

## NEUTRON TOMOGRAPHY FOR THE ASSESSMENT OF CONSOLIDANT IMPREGNATION EFFICIENCY IN PORTUGUESE GLAZED TILES (XVII - XVIII CENTURIES)

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**Main scientific topic: Synchrotron, ion beam and neutron based techniques/instrumentation**

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**I intend to submit a full paper to Analytical Bioanalytical Chemistry: YES x NO**

### Introduction

Glazed tiles ("azulejos") have been manufactured in Portugal for many centuries. They became an art form, and are present in many historical Portuguese buildings of the XVII to the XIX centuries. Many of these "azulejos" present various degradation features. In this work neutron tomography (NT) is applied to visualize the inner structure of glazed tiles and explore its potential to assess conservation products inside the samples.

### Experimental

Three-dimensional images of tile fragments were generated using NT. With the prototype setup at the Portuguese Research Reactor, each two-dimensional image is obtained from a 7 minute exposure, at a thermal neutron flux of  $2 \times 10^5 \text{ n cm}^{-2} \text{ s}^{-1}$ . The sample is automatically rotated by an angle of 0.9 degrees between successive images. The activation of the object is negligible. Images were obtained before and after the application of Paraloid B72, an acrylic co-polymer of ethylmethacrylate and methylacrylate (70/30), for consolidation treatment of tiles.

### Results

The brush application of Paraloid + acetone (10/90) on the surfaces of the tile appears to result in efficient impregnation, particularly in degraded tiles with a high porosity. Before treatment (Fig.1a) the gray level is similar across the tile except for the glaze, which exhibits higher neutron flux attenuation (Fig.2a). After treatment (Fig.1b), the resin is more concentrated in the glaze surface than in the back surface (Fig.2b). The distribution of the resin in the interior of the ceramic body is similar, with a slightly lower concentration in the middle part (see Fig. 2).

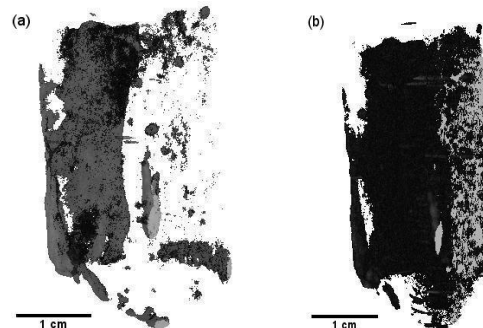
### Conclusions

The inner visualization of glazed tiles by NT allowed evaluation of impregnation by the

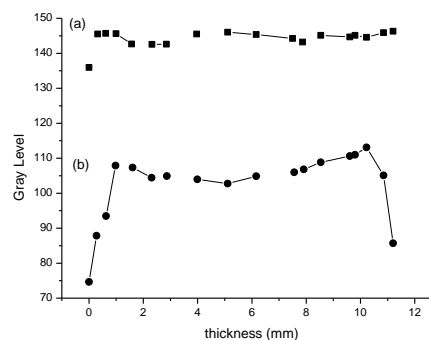
Paraloid B72, demonstrating effective consolidant-flow in the porous tile. The brush application benefits all the ceramic body, since a significant decrease was observed in the gray level ( $\sim 23\%$ ) reflecting a higher neutron attenuation.

### Acknowledgements

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**Figure 1:** Tomographic images (45°) of dried tile: (a) before treatment; (b) with resin.



**Figure 2:** Gray level across tile before (a) and after resin application (b) obtained by NT.