório-4, Gabinete de Arqueologia Urbana, Associação de Arqueologia de Amadora, 1996.
 [2] - DAVISON, Sandra, Conservation and Restoration of Glass, Butterworth-Heinemann, Elsevier Science, Oxford, 2003, ISBN-0-7506-4581-2.
 [3] - PAYNTER, Sarah, "Analysis of Colourless Roman Glass from Binschester, County Durham" in Journal of Archaeological Science, 33, 2006, 1037-1057.



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ANEXO 3b: Certificado de atribuição de prémio de melhor painel



*ELEVENTH INTERNATIONAL CONFERENCE ON PIXE
AND ITS ANALYTICAL APPLICATIONS*
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BY

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