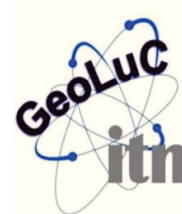




Livro de Resumos

Lisboa, 26 a 28 de Outubro de 2011



Tomografia de neutrões aplicada a azulejos do séc. XVII – visualização para caracterização, diagnóstico e optimização de técnicas de conservação.

*M.A. Stanojev Pereira⁽¹⁾, M.I. Prudêncio⁽¹⁾, J.G. Marques⁽¹⁾, M.O. Figueiredo⁽²⁾, M.I. Dias⁽¹⁾,
T.P. Silva⁽²⁾, L. Esteves⁽³⁾, C.I. Burbidge⁽¹⁾, M.J. Trindade⁽¹⁾, M.B. Albuquerque⁽⁴⁾*

⁽¹⁾ Instituto Tecnológico e Nuclear (ITN), Estrada Nacional 10, 2686-953 Sacavém, Portugal.
iprudenc@itn.pt.

⁽²⁾ LNEG, Unity of Mineral Resources and Geophysics, Apt. 7586, 2721-866 Alfragide & CENIMAT / I3N, Mat. Sci. Dept., Fac. Sci. Technol., New Univ. Lisbon, 2829-516 Caparica, Portugal. teresa.pena@lneg.pt.

⁽³⁾ Museu Nacional do Azulejo, Rua da Madre de Deus nº 4, 1900-312 Lisboa, Portugal.
mnazulejo.lurdesesteves@imc-ip.pt.

⁽⁴⁾ Conservar-Inovar, Lda, Av. Duque de Loulé nº 77, 4º Dto, 1055-088 Lisboa, Portugal.
bealbuquerque@iol.pt.

RESUMO

O património cultural apresenta-se muitas vezes com problemas graves de degradação, cuja solução deve passar pelo uso de técnicas não destrutivas para a visualização, caracterização e diagnóstico, tendo em vista a selecção de métodos de conservação. Entre os objectos culturais, os azulejos, presentes em monumentos do património português, foram seleccionados para serem alvo de um estudo detalhado utilizando a tomografia de neutrões (TN). Além disso outras técnicas de análise, como difracção de raios-X, análise por activação neutrónica e fluorescência de raios-X foram utilizadas como técnicas complementares neste trabalho a fim de se estudar as variações na composição química e mineralógica do corpo cerâmico e do vidrado de azulejos do séc. XVII. O equipamento para tomografia utilizado neste trabalho está instalado num canal de irradiação horizontal da coluna térmica do Reactor Português de Investigação (ITN). No interior deste canal, existe um colimador que fornece um feixe de neutrões com um fluxo de $2 \times 10^5 \text{ n cm}^{-2} \text{ s}^{-1}$. Obtiveram-se imagens dos azulejos antes e depois de aplicar o consolidante Paraloid B-72. Os resultados obtidos mostram que a TN é um método muito útil na visualização do interior dos azulejos, permitindo avaliar a profundidade e distribuição da resina no interior. Para além disso, verificou-se que a técnica de aplicação do consolidante por pincelagem parece ser mais eficiente do que a de imersão.

Palavras-chave: tomografia de neutrões, conservação de azulejos, composição química e mineralógica.

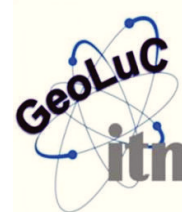
Agradecimentos

Agradece-se o financiamento da FCT – projecto PTDC/HIS-HEC/101756/2008 e bolsa POCI/FIS/59287.



Livro de Resumos

Lisboa, 26 a 28 de Outubro de 2011



Dosimetria Retrospectiva, na gama dos kGy, para Monitorização no Tratamento de Azulejos Históricos.

*C.I. Burbidge^(1,2), S.I. Cabo Verde⁽¹⁾, A.C. Fernandes⁽¹⁾, M.I. Prudêncio^(1,2), M.L. Botelho⁽¹⁾,
M.I. Dias^(1,2), G. Cardoso⁽¹⁾*

⁽¹⁾ Instituto Tecnológico e Nuclear, Sacavém, Portugal. christoph@itn.pt.

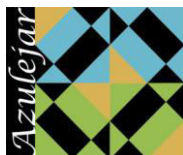
⁽²⁾ GeoBioTec, Universidade de Aveiro, Portugal.

RESUMO

Um sinal de luminescência tem sido identificado para permitir a avaliação retrospectiva de doses absorvidas em quartzo até dezenas de kGy. Sub-amostras de azulejos históricos tem estado irradiadas por ⁶⁰Co gama para os propósitos de descontaminação biológica, acompanhadas por dosímetros de Perspex, e por quartzo geológico conhecido de exibir o sinal de luminescência termicamente transferida e opticamente estimulada (TTOSL). Os sinais OSL e TTOSL foram medidos de grãos de quartzo após pré-aquecimentos diferentes, e após re-irradiação com uma fonte beta de ⁹⁰Sr/⁹⁰Y no GeoLuC (ITN). Modulação linear (LMOSL) foi aplicada para a diminuição da gama dinâmica dos níveis de sinal para evitar saturação do detector sem reduzir a sua sensibilidade. Curvas ajustadas às respostas à irradiação gama foram interpoladas através de outras às respostas beta, para investigar a utilidade de diferentes integrais de sinal e combinações de pré-aquecimento, na avaliação retrospectiva de diferentes gamas de doses.

Os sinais de OSL evidentes para tempos de estimulação breves, os que são convencionalmente utilizados na dosimetria e datação, mostram comportamento inconsistente para doses altas. A contribuição de componentes da resposta a dose que saturaram rapidamente ou mostraram tendências negativas foi reduzida após pré-aquecimentos severos, que também reduziram preferencialmente os sinais OSL e TTOSL evidentes para tempos de estimulação mais longos: os restantes sinais forneceram melhores estimativas. Os sinais TTOSL evidentes para tempos de estimulação breves aumentaram proporcionalmente com dose entre 1 e 30 kGy após um pré-aquecimento de 300 °C. As doses gama foram subestimadas por 13-20%: o método precisa ser afinada, mas este resultado já facilita a avaliação da magnitude da exposição à radiação até uma ordem de magnitude para além do máximo convencionalmente medida por meio deste ubíquo dosímetro natural.

Palavras-chave: Dosimetria retrospectiva de altas doses; Luminescência; LM-TT-OSL; Quartzo.



GEOCHEMICAL PATTERNS AND FIRING TECHNOLOGY RESEARCH ON CERAMIC GLAZED TILES FROM THE 17th – 20th CENTURIES (LISBON REGION, PORTUGAL)

M. Isabel Dias, IST/ITN, Univ. Técnica de Lisboa, EN 10, 2686-953 Sacavém, GeoBioTec, Univ. Aveiro; isadias@itn.pt

M. José Trindade, IST/ITN, Univ. Técnica de Lisboa, EN 10, 2686-953 Sacavém, GeoBioTec, Univ. Aveiro; mjtrindade@itn.pt

Leonel Ribeiro, Instituto de História de Arte/FCSH/UNL, PISAL/DSPC/DPC/DMC/CML, Rua do Machadinho nº20, 1249-150 Lisboa, leonel.d.ribeiro@cm-lisboa.pt

M. Isabel Prudêncio, IST/ITN, Univ. Técnica de Lisboa, EN 10, 2686-953 Sacavém, GeoBioTec, Univ. Aveiro; iprudenc@itn.pt

M. Teresa Bispo, ESEAG, Instituto de História de Arte/FCSH/UNL, PISAL/DPC/DMC/CML, Rua do Machadinho nº20, 1249-150 Lisboa, maria.bispo@cm-lisboa.pt

Laura Trindade, Instituto de História de Arte/FCSH/UNL, PISAL/DSPC/DPC/DMC/CML, Rua do Machadinho nº20, 1249-150 Lisboa, laura.trindade@cm-lisboa.pt

Pedro Flor, Universidade Aberta, Rua da Escola Politécnica, 147, 1269-001 Lisboa. Instituto de História de Arte/FCSH/UNL, Av. de Berna 26c, 1069-061 Lisboa, pedfaf@sapo.pt

Susana Varela Flor, Instituto de História da Arte da Fac. Letras da Universidade de Lisboa / RTEACJMSS, Alameda da Universidade, 1600-214 Lisboa, susanavarelaflor@sapo.pt

Fernando T. Rocha, Campus Universitário de Santiago, Univ. Aveiro, 3810-193 Aveiro, GeoBioTec, Univ. Aveiro; tavares.rocha@ua.pt

ABSTRACT

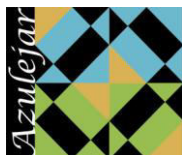
A set of 17th – 20th century glazed tiles supplied by the Department of Cultural Heritage tile collection, Lisbon City Hall, is studied in this work. The tiles were described and classified in a chronological point of view and analytical work includes chemical and mineralogical characterization of the ceramic bodies and mortars by instrumental neutron activation analysis and X-ray diffraction.

Most tile bodies consist mainly of quartz, gehlenite and calcite in variable proportions; commonly these main phases are accompanied by high temperatures phases, namely wollastonite or diopside, pointing to a Ca- or Mg-rich raw material, and mullite (in one sample) indicating the use of non-carbonated raw materials. Small amounts of K-feldspar and hematite are present in most tiles, whereas analcime, plagioclase, vaterite and cristobalite are found in just a few samples.

Chemical composition points to a certain homogeneity within 18th century tile bodies; the 20th century samples analysed are heterogeneous and have a different rare earth elements (REE) pattern, two are enriched in the first transition row elements, pointing to higher amounts of ferromagnesian minerals, and the other has lower amounts of Na, Fe, Cr and Co, and higher of Cs, light rare earth elements (LREE), Th and U suggesting high aluminium silicates content. The 17th century samples have a more heterogeneous chemical composition and higher contents of As and Na, which is explained by the presence of analcime. The ancient tiles have a general depletion of chemical elements, probably due to a dilution effect of the higher calcite content.

The mortars are all lime rich, but the 20th century ones have a general enrichment in all elements, and more k-feldspar and mica.

KEYWORDS: Azulejos, Glazed tiles, mineralogical composition, chemical composition, firing temperatures



THE ADAPTATION OF THE MAIN FLOOR OF THE PALACE MELO E ABREU (18TH CENTURY) TO AN INFIRMARY OF THE OLD ASYLUM OF MENDICITY: HISTORY AND TILE PANELS COMPOSITIONAL CHARACTERIZATION

Susana Varela Flor; IHA-FLUL/RTEACJMSS/FCT, Alameda da Universidade, 1600-214 Lisboa, Portugal; susanavarelaflor@sapo.pt

Catarina Figueiredo; IHA-FLUL/RTEACJMSS/FCT, Alameda da Universidade, 1600-214 Lisboa, Portugal; mcatarinavf@gmail.com

Célia Pilão; Comissão do Património Cultural do Centro Hospitalar de Lisboa Central EPE, Hospital de S. José, R. José António Serrano, 1150-199 Lisboa celia.pilao@chlc.min-saude.pt

José Meco; IHA-FLUL Alameda da Universidade, 1600-214 Lisboa, Portugal

M. Isabel Marques Dias; GeoBioTec, Univ. Aveiro; IST/ITN, Estrada Nacional 10, 2686-953 Sacavém, isadias@itn.pt

M. Isabel Prudêncio; GeoBioTec, Univ. Aveiro; IST/ITN, Estrada Nacional 10, 2686-953 Sacavém, iprudenc@itn.pt

Maria José Trindade; GeoBioTec, Univ. Aveiro; IST/ITN, Estrada Nacional 10, 2686-953 Sacavém; mjtrindade@itn.pt

Pedro Flor; Universidade Aberta, Rua da Escola Politécnica, 147, 1269-001 Lisboa, Portugal IHA-FCSH/UNL, Av. de Berna 26c, 1069-061 Lisboa, Portugal; pedfaf@sapo.pt

Vítor Serrão, IHA-FLUL/RTEACJMSS, Alameda da Universidade, 1600-214 Lisboa, Portugal; vit.ser@fl.ul.pt

ABSTRACT

Due to its sunny location and mild climate, the hill of Sant'Ana in Lisbon was, since early times, the place of construction of religious and civil buildings. In the eighteenth century, near the former Santo António dos Capuchos Convent (later Hospital – HSAC), a Baroque palace was erected and later on rebuilt by the Melo e Abreu family (later Condes de Murça in the 19th century), whose noble rooms were decorated by a set of high quality tiles, concerned with iconographic and plasticity aspects.

The transfer of the Melo e Abreu family to the parish of Santos-o-Velho and subsequent founding of the Asilo da Mendicidade, allowed the purchase of the building in order to expand the assistance space. Currently, the palace serves hospital's needs, with all the constraints resulting from the cohabitation between cultural heritage and professional medical care day life.

Thus, Palace Melo e Abreu is a good case study, not only for the functional changes that it has been subjected to, but also for the rehabilitation measures for structural restoration and conservation made over time. For the assessment of its importance in terms of both heritage and scientific history, we will present an interdisciplinary study, including History of Art and Archaeometry;

In this work (together with the history of the adaptation of the main floor of the Palace Melo e Abreu to an infirmary of the old asylum of mendacity) a first stage of the archaeometric approach is presented, comprising the compositional characterization (chemical and mineralogical) of both mortar and glazed tile body of selected panels. We believe that this paper will promote a deep reflection about the safeguard and future heritage policies of this kind of Lisbon's hospitals.

KEYWORDS: History of Art, Archaeometry, Glazed tiles, Compositional analysis.



QUINTA DO TOREL GLAZED TILE PANEL: A FIRST COMPOSITIONAL APPROACH OF THE CERAMIC BODY (LISBOA, PORTUGAL)

M. Isabel Prudêncio, GeoBioTec, Univ. Aveiro; IST/ITN, Univ. Técnica de Lisboa, EN 10, 2686-953 Sacavém, iprudenc@itn.pt

Leonel Ribeiro, Instituto de História de Arte/FCSH/UNL, PISAL/DSPC/DPC/DMC/CML, Rua do Machadinho nº20, 1249-150 Lisboa, leonel.d.ribeiro@cm-lisboa.pt

M. Isabel Marques Dias, GeoBioTec, Univ. Aveiro; IST/ITN, Univ. Técnica de Lisboa, EN 10, 2686-953 Sacavém, isadias@itn.pt

Maria José Trindade GeoBioTec, Univ. Aveiro; IST/ITN, Univ. Técnica de Lisboa, EN 10, 2686-953 Sacavém, mjtrindade@itn.pt

Maria Teresa Bispo, Escola Superior Almeida Garrett (ESEAG), Instituto de História de Arte/FCSH/UNL, PISAL/DPC/DMC/CML, Rua do Machadinho nº20, 1249-150 Lisboa, maria.bispo@cm-lisboa.pt

Laura Trindade, Instituto de História de Arte/FCSH/UNL, PISAL/DSPC/DPC/DMC/CML, Rua do Machadinho nº20, 1249-150 Lisboa, laura.trindade@cm-lisboa.pt

Pedro Flor, Universidade Aberta, Rua da Escola Politécnica, 147, 1269-001 Lisboa / Instituto de História da Arte da Faculdade de Ciências Sociais e Humanas da Universidade Nova de Lisboa, Av. de Berna 26c, 1069-061 Lisboa, pedfaf@sapo.pt

Susana Varela Flor, Instituto de História da Arte da Faculdade de Letras da Universidade de Lisboa / Rede Temática em Estudos de Azulejaria e Cerâmica João Miguel dos Santos Simões, Alameda da Universidade, 1600-214 Lisboa, susanavarelaflor@sapo.pt

Abstract

The city of Lisbon has in situ seventeenth-century tiles that were decontextualized of its original architectural framework and landscape, owing to the deep urban changes operated in the following centuries. One example is the set of tiles in the Torel hill, near the Campo de Santana, whose advanced state of degradation requires immediate and integrated study into its historical, artistic and material component. From the plastic analysis and comparison with the coeval tile work with signature, together with the research literature developed in recent years, now it seems difficult to sustain the traditional assignment of the panel to Gabriel del Barco, as enunciated in 1959 by Santos Simões and followed by more recent historiography.

In order to contribute to the clarification of this issue of allocation of the Torel tile panel (or not) to a particular artist, as well as, to contribute to future actions of conservation/restoration, a study of compositional features of the tiles paste together with absolute dating methods was initiated.

The mineralogical composition of the ceramic body was obtained by X-ray diffraction (XRD) of non-oriented aggregate powders by using a RX diffractometer, CuK α radiation at 45 kV and 40 mA, a step size of 1° 2 θ /min from 2 to 70° 2 θ . The chemical composition was obtained by instrumental neutron activation analysis (INAA) in the Portuguese Research Reactor, Sacavém, Portugal. Chemical elements considered for this study were the following: Na, K, Sc, Cr., Fe, Co, Zn, As, Ga, Rb, Cs, Ba, La, Ce, Nd, Sm, Eu, Tb, Yb, Lu, Hf, Ta, Th, U.

The results obtained so far allowed to establish a geochemical signature of the ceramic body, which is mainly composed of gehlenite, calcite and quartz, with small amounts of hematite and K-feldspar.

Keywords: Compositional analysis, Portuguese glazed tiles, History of Art

Theme: C10. Poster

COMBINATION OF IBA TECHNIQUES TO STUDY ART-HISTORICAL OBJECTS USING A MICROPROBE.

V. CORREGIDOR^{1,2}, C. P. MARQUES^{1,2,3}, R. C. SILVA^{1,2}, P. A. RODRIGUES^{1,2}, M. VILARIGUES^{4,5},
T. SILVA¹, S. CABO VERDE¹, M. L. BOTELHO¹, M. I PRUDÊNCIO¹, S. COENTRO^{4,5},
V. S. F. MURALHA^{4,5}, E. ALVES^{1,2} AND L. C. ALVES^{1,2}

¹ Instituto Tecnológico e Nuclear, Instituto Superior Técnico, Universidade Técnica de Lisboa, E.N. 10,
2686-953 Sacavém, Portugal (vicky.corregidor@itn.pt)

² CFNUL, Av. Prof. Gama Pinto, 2, 1649-003 Lisboa, Portugal

³ Instituto Superior de Educação e Ciências, Alameda das Linhas de Torres, 179, 1750-042 Lisboa,
Portugal

⁴ Dep. de Conservação e Restauro, FCT-UNL, Quinta da Torre, 2829-516 Caparica, Portugal

⁵ VICARTE, Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa, 2829-516
Caparica, Portugal

The ion microbeam analytical end-station adds a set of valuable analytical techniques for the community involved in the study and conservation of Cultural Heritage. With the ion microbeam it is possible to analyze the elemental composition (in point, line or areal maps modes) and perform structural studies of different objects, large or small, using Ion Beam Analysis (IBA) techniques in open air or helium atmosphere – i.e. without vacuum conditions – and without the need of sampling or any special preparation. In this presentation, the details concerning the external beam set-up and a selection of the results obtained from selected analyzed objects will be presented.

Generally speaking, a beam of high energy particles (1 – 3 MeV) is directed towards the sample under study. Upon interaction in the sample, the beam induces the emission of secondary radiation (X-ray, light, gamma-ray photons and particles): depending on which we choose to explore, there will be associated a specific IBA technique: PIXE, IBIL, PIGE, RBS, etc. Each can provide different information, but what is really remarkable is the information that can be extracted when the techniques are used in combination. PIXE is very sensitive for elements with Z number higher than 12 (to the $\mu\text{g/g}$ level); from RBS spectra we can determine the elemental depth profiles; IBIL is a spectrometric technique where the luminescence signal is induced by the beam. It is sensitive to the local chemical environment of compounds and trace substitutes, very suitable to study the active optical centers usually found in pigments and mineral crystals. PIGE follows a similar mechanism operating at nuclear level.

The applications of IBA techniques to the study of Cultural Heritage objects are as varied as the objects themselves. Until now, different objects were studied using the microprobe (under vacuum and also in external conditions) located at ITN-IST [1]. Some examples are tiles, stained glasses, jewellery,

paintings and ceramics (figure 1) showing the versatility of the set-up since different detectors, software and experimental conditions were used to study each specific case. Also they can be used as complementary technique to the diagnosis of pathologies, for example in ceramic tiles.

Knowing the composition of an object is extremely important for conservation purposes, dating or attribution processes, etc. considering that along centuries the fabrication procedures and the elements used were modified. Furthermore, the trace element concentration can, in some cases, indicate the provenance or relate it with other objects of the same type. Finally, the possibility to analyze and identify corrosion products is also important, in order to better understand the mechanisms of degradation, which is essential for their preservation for the present and future generations.



Fig. 2: Photograph during the experiments with the proton beam using the external set-up. Object: Roman glass.

V. Corregidor and S. Cabo Verde acknowledge the support from FCT-Ciência program.

Part of this work was developed within the projects POCI/CTM/60685/2004 and RADIART PTDC/HIS-HEC/101756/2008 financed by FEDER and FCT.

[1] Corregidor, V., Alves, L.C., Rodrigues, P.A., Vilarigues, M. and Silva, R.C., *e-conservation magazine*. 22 (2011), 40-52

SCINTILLATORS APPLIED IN NEUTRON IMAGING TECHNIQUES

M. A. STANOJEV PEREIRA, J. G. MARQUES, C. BURBIDGE AND J. P. SANTOS

Instituto Superior Técnico/Instituto Tecnológico e Nuclear (IST/ITN) - Universidade Técnica de Lisboa
(mstanojev@itn.pt)

Introduction: The neutron imaging techniques (NIT) are a non - destructive testing techniques commonly employed to inspect the internal structure of objects. Because of the neutron - matter interaction characteristics, this technique is largely employed to inspect light substances even when these are surrounded by metallic layers which would make them invisible under X-ray imaging. Thus, the neutron imaging techniques find applications in the technological fields of the automotive, nuclear and aerospace industries, as well as in medicine, archeology, biology and geology. The radiography is obtained by irradiating the object in a uniform neutron beam and a converter screen transforms the transmitted neutron intensity into ionizing radiation which is able to sensitize a film forming the image. The screens consist of strongly neutron absorbing elements (gadolinium, dysprosium, lithium) and the films are the conventional for X-ray films and the track-etch foils. Alternatively, neutron scintillators are also used as converter and in this case the light emitted sensitize either a film or the CCD of a video camera. In the last case the radiography image can be obtained in real-time. For both cases the radiographs are 2-D projections of the internal structure of the object.

Among the many technical efforts to improve the neutron imaging methods, the employment of digital systems for image acquisition and processing is the best option in terms of image quality. Another very important technical effort which spread the use of the neutron imaging around the world was the development of neutron tomography systems to provide a 3-D view of the internal structure of the object under investigation. Basically these systems consist of an automated rotating table able to rotate an object between 0 and 360 degrees, associated to a real-time neutron imaging system and to softwares for image processing, reconstruction and visualization.

The neutron tomography setup of IST/ITN was installed in 2008 in the horizontal access of the thermal column of the 1MW Nuclear research reactor, and is operational since 2009 and being used for multipurpose applications, especially in samples of interest of the cultural heritage. The IST/ITN tomography system consists of a water cooled CCD digital video camera, which captures an image from LiF scintillator which is reflected by a 45° mirror, with respect to the neutron beam, to keep the camera

out of the neutron beam. The camera is also coupled to a high performance computer and to a rotating table making the system automated. The images are formed by the neutron transmitted by the sample in a LiF converter. In the present two softwares are employed: Octopus and VG Studio for image reconstruction and for 3-D visualization respectively.

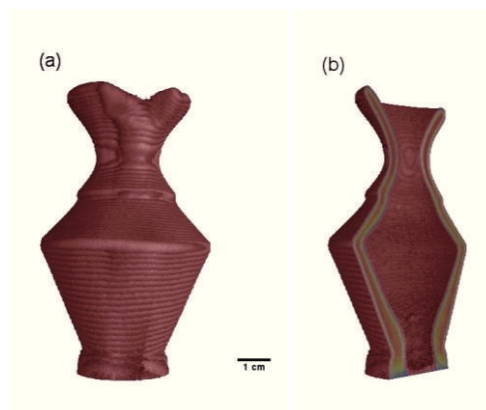


Figure 4: 3-D Ceramic vessel image. Original aspect (a), transverse section (b).

References:

- Prudêncio, M.I., Stanojev Pereira, M. A., Marques, J.G., Dias, M.I., Esteves, L. Burbidge, C.I., Trindade, M.J., Albuquerque, M.B. (2011) Neutron tomography for the assessment of consolidant impregnation efficiency in Portuguese glazed tiles (16th and 18th centuries). *Journal of Archaeological Science*, Vol. 39, 4 [964-969].
- Stanojev Pereira, M.A., Prudêncio, M.I., Marques, J.G., Figueiredo, M.O., Dias, M.I., Silva, T.P., Esteves, L., Burbidge, C.I., Trindade, M.J. and Albuquerque, M.B.(2011) Tomografia de neutrões aplicada a azulejos do séc. XVII – visualização para caracterização, diagnóstico e optimização de técnicas de conservação. *IX Congresso Ibérico de Arqueometria*, CIA-IX, 26 -28 Outubro, Lisboa, Portugal.
- Stanojev-Pereira, M.A., Madeira, T.I., Le Gac, A., Santos, J. P., Candeias, A., Carvalho, M.L., Marques, J.G. (2012). Neutron Tomography applied to a wax cast figurine. *2nd International Workshop Centro de Física Atómica, Universidade de Lisboa* – 4th and 5th June.

39th International Symposium on Archaeometry

28 May - 1 June 2012
Leuven, Belgium



Programme and Abstracts

Organizing Institutions

KU Leuven
Departement of Earth and Environmental Sciences
Centre for Archaeological Sciences
Divison Geology

V80 Portuguese Glazed Tiles (16th-18th Centuries): INAA, XRD and Luminescence for Raw Materials Characterization and Production Technologies of the Ceramic Bodies, and Chronology

M. Isabel Prudêncio^{1,2}, M. Isabel Dias^{1,2}, Christopher I. Burbidge^{1,2}, Lurdes Esteves³, M. José Trindade^{1,2}, Rosa Marques^{1,2}, Guilherme Cardoso¹ and Dulce Franco¹

¹ Instituto Tecnológico e Nuclear, Estrada Nacional 10, 2686-953 Sacavém, Portugal

² GeoBioTec—GeoBiociências, GeoTecnologias e GeoEngenharias (Foundation for Science and Technology), Univ. Aveiro, Campus de Santiago, 3810-193 Aveiro, Portugal

³ Museu Nacional do Azulejo, Rua da Madre de Deus 4, 1900-312 Lisboa, Portugal

iprudenc@itn.pt

Glazed tiles (“azulejos”) are everywhere in Portugal, decorating walls of churches, monasteries and palaces as well as ordinary houses. The cultural materials to be studied in this work are ancient glazed tiles (16th-18th centuries) belonging to the Museu Nacional do Azulejo (Lisboa) and coming from Lisbon and vicinities.

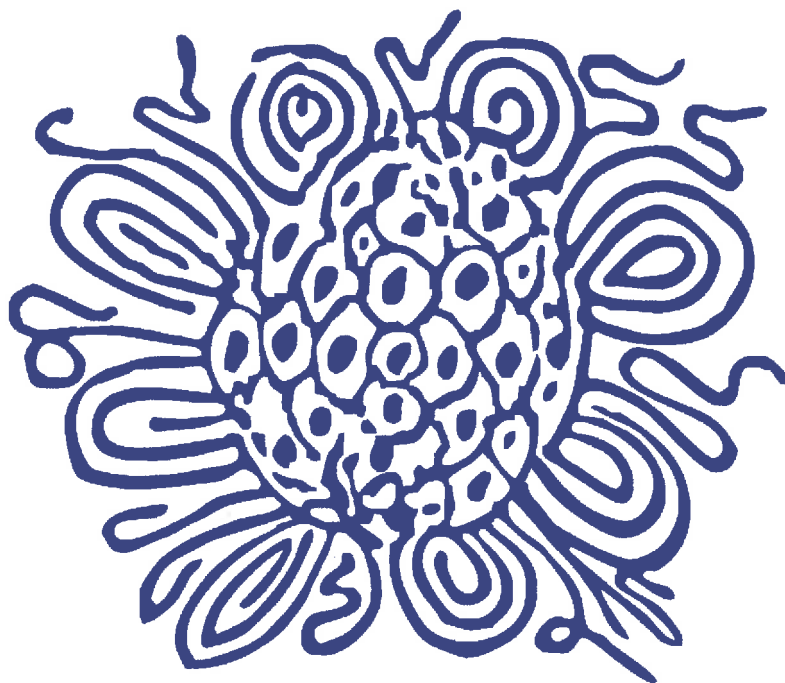
The highlight of the Museu Nacional do Azulejo (MNA) is a blue and white composition of 1300 tiles, 23m in length, of Lisbon's cityscape (“Grande Panorama de Lisboa”). It was made around 1700, prior to the Great Earthquake (1755), and reputedly the country's longest tile piece (see figure).

Chemical analyses are done by instrumental neutron activation analysis (INAA) using the Portuguese research reactor (RPI, Sacavém); XRD measurements were performed by using a Philips X'Pert Pro diffractometer; and dating by luminescence techniques.

The main goals of this work are the determination of the raw materials variability for the production of the tiles to be painted by the artists of those times, and the technologies of production of the ceramic bodies. The results obtained so far point to several raw materials used in the workshops to produce tiles of different qualities for painting purposes. Among the glazed tiles studied, a special attention is paid to the “Grande Panorama de Lisboa”, classified as national treasure.

This work was conducted as part of the FCT funded Project: RADIART, PTDC/HIS-HEC/101756/2008.





1º CONGRESSO INTERNACIONAL DE FAIANÇA
PORTUGUESA

Museu Nacional de Arte Antiga
22 a 25 de Maio de 2013

Lisboa

paper tests this hypothesis by exploring the blending or creolization of colonial pottery traditions in the former British colonies of Massachusetts and New Hampshire.

The SK bowls (Ferryland – Newfoundland)

Tânia Manuel Casimiro (Instituto de Arqueologia e Paleociências da Universidade Nova de Lisboa)
Barry Gaulton (Memorial University Newfoundland)

Nos últimos anos têm sido recuperadas consideráveis quantidades de faiança Portuguesa nas colónias inglesas localizadas na Terra Nova (Canadá), parecendo tratar-se de um comércio intenso e organizado, algo que parece distinguir este territórios das demais colónias inglesas. Esta conclusão é retirada não apenas na variedade e no longo espectro cronológicas das cerâmicas ali recuperadas, mas igualmente nas evidências documentais proporcionadas pelos registos portuários.

Dos achados mais emblemáticos trata-se de conjunto de taças e pratos com as iniciais S.K. recuperados em Ferryland. A ideia de que as iniciais presentes na faiança portuguesa correspondem a marcas de pertença foi avançada por diversos autores desde finais do século XIX, no entanto, pela primeira vez é possível colocar um indivíduo por detrás destes objectos atendendo que todos eles fora, recuperados no interior e imediações da casa de Lady Sarah Kirke, comprovando assim não apenas que a produção de faiança em Portugal era feita sob encomenda, mas igualmente que essas encomendas não se destinavam apenas ao mercado nacional.

A chemical study of Portuguese archaeological faience by INAA as a valid tool to investigate provenance

Maria Isabel Dias (Campus Tecnológico e Nuclear, Instituto Superior Técnico)
Maria Isabel Prudêncio (Campus Tecnológico e Nuclear, Instituto Superior Técnico)
Alexandre Pais (Museu Nacional do Azulejo)
A. Luísa Rodrigues (Campus Tecnológico e Nuclear, Instituto Superior Técnico)
Rosa Marques (Campus Tecnológico e Nuclear, Instituto Superior Técnico)

In the frame of a FCT research project national movable assets of various types and chronologies were studied in an interdisciplinary point of view. In this work, particular emphasis will be done to early Portuguese faience (XVII – 1st half XVIII cent.). Our main purpose is to obtain a more precise understanding of Lisbon and Coimbra faience productions from XVII to the 1st half XVIII cent., with the compositional-based differentiation of faience collected in archaeological excavations from Lisbon and Coimbra, contributing to the establishment of compositional (chemical) reference groups of each production. This will enable to contribute for further studies, i.e. by knowing the chemical “signatures” of faience that was exported to areas outside of Portugal, such as Holland, Belgium (Antwerp), Germany (namely Hamburg) and Americas (Brasil, Venezuela, United States). Chemical analyses were done by instrumental neutron activation analysis (INAA) of around 100 faience sherds. Core samples were taken from the ceramic body (avoiding contamination from the surface layers) for analysis. The concentration of the following elements were determined: Na, K, Fe, Sc, Cr, Co, Zn, As, Ga, Br, Sb, Rb, Cs, Ba, La, Ce, Nd, Sm, Eu, Tb, Yb, Lu, Hf, Ta, Th, U.

The results allowed to clearly distinguish in a geochemical point of view the production of faience of Coimbra from that of Lisbon. Coimbra production have higher contents of rare earth elements particularly light rare earth elements, U and Th, and lower cerium anomaly, pointing to the use of raw materials resources from the regional Meso-Cenozoic. In the Lisbon faience studied, two main chemically differentiated productions were identified from the same chronological period, probably pointing to the two main known faience production centers: occidental and oriental Lisbon.

Book of Abstracts



ISEAC-37

37th International Symposium on Environmental Analytical Chemistry

analytikjena



ENVIRONMENTAL EFFECTS ON GLAZED CERAMICS: GREEN STAINS IN 18th CENTURY BLUE-AND-WHITE PORTUGUESE TILE GLAZES

T.P. Silva^{1,*}, M.O. Figueiredo², A. Barreiros³ and M.I. Prudêncio⁴

¹ LNEG - Laboratório Nacional de Energia e Geologia I.P., Unity of Mineral Resources and Geophysics
P.O. Box 7586, PT-2721-866 Alfragide, Portugal

² New University of Lisbon, Faculty of Science and Technology, Materials Science Department, CENIMAT/ISN
PT-2829-516 Caparica, Portugal

³ LNEG - Laboratório Nacional de Energia e Geologia I.P., Unity of Product Engineering
Estrada do Paço do Lumiar 22, PT-1649-038 Lisbon, Portugal

⁴ ITN - Nuclear and Technologic Institute
Estrada Nacional 10, PT-2686-953 Sacavém, Portugal

* teresa.pena@lneg.pt

ABSTRACT

Ancient ceramic tiles exposed to environmental conditions are liable to the development of micro-organisms that give rise to various pathologies and ultimately, to severe degradation. Decorated tiles are particularly vulnerable to environmental effect whenever exposed, as in the case of an 18th century blue-and-white Portuguese tile panel called “Cura do Cego”, belonging to the collection of the National Tile Museum (MNAz), where green stains are nowadays observable in the glaze.

The present work reports a prospective diagnosis of this green tarnishing. Chemical characterisation of the tile glaze was performed by irradiating small tile fragments in a wavelength-dispersive X-ray fluorescence spectrometer and phase constitution was concomitantly assessed using a powder diffractometer. Scanning electron microscopy with energy-dispersive system was applied to infer the chemical changes induced in the glaze and tentatively observe the morphology of green-staining micro-organisms.

Such tile pathologies are particularly suitable for testing an innovative non-destructive decontamination technique applying gamma radiation. Preliminary results of this study are reported and discussed.

Acknowledgement. Work developed under project RADIART (PTDC/HIS-HEC/101756/2008), financed by the Portuguese Foundation for Science and Technology (FCT/MCTES).



2013 Spring Meeting

Congress Center - Strasbourg, France

May 27th - 31st, 2013

30
YEARS

ANNIVERSARY

www.european-mrs.com

Strasbourg
the **eu**roptimist



PROGRAM VIEW : 2013 Spring

MY PROGRAM : 2013 Spring

Symposium : Y

WORKSHOP - Protecting and securing our cultural heritage: diagnostics, characterization, conservation and restoration

27 May 2013	28 May 2013	29 May 2013
-------------	-------------	-------------

hide a

Subject

Num.

Session: Diagnostics and Characterization : Michael Stuke

12:00

Diagnostics of glaze pathologies in ancient (XVII-XVIII cents.) decorative blue-and-white ceramic tiles with the aim of implementing innovative conservation techniques**Authors :** Teresa P. Silva, Maria-Ondina Figueiredo, Maria-Alexandra Barreiros, Maria-Isabel Prudêncio**Affiliations :** LNEG, Unity of Mineral Resources and Geophysics, Estrada da Portela, Apt. 7586, 2610-999 Amadora, Portugal; CENIMAT / I3N, Mat. Sci. Dept., Fac. Sci. Technol., New Univ. Lisbon, 2829-516 Caparica & LNEG, Unity of Mineral Resources and Geophysics, Apt. 7586, 2610-999 Amadora, Portugal; LNEG, Unity of Product Engineering, Estrada do Paço do Lumiar, 22, 1649-038 Lisboa, Portugal; ITN/IST, Instituto Tecnológico e Nuclear, Instituto Superior Técnico, Universidade Técnica de Lisboa, EN 10, 2686-953 Sacavém, Portugal**Resume :** Decorative panels of ceramic glazed tiles configure a valuable cultural heritage in Mediterranean Countries and their preservation requires the development of a systematic scientific approach. Environmental conditions are responsible for the degradation of exposed ancient tile panels originating various pathologies, namely related with the development of micro-organisms and resulting in a very common effect observed nowadays in panels manufactured centuries ago - glaze surface staining. The present work describes a study about the nature of green stains appearing at the surface of Portuguese blue-and-white tile panels from the XVII-XVIII centuries, namely Vista de Lisboa (depicting the city before the great destruction caused by the 1755 earthquake) and Cura do Cego, both belonging to the collection of the National Tile Museum (MNAz) in Lisbon. Tile fragments were directly irradiated using non-destructive but invasive techniques - X-ray fluorescence spectrometry with a wavelength-dispersive system (WDXRF) for chemical characterization of the tile glaze and X-ray powder diffraction (XRD) to assess the phase constitution of both the glaze and the ceramic body. Obtained results are reported and discussed, as a preliminary step for testing an innovative decontamination technique, particularly suitable for overcoming such tile pathologies, making use of gamma radiation.

2 4

add to my program

(close full abstract)

12:20

Lunch

Session: Conservation and Restoration : Giacomo Chiari

14:30

Novel approach of mural painting materials identification by LIBS (Laser Induced Breakdown Spectroscopy)**Authors :** V. Detalle (a)*, S. Grégoire (a,d), F. Surma (b), V. Motto-Ross (c), F. Pelascini (d), D. Syvilay (a), Stéphanie Duchêne (a)**Affiliations :** (a) Laboratoire de Recherche des Monuments Historiques, 29 rue de Paris, 77420 Champs-sur-Marne, France (b) EPITOPOS, 19 rue de Saint-Junien, 67300 Schiltigheim, France (c) Université de Lyon, F-69622, Villeurbanne, CNRS, France (d) Centre Régional d'Innovations et de Transfert de Technologies Matériaux Alsace, 19 rue de Saint-Junien, 67300 Schiltigheim, France *corresponding Author

3 1

Resume : Libs (Laser Induced Breakdown Spectroscopy) is well known as elemental techniques for detection of solids, liquids or gas. However, it can be used for molecular characterization and some new application can be approached by this way. The laboratory of historical monuments (LRMH, France) was the first laboratory depending from the French Ministry of Culture to develop (LIBS) in order to identify