

Studies in Heritage Glazed Ceramics

On the origin of majolica
azulejos production in Portugal



1

February
2019

ISBN
978-972-49-2307-9

Studies in Heritage Glazed Ceramics

**On the origin of majolica
azulejos production in Portugal**

No. 1 | February 2019

This number is published within the FCT-AzuRe (PTDC/EPH-PAT/5096/2014) project funded by the Portuguese Foundation for Science and Technology.



LABORATÓRIO NACIONAL
DE ENGENHARIA CIVIL



**PATRIMÓNIO
CULTURAL**
Divisão de Património Cultural



FCT Fundação
para a Ciência
e a Tecnologia

Site: <http://glazedceramics.lnec.pt/>

Legal Notice

The views expressed in the papers published are the sole responsibility of the authors.

Copyright © LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL, I.P.
Divisão de Divulgação Científica e Técnica
AV DO BRASIL 101 • 1700-066 LISBOA
e-e: livraria@lnec.pt
www.lnec.pt

Publisher: LNEC

Collection: Studies in Heritage Glazed Ceramics

Series: SHGC 1

1st. edition: 2019

Printing: 100 copies

Descriptors: Azulejo / Historic heritage / Glazed ceramics / Manufacture / Physical-chemical characterization / PT

Descritores: Azulejo / Património histórico / Cerâmica vidrada / Fabrico / Caracterização físico-química / PT

CDU 691.833"15"(469)

691.434"15"(469)

ISBN 978-972-49-2307-9

CONTENTS

The beginning of the production of majolica azulejos in Portugal – João and Filipe de Góis in 16 th century Lisbon	1
<i>Alexandre Pais, Maria da Conceição Reis, Joana Campelo, João Manuel Mimoso, Miguel Ângelo Silva</i>	
A comparison of the earliest faience tiles produced in Lisbon with earlier and later types	25
<i>João Manuel Mimoso, Sílvia R. M. Pereira, Alexandre Pais, Maria Augusta Antunes, Ana Margarida Cardoso, Maria de Lurdes Esteves, António Candeias</i>	
Study of the azulejo panels in Graça church signed by João de Góis	47
<i>Alexandre Pais, João Manuel Mimoso, Maria de Lurdes Esteves, Miguel Ângelo Silva, Ana Margarida Cardoso, Maria Augusta Antunes, Sílvia R. M. Pereira, António Candeias</i>	
The 16 th century Nativity azulejo panel called “de Nossa Senhora da Vida” ...	67
<i>Alexandre Pais, João Manuel Mimoso, Victor Filipe, Maria de Lurdes Esteves, Maria Antónia Pinto de Matos</i>	
Analytical study of the 16 th century azulejo panel “Nossa Senhora da Vida” and related archaeologic findings	77
<i>João Manuel Mimoso, Alexandre Pais, Victor Filipe, Maria de Lurdes Esteves, Sílvia R. M. Pereira, Maria Antónia Pinto de Matos, Ana Margarida Cardoso, António Candeias</i>	
A research on the azulejo panels of the São Roque chapel in Lisbon	93
<i>João Manuel Mimoso, Alexandre Pais, Teresa Morna, João Miguel Simões, Maria de Lurdes Esteves, Ana Margarida Cardoso, Sílvia R. M. Pereira, António Candeias</i>	
A technical comparison of three renaissance azulejo panels from the workshops of Lisbon	113
<i>João Manuel Mimoso; Sílvia R. M. Pereira; Alexandre N. Pais; Maria Augusta Antunes; Ana Margarida Cardoso; Maria de Lurdes Esteves; António Candeias</i>	

PREFACE

Tin-glazed wares originated in the Middle East when potters began opacifying transparent glazes to mask the ceramic bodies underneath. The white glazes were decorated with pigments in increasingly creative patterns and the new technique was applied to a wide range of architectural finishes and decorative objects. In Islamic countries, glazed ceramic tiling decorated with intricate geometric patterns and Arabic writing was for centuries, and still is, in widespread use, becoming one of the most distinctive decorations that characterize the splendour of the mosques.

The majolica technique was brought to Europe with the spread of Islam to the Iberian Peninsula and the production was established in centres such as Malaga and Valencia and from there exported to Italy where it was perfected and took roots. By 1500 the great Italian masters were producing majolica showpieces that were the pride of the rich and powerful, creating a market that led to its spread throughout Europe.

In the 16th century glazed ceramic tiles were used as decorative panels or as floor and wall finishes in many European countries such as Portugal where, during the following century, azulejos developed as a preferred architectural decoration, becoming ubiquitous in palaces, churches, gardens and bourgeois houses. The widespread use of cobalt blue painting over the white staniferous azulejo glazes took roots in Portugal after the Dutch inspired their designs in Ming porcelain brought to Europe through the China trade routes. Such decorations are readily associated to the Baroque architecture of Portugal and Brazil and became a very relevant part of the national cultural heritage. Glazed ware evolved in quality and sophistication during the same period, often stimulated by the challenge of duplicating the appeal of the peerless Chinese porcelain and the word *faience* testifies to the rise of Faenza as a source of quality glazed earthenware.

Although historic glazed ceramics are remarkable by their architectural applications and as the material support of decorative and artistic artefacts that are today the pride of museums and private collections, there have been few periodic scientific publications solely devoted to research results in the field. *Studies in Heritage Glazed Ceramics* is published twice a year in English by *Laboratório Nacional de Engenharia Civil* (LNEC) and aims to offer researchers a choice peer-reviewed medium for scientific results pertaining to glazed ceramics in general with a particular emphasis on analytical investigation, conservation issues and historical studies and very specially welcoming to multidisciplinary research in the field.

LNEC is presently involved in Project *FCT-AzuRe* in partnership with *Direcção Geral do Património Cultural* (DGPC – the Portuguese General Directorate for Cultural Heritage) through *Museu Nacional do Azulejo* (MNAz – the National Azulejo Museum) and *Laboratório José de Figueiredo*, and with University of Évora through its *Laboratório HERCULES*. The Project aims to contribute to technical and historical knowledge about Portuguese azulejos and is funded by Fundação para a Ciência e a Tecnologia (FCT), the Portuguese Foundation for Science and Technology. The first three numbers of *Studies in Heritage Glazed Ceramics* will be individually themed and dedicated to research results of that Project.

Therefore, LNEC presents this first number dedicated to the early *faience* azulejo production in Portugal with articles individually devoted to a known workshop master and to some of the most representative and important azulejo panels by the workshops of Lisbon in the second half of the 16th century. The corpus of articles presents results of the application of a comprehensive research methodology in the field, aiming to support in solid scientific foundations a broader knowledge about one of the most prized heritages of Portugal.

The Editors

EDITORS

João-Manuel Mimoso (LNEC), Alexandre Nobre Pais (MNAz), José Delgado Rodrigues (LNEC) & Sílvia R.M. Pereira (HERCULES & LNEC)

EDITORIAL BOARD

(An international Board of experts will be made public in early 2020)

SCOPE

Studies in Heritage Glazed Ceramics is dedicated to the results of scientific studies in the field with a particular emphasis on analytical results, conservation issues and historical studies and very specially to multidisciplinary research in the domain.

The contents will include:

- Archaeometry studies, namely the application of analytic methods to the identification of materials and the establishment of technologies, provenance or the setting of chronologies;
- The artistic and historical context of productions, materials and evolving technologies, as well as the origin, preparation and trade routes of pigments and other raw materials;
- Decay of glazed ceramics, techniques and materials for conservation;
- Other innovative research results in the field.

HOW TO CITE

Authors, Title, *Studies in Heritage Glazed Ceramics*, No 1, LNEC, Lisbon, Portugal, 2019.

The beginning of the production of majolica azulejos in Portugal - João and Filipe de Góis in 16th century Lisbon

Alexandre Pais, Maria da Conceição Reis, Joana Campelo, João Manuel Mimoso, Miguel Ângelo Silva

ABSTRACT

The names of João and Filipe de Góis and their connection to the production of glazed ceramics and azulejos in the third quarter of the 16th century were already known and had already been documented. However, there was not a single work that could be objectively associated with any of them. The discovery of the monogram of João de Góis in the remaining azulejos from incomplete panels in the Igreja da Graça (Graça Church), in Lisbon, changed our perception about the importance of these two men in the beginning of the manufacture of majolica azulejos in Portugal.

This paper includes a transcription to modern Portuguese of the full documents from the archives of the Holy Inquisition of Lisbon relative to the two brothers with some notes in English about the most relevant parts for the history of the early production of majolica azulejos in Lisbon.

RESUMO

Não obstante os nomes de João e Filipe de Góis e a sua relação com a produção da faiança vidrada e azulejos no 3^o quartel do século XVI serem já conhecidos através da descoberta de documentos que os mencionam, não se conhecia nenhuma obra que lhes pudesse ser associada com segurança. A descoberta do monograma de João de Góis no remanescente incompleto dos painéis de azulejos que se podem ver num dos espaços da Igreja da Graça, em Lisboa, alterou a nossa percepção acerca da importância destes dois homens, que agora sabemos serem irmãos, para o início da manufatura de azulejos de faiança em Portugal.

Este texto inclui transcrições em português moderno dos dois documentos da Santa Inquisição de Lisboa sobre João e Filipe de Góis bem como um conjunto de comentários interpretativos das partes importantes para a história do início da produção de azulejos de faiança em Portugal.

Alexandre Pais

Museu Nacional do Azulejo, Lisbon, Portugal, apais@mnazulejo.dgpc.pt

Maria da Conceição Reis

Documentary researcher, palaeographer, Lisbon, Portugal

Joana Campelo

Laboratório José de Figueiredo, Lisbon, Portugal

João Manuel Mimoso

LNEC - Laboratório Nacional de Engenharia Civil, Lisbon, Portugal

Miguel Ângelo Silva

Igreja da Graça, Lisbon, Portugal

KEYWORDS: Renaissance majolica / Early Portuguese azulejos / Holy Inquisition / João de Góis / Hans Goos / Jan Goos / Filipe de Góis / Flemish in 16th century Lisbon

ACKNOWLEDGEMENTS

Thanks to our colleagues in Belgium (Claire Dumortier) and Holland (Kate van Lookeren Campagne and Corrina de Regt) for valuable information.

Communication produced as an outcome of Project FCT-AzuRe - Estudos no Azulejo Português para Candidatura a Património da Humanidade (PTDC/EPH-PAT/5096/2014) funded by FCT, the Portuguese Foundation for Science and Technology.

LNEC Research Project 0202/111/19747.

Aviso legal

As opiniões manifestadas no *Studies in Heritage Glazed Ceramics* são da exclusiva responsabilidade dos seus autores.

Legal notice

The views expressed in the *Studies in Heritage Glazed Ceramics* are the sole responsibility of the authors.

1. PROCESS AGAINST JOÃO DE GÓIS

The following text is a transcription to modern Portuguese of the full document [1] of the Holy Inquisition process against João de Góis. However, the distinctive semantics of the time, the varying use of capitals, the names of persons or places were maintained as in the original. Some sentences, considered more important for the purposes of this paper, were highlighted in boldface and translated, commented or given possible interpretations in footnotes. Of particular importance are points that may contribute towards the elucidation of the early production of faience azulejos in Lisbon. The text is complemented by a number of notes at the end of this section.

START OF THE TRANSCRIPTION

Joam de Goes flamengo

Processo de Joam de Goes flamengo de nação malegueiro de azulejos, morador em esta cidade preso no cárcere da Santa Inquisição

Procurador do Réu ----- O Licenciado António Pires

Os Inquisidores Apostólicos em este Arcebispado de Lisboa e sua comarca etc^a mandamos a vós Damiam Mendes meirinho da Santa Inquisição que prendais a um Joam de Maram francês serralhador que trabalha na Rua Nova e vive na Rua da Silvestra que é na Sombreira e é homem de mais de trinta anos de barba preta e muito grande e anda vestido de preto com seu chapéu. **E aí prendereis a Joam de Goes flamengo oleiro d'azulejos e malegueiro, homem de corpo pequeno de pouca barba e loura comprida e da idade de trinta anos** e anda contratado e morava além de Santos o Velho passando as casas de Beatriz Filipe em casas de Bernaldo Corte Real. E presos e a bom recado os trareis ao cárcere deste Santo Ofício e entregareis ao Alcaide dele por culpas que deles há em este Santo Ofício.

Feito em Lisboa aos 28 dias do mês de Julho. Ano de mil quinhentos e sessenta e um anos¹

Jorge Gonçalves Rebelo Ambrosio Campelo doutor

Aos vinte e nove de Julho de mil quinhentos e sessenta e um anos em Lisboa foi entregue a Pedro Fernandes alcaide do cárcere Joam de Goes flamengo conteúdo em todos autos e por que se houve dele por entregue assinou aqui Manuel Cordeyro o escrevi

Pedro Fernandes ... 1561

1 This is the order to arrest João de Góis (in 16th century orthography referred to as both "Joam de Goes" and "Joam de Guoes") in which, interestingly, he is noted as "oleiro d'azulejos e malegueiro" (potter of azulejos and faience). This order, dated July 28, 1561, is a very early instance when "potter of azulejos" is used in Portugal to describe a profession (another is in the statement of the man who denounced him four days earlier). Since it aimed to describe the accused for the purposes of identification (to which was added a physical description as a small man with a long thin blond beard) we have to conclude that the profession was, by that time, already established and the appellation was meaningful enough to be generally understood.

Culpas do processo de Ruy Gomez, boticário

Aos 24 dias do mês de Julho 1561 anos em Lisboa na casa do despacho da Santa Inquisição estando aí os Senhores Inquisidores mandaram vir perante si a Ruy Gomez cristão novo preso no cárcere do Santo Ofício por ele pedir audiência e lhe deram juramento dos Santos Evangelhos em que pôs sua mão e prometeu dizer verdade e dizer que era lembrado que estando ele em sua casa em cima na sobreloja da sua botica **veio aí ter avia quatro anos pouco mais ou menos** um homem flamengo que se chama Joam de Goes oleiro de Málaga e azulejos do qual **ele declarante dantes tinha conhecimento por lhe fazer a sua botica**² e estando ele à mesa comendo uma pouca de abóbora ou outra coisa de dieta por estar mal disposto o dito Joam de Goes ouvindo isto em dia que se não comia carne lhe disse por que não comia carne e ele alevantando-se lhe disse que a não comia por que não era luterio porque os luterios diziam que se podia comer carne em tempo vedado dizendo ele declarante muito mal dos luterios e que eram uns tão e quanto e que afirmavam muitas errôneas e heresias e que a isto lhe respondeu o dito Joam de Goes dizendo que cuidais vós que são os luterios. Os luterios não são bestas nem pedras confessam a nosso Senhor Jesus Cristo mas dizem que nosso Senhor não é como os outros reis que esperam que lhes falem por terceiras pessoas dizendo rogai a Joam que fale a Joam e que diziam também que os santos não se haviam de chamar santos por que haviam sido homens e haviam de ir em corpo e em alma ouvir sua sentença ao dia do Juízo dizendo mais que diziam os luterios que não devia de haver clérigos nem frades por que tudo se fazia por dinheiro em Roma e que se gastavam as rendas das igrejas que eram rendas de pobres em sustentamento da corte romana e assim lhe falou outras cousas das opiniões dos luterios de que ele declarante ao presente não se lembrava dizendo-lhe o dito Joam de Goes estas cousas com a eficácia e aviso de homem que as aprovava e folgava com elas dizendo: vós cuidais os luterios são tão e tão particularizando as cousas que acima são ditas e ele declarante lhe não respondeu nada a isto saindo e baixando a cabeça mostrou como que se espantava daquilo e que estavam sós quando isto se passou e declarou que quando o dito Joam de Goes lhe perguntou por que não comia carne sendo o dia que era por lhe parecer a ele declarante que tinha alguma cousa deles por lhe por dito que andava em Alemanha e em outras partes lhe disse mal dos luterios para ver o que lhe a isto dizia e que estando ele declarante aí ora em este cárcere e estando em sua companhia alguns estrangeiros que diziam que eram acusados destas cousas lhe lembrou o que tem dito que passou com o dito João de Goes e por lhe parecer que estava obrigado ao dizer o diz para descargo de sua consciência. E que o dito **Joam de Goes flamengo é pequeno de corpo e de pouca barba e loura e pequena de idade de trinta anos** homem que anda bem tratado e morava ao tempo que prenderam a ele declarante além de Santos o Velho passando as casas de Beatriz Filipe em as casas de Bernaldo Corte Real **e que está agora casado**³

2 Rui Gomes, a Jewish convert, himself in the prison of the Inquisition, offers in July 24, 1561 to expose João de Góis for views (such as suggesting him to eat meat in a holy day, about four years before) that could indicate he was actually a Lutheran. This man identifies João de Góis as a “potter of faience and azulejos” and declares to know him because he had manufactured jars for his pharmacy. From this we conclude that João de Góis had been active in Lisbon as a potter of faience since at least around 1556.

3 Rui Gomes gives here the description of João de Góis used four days later on the order for his arrest and states that he lives in Santos-o-Velho (a part of Lisbon noted for its potter workshops) is (around) thirty years old and that he is *now* married (implying that he married recently).

e al (e mais) não disse e do costume disse que eram amigos e assinou aqui juntamente com eles Senhores Inquisidores Manuel Cordeyro o escrevi

Perguntação de Ruy Gomes

Aos vinte e um dias do mês de Agosto de mil quinhentos e sessenta e um anos em Lisboa na Casa do Despacho da Santa Inquisição estando aí os Senhores Inquisidores mandaram vir perante si a Ruy Gomez cristão-novo preso no cárcere do Santo Ofício testemunha da Justiça. E lhe deram juramento dos Santos Evangelhos em que pôs sua mão e prometeu dizer verdade pelo dito juramento lhe foi feita pergunta se era lembrado dizer em sua confissão alguma cousa do réu Joam de Goes flamengo. E se era o que disse. Dissera e por ele já foi dito que lembrado era dizer em sua confissão o que passara com o dito réu Joam de Goes e logo disse em sustância o que com ele passara e que pedia a suas mercês lhe mandassem em a dita sua confissão e que falara no dito réu para assentar na verdade. E sendo-lhe lido tudo e por ele testemunha entendido disse o dito Ruy Gomez que aquela era sua confissão e testemunho e que nele se afirmava e ratificava e de novo dizia se necessário fosse por tudo o conteúdo em sua denúncia e testemunho ser verdade e ao costume disse o que dito se costuma aqui. Estiveram presentes por honestas e religiosas pessoas que tudo viram e ouviram os Reverendos padres frei Hieronymo de Lys e frei Ayres Correa ambos sacerdotes de missa e pregadores da Ordem do bem aventurado padre São Domingos que prometeram ter segredo e assim o juraram e assinaram aqui juntamente com eles os Senhores Inquisidores Manuel Cordeyro o escrevi

Frei Jerónimo de Lys

Rui Gomes

frei aires correa

Jorge Gonçalves Rebelo

Ambrosius doctor

Depois de ida a dita testemunha disseram os Reverendos padres sendo perguntados que lhes parecia que falava verdade a dita testemunha e tornaram a assinar o que Cordeyro o escrevi

Frei Jerónimo de Lys

frei aires correa

Pareceu na mesa que este Joam de Goes flamengo oleiro d'azulejos conteúdo na denúncia atrás fosse chamado pessoalmente ao Santo Ofício e examinado pela informação que contra ele resulta e confessando se visse sua confissão para ver o que no caso se devera de fazer. E negando que ficasse preso no cárcere para dele se livrar das ditas culpas e informação que contra ele há vista a qualidade do dito caso. Em Lisboa XXVIII de Julho de 1561. E logo no dia seguinte chamado foi examinado e por negar ficou preso no dito cárcere e se fez disso esta lembrança para em todo tempo disso constar

Ambrosius doctor

Jorge Gonçalves Rebelo

Perguntação do Réu

Aos XXIX dias do mês de Julho de mil quinhentos e sessenta e um anos em Lisboa na Casa do Despacho da Santa Inquisição estando aí os Senhores Inquisidores mandarão vir perante si a Joam de Goes **flamengo de nação natural d' Emues**⁴ malegueiro de azulejos morador em esta cidade **no Forno de vidro**⁵ e aí casado com uma **francesa de Taçim do Rei francês**⁶ e lhe deram juramento dos Santos Evangelhos em que pôs sua mão e prometeu dizer verdade e foi o Réu trazido ao cárcere do Santo Ofício e aí respondeu. E o admoestaram que dissesse a verdade de tudo o que fosse perguntado e assim o prometeu. E lhe fizeram pergunta se ele trazia sua consciência encarregada com alguma cousa que tivesse crida dita comunicada e praticada da seita luterana contra nossa Santa Fé Católica e contra o que diz e tem a santa madre Igreja de Roma. E por ele foi dito que não sentia sua consciência encarregada somente em uma cousa a qual é que havia dois anos que dormindo ele um dia de entrudo em casa de uma mulher solteira e alevantando-se já dia de Cinzas da cama para lavar as mãos achou um pedaço de carne na cantareira fria e partiu um pedaço de pão e comeu a dita carne no dito dia a qual seria tamanha como uma laranja a qual era carne de carneiro. E que **disse a um seu irmão mais moço que aí estava que se chama Felipe de Goes que é ido para Flandres**⁷ que comia aquela carne por lhe parecer que era pecado deixa-la por assim a longe a perder. E que a não comeu em defeso nem por gula se não parecendo-lhe que não era pecado come-la por se não perder e que ele bem sabe que era pecado comer carne em dias defesos e depois se confessou disto a um padre dos Mártires sua freguesia que se chama Valadom o qual lhe deu uma penitência e o absolveu. E foi perguntado se lhe pareceram alguma hora bem as cousas dos luteranos e que o que eles têm e creem essa é a verdade e se praticava isto com alguma pessoa dizendo que os luteranos não eram paus nem pedras nem bestas e que eram homens como os outros e que criam em nosso Senhor Jesus Cristo e porem que diziam que nosso Senhor Jesus Cristo não tinha necessidade de lhe meterem rogadores como os outros reis e príncipes que tinham necessidade de lhe falarem outras pessoas disse que não era lembrado praticar isto nem o cria perguntado se dizia que os luteranos afirmavam que os santos não se haviam chamar santos por quanto haviam sido homens e haviam de ir em corpo com alma ouvir sua sentença no dia do Juízo e que também diziam que não havia de haver clérigos nem frades por que tudo se fazia por dinheiro em Roma e se gastavam as rendas das igrejas que eram dos pobres em sustentamento da corte Romana. E assim se dizia que ditos os luteranos tinham e criam outras cousas levando contentamento de contar isto como pessoa que aprovava e louvava isto. Disse que nunca tal dissera nem praticara nem crera que verdade era que quando se fazia

- 4 This, on July 29, 1561 is the first interrogation of João de Góis in which he is stated to be Flemish from *Emues*. This place is likely Arnemuïden, a small town in Dutch Zeeland, not far from Antwerp, where a local dialect is spoken. In the Zeeland dialect the name of the town can be transcribed as *Erremuje* or *Erremu* [2]. It is very near the important coastal town and harbour of Middelburg.
- 5 This means that he lived in an area known as “the glass kiln” and it is important to note that the designation seems to have been sufficient to identify the place suggesting that there was, at least in that area, only one kiln where glass and glazed ceramics could be fired.
- 6 At this time, he was married to a French woman, born in “Tacim” (maybe *Tassin-La-Demi-Lune*, near Lyon?).
- 7 We hear for the first time of Filipe de Góis, younger brother of João, who also lives in Lisbon but at this time went to Flanders.

o auto da fé na Ribeira ouvia algumas sentenças daqueles que condenavam e que quando vinha para casa contava espantando-se daqueles erros e como morriam tão parvoamente mas que nunca lhe pareceram bem os erros luteranos nem de outros hereges nem os aprovava e lhe foi dito que no Santo Ofício havia informação contrária ao que ele respondia que pois não queria confessar a verdade que era necessário ficar preso e o mandavam entregar ao Alcaide do cárcere que se houve por entregue dele para se livrar preso e do cárcere das culpas que contra ele havia. E assinou aqui juntamente com eles Senhores Inquisidores António Rodrigues o escrevi. E disse ele Joam de Goes que dizia algumas vezes aí na rua diante de homens com que aceitava de praticarem luteranos que ninguém não sabia onde suas almas haviam de ir porque morriam na fé de nosso Senhor Jesus Cristo e que isto dizia por alguns que morriam aqui por justiça no tempo que se faziam os autos vendo-os chamar por algum cristão e rezando o credo. António Rodrigues o escrevi.

Hans Goos⁸

Jorge Gonçalves Rebelo Ambrosius Doctor

Aos trinta dias do mês de Julho de mil e quinhentos e sessenta e um anos em Lisboa na Casa do Despacho da Santa Inquisição estando aí os Senhores Inquisidores mandaram vir perante si a Joam de Goes flamengo preso no cárcere do Santo Ofício conteúdo em estes autos por ele pedir audiência. E lhe deram Juramento dos Santos Evangelhos em que pôs sua mão e prometeu dizer verdade. E disse que era lembrado que ele disse em prática estando em sua casa nesta cidade diante de **sua mulher Maria de Goes⁹** e uns seus criados que se chamam Lopo de Leyçom e Duarte Veyros homens mancebos falando nas gentes que prendiam e como França e Espanha se perdiam disse que toda esta gente que prendiam era por não crerem nos santos. E dizerem que lhes não haviam de rogar senão a Deus. E que por isso prendiam aqui em Lisboa estes forasteiros por quanto quando ele ia ao cadafalso lhes ouvia cá em estes reinos. Porém que a ele nunca lhe pareceram bem estas cousas nem as creu nem disse que as cria. Se não contava assim isto. E assim disse mais que estando um dia em sua casa e que foi aproximadamente segunda-feira depois deste auto passado veio aí ter um padre da Companhia de Jesus que se chama Silvestre Jorge. E falando do dia do Juízo e da conta que se havia de dar então tão estreita dizendo o dito padre Silvestre Jorge que na própria hora que uma alma partia deste mundo logo ia dar conta diante de Nosso Senhor. E que declarante achando-se alcançado disto lhe disse que cuidava que depois de morta a pessoa e falecida desta vida presente estava no limbo até ao dia do Juízo e que todos haviam de ser julgados e que ele confessante por sua simpleza cria assim isto posto que nunca o ouvira nem lho ensinara ninguém. E que por isso o disse ao dito padre Silvestre Jorge - e se achou e alcançado ouvindo o que lhe disse o dito Silvestre Jorge. E muito arrependido disto que assim ouvia e lhe disse o dito Silvestre Jorge que tinha necessidade de se confessar. E por já então ser confessado daquela Quaresma se não confessou mais. E prometeu ao dito padre de se confessar

8 Here João de Góis uses his Flemish name (Hans Goos) and signs his declarations for the first time with his monogram, the same found on the azulejo panels in *Igreja da Graça* (Graça church) in Lisbon (Figure 1) [3].

9 Here we learn that his wife was named Maria de Góis.

antes que se fosse para flandres¹⁰. E que doutra cousa não é lembrado e que pede disto perdão e misericórdia. E que pede que lhe ensinem tudo o que não souber que for necessário para salvação da sua alma. E foi admoestado que cuidasse bem em sua consciência e declarasse se crera praticara comunicara alguns erros da seita luterana, especialmente contra o rogar dos santos contra as Imagens e contra o purgatório. E contra as Religiões e Religiosos delas e clérigos e assim contra as cerimónias da Santa Madre Igreja e poderes do Santo Padre. Que confessasse a verdade de tudo e pedisse perdão para poderem usar em ele da misericórdia da Santa Madre Igreja e lhe darem penitência saudável para sua alma. E por mais não dizer foi tornado a mandar a seu cárcere e assinou aqui juntamente com ele e os senhores Inquisidores Manuel Cordeyro o escrevi.

Hans Goos¹¹

Jorge Gonçalves Rebelo

Ambrosius doctor

Ao primeiro dia do mês de Agosto de 1561 anos em Lisboa na Casa do despacho da Santa Inquisição estando aí os Senhores Inquisidores perante eles apareceu Joam de Goes preso em este cárcere por ele pedir Audiência e lhe deram juramento dos Santos Evangelhos em que pôs sua mão e prometeu dizer verdade e disse que a haver dois meses pouco mais ou menos que estando ele na Rua Nova se encostou aos ferros da dita Rua estava praticando com um Jacques flamengo lapidário o qual lhe disse que estava muito mal do rosto de uma perna perguntando-lhe que faria. E que ele declarante lhe disse que aquilo eram boubas e doença velha que se fosse a Santo Amaro e lhe rezasse algumas orações e lhe deitasse três ou quatro padres nossos e ave marias e que desse uma esmola de bom coração e que trouxesse uma perna de pau de lá da ermida e a deixasse de noite na cama junto da perna e que se acharia bem por que assim fizera ele declarante tendo outra perna doente e se achava bem. E que o dito Jaques flamengo não disse a isto nada somente se sorriu. E lhe parecia que estavam aí outros flamengos e que não é lembrado quais eram. E que se ele pecou em dizer as ditas palavras: ide lá e arremessai-lhe ou deixai-lhe lá três ou quatro padres nossos e avé marias, que pede disso perdão e misericórdia. E disse mais que lhe pareceu que seu irmão Felipe de Goes comeu a metade daquela carne que tem confessado que comeu dia de quarta-feira de cinzas. E assim disse mais que esta véspera de Santo António que ora passou estando ele mal disposto comeu de umas tripas de carneiro cozidas com sua cebola e posto que o fez sem licença do físico estava mal disposto. E por mais não dizer lhe foram feitas as perguntas Gerais. E por ele foi dito que ele **é flamengo de nação e cristão baptizado e que o baptizaram em Emues na igreja maior** e aí têm seus **padrinhos de baptismo e crisma** e que seu **pai e mãe são ainda vivos** e que **há de idade de vinte e cinco anos**. E que **foi casado outra vez com uma mulher portuguesa que se chamava Branca Coutinha já defunta**. E que sua mulher com quem ora é casado se chama **Maria de Goes francesa de Taçim de lo Rei** e que ele cada ano se confessava e comungava e ia às missas e pregações domingos

10 João de Góis states that he had promised to confess “before going to Flanders” from which we conclude that, not only his younger brother, but also him, travelled to Flanders. A surprising aspect of his productions is the quality of the pigments used. Their excellence and the fact that he used at least an uncommon yellow pigment known from Antwerp productions [16] suggests that they were acquired there.

11 Second signature of João de Góis with his monogram.

e festas e **que havia sete ou oito anos que está em este reino e nunca esteve em outras partes senão em Emues e em Sevilha e em Berberia.** E que **não sabe latim nem tem nenhum livro de latim nem de francês somente tem um livro de rezar em flamengo.**¹² Perguntado se lera por alguns livros luteranos ou de outros hereges em linguagem disse que não, perguntado se praticava em sua terra ou em esta cidade com alguns luteranos ou outros hereges algumas cousas contra a fé ou contra o que tem e crê a Santa madre Igreja de Roma disse que não. E foi perguntado por as orações e doutrina cristã e se benzeu e disse o padre Nosso e Ave Maria e o credo em latim. Não soube a Salve Regina nem mandamentos nem pecados mortais nem outra cousa da doutrina cristã e com isto foi admoestado em forma e mandado a seu cárcere e assinou aqui com eles Senhores Inquisidores António Rodrigues

Hans Goos¹³

Jorge Gonçalves Rebelo

Ambrosius doctor

Aos oito dias do mês d'Agosto de mil quinhentos e sessenta e um anos em Lisboa na Casa do Despacho da Santa Inquisição estando aí os Senhores Inquisidores mandaram vir perante si a Joam de Goes flamengo preso no cárcere do Santo Ofício conteúdo em estes Autos. E lhe disse que ele fora por muitas vezes admoestado que confessasse suas culpas. O que ele até agora não quisera fazer que o tornavam a admoestar que ele confessasse suas culpas e delas pedisse perdão por que não fazendo assim seria necessário ser acusado porque não tinha que confessar que lembrado fosse. E logo ali apareceu o promotor fiscal do Santo Ofício e apresentou um libelo acusatório contra o Réu pedindo que o recebessem e o mandassem ler e lhe mandassem que o contestasse. E eles Senhores Inquisidores lho mandaram ler e é o seguinte. Manuel Cordeyro o escreveu.

Muito Magníficos e Reverendos Senhores Inquisidores

Perante vossas mercês diz o Promotor fiscal do Santo Ofício em nome da Justiça. A. contra Joam de guoes flamengo de nação malegueiro d'azulejos morador nesta Cidade preso no Cárcere da santa inquisição pelo crime da heresia.

Para se cumprir

Provará que sendo o Réu Joam de guoes cristão baptizado e por tal havido e conhecido e obrigado a ser e crer tudo o que tem e crê e ensina a Santa Madre Igreja de Roma assim como no santo baptismo professou ele Réu o fez muito pelo contrário apartando-se da nossa Santa fé católica e lei Evangélica afirmando proposições

12 This is one of the most important parts. João de Góis states that he is 25 years old and has been in Portugal for seven or eight years (indicating that he arrived in 1553 or 1554) and that he was baptized in the Main Church (Igreja Maior – the Cathedral) of his hometown. His parents were still alive. He had been married to a Portuguese woman called Branca Coutinho, already deceased, and now is married to Maria de Góis. He states that, besides Lisbon and his hometown, he had only been in Seville and *Berberia*. “*Berberia*” was the name given to the region inhabited by the Berbers and is usually understood as encompassing a part of North Africa that today corresponds to Morocco, Tunisia and Algeria. He is literate and reads Flemish and possibly Portuguese and French, but not Latin.

13 Third signature of João de Góis with his monogram.

erróneas e luteranas contra o que tem a santa Madre Igreja. Provará que onde o Réu se achava claramente por palavras manifestava e descobria a inclinação que tinha a seita luterana, por que estando uma certa pessoa que estava mal disposta comendo uma comida de dieta o Réu lhe disse que porque não comia carne (sendo dia em que a Igreja a vedava e proibia) e a dita pessoa lhe respondeu que não comia porque não era lutero, e porque os luteranos diziam que se podia comer em dias proibidos, e assim lhe disse mais que os luteranos eram uns tais e quais e que afirmavam muitas heresias e erróneas ao que o dito Réu respondeu que cuidais vós que são os luteranos? Os luteranos não são bestas nem pedras confessam a nosso senhor Jesus Cristo mas dizem que nosso senhor não é como os outros Reis esperam que lhes falem por terceiras pessoas dizendo rogai a João que fale a João e que diziam também que os santos não haviam de chamar-se santos porque haviam sido homens e haviam de ir em corpo e em alma ouvir sua sentença ao dia do Juízo dizendo mais que diziam os luteranos que não havia de haver clérigos nem frades, porque tudo se fazia por dinheiro em Roma e que se gastavam as rendas das Igrejas que eram rendas de pobres em sustentamento da Corte de Roma e assim referiu mais o dito Réu outras proposições de Lutero as quais o Réu assim referia e dizia com muita eficácia como homem que as aprovava e folgava com elas [riscado surge: observando gosto de as praticar] dizendo vós cuidais que os luteranos são bestas? Como pessoa que os queria louvar e aprovar seus erros, pelo que está claro e manifesto o Réu ser errado na nossa Santa fé católica [riscado surge: e como tal afirmasse todo o sobredito / levava que sendo por isso] perguntado pelo sobredito o não quis nunca confessar antes o nega como pertinaz e negativo e por tal deve ser declarado culpado e relaxado à justiça secular para dele se fazer cumprimento de direito com áspero rigor de justiça. Pede Recebimento e provado o necessário somente que baste para condenação o Réu seja declarado por herege e relaxado à justiça secular.

Para as custas

E lido o dito libelo como dito é por os Senhores Inquisidores foi dito que receberam o dito libelo e que assim se assentasse por termo. E deram juramento, em forma de Direito ao dito Réu Joam de Goes em que ele pôs sua mão para responder ao dito libelo e o contestar como era pedido pelo dito promotor. E por o dito Réu foi dito que ele era cristão baptizado e por tal se tem como já tem dito nas perguntas que neste Santo Ofício lhe foram feitas. E quanto ao mais conteúdo no dito artigo e artigos do dito libelo ele o contestava por negação, por que nunca tal fizera nem crera nem praticara somente como tem dito nas perguntas que lhe foram feitas em este Santo Ofício. E lhe foi dito que pois negava o conteúdo no dito libelo era necessário fazer procurador que o ajudasse a defender em esta sua causa e por ele foi dito que fazia seu procurador *Apud Auta* ao licenciado António Pires procurador na casa do cível e lhe dava os poderes acostumados. E os senhores Inquisidores lhe mandaram assentar a procuração e que fosse dado recado ao dito senhor procurador para vir aceitar a causa e receber juramento em forma e a ele Réu fosse dado o traslado do libelo da Justiça para ao tempo o dito senhor procurador vier falar com ele, ele Réu estar instruído na matéria de sua acusação. E de tudo se mandou fazer este termo e que ele Réu o assinasse. Manuel Cordeyro o escreveu.

Hans Goos¹⁴

O Licenciado Pedro Alvares

Jorge Gonçalves Rebelo

Ambrosius doctor

14 Fourth signature of João de Góis with his monogram.

Aos doze dias do mês de Agosto de mil quinhentos e sessenta e um Anos em Lisboa na Casa do Despacho da Santa Inquisição estando aí os Senhores Inquisidores perante eles apareceu o licenciado António Pires procurador na Casa do Cível sendo presente o Réu Joam de Goes flamengo o qual o nomeou por seu procurador e presente lhe foi dado juramento dos Santos Evangelhos em forma de direito para que bem e verdadeiramente o defendesse em esta sua causa. E constando-lhe no progresso da causa que não tem justiça o virá dizer e denunciar a esta mesa diante deles Senhores Inquisidores conforme ao Regimento do Santo Ofício e por aceitar a causa e prometer o sobredito assina aqui e lhe foi lido o libelo da Justiça e dado relação do mais que era feito com o dito Réu e como contestara o dito libelo da Justiça. Manuel Cordeyro o escrevi.

Aos 14 dias do mês d'Agosto de mil quinhentos e sessenta e um Anos em Lisboa na Casa do Despacho da Santa Inquisição estando aí os Senhores Inquisidores por o licenciado António Pires procurador do Réu Joam de Goes foi dado o traslado do libelo da Justiça e Rol de testemunhas com a defesa seguinte pedindo que lha mandassem ajuntar aos autos do dito Réu e lha recebessem Manuel Cordeyro o escrevi.

Treslado do libelo de João de Goes flamengo

1^o Provará que sendo o Réu Joam de Goes cristão baptizado e por tal havido e conhecido e obrigado a ter e crer tudo o que tem e diz e ensina a santa madre Igreja de Roma, assim como no Santo baptismo professou ele Réu o fez muito pelo contrário apartando-se da nossa santa fé católica e lei evangélica afirmando proposições heréticas e luteranas contra o que tem a Santa Madre Igreja.

2^a Provará que onde o Réu se achava claramente por palavras manifestava e descobria a Inclinação que tinha a seita luterana porque estando uma certa pessoa que estava mal disposta comendo uma comida da dieta o Réu lhe disse que por que não comia carne (sendo dia em que a Igreja a vedava e proibia) e a dita pessoa lhe respondeu que a não comia por que não era Lutero e por que os luteranos diziam que se podia comer em dias proibidos. E assim lhe disse mais que os luteranos eram uns tais e quais e que afirmavam muitas heresias e erróneas ao que o dito Réu respondeu que cuidais vós que são os luteranos? Os luteranos não são bestas nem pedras confessam a nosso senhor Jesus Cristo mas dizem que nosso senhor não é como os outros Reis que esperam que lhes falem por terceiras pessoas dizendo rogai a Joam que fale a Joam. E que diziam também que os santos não se haviam de chamar santos por que haviam sido homens que haviam de ir em corpo e em alma ouvir sua sentença ao Dia do Juízo dizendo mais que diziam os luteranos que não havia d'haver clérigos nem frades por que tudo se fazia por dinheiro em Roma e que se gastavam as rendas das Igrejas que eram rendas de pobres em sustentamento da Corte de Roma. E assim referiu mais o dito Réu outras proposições de Lutero as quais o Réu assim referia e dizia com muita eficácia como homem que as aprovava e folgava com elas dizendo vós cuidais que os luteranos que são bestas? como pessoa que os queria louvar e aprovar seus erros pelo que está claro e manifesto o Réu ser errado na nossa Santa Fé Católica. E sendo perguntado pelo sobredito não quis nunca confessar antes o nega como pertinaz e negativo e por tal deve ser declarado e relaxado a Justiça secular para dela se fazer

cumprimento de direito com áspero rigor da Justiça.

Poti admitti

Perante vós muito magníficos e Reverendos Senhores inquisidores diz João de Goes contrariando o libelo fiscal e se cumprir

1º Provará que ele Réu é bom cristão e o foi sempre e se confessa cada ano três quatro vezes e toma o santo sacramento e assim os jubileus que vinham a esta cidade e é muito amigo de deus e da santa fé católica dando esmolas a pobres e é confrade de nossa Senhora das mercês e de Jesus e da Misericórdia e de santo António ouvindo os domingos e santos missas e pregação em santos o velho e é tido e havido por de boa fama e consciência jejuando as sextas-feiras da quaresma à hora e morte e Paixão de nosso senhor Jesus Cristo.

2º Provará que ele Réu com algumas pessoas e bons cristãos praticaram todos pesando-lhe dos erros e erronias que os luteranos tinham contra a nossa Santa fé e ele Réu com as mais pessoas contaram alguns erros que os luteranos tinham e isto por ele Réu os ouvir a outras pessoas e assim no auto do Santo Ofício na Ribeira no cadafalso e tudo por lhe pesar os luteranos terem tantos erros como dizem que têm mas não que ele Réu cresse nunca nem tivesse os tais erros luteranos nem tivesse para si ser boa a tal seita antes muito má e aborrecida em toda a cristandade.

3º Provará que ele contou por o ouvir dizer os tais erros que os luteranos tinham e que diziam que eles têm por erro que os santos não se haviam de rogar por que haviam de ir a Juízo em corpo e em alma e isto o contara que o diziam mas não que nisso cresse nem o tivesse para si antes lhe pesava muito os luteranos terem tais erros contra a nossa santa fé católica.

Do que é pouca voz e fama

Potti admitti et absolvi op cum expensis

*

Testemunhas do Réu

Item. o tesoureiro dos mártires. Já

Item. **Riberte Jacome**¹⁵ morador ao forno do vidro seu compadre

Item. **Tristão de Colónia** morador ao forno de vidro seu compadre

Item. o cura dos mártires

Item. o padre Valadão que anda na igreja dos mártires

Item. um padre que diz missa em santos o velho que reside nos mártires

Item. Brás Reinell mercador morador junto de São Francisco

15 This Riberte Jacome (or Roberto Jácome) was Flemish and an important figure in Lisbon and it is interesting that both he and Tristão de Colónia (probably a German from Cologne) were his "compadres". Without further information this would mean that João de Góis was godfather of one of their children or else they were godfathers of a son or daughter of João de Góis – this matter will be addressed in the notes at the end of this section.

Item. Diogo Luís oleiro morador na mouraria

Item. Lopo de Licão oleiro morador à boa vista

Item. **Vicente Venezeano**¹⁶ seu criado morador em casa dele Réu

Item. João Fernandes ferrador morador junto do forno de vidro

Hans Goos¹⁷

E dado tudo como dito é e junto aos Autos do dito Réu por os senhores Inquisidores foi dito que recebiam a dita defesa *salvo jure impertinentius* e que assim se assentasse por termo e assinaram de dilação as partes para fazerem sua prova de vinte dias e que lhe fosse dado recado para fazerem diligência. Manuel Cordeyro o escrevi.

Aos 26 dias do mês de Agosto de mil quinhentos e sessenta e um Anos em Lisboa na Casa do despacho da Santa Inquisição estando aí os Senhores Inquisidores mandaram vir perante si a Joam de Goes flamengo de nação conteúdo em estes Autos e lhe disseram que a prova da Justiça estava Ratificada e que estava seu licenciado em termos de se fazer publicação dos ditos das testemunhas da Justiça calados os nomes que o Admoestavam que confessasse suas culpas para poderem usar com eles de misericórdia por que lhe aproveitasse mais confessa-las agora que depois da publicação e por ele Joam de Goes foi dito que não tinha que confessar nem dizer mais do que dito tem atrás. E logo lhe foi lido publicação dos ditos das testemunhas da Justiça calados os nomes e depois de lhe ser feito publicação lhe foi dado juramento dos Santos Evangelhos ao dito Réu Joam de Goes em que pôs sua mão para responder verdade ao conteúdo na dita publicação e por ele foi dito que não era lembrado dizer as tais cousas contidas na dita publicação. O que visto pelos Senhores Inquisidores lhe mandaram dar o treslado da dita publicação e que fosse dado recado ao licenciado António Pires seu procurador para vir falar com ele Réu e informar quais os artigos de contradição que tiverem as testemunhas da Justiça e de tudo mandaram fazer este termo e que ele o assinasse como assinou.

António Pires

Hans Goos¹⁸

Jorge Gonçalves Rebelo

Ambrosius doctor

END OF THE TRANSCRIPTION

João de Góis was denounced on July 24, 1561 and incarcerated four days later. According to the inquisitorial procedure he was not aware of the accusation until late in the process and he voluntarily offered to narrate a number of instances when his procedure or discourse might have been against strict Catholic conduct. He would remain imprisoned until August 26 and during this period of nearly a month inquiries were conducted and witnesses were heard and through the minutes we learn more about this man.

16 The fact that João de Góis had a Venetian working for him is also relevant, given the importance of Venice in the production of glass and majolica at the time.

17 Fifth signature of João de Góis with his monogram.

18 Sixth and last signature of João de Góis with his monogram.

In the end, it was decided that he had a good background of catholic Christianity and he did not suffer any harsh sentence. Otherwise the history of Portuguese azulejos might conceivably have been very different...

It was Rui Gomes, an apothecary (*boticário*) for whom João de Góis made the pots for his pharmacy ("*botica*") around 1557, who testified against him. This man, a "new christian" (*cristão novo*) i.e. a convert to Christianity from Judaism, was in prison during the period of inquiry against João de Góis and it was him who made the incriminatory accusation, presumably in hopes of a lighter sentence for himself. The testimony was intended to show that he professed Lutheran inclinations and that some of his religious views were very similar to those beliefs. The tone of the documentation seems to show an increasing level of hostility during the process and at a point it was necessary for João de Góis to appoint a legal representative, António Pires (*licenciado*, which means he had a degree in Law), prosecutor in the Casa do Cível (the court of justice for non-religious matters). In the arguments for his defence we are informed that João de Góis belonged to four Confraternities (*Confrarias*): those of Our Lady of Mercy (*Mercês*), of Jesus, of the *Misericórdia*, and of Saint Anthony, which intended to show that he was pious but could also imply that he was a person of means, although some of these groups could be poor.

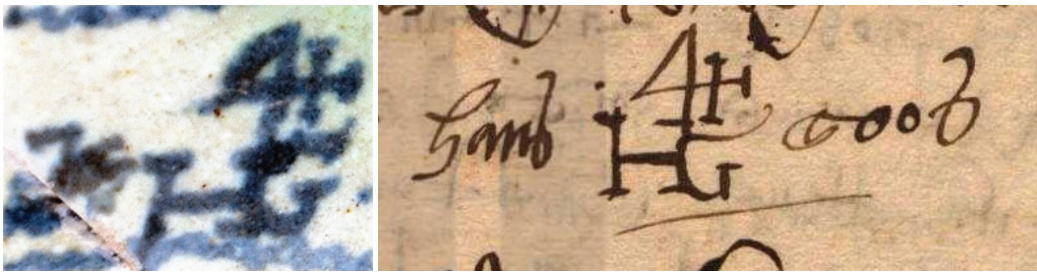


Figure 1. The signature of João de Góis in the panels of *Igreja da Graça* (left side) and one of his signatures in his declarations (right side- source: *Arquivo Nacional Torre do Tombo*, PT-TT-TSO-IL-28-6820_m0025)

The witnesses that testified on his behalf shed further light on João de Góis. Among those we have the treasurer and three priests (one of them his confessor) from the *Igreja dos Mártires* (Church of Martyrs) where the accused attended Mass regularly. Among the other people who were called in his defence there was a potter who lived in *Mouraria*, named Diogo Luís, one of João de Góis' servants – a young man called Vicente Veneziano (Venetian), who lived in his house (another young man who also lived in his house, Duarte Veiros, was not called), and a former employee, also a potter, called Lopo de Licão, possibly of French origin (Luçon?). The remaining three witnesses are also interesting. Two were his neighbours and also his *compadres* (a relation based on the godfathering of children): Tristão de Colónia (which means he was from Cologne) and Roberto Jácome, a Flemish merchant who was killed in December 15, 1576 in an accident with black powder [4]. This was probably the recorded dramatic explosion of many casks of powder imported from Flanders to Portugal that were in storage near *Igreja de Santos*, not far from the Royal Palace of Santos¹⁹ [5]. At that time Jácome was living in the *Rua do Guarda-Mor*, in the same parish, and was probably not any longer a neighbour of the De Góis family. But the relations between these two men continued after the release of João de Góis

¹⁹ It was said that the sound of the blast was even heard in Santarém some 70 km away and there was much destruction and many victims.

in 1561 and although we do not have information prior to his captivity we know that Roberto Jácome would be the godfather of Isabel (1/11/1570), the first daughter of a João de Góis and Luísa da Silva who seems to have been his third wife [6]. Bárbara Jácome, the wife of the merchant, would also be godmother of another child from João de Góis and Luísa da Silva, Ambrósio, their first-born boy in 9/9/1573 [7]. The last information we have in documentation related to João de Góis is when he and Bárbara Jácome were the godparents of a baby girl named Caterina, daughter of Giraldo Gonçalves and his wife Maria Luis (1578) [8]. Although it is not straightforward to relate this João de Góis, married to a Luísa da Silva, with the man incarcerated in 1561, the proximity of the Jácome family seems to indicate that they are the same person, now with a new wife, probably because Maria had by then died. Other points lead us in that direction but we will refer them later in the text.

We do not know if João de Góis had children from his second wife Maria de Góis, but he had not any from the first, otherwise they would have been referred in the Inquisition process. It follows that the relation he had with Roberto Jácome and Tristão de Colónia, referred as his “*compadres*”, meant he was godfather to their children, and not the other way around. This is an interesting aspect because we have information that he was also godfather to five other children from different couples²⁰ and is important because it suggests that he was an influential and maybe also a somewhat wealthy member of the community, with whom a number of parents wanted to have bonds.

One final aspect we can infer from the Inquisition process of 1561 has to do with the last witness for the defence. He was another Flemish merchant called Brás Reinell who, at the time, lived near the *Convento de São Francisco* (Convent of St. Francis) not far from Terreiro do Paço. He would also be incarcerated by the Inquisition two years later, in 1563, when he was in his fifties, in a complex process that lasted for more than six months²¹ and was sentenced to be present in an *Auto de Fé* but without being executed [13]. It is peculiar in the process of this man that among the more than 50 witnesses called in his defence there is no reference to the De Góis brothers²². Nevertheless, among these witnesses there is one Luís de Labanha, a broker in an area called Pedras Negras (*corrector nas Pedras Negras*) who is probably one of the godfathers of Luís, the third child of João de Góis and Luísa da Silva, baptized in 30/1/1575 [14], showing once again the proximity of all these persons.

The Igreja da Graça panels were likely made after the process of 1561 because João de Góis would probably mention this work for the influential order of Saint Augustin or one of the priests of Graça might appear amongst the vouching witnesses.

20 Besides the already mentioned Caterina, there is Julia, by Domingos Pirez and Maria Fernandez, 1568 [9], Maria, by Domingos Anes and Catarina Pirez, 1570 [10], Isabel, by António Moniz and Marta Simões, 1576 [11], and another Isabel, by António Luís and Lianor Dias, 1577 [12].

21 Among his accusers there was a former house maid whose name was not mentioned but referred by the nickname “a Fonseca” (this is a common Portuguese surname). She, and her sister, named Beatriz Gomes, did something very dishonest (*praticaram grande desonestidade*) and for this they were severely spanked (*levaram muitas porradas*). They were expelled from the house of Reynel becoming his enemies. In the year 1563 *a Fonseca* changed her name and married an unnamed potter.

22 We can find among them the physician of the King (*Físico d’El Rey*), the treasurer of the Princess of Castille (probably Joanna of Austria, daughter of Holy Roman Emperor Charles V and mother of Sebastian, future king of Portugal), and the bishop of Portalegre.

It is surprising that in 1561 he is acknowledged as a “potter of azulejos”, which means he had already established himself in this specific trade, and he is the only one in the known documentation of the period referred to in this way. Another unusual note is João de Góis’ monogram with which he signs his work and declarations. Above the initials of his name “HG” he uses a symbol similar to a “4” and called in French “quatre de chiffre” which, in Antwerp, is connected to the names of artisans of different trades including tapestry makers and majolica potters [15, pp. 79-82 and personal communication by the author of the book]. And this raises an interesting question because if João de Góis was a master who learned his trade in Antwerp (at first sight the likeliest possibility) then his monogram would be adequate; however, he is not mentioned amidst the master potters of the local guild whose list was started in 1550, nor as an apprentice [15, pp. 71-75 and 225-251 and personal communication by the author of the book] and in his declarations of 1561, he does not even mention having ever been in Antwerp. Also, his age when he arrives in Lisbon (ca.18 years) implies that he would have become a master at 16 or 17 which seems unusually early when compared to other cases [15, pp. 71-75 and 225-251]. One possibility is that he was representing himself through the monogram as someone recognized in the Flemish pottery milieu. He said he had been in Seville and North Africa but we do not know whether his ship simply made port there before sailing to Lisbon or whether he was there for quite some time. The recipe for his glazes seems unrelated to the Seville Hispano-Moresque tradition [17].

If João de Góis’ statement about the places he visited is accepted (and there seems to be no reason why he would omit Antwerp) he could only conceivably have learned his trade, either in Seville, or in Lisbon... but from whom? To base his statement that in the 1550s a majolica technology capable of quality results was unknown in Seville or Talavera, Alfonso Pleguezuelo [18] mentions a lamentation by Felipe de Guevara (written ca. 1553-63) who complains of a total lack of knowledge in the whole of Spain allowing results such as seen in the majolicas of Faenza and Pisa²³.

Frans (or *Franchois*) Andries, son of Guido Andries who brought the technique of Italian majolica to Antwerp and was the owner of *Den Salm*, the most famous local faience pottery [15, pp. 15-22 and 27-34], left Antwerp after becoming a master in 1552. He is known to have been abroad by 1556 and was living in Seville in 1561 under the name *Francisco Andrea* [15, p. 226]. A possibility compatible with what is presently known is that João de Góis could eventually have worked for Andries and learned with him, either in Seville or in Lisbon. Although apparently unrelated, it may be interesting to point out that Joris Andries, a brother of Frans, established himself in Middelburg ca.1564 with a faience workshop and may have manufactured glazed tiles there [19].

2. DENUNCIATION AGAINST FILIPE DE GÓIS

The following text is a transcription to modern Portuguese of the full document [20] of the denunciation (on April 11, 1575) to the Holy Inquisition of Filipe de Góis. Some sentences, considered more important pertaining the early production of majolica

23 “... in Spain they do not know how to fix the colours in the fire, as they do in Faenza and Pisa, nor do they know here how to use but two or three colours only. And it is true that the way to paint and glaze the clay with diverse and good colours eludes them, and to say the truth they ignore everything except these vulgarities used on tiles” (modernized translation by us from *Comentarios de la pintura, que escribió don Felipe de Guevara*, 1788 edition, pp. 110)

azulejos in Lisbon, were highlighted in boldface and translated, commented or given possible interpretations in footnotes. The text is complemented by a number of endnotes.

START OF THE TRANSCRIPTION

Denúnciação contra Felipe de Gois²⁴

Aos onze dias do mês de abril de mil quinhentos setenta e cinco anos em Lisboa nos Estaus na casa do despacho da Santa Inquisição estando aí o senhor Inquisidor Jorge Gonçalves Ribeiro e o doutor Rodrigo aires [...] -este Santo Ofício perante eles apareceu **Marçal de Matos pintor de idade que disse ser de vinte e um anos pouco mais ou menos**²⁵ morador a São Cristovão natural que disse ser desta cidade cristão velho ao qual foi dado o juramento dos Santos Evangelhos em que pôs sua mão e prometeu dizer verdade e denunciando disse que nesta quaresma passada **estando ele denunciante na praia da boa vista onde estão as casas caídas no forno onde se coze a louça vidrada onde mora um estrangeiro que se chama Felipe de Guois**²⁶ foi ali ter um mancebo que se chamava Guaspar Carvalho que diziam que era natural do Porto e que está agora frade em mosteiro de São Francisco de Serpa estando assim de bruços o dito Gaspar Carvalho perguntou ao dito Felipe de Guois em que tempo estivera ele em sua terra por lhe ter dito dantes que fora pra lá ir e o dito **Guaspar Carvalho lhe disse que estivera nela no tempo em que o duque de Alva fora lá matar aquela gente**²⁷ dizendo-lhe o dito Guaspar Carvalho que os matavam *da jus* [latim, *por justiça*] dizendo o dito Felipe de Guois que os matavam porque lá na sua terra não queriam se não que dissessem missa em linguagem que a entendessem todos e que os clérigos que fossem casados para lhes não andarem com suas mulheres e que o dito Guaspar Carvalho respondeu que era muito bem feito matarem-nos porque aquilo era luteranismo e o dito Felipe de Gois respondeu então agastado que os não matassem mas que os prendessem porque eles não queriam ser sujeitos ao rei Felipe e não passaram mais nada e ficou falando feio o dito Felipe de Gois agastado mas que ele testemunha o não entendia por falar em sua língua sendo que isto foi depois de jantar e não sabe se tinha já comido e saindo o dito Felipe de Gois e depois disto disse o dito Felipe de Gois a ele confessante um dia em sua casa estando sua mulher presente e outro flamengo que se achou ali então a que não sabe o nome que para que jejuava ele denunciante tanto por ser na quaresma e dando-lhe um queijo para comer ele denunciante lhe respondeu que não comia aquilo na quaresma e o dito Felipe de

24 In this document the surname of Filipe occurs written both “Gois” and “Guis”.

25 The accuser, Marçal de Matos, is 21 years old (more or less, as he himself states) at this time. He is a painter by profession.

26 He says literally that he was “in the *Boa Vista* Beach, at the place of the *Fallen Houses*, in the kiln where glazed pottery is fired, where lives a foreigner named Filipe de Góis”. According to this statement Filipe de Góis lived in the same neighbourhood where the kiln was, maybe even in the same constructed dwelling. The “kiln where glazed pottery is fired” may well be the same mentioned in relation to the process of 1561 against João de Góis. He sets the precise location and this was an area near which the municipality commissioned a fountain known as *Bica de Duarte Belo* (Duarte Belo was an important merchant who lived there in the 16th century). The name remains today in the local neighbourhood, the *Bairro da Bica* [21, p. 525].

27 In the account, referring to a time in the recent past, young Gaspar Carvalho mentions a trip to Flanders “when the Duke of Alba went there to kill that people”. The Duke was governor of the Netherlands from 1567 to 1573.

Góis lhe disse que comesse que o que entrava pela boca não fazia mal nem era pecado e ele denunciante lhe respondeu que o não queria comer e não sabe se o dito flamengo e sua mulher ouviram também isto mas que pode ser que o ouviram porque falou alto e declarou que se vir o dito flamengo que o conheceu mas que lhe não sabe o nome e que o dito **Filipe de Góis será de trinta cinco anos pouco mais ou menos homem de boa estatura barba loura e é mestre da louça vidrada**²⁸ e ele denunciante estava em sua casa quando lhe ouviu o sobredito **pintando um arco para a capela de Nossa Senhora da Conceição**²⁹ e al (e mais) não disse e do costume disse nada e lhe foi mandado ter segredo sob cargo do juramento que recebeu e ele assim o prometeu dando ele denunciante conta do sobredito o senhor frade de nossa senhora da Graça seu confessor o mandou que o viesse dizer nesta mesa para se haver denunciar e assinou juntamente com eles Senhores. Joam Campello no Livro Apostólico o escrevi

Jorge Gonçalves Ribeiro

Marçal de Matos

Doutor Rodrigo Aires (Figure 2)

END OF THE TRANSCRIPTION

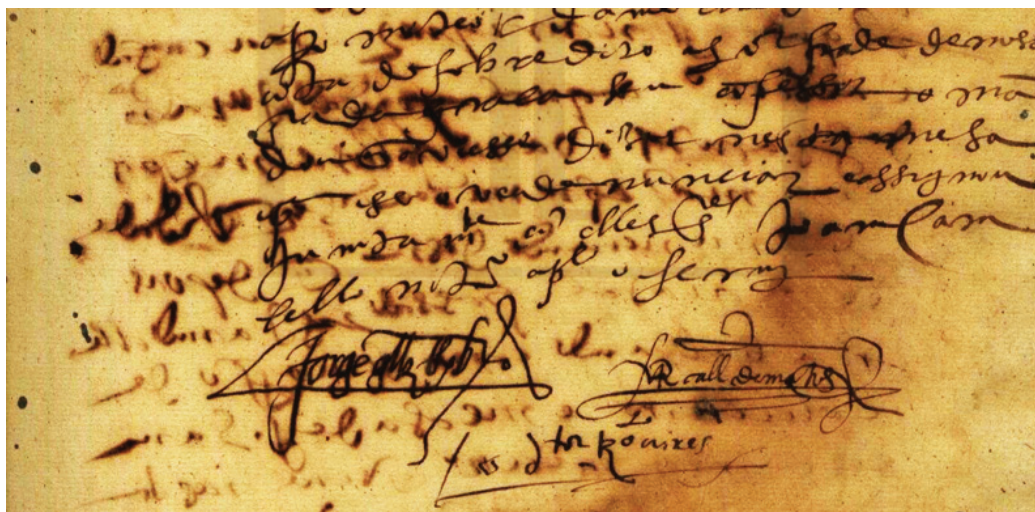


Figure 2. Last part of the document with the signature of Marçal de Matos on the right side

In the 1561 process against João de Góis he is specifically referred by the accuser as “oleiro de Málaga e azulejos” (potter of faience and azulejos) and by the board that decided his arrest as “potter of azulejos” [1]. In a 1565 document [22] referring manufacturers of pottery, João de Góis is only mentioned as a potter of faience and we have others which are stated to know how to make faience such as Pero Fernandes, João Álvares and Francisco

28 Filipe de Góis is said to be around 35 at this time, tall, with blond beard and a master of glazed ceramics.

29 Marçal de Matos now tells of a second instance when he was at Filipe de Góis’ home with his wife (Filipe de Góis’ presumably) and another Flemish. One of them (Matos or Góis but presumably the first) was painting an arch for a chapel. He does not state on what medium he was painting but, given the location, the arch is probably of azulejos because he was working by the kiln instead of painting in the church itself.

Jácome, also a Flemish, all potters of lead and tin glazed ceramics (“malegueiros”) and all active in 1565, but none is referred in connection to azulejos. In the same document, the brother of João, Filipe de Góis, was also referred but without mention to a profession.

It is in the 1575 denunciation to the Inquisition by the painter Marçal de Matos (1554-c.1613) that we find that Filipe was a master of glazed ceramics (“mestre de louça vidrada”) but again there is no specific reference to azulejos, although we may hypothesize that anyone working in faience might conceivably also handle the specificities of azulejo manufacture, particularly in his case, since his own brother worked in the field. The denunciation had no sequence and therefore Filipe was never incarcerated or even questioned.



Figure 3. In the bird's eye view of Lisbon published by Georg Braun ca. 1598 [26] one can see in the detail above the area of the Boa Vista Beach, a name that survives today in the *Rua da Boavista*. The area known as *Casas Caídas* (Fallen Houses) derived its name from the sliding earth of the Santa Catarina hill – from the river, its shape resembled ruins of collapsed houses. At the bottom of the slope, on the left side of the Casas Caídas, two constructions stand for their high chimneys, the tallest in the drawing of this area of the chart. They could hypothetically correspond to the dwelling where was the kiln that fired glazed pottery and the place where the narrative of Marçal de Matos takes place. The dwelling is separated from most other houses, an important aspect if we bear in mind that kilns at work would not be pleasant neighbours. On the other side, the clay of the hill and the water of the fountains nearby would have made this a very suitable location for pottery workshops. The *Convento da Esperança*, near which João de Góis lived in 1565, is marked “109”

The document of 1565 already mentioned [22] resulted from an important survey made in Lisbon that allows us to somehow characterize aspects of the city and understand

more about the two brothers. In this document there are references to about 15,000 people living in the town, but this number encompasses only the head of each house which means we do not actually have a correct number for the whole population. From these, 77 had activities related with pottery, of which 55 were potters and five *malegueiros*, which means they worked with lead and tin glazed ceramics. Each of these artisans was evaluated in terms of financial revenue and it is interesting to see that the De Góis brothers do not have the same standing. In fact, João de Góis' annual revenue is of ca. 3\$000 rs, while the younger Filipe's is 8\$000 rs. Another aspect that is interesting when comparing the revenues of all those related to pottery is that amongst malegueiros 3\$000 rs, is the minimum, the maximum being 80\$000 rs [23]. One could also assume that the specialized line of work of the malegueiros would put them amongst those with the highest revenue, but we see that many potters have higher revenues and if the potter of the King (*oleiro d'El Rey*, Bartolomeu Luís) reaches 50\$000 rs, three others reach 100\$000 rs, two 150\$000 rs, one 200\$000 rs, and another even 300\$000 rs.

Considering their income, we see that the De Góis brothers, although well provided, were not the wealthiest amongst the potters active in Lisbon at that time. Nevertheless, they were very well connected as we can see by all the relations mentioned previously and by at least one other godfather of João de Góis' children: the already mentioned Ambrósio, born in 1573, was sponsored at baptism by Nicolau de Frias [6] referred as "marceneiro" (cabinet-maker) but who was also the Master Architect for the Churches in the Arch-episcopate of Lisbon and the Master of Public Works in Lisbon. The last child of João de Góis and Luísa da Silva to which we found a reference, another girl called Isabel (probably because her elder sister had died) baptized in 8/4/1576, had two godfathers: João Sinel and António Rodriguez de Castellobranco [24].

The most surprising element in the census of 1565 pertaining to the two brothers is the fact that the younger Filipe is the one who has the higher income and not João, who was recognized as an azulejo maker. But who was Filipe de Góis? As yet we do not know much about him or his work. What we know comes from the 1575 denunciation to the Inquisition. But because the process against Filipe was never pursued, we do not have as much information as we have about his brother. However, some of what we learned is relevant. At that time Filipe was 35 years, being four years younger than João, and was probably still married to an Isabel de Góis, the mother of their child Ambrósio, baptized in 2/11/1567 [25] although the name of the wife is never mentioned in the document. An interesting fact is that the seemingly first-born male child of both brothers had the same name which may have been that of their own father.

The events that Marçal de Matos testifies about occurred one at the kiln where the glazed pottery was fired, and the other in the house of Filipe. The kiln is located in the Boa Vista Beach (Figure 3) and Filipe lives there or nearby – it may even be that the kiln is in a part of Filipe de Góis' house. This is very near the *Convento da Esperança*, the area of the parish where his brother lived in 1565 [22]. Marçal de Matos refers to a conversation he heard stating that one of them (presumably Matos) was there painting an arch for the chapel of Our Lady of Conception, chapel which, unfortunately, it was not possible to identify yet. Two relevant aspects can be inferred from this statement: that Marçal de Matos was probably working for Filipe as a painter, because he was in the former's house painting and being fed – both events he describes occurred during meals in different days; and that he nurtured some serious grudge against his employer or expected some substantial gain to risk accusing a person that seemingly had a higher standing than himself.

3. CONCLUDING NOTES

We have evidence that suggests that the workshop of João de Góis produced the azulejo panel known as *Nossa Senhora da Vida* around 1580 and he stated it in a note inscribed with his own hand [27]. We also believe, through the analytical results of our research, that his workshop or a workshop within the same technological circle produced the azulejo panels for *Capela de São Roque* (Saint Roch chapel) in Lisbon in 1584 [28] but in this case they are signed by Francisco de Matos and maybe he was no longer the workshop master. Were there two workshops with a similar technology? If not, did he sell his workshop? Did he die, or did he go elsewhere?

The dialogue related by Marçal de Matos testifies to the animosity of Filipe de Góis against the Spanish king Philippe II, an aspect that may explain the lack of information about the brothers after 1580. One hypothesis is that they went out of the country to escape a ruler they were, or at least Filipe was, so clearly against. The 1575 denunciation is the last reference as yet found to him. Coincidentally the last date when, as yet, we have reference to João de Góis [8] is that of the departure of King Sebastian to Africa to die in the battle of El-Ksar el-Kebir, a fateful event that would ultimately lead to the crown of Portugal passing on to the Spanish king, son of Emperor Charles V and Isabella of Portugal.

Because the denunciation against Filipe de Góis was not pursued we are also at a lack of information about Marçal de Matos. We know that the painter lived in the parish of São Cristovão, and was born in Lisbon from a Christian family. A later document, from 1614, mentions that his widow was named Luisa and that they lived in the São Cristovão parish in an area called *Terreirinho das Gralhas* [29] which the widow had left the year before, presumably due to the death of her husband who was ca. 59 years old. Matos is once again referred to in this document as “painter” and there is no mention in the text associating him to ceramic production.

Although both brothers lived in Lisbon for a long period of at least 20 years, besides the azulejos we do not know anything else of their production. However, the facts that at least João fancied signing his work and that both brothers worked with faience give us a reasonable hope to be able to identify more of their work in museum collections or in fragments recovered from archaeological excavations.

But maybe João did not leave Portugal or else returned at a later time. While still hypothetical and needing a thorough corroboration by further research, one last aspect will be mentioned that, if related, can be significant of the importance of João de Góis in relation to Lisbon and also evolve our perception of his staying in the city after 1578. Documentation from 1589 until 1593 mentions an important water well referred to as *Poço de João de Góis* and that the city council determined that it was necessary to make an aqueduct to bring its water to a central area of the town [30]. The well was abundant in water and was located in an area of Lisbon called *Bemposta*, in the parish of Anjos, where there was a large concentration of potters. Although it was the property of one João de Góis, he paid 7\$800 rs. each year to one Simão Solis, another Flemish who owned the land. The Senate of the town levied a tax on meat and wine, called *real do poço* (tax of the well) or *real dos pobres* (tax of the poor) and took possession of the well, intending to make an aqueduct from Bemposta to Rossio, where a public fountain was erected. When, in 1597, the proprietors were forced to relinquish both land and well, João de Góis and Simão Solis were already deceased and the heirs of this João de Góis received a compensation of 208\$000 rs. The fountain in Rossio was called *Bica da Carreirinha do Socorro* and remained in use until 1836, when the water started to be scarce.

We do not know whether this proprietor was the tile-maker João de Góis. The name and the proximity to an area of ceramic production may be coincidental because this is not

the parish where he used to live. The documentation referring to this De Góis mentions that he was married to one Branca Loba (if the same man, she would be, at least, his fourth wife!) who prior to his death acts in the business by proxy from her husband. This is an interesting aspect because it could mean that he was not in the country or that he was incapacitated and could not act for himself. Also interesting is the fact that one of the two representatives of the Senate, the taskmaster of this assembly, was Nicolau de Frias whom we have already found in 1573 as godfather of Ambrósio, the first-born son of João de Góis and his then wife Luisa da Silva [6]. There were disputes between this De Góis and Simão Solis that started in 1591 and were resolved with the dispossession by the Senate [31]. At this point nothing else relates the potter of azulejos to the owner of the well but this is nevertheless an interesting aspect to unravel in the future since it might mean a longer permanence of João de Góis in Lisbon and determine, at least approximately, the year of his death.

Although other information is still likely to surface, the identification of the monogram of João de Góis on the panels of Igreja da Graça and of his probable signature on the panel Nossa Senhora da Vida [27] marks a milestone in the research on the origins of faience azulejo production in Lisbon. We can testify today to the probable importance of Filipe de Góis, but most definitively of his brother João de Góis who may have started a chain of events leading to the singular development of the azulejo in Portugal.

BIBLIOGRAPHIC REFERENCES:

- 1 ARCH. TORRE DO TOMBO, *Processo de João de Góis* (29/07/1561 - 08/02/1562), proc. 6820. Tribunal do Santo Ofício, Inquisição de Lisboa, processos (1536-1821), (1561/1562).
- 2 VAN DER AA, A. – *Aardrijkskundig woordenboek der Nederlanden*, Vol. 1, p. 322, J. Noorduynd, Holland, 1839.
- 3 PAIS, A. et al. – *Graça Church Revisited* in Proc. Int. Conf. Glazed Ceramics in Cultural Heritage (GlazeArch2015), LNEC, Lisbon, Portugal, 2015.
- 4 ARCH. TORRE DO TOMBO, Paróquia de Santos-o-Velho, *Livro de registo de registos mistos* (1566/1578), fl.100v.
- 5 CONCEIÇÃO, Fr. C. – *Gabinete historico que a Sua Magestade fidelissima o Senhor rei D. João VI em o dia de seus felicissimos annos 13 de maio de 1818 offerece Fr. Claudio da Conceição*, Tomo II, p. 312, Impressão Régia, Lisboa, 1818.
- 6 ARCH. TORRE DO TOMBO, Paróquia de Santos-o-Velho, *Livro de registo de registos mistos* (1566/1578), fl. 16v.
- 7 ARCH. TORRE DO TOMBO, Paróquia de Santos-o-Velho, *Livro de registo de registos mistos* (1566/1578), fl. 41.
- 8 ARCH. TORRE DO TOMBO, Paróquia de Santos-o-Velho, *Livro de registo de registos mistos* (1566/1578), fl. 97.
- 9 ARCH. TORRE DO TOMBO, Paróquia de Santos-o-Velho, *Livro de registo de registos mistos* (1566/1578), fl. 8v.
- 10 ARCH. TORRE DO TOMBO, Paróquia de Santos-o-Velho, *Livro de registo de registos mistos* (1566/1578), fl. 14.
- 11 ARCH. TORRE DO TOMBO, Paróquia de Santos-o-Velho, *Livro de registo de registos mistos* (1566/1578), fl. 68.
- 12 ARCH. TORRE DO TOMBO, Paróquia de Santos-o-Velho, *Livro de registo de registos mistos* (1566/1578), fl. 97v.
- 13 ARCH. TORRE DO TOMBO, *Processo de Brás Reinol* (15/04/1563 – 13/12/1563), proc. 17014. Tribunal do Santo Ofício, Inquisição de Lisboa, processos (1536-1821), (1563/1564).

- 14 ARCH. TORRE DO TOMBO, Paróquia de Santos-o-Velho, *Livro de registo de registos mistos* (1566/1578), fl. 55v.
- 15 DUMORTIER, C. – *Céramique de la Renaissance à Anvers: de Venise à Delft*, Éditions de l'Amateur, Éditions Racine, Bruxelles, Belgium 2002.
- 16 MIMOSO, J. et al. – *A technical comparison of three renaissance azulejo panels from the workshops of Lisbon* in *Studies in Heritage Glazed Ceramics*, Nr. 1, pp. 113-132, LNEC, Lisbon, February 2019.
- 17 MIMOSO, J. et al. – *A comparison of the earliest faience tiles produced in Lisbon with earlier and later types* in *Studies in Heritage Glazed Ceramics*, Nr. 1, pp. 25-46, LNEC, Lisbon, February 2019.
- 18 PLEGUEZUELO HERNANDEZ, A. – *Sevilla y Talavera entre la colaboración y la competencia*, in *Laboratorio de Arte: Revista del Departamento de Historia del Arte*, Nº 5, 1, p. 275, Universidad de Sevilla, Spain 1992.
- 19 GIERVELD, A. – *Tegels op Walcheren* in *Tegel nr.25*, pp. 14-15, Otterlo, Holland, 1997.
- 20 ARCH. TORRE DO TOMBO, *Denúnciação contra de Filipe de Góis* (11/04/1575), Tribunal do Santo Ofício, Inquisição de Lisboa, Denúncias – Livro 5 (1560-1576), fl. 686-689.
- 21 CASTILHO, J. – *A Ribeira de Lisboa. Descrição histórica da margem do Tejo, desde a Madre-de-Deus até Santos-o-Velho*, Imprensa Nacional, Lisbon, 1893.
- 22 LISBON TOWN HALL – *Livro do lançamento e serviço que a Cidade de Lisboa fez a el Rei Nosso Senhor no ano de 1565*, in *Documentos para a história da cidade de Lisboa- Volume II*, Câmara Municipal de Lisboa, 1947.
- 23 PAIS, A. – *“Fabricado no Reino Lusitano o que antes nos vendeu tão caro a China”: a produção de faiança em Lisboa, entre os reinados de Filipe II e D. João V*. Tese de doutoramento, Universidade Católica Portuguesa, pp. 165-166, Porto, Portugal, 2012.
- 24 ARCH. TORRE DO TOMBO, Paróquia de Santos-o-Velho, *Livro de registo de registos mistos* (1566/1578), fl. 66.
- 25 ARCH. TORRE DO TOMBO, Paróquia de Santos-o-Velho, *Livro de registo de registos mistos* (1566/1578), fl. 7.
- 26 BRAUN, G. – *Civitates Orbis Terrarum*, Vol.V, Amsterdam, Holland, 1598.
- 27 PAIS, A. et al. – *The 16th century nativity azulejo panel called “de Nossa Senhora da Vida”* in *Studies in Heritage Glazed Ceramics*, Nr. 1, pp. 67-76, LNEC, Lisbon, February 2019.
- 28 MIMOSO, J. et al. – *The azulejos in the Capela de São Roque in Lisbon* in *Studies in Heritage Glazed Ceramics*, Nr. 1, pp. 93-112, LNEC, Lisbon, February 2019.
- 29 ARCH. TORRE DO TOMBO, *Auto de habilitação de Francisco de Matos* (1614), Tribunal do Santo Ofício, Conselho Geral, Habilitações, Francisco, mç.2, doc.71.
- 30 VELLOSO D’ANDRADE, J. – *Memória sobre chafarizes, bicas, fontes e poços públicos de Lisboa, Belem, e muitos logares do termo*, pp. 120-121, Imprensa Sylviana, Lisboa, 1851.
- 31 OLIVEIRA, E. – *Elementos para a História do Município de Lisboa*, Tomo II, 1^a parte, pp. 63 & 83-84, Typographia Universal, Lisboa, 1887.

A comparison of the earliest faience tiles produced in Lisbon with earlier and later types

João Manuel Mimoso, Sílvia R. M. Pereira, Alexandre Pais, Maria Augusta Antunes, Ana Margarida Cardoso, Maria de Lurdes Esteves, António Candeias

ABSTRACT

The manufacture of majolica azulejos in Portugal started, as far as we know presently, during the 1550s by the workshop of Hans Goos, a Flemish potter established in Lisbon as João de Góis.

The productions of what we may call “the circle of João de Góis” (maybe only a single workshop, or maybe several sharing the same technology) encompasses a period starting with his own productions before 1560 and lasting at least until the 1580s, possibly beyond.

To address the characteristics of those productions and what makes them distinguishable, we have to compare them with those that chronologically preceded or followed it. This article presents such a study concluding that the productions of the circle of João de Góis have defining characteristics that allow to identify azulejos of unknown origin as stemming from workshops using the same basic materials and technology.

RESUMO

A fabricação de azulejos de faiança em Portugal começou, tanto quanto sabemos atualmente, durante a década de 1550 pela oficina de Hans Goos, um oleiro flamengo estabelecido em Lisboa como João de Góis.

As produções do que podemos chamar de “círculo de João de Góis” (talvez apenas uma única oficina, ou talvez várias compartilhando a mesma tecnologia) abrangem um período que se inicia com as suas próprias produções antes de 1560 e que continuou pelo menos até à década de 1580, prolongando-se possivelmente até uma época mais tardia.

Para abordar as características dessas produções e o que as torna distinguíveis, temos que compará-las com aquelas que as precederam ou que lhes sucederam cronologicamente. Este artigo apresenta um estudo realizado nessa base concluindo-se que as produções do círculo de João de Góis apresentam características próprias que as tornam distinguíveis permitindo, em geral, identificar como portugueses azulejos cuja origem é desconhecida mas apresentam morfologias e composições que os ligam ao mesmo círculo tecnológico.

João Manuel Mimoso

LNEC - Laboratório Nacional de Engenharia Civil, Lisbon, Portugal, jmimoso@lnec.pt

Sílvia R. M. Pereira

LNEC - Laboratório Nacional de Engenharia Civil, Lisbon, Portugal / Laboratório HERCULES - Universidade de Évora, Portugal

Alexandre Pais

Museu Nacional do Azulejo, Lisbon, Portugal

Maria Augusta Antunes

LNEC - Laboratório Nacional de Engenharia Civil, Lisbon, Portugal

Ana Margarida Cardoso

Laboratório HERCULES - Universidade de Évora, Portugal

Maria de Lurdes Esteves

Museu Nacional do Azulejo, Lisbon, Portugal

António Candeias

Laboratório HERCULES - Universidade de Évora, Portugal

KEYWORDS: Renaissance majolica / Hispano-Moresque tiles / Azulejos / João de Góis /
/ Museu Nacional do Azulejo

ACKNOWLEDGEMENTS

Teresa Morna, Director of the Museu de São Roque, André Martins da Silva and the remarkable Irmandade de São Roque, Jorge Manuel Tomaz Dias, parish Priest of Santo André e Sta. Marinha à Graça and Miguel Ângelo da Silva of the Graça church are gratefully acknowledged for authorizing or helping with a limited sampling of azulejo panels still in loco.

Communication produced as an outcome of Project FCT-AzuRe - Estudos no Azulejo Português para Candidatura a Património da Humanidade (PTDC/EPH-PAT/5096/2014) funded by FCT, the Portuguese Foundation for Science and Technology. S. Pereira also acknowledges FCT for her Post-Doc Grant (SFRH/BPD/116807/2016).

LNEC Research Project 0202/111/19747.

Aviso legal

As opiniões manifestadas no *Studies in Heritage Glazed Ceramics* são da exclusiva responsabilidade dos seus autores.

Legal notice

The views expressed in the *Studies in Heritage Glazed Ceramics* are the sole responsibility of the authors.

1. INTRODUCTION

Architecturally integrated tiles are used in Portugal since at least the 16th century. The oldest are believed to have been glazed slabs of a single colour and Hispano-Moresque tiles. Despite the possibility of a local production in small numbers, many Hispano-Moresque tiles applied in Portugal depict a compositional proximity that suggests they were imported from a single place, namely Seville, where they were manufactured in the Islamic tradition [1, pp. 95-98]. Hispano-Moresque tiles are decorated according to a *cloisonné* technique: raw glass pigmented in several colours is used to fill partitions on the surface of the tile. Once fired, a colourful decorative design is obtained with the shape of the partitions.

In majolica (also known as faience) a raw lead-tin glass which can be fired to an opaque white glaze is used to cover the surface of the tile. The raw glass can be painted, as if it was a canvas, with colours based on pigments able to sustain temperatures above 1,000 °C. Some of the earliest faience tiles used in Portugal were imported from Antwerp, of which the tiles dated “1558” used in the Ducal Palace of Vila Viçosa are an example [2]. The manufacture of majolica azulejos in Portugal started, as far as we know presently, during the 1550s by the workshop of Hans Goos, a Flemish potter established in Lisbon as João de Góis [3].

The productions of what we may call *the technological circle of João de Góis* (maybe only a single workshop, or maybe several sharing the same technology) encompasses a period starting with his own work before 1560 [3] and lasting at least until the 1580s [4], and possibly beyond. To address the technical characteristics of this production and what makes it distinguishable, we have to compare it with those that chronologically preceded or followed it. This article attempts such a study, noting however that the notions of “antecedent” and “subsequent” do not imply, in this case, a technological connection in the form that the latter is rooted in the former.

2. EXPERIMENTAL

2.1. Samples

We considered four groups of azulejos. Besides the productions of the workshop of João de Góis or his circle, as chronological predecessors we considered Hispano-Moresque tiles and majolica tiles from Antwerp. As chronological successors we considered Portuguese productions of the 17th century. Except for the Antwerp tiles, of which only two clearly distinct productions were available, six tiles or panels from each group (Hispano-Moresque, circle of João de Góis and 17th century Portuguese) were selected. The samples used in this study were chosen to correspond to the largest chronological spread in each group. They were collected from:

- six Hispano-Moresque tiles of different origins, mostly unknown but presumed to be from the workshops of Seville, from the collections of the Museu Nacional do Azulejo (MNAz – National Museum of Azulejos) and tentatively dated from the early 16th century to the 1560s (Figure 1);
- two majolica tiles produced in Antwerp, one from the Flemish panels applied in the Ducal Palace of Vila Viçosa and one from a group excavated in Lisbon [5] and



Figure 1. From left to right and top to bottom: tiles and panels from which samples were collected: Hispano-Moresque Az317/00; Az304/00; Az017/00; Az301/00; Az065/00 and Az066/00; Antwerp Az030/A1 and Az031/A; Portuguese 17th century Az003/00; Az024/00; Az100/01; Az197/01; Az198/AR2 and Az052/00

presumed older (Figure 1);

- six tiles from the three panels ascribed to the circle of João de Góis: two samples from the earliest confirmed panel (Graça church in Lisbon – Figure 2, presumed to date from the 1560s), two samples from the latest (São Roque chapel in Lisbon – Figure 3, dated “1584”) and two samples from the only other azulejo ensemble that may, at this time, be indisputably ascribed to a Portuguese production by the workshop of João de Góis or one of the same circle – the panel Nossa Senhora da Vida (Figure 4) tentatively dated to ca. 1580 and belonging to the MNAz collection. More images of the panels and details of the tile units from which samples were taken can be found in the literature [6; 7; 8];
- six Portuguese panels or loose tiles ascribed to the 17th century from ca. 1620 to ca. 1690 (Figure 1).

Table 1 includes further relevant data on all samples.



Figure 2. The monogrammed panel of Graça church from which samples Az013/L1 and Az013/L2 were collected



Figure 3. The signed and dated panel at São Roque chapel from which samples Az068/03 and Az068/13 were collected



Figure 4. The lower part of the panel Nossa Senhora da Vida from which samples Az032/00 and Az032/01 were collected

Table 1. Samples references and characteristics

Reference	Group*	Date	Origin/ Location	Glaze Colour	Notes
Az317/00	HM	1500-1510	Palace of Vila Viçosa / MNAz	white	Seville (?)
Az304/00	HM	early 16 th century	Royal Palace of Sintra / MNAz	white	Seville (?)
Az017/00	HM	2 nd quarter 16 th century	collection MNAz, Lisbon	blue	Seville (?)
Az301/00	HM	1 st quarter 16 th century	collection MNAz, Lisbon	white	probably Seville, excavated (?)
Az065/00	HM	ca. 1520-1560 (?)	collection MNAz, Lisbon	white	probably Seville
Az066/00	HM	ca. 1520-1560 (?)	collection MNAz, Lisbon	white	probably Seville
Az030/A1	Antw	before 1558 (?)	collection MNAz, Lisbon	grey	archaeological find
Az031/A	Antw	1558	Palace of Vila Viçosa / MNAz	white and blue	fragment
Az013/L1	JGc	1560s	Graça church, Lisbon	green	from tile bearing monogram
Az013/L2	JGc	1560s	Graça church, Lisbon	white	from different tile, as above
Az032/00	JGc	ca. 1580	Igreja de Santo André / MNAz	white	child Jesus elbow/arm
Az032/01	JGc	ca. 1580	Igreja de Santo André / MNAz	yellow-brown	child Jesus crib
Az068/03	JGc	1584	São Roque chapel, Lisbon	blue	signed panel of the dog
Az068/13	JGc	1584	São Roque chapel, Lisbon	dark blue	signed panel of the dog
Az003/00	PT17	1600-1620	collection MNAz, Lisbon	white with orange paint	fragment
Az024/00	PT17	before 1640 (?)	collection MNAz, Lisbon	white and blue	fragment
Az100/01	PT17	2 nd quarter of the 17 th century	collection MNAz, Lisbon	white	panel decorated with <i>groteschi</i>
Az197/01	PT17	1660-1680	Graça church, Lisbon	white and blue	azulejo panel still in situ
Az198/AR2	PT17	1660-1690	Graça church, Lisbon	white and blue	azulejo arch still in situ
Az052/00	PT17	1670-1690	collection MNAz, Lisbon	white	fragment

* HM - Hispano-Moresque; Antw – Antwerp; JGc – 16th century, circle of João de Góis; PT17 – 17th century Portuguese

2.2. Analytical methodology

Small fragments were detached from the azulejos, stabilized in epoxy resin, lapped and polished to obtain a flat surface for observation and analysis by scanning electron microscopy coupled with an X-ray energy-dispersive spectrometer (SEM-EDS). SEM-EDS observations and analyses were made at the HERCULES Laboratory in Évora using a HITACHI 3700N SEM coupled to a BRUKER XFlash 5010 EDS. The specimens were uncoated and the observations were made in backscattered electrons mode (BSE) with a chamber pressure of 40 Pa and at an accelerating voltage of 20 kV. The acquisition of X-ray spectra was done with the detector set at ca. 8 mm working distance.

The selection of areas for EDS analysis avoided inclusions in the glaze or biscuit representing more than ca. 5 % of the full area analysed. The area sizes were ca. $200 \times 200 \mu\text{m}^2$ for glazes and $500 \times 500 \mu\text{m}^2$ for biscuits but acceptable repeatability was verified in areas four times smaller. For comparison purposes, only the elements usually representing the major contents were considered, excluding tin (Sn) in the glaze and lead (Pb) in the biscuit due to their variability with the area chosen (in the case of Sn because of local aggregations of SnO_2 crystals; in the case of Pb because its content in the biscuit increases with proximity to the interface with the glaze). The results of the EDS analyses are given in weight % of each element identified.

Principal component analysis (PCA) was made of EDS results using the SPSS® software platform by IBM Analytics.

3. RESULTS

3.1. Glaze morphology

Figures 5 to 8 depict, at the same scale for comparison purposes, SEM images of the samples showing the main micro-morphologic characteristics generally associated with the glazes and their interfaces.

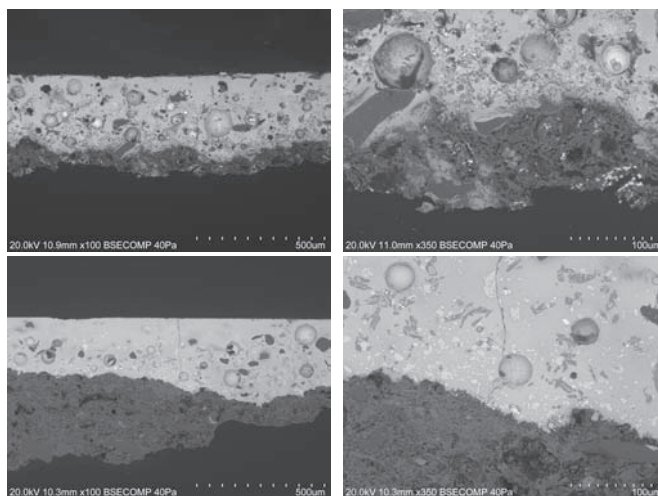


Figure 5. SEM-BSE images showing the main micro-morphologic characteristics of Antwerp majolica tiles glazes (left side) and biscuit-glaze interfaces (right side). From top to bottom: samples Az030/A1 and Az031/A

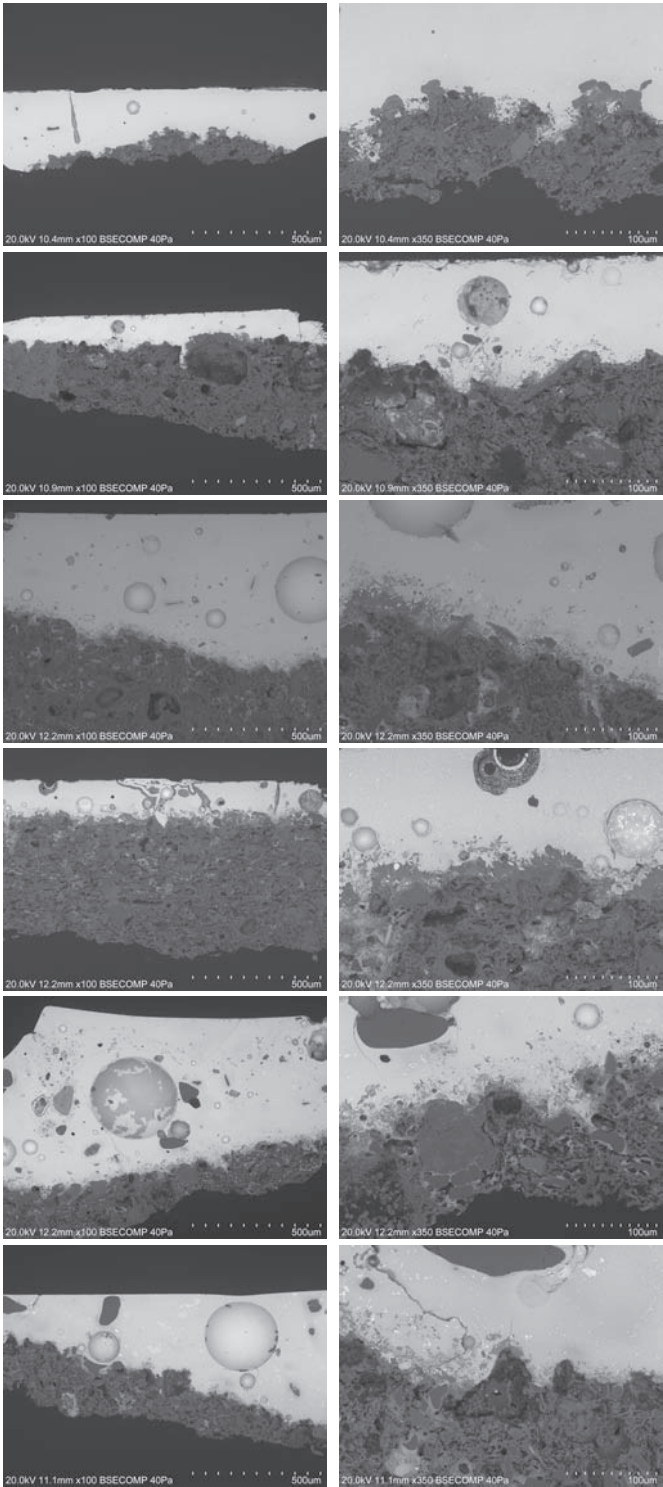


Figure 6. SEM-BSE images showing the main micro-morphologic characteristics of Hispano-Moresque tiles glazes (left side) and biscuit-glaze interfaces (right side). From top to bottom: samples Az317/00; Az304/00; Az017/00; Az301/00; Az065/00 and Az066/00

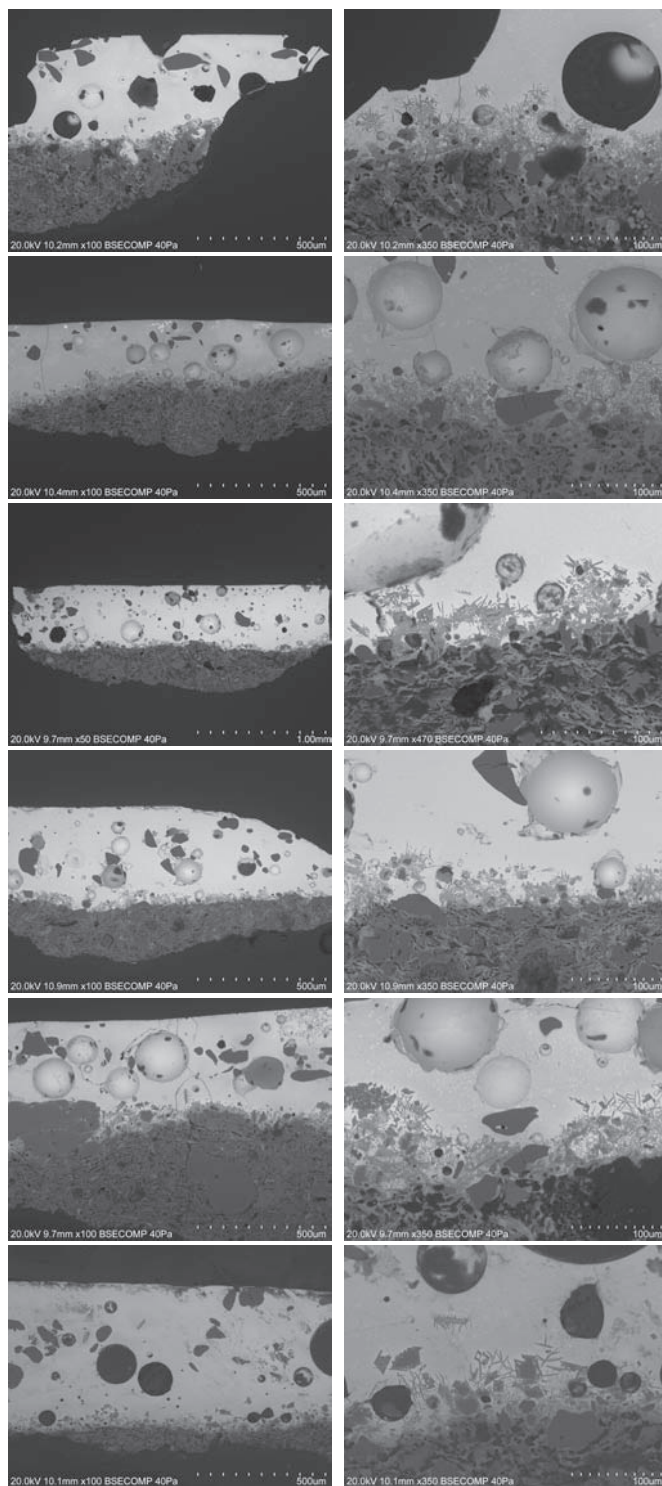


Figure 7. SEM-BSE images showing the main micro-morphologic characteristics of glazes (left side) and biscuit-glaze interfaces (right side) ascribed to glazed tiles of the circle of João de Góis. From top to bottom: samples Az013/L1; Az013/L2; Az032/00; Az032/01; Az068/02 and Az068/13

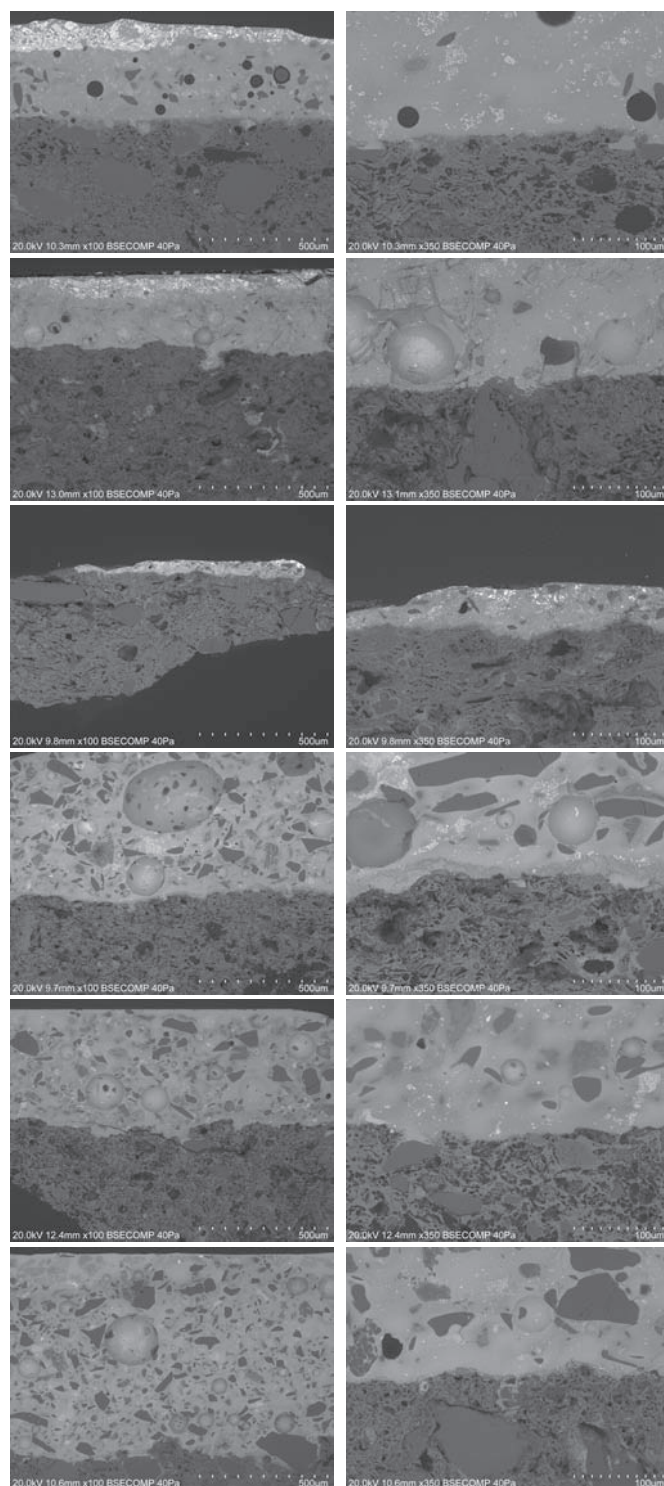


Figure 8. SEM-BSE images showing the main micro-morphologic characteristics of 17th century Portuguese tiles glazes (left side) and biscuit-glaze interfaces (right side). From top to bottom: samples Az003/00; Az024/00; Az100/01; Az197/01; Az198/AR2 and Az052/00. The darker colour of the glaze as compared with e.g. the previous figure results from a lower content in Pb

3.2. Glaze composition

Table 2 includes the semi-quantitative results of analyses of the glazes by EDS in weight %. Sn was excluded for the reasons pointed out in section 2.2. The amount of oxygen was calculated through the remaining elements stoichiometry considering their most commonly considered oxides (Na_2O , MgO , Al_2O_3 , SiO_2 , K_2O , Fe_2O_3 and PbO). The results were normalized to 100 % and the table also indicates the ratios Si/Pb.

Table 2. Semi-quantitative composition (% w/w) of the glazes determined by EDS (weight of the elements normalized to 100 %) and Si/Pb ratio

Sample	Group*	Na	Mg	Al	Si	K	Fe	Pb	O	Si/Pb
Az317/00	HM	2.3	0.7	1.3	17.9	2.5	0.4	47.8	27.1	0.4
Az304/00	HM	2.0	0.6	1.4	17.1	2.9	1.0	48.6	26.5	0.4
Az017/00	HM	3.5	0.4	2.1	20.4	1.8	2.3	38.5	30.9	0.5
Az301/00	HM	2.7	0.8	1.8	19.3	1.6	1.1	43.6	29.2	0.4
Az065/00	HM	2.5	0.7	1.6	19.1	1.1	0.7	45.8	28.6	0.4
Az066/00	HM	2.6	0.6	1.6	19.8	2.0	0.7	43.5	29.3	0.5
Az030/A1	Antw	2.2	0.7	1.2	23.6	4.4	0.7	34.0	33.1	0.7
Az031/A	Antw	1.1	0.5	1.5	24.2	6.9	0.9	31.0	33.8	0.8
Az013/L1	JGc	1.2	0.4	2.9	19.5	1.7	0.5	44.2	29.5	0.4
Az013/L2	JGc	1.1	0.5	3.3	20.2	1.9	1.1	41.2	30.7	0.5
Az032/00	JGc	0.9	0.5	2.4	14.5	0.9	0.6	56.1	24.1	0.3
Az032/01	JGc	1.4	0.7	2.6	15.3	0.8	0.6	53.3	25.3	0.3
Az068/3	JGc	1.3	0.8	3.5	17.6	1.9	0.9	45.6	28.4	0.4
Az068/13	JGc	0.7	0.1	2.3	19.4	1.4	0.8	46.6	28.7	0.4
Az003/00	PT17	1.3	1.1	2.9	25.9	6.0	2.4	23.1	37.3	1.1
Az024/00	PT17	1.7	0.8	4.7	26.5	5.8	1.2	20.5	38.8	1.3
Az100/01	PT17	2.4	0.9	4.3	28.7	4.4	0.9	17.7	40.6	1.6
Az197/01	PT17	2.1	0.3	3.7	30.8	4.6	0.5	16.1	41.8	1.9
Az198/AR2	PT17	2.5	0.4	4.2	29.0	6.3	0.7	16.2	40.7	1.8
Az052/00	PT17	4.1	0.9	4.3	24.3	4.1	1.3	24.4	36.7	1.0

* HM - Hispano-Moresque; Antw – Antwerp; JGc – 16th century, circle of João de Góis; PT17 – 17th century Portuguese.

Figure 9 shows the results of a log-based principal component analysis (PCA) of the glazes of all samples, considering the analytical results in Table 2, through a plot in the plane of the two first principal components (PC1 and PC2). PC1 explains 47 % of the variation and is controlled in the positive sense mostly by the contents in Si and K; and in the opposite sense singly by the content in Pb, as can be seen from the loadings plot of Figure 10 in which the projections of the vectors on an axis show the contribution of each element to the respective principal component. PC2 explains 21 % and is controlled in the positive sense mostly by the contents in Mg, Na and Fe; and in the opposite sense mostly by the content in Al (Figure 10). The contents in those elements are reflected in the position of the point representing the composition of each glaze in the score plot of Figure 9, and these positions together with the provenance of the samples, when known, are the bases for a graphical clustering that is much clearer than the perception obtained directly from the tables of results.

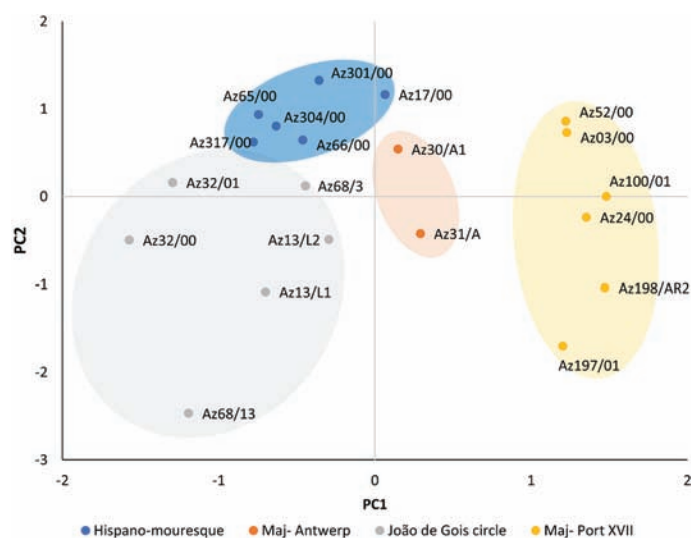


Figure 9. Score plot of the PCA analysis of the glazes with tentative clustering of the groups

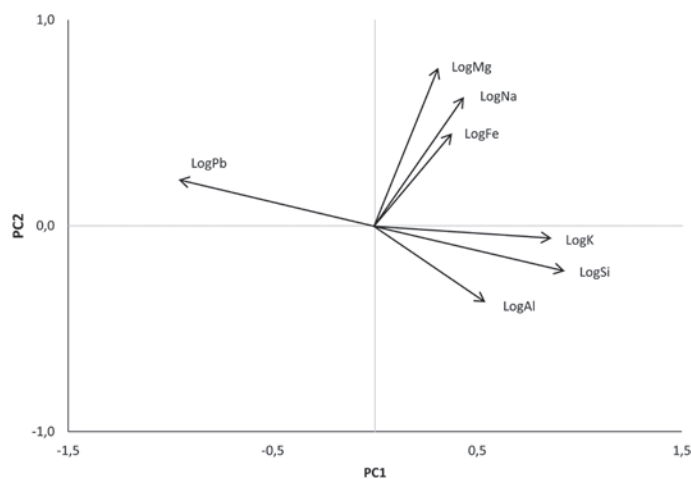


Figure 10. Loadings plot of the PCA analysis of the glazes

3.3. Biscuit composition

Table 3 includes the semi-quantitative results of analyses of the biscuits by EDS in weight %. Pb was excluded for the reasons pointed out in section 2.2. The amount of oxygen was calculated through the remaining elements stoichiometry considering their most commonly used oxides (Na_2O , MgO , Al_2O_3 , SiO_2 , K_2O , CaO and Fe_2O_3). The results were normalized to 100% and the table also indicates the ratios Ca/Si.

Table 3. Semi-quantitative composition (% w/w) of the biscuits determined by EDS (weight of the elements normalized to 100 %) and Ca/Si ratio

Sample	Group*	Na	Mg	Al	Si	K	Ca	Fe	O	Ca/Si
Az317/00	HM	3.5	2.9	7.1	22.9	1.9	15.7	2.8	43.3	0.7
Az304/00	HM	1.6	4.2	7.2	19.7	1.3	19.8	3.9	42.1	1.0
Az017/00	HM	1.1	7.8	7.9	21.3	1.7	12.3	4.0	43.8	0.6
Az301/00	HM	1.9	2.5	7.0	21.2	2.1	18.3	4.5	42.4	0.9
Az065/00	HM	1.7	3.3	7.5	20.2	1.8	19.1	4.2	42.2	0.9
Az066/00	HM	2.2	2.1	7.3	25.3	1.5	13.9	3.1	44.6	0.5
Az030/01	Antw	1.8	1.8	8.5	21.5	1.6	18.3	3.6	43.0	0.9
Az031/A	Antw	1.0	2.7	6.8	21.9	1.2	20.0	3.5	42.9	0.9
Az013/L1	JGc	1.3	1.7	8.4	26.5	2.6	10.6	3.3	45.5	0.4
Az013/L2	JGc	1.2	1.4	8.3	26.8	3.2	9.2	4.4	45.5	0.3
Az032/00	JGc	1.5	1.7	10.5	25.3	3.8	6.4	5.3	45.4	0.3
Az032/01	JGc	1.2	2.2	9.1	24.6	2.6	9.5	5.9	44.9	0.4
Az068/03	JGc	1.3	1.3	7.7	28.9	2.5	8.7	3.2	46.4	0.3
Az068/13	JGc	0.7	0.9	7.9	28.5	4.0	8.7	3.2	46.0	0.3
Az003/00	PT17	1.4	2.3	5.9	17.8	1.0	28.9	2.5	40.3	1.6
Az024/00	PT17	1.4	1.5	6.7	16.8	1.6	28.5	3.6	39.9	1.7
Az100/01	PT17	1.7	2.0	7.5	20.1	2.1	20.9	3.9	41.9	1.0
Az197/01	PT17	1.6	2.0	6.2	19.0	1.3	25.9	3.0	41.0	1.4
Az198/AR2	PT17	1.4	1.9	6.8	17.8	1.1	26.7	3.8	40.5	1.5
Az052/00	PT17	1.6	1.6	6.8	16.3	1.6	28.4	4.0	39.7	1.7

* HM - Hispano-Moresque; Antw – Antwerp; JGc – 16th century, circle of João de Gois; PT17 – 17th century Portuguese

Figure 11 shows the results of a log-based principal component analysis (PCA) of the biscuits of all samples, considering the analytical results in Table 3, through a plot in the plane of the two first principal components (PC1 and PC2). PC1 explains 46 % of the variation and is controlled in the positive sense mostly by the contents in Al, Si and K; and in the opposite sense mostly by the content in Ca, as can be seen from the loadings plot of Figure 12. PC2 explains 18 % and is controlled in the positive sense mostly by the contents in Fe and Mg and in the opposite sense mostly by the content in Si (Figure 12).

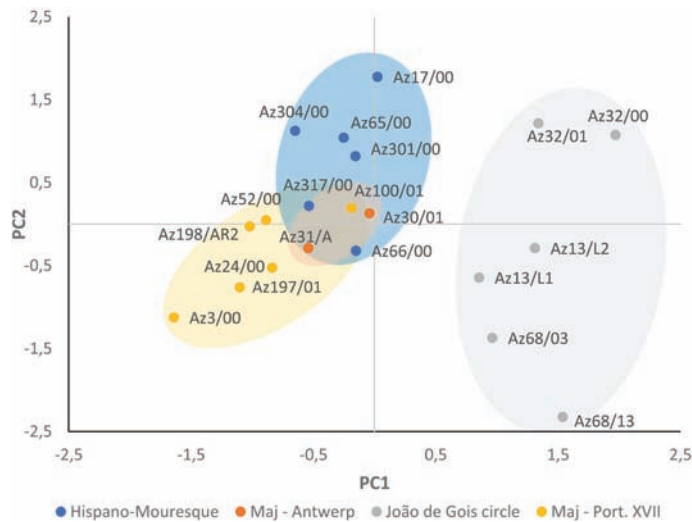


Figure 11. Score plot of the PCA analysis of the biscuits with tentative clustering of the groups

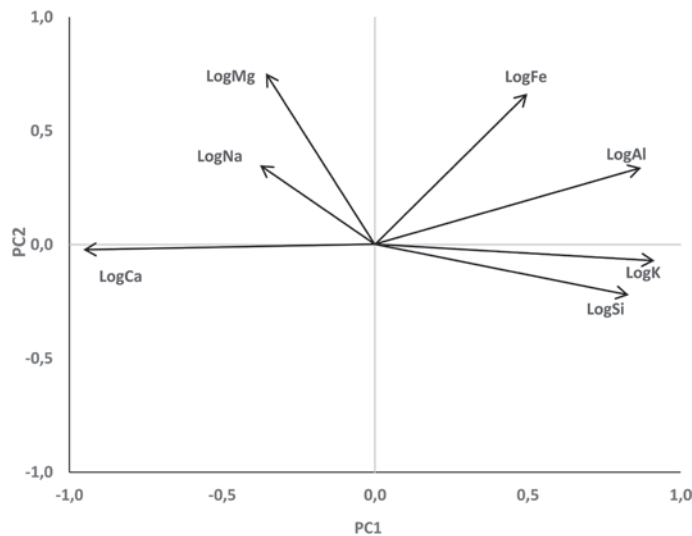


Figure 12. Loadings plot of the PCA analysis of the biscuits

4. DISCUSSION

4.1. Morphology of the glazes

A comparison of the images in Figures 5 to 8 shows that the morphology of the glazes of the productions within the technological circle of João de Góis is different from all others. The most revealing difference lies in the crystalline outgrowth from the biscuit into the glaze. This is determined by both the composition and the firing cycle, but particularly by the period the tiles are kept at a temperature high enough for the glaze to be molten and by a long cooling time [9; 10]. Antwerp and later Portuguese productions that we analysed are completely different in this respect, depicting minimal crystalline outgrowths in the interface. Only Hispano-Moresque tiles depict, at times, a similar interface – Figure 6 and [1, white glazes¹ in pp. 161-196] – but the size of the crystals is usually smaller and the glaze is often devoid of any large inclusions, contrarily to tiles from the circle of João de Góis.

4.2. Composition of the glazes

As pertains the glazes, the PCA score plot of Figure 9 allows the graphical separation of the productions of the circle of João de Góis from all the other groups studied. They separate from the coeval Antwerp majolica and later Portuguese tiles by their lower Si/Pb ratio that allowed firing at a lesser temperature, and from Hispano-Moresque productions, which share with them a similarly low Si/Pb ratio, by their higher content in Al and much lower content in Na. It is interesting to note that the same plot also clearly allows a tentative separation of the other groups but particularly of the 17th century Portuguese productions because their Si/Pb ratio is very different.

Except for the tiles from Antwerp, of which we had only two distinct samples available, Table 4 summarizes the results of Table 2, depicting the estimates of the averages of the elemental contents of the glazes, as well as of the Si/Pb ratio. To each value is associated a ca. 90 % confidence interval on the reasonable assumption that Student's t-distribution with 5 degrees of freedom is approximately applicable. Important similarities with the results for the circle of João de Góis are displayed on a green ground while remarkable contrasts are highlighted on a red ground.

Table 4. Averages of glaze elemental contents (% w/w) and Si/Pb ratios estimated with ca. 90 % confidence intervals

Averages with ca. 90 % confidence intervals	Na	Mg	Al	Si	K	Fe	Pb	Si/Pb
Circle of João de Góis	1.1±0.2	0.5±0.2	2.8±0.4	17.8±2	1.4±0.4	0.7±0.2	47.8±4.7	0.4±0.1
Hispano-moresque	2.6±0.5	0.6±0.1	1.6±0.3	18.9±1.2	2±0.6	1±0.6	44.6±3.7	0.4±0.1
Portugal 17th century	2.3±0.9	0.7±0.3	4±0.7	27.5±2.4	5.2±0.9	1.2±0.7	19.7±3.6	1.5±0.4

¹ Faience glazes are white and for a strict comparison of Hispano-Moresque to them, the white glazes should be preferred.

4.3. Composition of the biscuits

As pertains the biscuits, the PCA score plot of Figure 11 also allows the separation of the productions of the circle of João de Góis from all the other groups studied. The separation is based on their much lower Ca/Si ratio as well as on the higher content in K.

The Hispano-Moresque and later 17th century Portugal majolica azulejos groups are partially entangled. The later Portuguese productions have on average higher Ca/Si ratios (1.5 vs 0.8) compared to the Hispano-Moresque tiles. However, the separation is not as clear as it is for the glazes. Antwerp tiles cannot be separated from the previous groups based on the two first principal components depicted in Figure 11.

Table 5 summarizes the results in Table 3, depicting the estimates of the averages of the elemental contents of the biscuits, as well as of the Ca/Si ratio. To each value is associated a ca. 90% confidence interval as before. The tiles from Antwerp were not considered since we had only two distinct samples available.

In this case, similarities do not seem particularly relevant as they pertain mostly to low-content elements present in clays. However, contrasts are revealing and possibly valuable as rough indicators of provenance and are therefore highlighted on a red ground for comparison with the values for the circle of João de Góis, shown on a green ground. They refer to the low Ca content and related Ca/Si ratio of the productions of João de Góis as compared to the remaining groups studied. The high content in K is also important since it does not have a counterpart in either Hispano-Moresque or later Portuguese productions.

Table 5. Averages of biscuit elemental contents (% w/w) and Ca/Si ratios estimated with 90 % confidence intervals

Averages with ca. 90 % confidence intervals	Na	Mg	Al	Si	K	Ca	Fe	Ca/Si
Circle of João de Góis	1.2±0.2	1.5±0.4	8.6±0.9	26.8±1.4	3.1±0.5	8.9±1.2	4.2±1.0	0.3±0.0
Hispano-moresque	2.0±0.8	3.8±2.1	7.3±0.3	21.8±2.0	1.7±0.3	16.5±3	3.7±0.7	0.8±0.2
Portugal 17th century	1.5±0.1	1.9±0.3	6.6±0.6	18±1.4	1.4±0.4	26.6±3	3.5±0.6	1.5±0.3

4.4. Origin of the earliest azulejo technology in Portugal

Given that the earliest Portuguese azulejo productions are different from those that preceded them in the Peninsula, a question can be put forward: from where was the technology acquired? To hypothesize about a source based on the characteristics discussed in this paper, three potentially indicative aspects may be considered: the composition of the biscuits; the composition of the glazes; and the morphologic features.

For the production of the biscuits, potters had to rely on clays and marl available locally and therefore the compositions could result more from the geological context than from technical options. The glaze, on the other side, is a product of the technology of the workshop, made from selected raw materials according to a prescription presumably obtained elsewhere and eventually incorporating local specificities or improvements. The

morphology of the glaze and of its interface with the biscuit depends, in a great measure, of the kiln and associated firing technique [9; 10] – therefore it may reflect conditions previously established for the firing of glazed ceramics other than azulejos, using an already extant kiln, rather than a workshop option. Accordingly, the glaze composition is the most promising discriminant characteristic as pertains the identification of a technological source. However, for the purposes of this section, the Si/Pb is not particularly relevant because it, too, may well derive from an imposition of the firing conditions.

On dealing with the preparation of the glazes in his 16th century treatise *Li tre libri dell'arte del vasaio* (*The three books of the potter's art*), Cipriano Piccolpasso describes the raw glaze as a mixture of *marzacotto* with lead and tin compounds. The *marzacotto* follows several recipes according to the region of Italy but those more often mentioned are: i) a mixture of sand with calcined lees or tartar (potassium carbonate); or ii) the same with a third component- sea salt [11, pp. 62-81].

For a visual support to the argument that will follow, Figure 13 depicts the relevant parts of eight EDS glaze spectra: two for the circle of João de Góis (Az013/L2 and Az068/03); two for Hispano-Moresque tiles (Az017 and Az065); two for both Antwerp tiles (Az030 and Az031); and two for 17th century Portuguese tiles (Az100 and Az198). The peaks considered more important for comparative purposes are identified in all spectra and on considering them it will be noticed that in the glazes produced within the circle of João de Góis the content in sodium is low, sometimes only residual. A study of the glazes of Graça church, the earliest group of panels from that circle identified so far [6], demonstrated, through the correlation matrix of the elemental composition of the glaze, that the contents in Si and K were highly correlated, but Si was uncorrelated with Na. From all this we may deduce that the workshop of João de Góis, at least in an early phase, prepared a *marzacotto* from sand and a source of potassium but did not add sea salt. Reviewing the spectra in Figure 13, the only sample where we recognize a similar and unusually low content in Na is Az031/A – one of the azulejos supplied in 1558 by an Antwerp workshop for the Ducal Palace of Vila Viçosa [2] but this is not enough to define a correlation.

The fact that no obvious similarity was observed with the Hispano-Moresque glaze composition and that by the time João de Góis may have been in Seville there seemingly was not a local majolica technology capable of quality results [12] is relevant and leaves as possible technological sources of his craftsmanship Antwerp and Italy. Two Flemish majolica masters are known to have been in the Iberian Peninsula in the 1550s [13] and João de Góis employed a Venetian [3].

The remark that dissimilarities are more noteworthy than similarities leaves the question of the technological ancestry of the technique used open until more results are available but we should also advance the possibility that the technology was perfected locally from several sources and therefore a definite origin may be impossible to pinpoint.

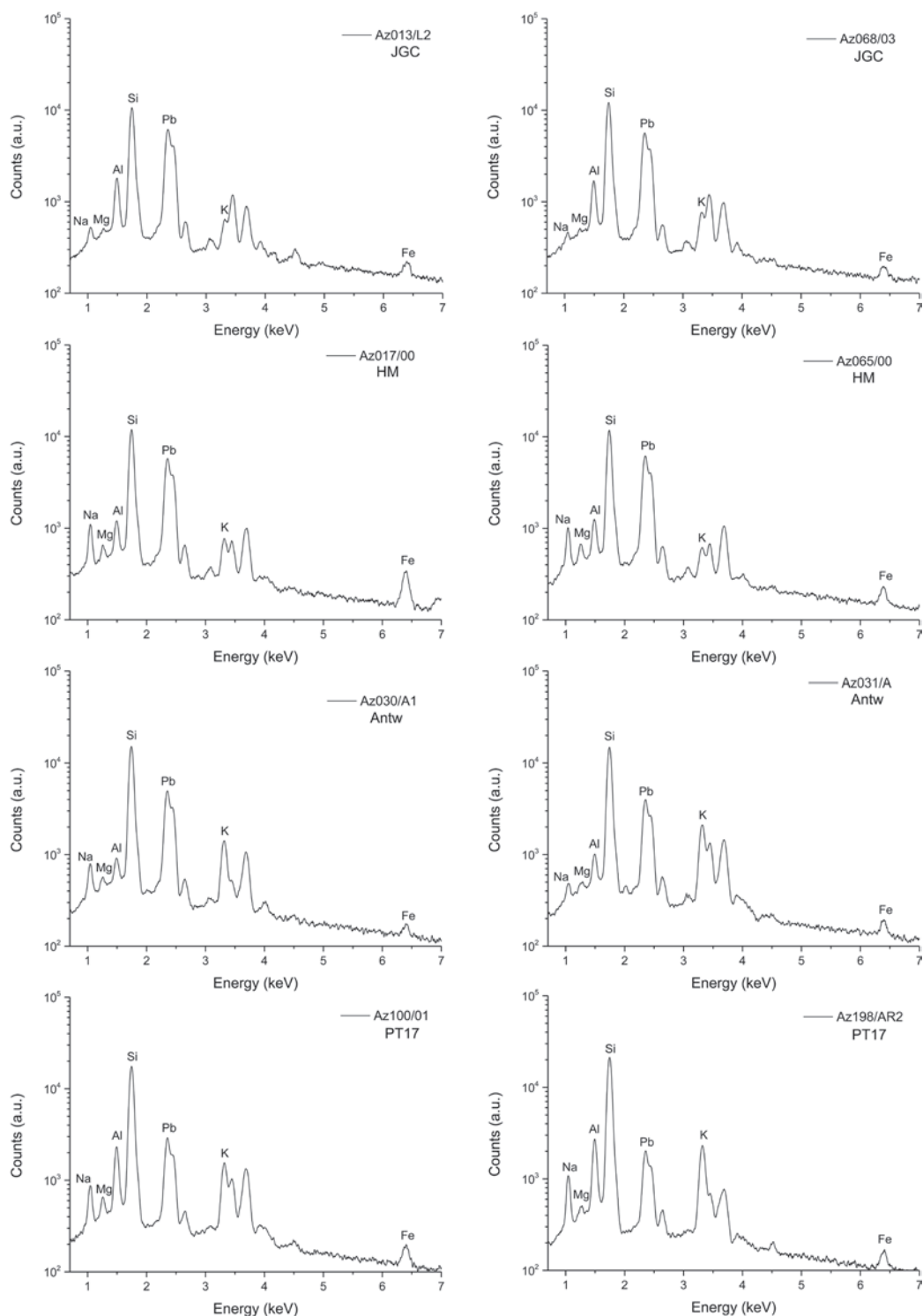


Figure 13. EDS spectra of the glaze analyses of (from left to right and from top to bottom): Az013/L2 and Az068/03 (João de Góis circle); Az017/00 and Az065/00 (Hispano-Moresque); Az030/A1 and Az031/A (Antwerp); Az100/01 and Az198/AR2 (17th century Portugal)

5. CONCLUSION

The azulejo productions of the circle of João de Góis, as represented by the monogrammed panels of Graça church in Lisbon, the panel Nossa Senhora da Vida conserved at the Museu Nacional do Azulejo, and the signed and dated panels lining the São Roque chapel in Lisbon, constitute a cluster distinct from previous productions (Hispano-Moresque tiles presumed of Seville manufacture and majolica tiles from Antwerp). They are also very different from later Portuguese productions of the 17th century. The differences pertain mostly to the morphology and composition of the glazes. The very distinct morphology that endured through the period of ca. 20 years covered by the three panels considered is related, not only with the composition, but also and particularly with a possibly long firing cycle.

This result is capital because the composition and morphology of the glazes of the circle of João de Góis should now be sufficient, in most cases, to separate them from other nearly contemporary productions imported to Portugal, as well as from later Portuguese productions. The biscuits, though more variable, also depict distinguishing characteristics that may help sustain doubtful attributions to the circle of João de Góis and to a Portuguese production spanning from the 1560s (maybe even before) to, at least, the 1580s.

It is certainly fortunate for the research of the early production of majolica azulejos in Portugal that such clear differences were found. The composition of the glazes as pertains the Si/Pb ratio was, in a large measure, connected to the firing method, which depended on the kiln technology available. The constancy of the morphologic characteristics suggests that the firing conditions remained essentially unchanged during this period and maybe the kiln used was always the same. When a new kiln or improved technology became available, allowing a quicker firing at probably a higher temperature, the ratio Si/Pb was increased to save on the cost of lead and the duration of the cycle was decreased to save on both time and fuel, leading to a sharp diminution of the interfacial crystalline outgrowths.

The focus on the kiln technology and the constancy of the firings brings to memory that on both the Holly Inquisition process against João de Góis and the denunciation against his brother Filipe, a kiln is mentioned (“the kiln where glazed ceramics are fired” [3]), maybe precisely the kiln whose firing cycle made these productions so very recognisable.

BIBLIOGRAPHIC REFERENCES

- 1 COENTRO, S. – *An Iberian Heritage: Hispano-Moresque architectural tiles in Portuguese and Spanish collections*, PhD thesis, Universidade Nova de Lisboa, Lisbon, Portugal, 2017.
- 2 PAIS, A. – *Reminiscences of a forgotten memory: the 16th century Flemish azulejos at the Ducal Palace in Vila Viçosa*, in “From Flanders. The azulejos commissioned by D. Teodosio I, 5th Duke of Braganza (c.1510-1563)”, pp. 42-57, Museu Nacional do Azulejo | Museu-Biblioteca do Paço Ducal de Vila Viçosa, Lisbon, 2012.
- 3 PAIS, A. et al. – *The beginning of the production of majolica azulejos in Portugal- João and Filipe de Góis in 16th century Lisbon* in *Studies in Heritage Glazed Ceramics*, Nr. 1, pp. 1-24, LNEC, Lisbon, February 2019.
- 4 MIMOSO, J. et al. – *A technical comparison of three renaissance azulejo panels from the workshops of Lisbon* in *Studies in Heritage Glazed Ceramics*, Nr. 1, pp. 113-132, LNEC, Lisbon, February 2019.

- 5 PAIS, A. et al. – *16th century azulejos- what lies beneath the ground of Lisbon?* in Proc. Int. Conf. Glazed Ceramics in Cultural Heritage (GlazeArt 2018), LNEC, Lisbon Oct. 29-30, pp. 298-312, LNEC, Lisbon, 2018.
- 6 PAIS, A. et al. – *Study of the azulejo panels in Graça church signed by João de Góis* in Studies in Heritage Glazed Ceramics, Nr. 1, pp. 47-66, LNEC, Lisbon, February 2019.
- 7 MIMOSO, J. et al. – *Analytical study of the 16th century azulejo panel called “de Nossa Senhora da Vida” and related archaeologic findings*, in Studies in Heritage Glazed Ceramics, Nr. 1, pp. 77-92, LNEC, Lisbon, February 2019.
- 8 MIMOSO, J. et al. – *A research on the azulejo panels of the São Roque chapel in Lisbon* in Studies in Heritage Glazed Ceramics, Nr. 1, pp. 93-112, LNEC, Lisbon, February 2019.
- 9 PEREIRA, S. et al. – *Influence of the production technology on the morphological characteristics of azulejos* in Proc. Int. Conf. Glazed Ceramics in Cultural Heritage (GlazeArt 2018), pp. 140-149, LNEC, Lisbon, 2018.
- 10 MOLERA, J. et al. – *Interactions between Clay Bodies and Lead Glazes*, Journal of the American Ceramic Society, May 2001, Vol. 84, Nr. 5, pp. 1120-1128.
- 11 PICCOLPASSO, C. – *The three books of the potter’s art*, transl. and ed. R. Lightbown & A. Caiger-Smith, Editions La Revue de la Céramique et du Verre, Vendin-le-Vieil, France, 2007.
- 12 PLEGUEZUELO HERNÁNDEZ, A. – *Sevilla y Talavera entre la colaboración y la competencia*, Laboratorio de Arte: Revista del Departamento de Historia del Arte, N^o 5, 1, Universidad de Sevilla, Spain 1992, pp. 275.
- 13 DUMORTIER, C. – *Céramique de la Renaissance à Anvers: de Venise à Delft*, Éditions de l’Amateur, pp. 227 & 236, Éditions Racine, Bruxelles, Belgium, 2002.

Study of the azulejo panels in Graça church signed by João de Góis

Alexandre Pais, João Manuel Mimoso, Maria de Lurdes Esteves, Miguel Ângelo Silva, Ana Margarida Cardoso, Maria Augusta Antunes, Sílvia R. M. Pereira, António Candeias

ABSTRACT

After the panels of São Roque (Saint Roch) chapel in Lisbon, signed and dated, the incomplete and dispersed panels in Graça church are the second set of Renaissance azulejos produced in Lisbon that was found to be signed.

A selection of azulejo samples obtained from the panels has now been studied by scanning-electron microscopy coupled with energy-dispersive spectrometry (SEM-EDS). Samples from the azulejos on which is painted the image of the book bearing the signing monogram have been used to establish a morphological and analytical reference aimed at identifying in the future a common officinal provenance in azulejos of the same general chronology known or presumed to have been produced in Lisbon.

This paper attempts a partial reconstitution of the panels and discusses their original emplacement. It also reports the results of the analytical study identifying the main micro-morphological features and the compositional variations that may be ascribed to different chronologies.

RESUMO

Depois dos painéis da Capela de São Roque em Lisboa, assinados e datados, os painéis incompletos e dispersos da Igreja da Graça foram o segundo conjunto de azulejos renascentistas produzidos em Lisboa onde foi reconhecida uma assinatura.

Uma seleção de amostras de azulejos dos painéis foi agora estudada por microscopia eletrónica de varrimento acoplada a espectrometria de energia dispersiva (SEM-EDS). Os azulejos que compõem a imagem do livro onde se pode ver o monograma que assina os painéis foram utilizados para estabelecer um modelo morfológico e analítico destinado a identificar, no futuro, uma proveniência oficinal comum em azulejos da mesma época que se presume terem sido fabricados em Lisboa.

Este artigo apresenta uma reconstituição parcial dos painéis e discute a sua localização original na igreja. Inclui, também, os resultados do estudo morfológico e analítico identificando as principais características bem como as variações composicionais que podem ser atribuídas a diferentes cronologias dos azulejos que compunham os painéis.

Alexandre Pais

Museu Nacional do Azulejo, Lisbon, Portugal, apais@mnazulejo.dgpc.pt

João Manuel Mimoso

LNEC - Laboratório Nacional de Engenharia Civil, Lisbon, Portugal

Maria de Lurdes Esteves

Museu Nacional do Azulejo, Lisbon, Portugal

Miguel Ângelo Silva

Igreja da Graça, Lisbon, Portugal

Ana Margarida Cardoso

Laboratório HERCULES - Universidade de Évora, Portugal

Maria Augusta Antunes

LNEC - Laboratório Nacional de Engenharia Civil, Lisbon, Portugal

Sílvia R. M. Pereira

LNEC - Laboratório Nacional de Engenharia Civil, Lisbon, Portugal / Laboratório HERCULES - Universidade de Évora, Portugal

António Candeias

Laboratório HERCULES - Universidade de Évora, Portugal

KEYWORDS: Renaissance majolica / Azulejos / João de Góis / Analysis of majolica

ACKNOWLEDGEMENTS

The parish Priest of Santo André e Sta. Marinha à Graça Jorge Tomaz Dias is gratefully acknowledged for his support.

Paper produced as an output of Project FCT-AzuRe - Estudos no Azulejo Português para Candidatura a Património da Humanidade (PTDC/EPH-PAT/5096/2014) funded by FCT, the Portuguese Foundation for Science and Technology. S. Pereira also acknowledges FCT for her Post-Doc Grant (SFRH/BPD/116807/2016).

LNEC Research Project 0202/111/19747.

Aviso legal

As opiniões manifestadas no *Studies in Heritage Glazed Ceramics* são da exclusiva responsabilidade dos seus autores.

Legal notice

The views expressed in the *Studies in Heritage Glazed Ceramics* are the sole responsibility of the authors.

1. ON THE WALLS OF GRAÇA CHURCH

On the walls of the ante-sacristy of Graça church in Lisbon subsist parts of several azulejo panels decorated with grotesque motifs that suggest an early chronology (Figure 1). The incomplete panels have been reported by other authors [e.g. 1, pp. 108-109] and ascribed to the 2nd half of the 16th century based on the decoration. They were also often assumed to be of Portuguese production, although that assumption was never objectively proved.

In December 2014 we obtained an authorization from the church to make an exploratory inspection of the tiles, during which the painted monogram of the workshop master (and presumably also one of the painters of the original panels) was found [2]. That monogram (Figure 2) has been conclusively identified as that of the elusive João de Góis, a Flemish faience and tile manufacturer until now known only from an inquisitorial process for heresy of 1561/62 [3] and from a tally of professionals living in Lisbon, made in 1565, for taxation purposes [4]. He signed six times his declarations to the inquisitorial board with the same monogram (Figure 3).



Figure 1. Two aspects of the dispersed grotesque azulejo panels in Graça church. The monogram is painted on the book held by a figure seen on top of the right hand image

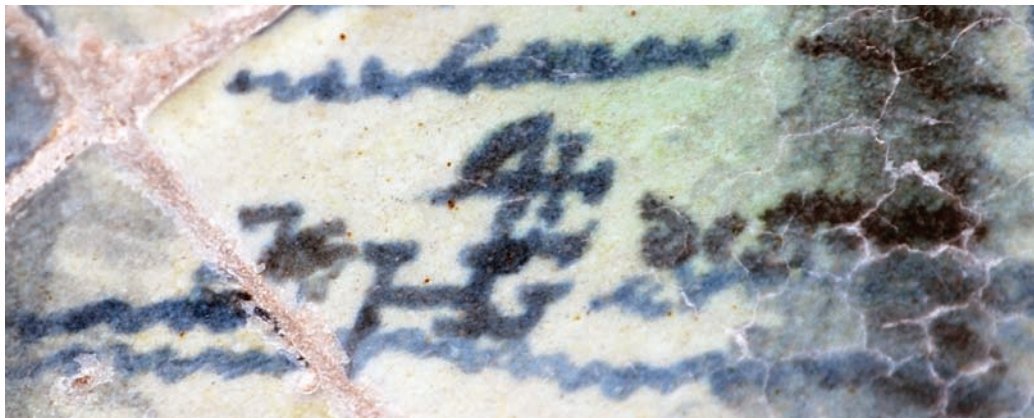


Figure 2. The monogram signing the panels

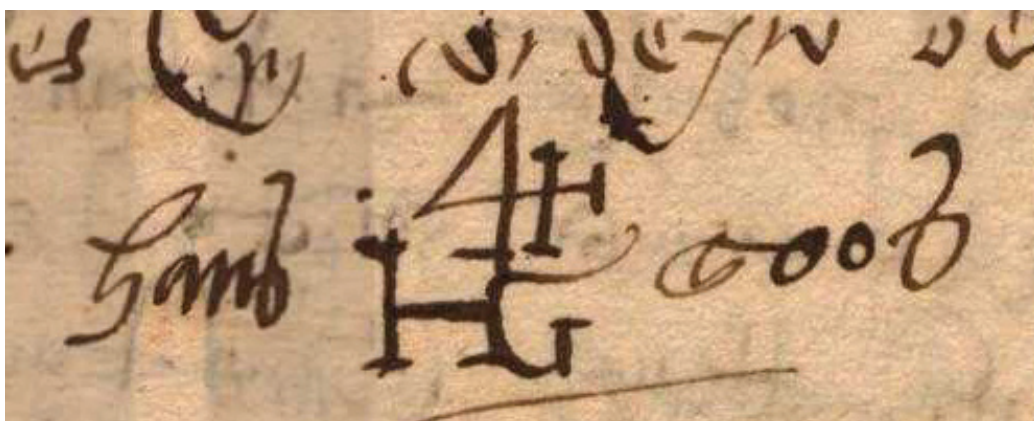


Figure 3. João de Góis' monogram
Source: Arquivo Nacional Torre do Tombo, PT-TT-TSO-IL-28-6820_m0025

From the images acquired during the visits, a first graphical reconstitution of the panel remains was attempted resorting to digital technology and the dispersed tiles started being assembled into what may have been a main panel once bearing a shield of arms together with smaller panels and pilasters (Figure 4).

This amazing collection of panels composes a striking and imaginative set of images that reflect a bizarre array of figures in what is probably the most accomplished example of grotesques in Portuguese azulejos. Contrary to other examples, most notably those at São Roque chapel in Lisbon [5] but also the dissociated panels in the Santa Maria da Graça church, in Setúbal [6], whose background in yellow contrasts with the motifs in white outlined in blue, the panels in Graça church are related to, among others, the Italian *frescoes* tradition. The option of using a white background as a means to emphasize the different hues of the colours that are used, sets the rule for what was to come in the following century and has no comparison with other known surviving contemporary examples. Only in some of the *Quinta da Bacalhoa* azulejo panels do we have a white background, notably in the series of the river sources [1, Est. XXXV] but the painter of those panels did not master the possibilities of the colours as in this case.



Figure 4. Proposed reconstitution of several of the panels

What was the purpose of such an extravagant and certainly costly set of panels? What was the intention that justified such a lavish of talent and where were they intended to be placed? We do not have yet any information regarding such aspects, however it is important to bear in mind that the use of grotesques was not solely decorative. Often these now bizarre-looking compositions had an intention more or less hidden in the combined elements. When, in 1562, the painter Taddeo Zuccaro was made responsible for the decoration of the Farnese Palace at Caprarola, referring to the Room of Aurora, the sleeping quarters of the Cardinal Alessandro Farnese, he wrote “for it I will do grotesques or small stories whose nature will be according to the subjects already referred and those in relation with their neighbourhood” (*pour laquelle je ferais des grotesques ou des petites histoires dont la nature devrait être conforme aux sujets déjà indiqués, et ceci en fonction de leur voisinage*) [7]. And so, among the fantastic elements one can see in that room that are usual in such decorations, appear *The Night, Aurora, The Moon* and *Mercury*. This of many possible examples intends to establish the possibility that there may have also been an intention other than aesthetic in the elements of the panels that were painted for Graça church.

Considering what may be assembled together at this time, it is possible that the panels once lined a chapel (Figure 5). The two mirror-like panels, in one of which is the monogram of João de Góis, may have once been a single panel set at the back of the chapel.



Figure 5. Proposed digital reconstruction of a hypothetical architecture incorporating the panels

But if they were meant for a chapel is it possible to define its purpose? Can we advance some hypothesis in hopes that it may one day be verified (or not) on documental grounds? Looking at the elements that are depicted in these panels one can see several candles and an assorted variety of thuribles, objects that are related to religious worship.

More unusual seem to be the scissors and the books in the hands of the two figures. One possible interpretation stems from an association to a mortuary chapel: the books would bear the narrative of the life of the deceased while the scissors meant the cutting of the thread of life and the domed eight-sided golden constructions with people or statues seen nearby could be an allusion to the thereafter.

2. EXPERIMENTAL

2.1. Samples

Samples were carefully collected from various tiles (Figure 6, Table 1), by removing small fractions of the glaze and biscuit with a scalpel. The samples were identified with the reference Az013 (corresponding to these panels at Graça church) plus an additional code to identify each sample (Table 1).

The sampling was conducted having in mind representability. Three of the samples pertain to the tiles adjoining the book bearing the monogram and these are identified as Az013/L1, Az013/L2 and Az013/L3 (Figure 6a). The corresponding analytical results will be the reference against which others are to be compared. Two of the samples pertain to adjoining tiles that have however remarkable differences in the colours and the painting and those bear the references Az013/T1 and Az013/T2 (Figure 6b). The sample identified as Az013/01 was collected from a tile once part of the frame (Figure 6c) and the other three (Az013/03, Az013/04 and Az013/07) from mixed up tiles (Figure 6d, 6e and 6f). In all cases the sampling was done on spots where the glaze was already partially detached.

Table 1. Samples collected for microscopic observation and analysis

Sample reference	Colour	Notes
Az013/01	yellow	frame tile
Az013/03	white + blue	misplaced tile with colour run
Az013/04	white	misplaced fragment
Az013/07	green	tile in a continuity group
Az013/T1	yellow	left side tile of thurible
Az013/T2	yellow	right side tile of thurible with colour run
Az013/L1	green	from book with monogram
Az013/L2	white	from book with monogram
Az013/L3	orange	from book with monogram

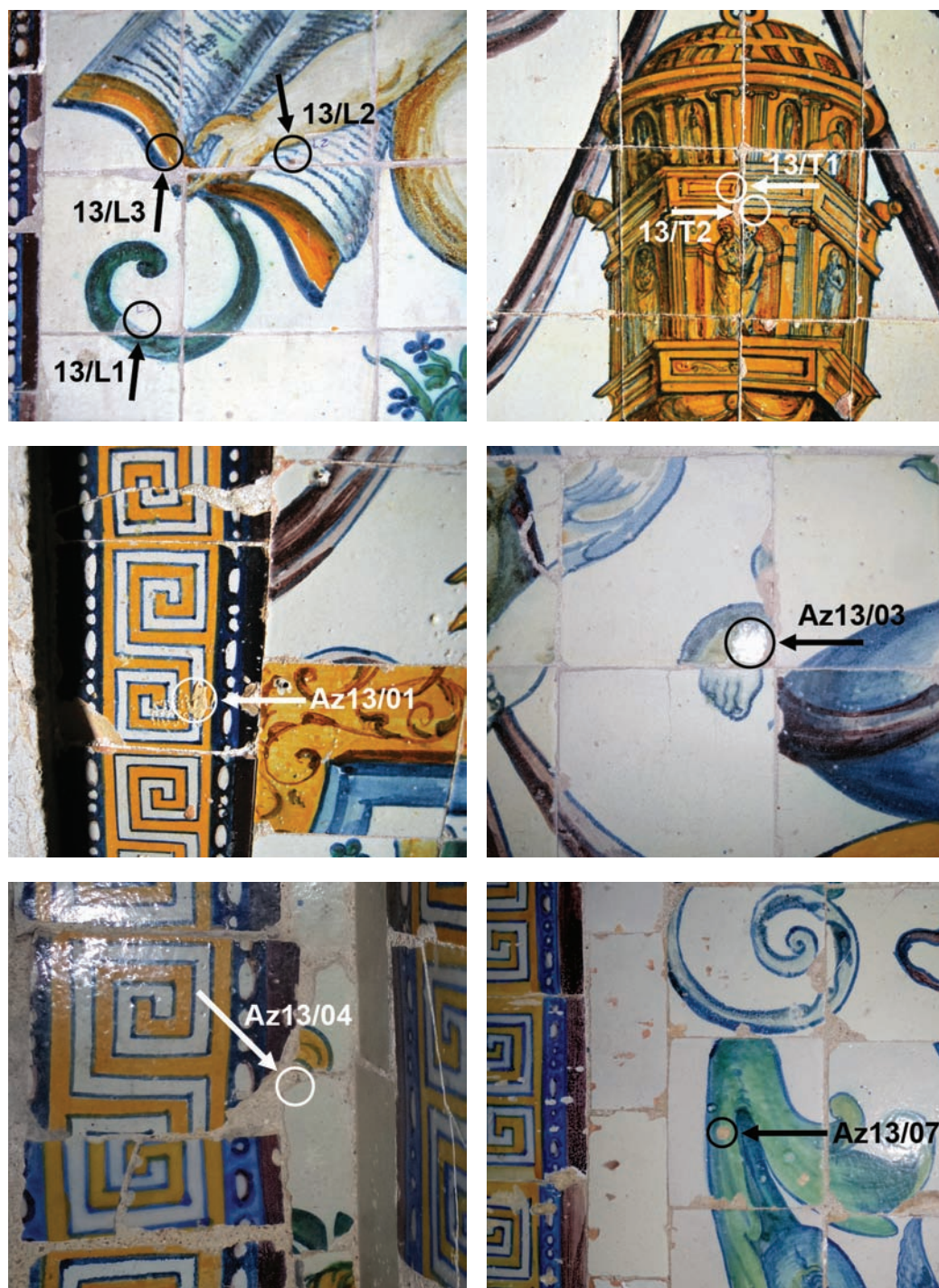


Figure 6. Some areas where the samples from the azulejo panels were collected – from left to right and top to bottom: a) Az013/L1, Az013/L2 and Az013/L3; b) Az013/T1 and Az013/T2; c) Az013/01; d) Az013/03; e) Az013/04; f) Az013/07

2.2. Equipment and technical methodology

The fragments detached from the azulejos were stabilized in epoxy resin, lapped and polished to obtain a flat surface for observation and analysis by scanning electron microscopy coupled with an X-ray energy-dispersive spectrometer (SEM-EDS).

The optical acquisition of sample images was made with a Leica DFC295 digital camera attached to a Leica M205C stereomicroscope.

SEM-EDS observations and analyses were made at the HERCULES Laboratory in Évora using a HITACHI 3700N SEM coupled to a BRUKER XFlash 5010 EDS. The specimens were uncoated and the observations were made in backscattered electrons mode (BSE) with a chamber pressure of 40 Pa and at an accelerating voltage of 20 kV. The acquisition of X-ray spectra was done with the detector set at ca. 8 mm working distance.

The selection of areas for EDS analysis avoided inclusions in the glaze or biscuit representing more than ca. 5 % of the full area analysed. The area sizes were ca. $200 \times 200 \mu\text{m}^2$ for glazes and $500 \times 500 \mu\text{m}^2$ for biscuits but acceptable repeatability was verified in areas four times smaller. For comparison purposes, only the elements usually representing the major contents were considered, excluding tin (Sn) in the glaze and lead (Pb) in the biscuit due to their variability with the area chosen (in the case of Sn because of local aggregations of SnO_2 crystals; in the case of Pb because its content in the biscuit increases with proximity to the interface with the glaze). The results of the EDS analyses are given in weight % of each element identified.

Principal component analysis (PCA) was made of EDS results using the SPSS® software platform by IBM Analytics.

2.3. Results

2.3.1. Glaze morphology

Figure 7 shows the sections of samples Az013/01 and Az013/L3, both from yellow areas and both depicting the use of *coperta* – a final layer of transparent glaze sprinkled over the pigment to render the finish shinier and protect the superficial colour from abrasion.

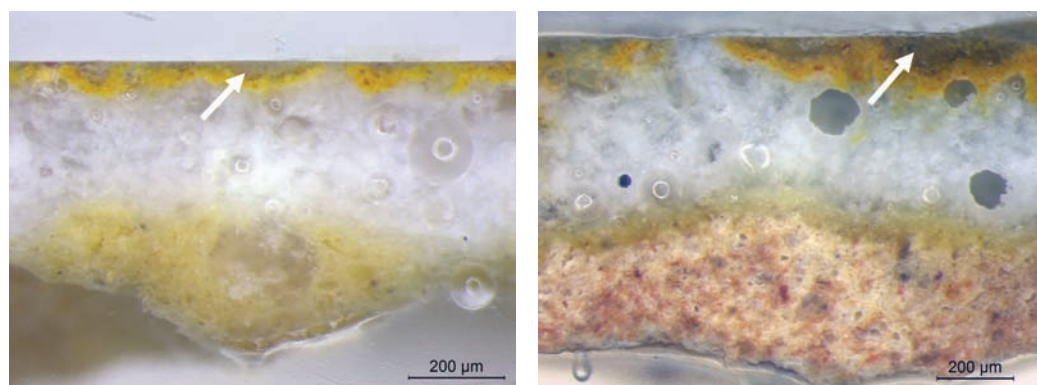


Figure 7. Use of *coperta* in samples Az013/01 (left side) and Az013/L3 (right side) – the arrows indicate spots where drops of transparent glaze fell

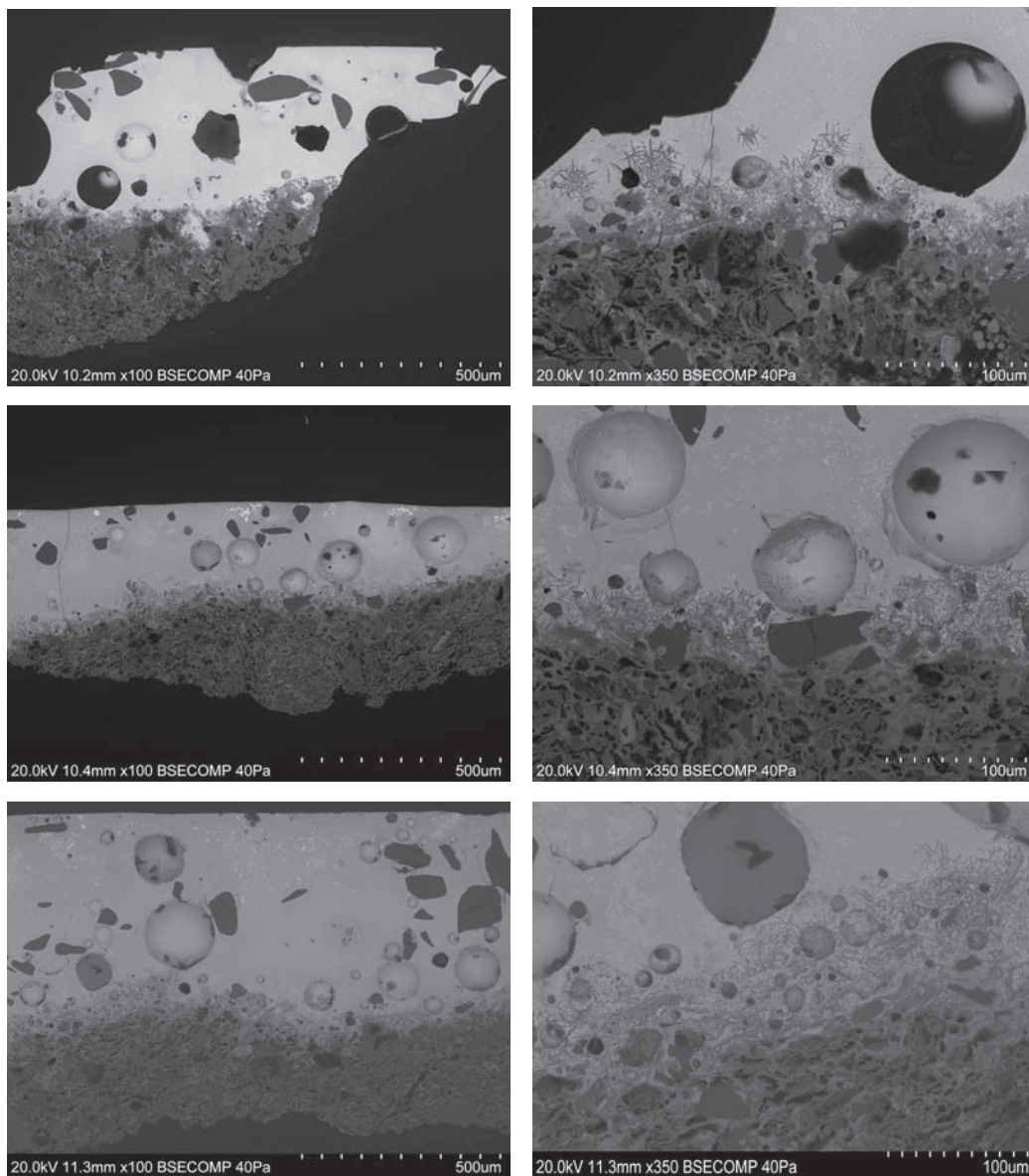


Figure 8. SEM images showing the glaze and the interfacial micro-morphology in (from top to bottom) samples Az013/L1; Az013/L2; and Az013/L3

Figure 8 depicts SEM images of samples Az013/L1, Az013/L2 and Az013/L3 that exemplify the main micro-morphologic characteristics associated with the white glazes of the workshop of João de Góis for Graça church: few inclusions, mostly large-sized grains of sand; interface glaze-biscuit with abundant crystals formed during the second firing. Both can be considered distinctive and the interfacial outgrowth is a particularly striking one that we had previously seen with similar profusion in white glazes only in some Hispano-Moresque tiles [8; 9 pp. 161-196]. This morphology likely results from the firing technology used, with long firing and cooling times [10; 11]. The glazes of all nine samples studied were morphologically similar with minor variations in the

size and shape of the interfacial outgrowths. These neoformation crystals are probably K-feldspars (Figure 9) and have been identified by other authors as a variant of a Pb-enriched sanidine [12]. Their size depends also on the availability of potassium minerals in the contact zone of the molten glaze with the biscuit. When e.g. the interface is locally formed of silica, the outgrowths are absent and in such cases the aspect of the interface may vary from one side of the section to the other, according to the minerals sectionally available.

When inclusions of minerals rich in potassium are present in the glaze, similar outgrowths are often seen. If the inclusions are thin scales (maybe a mica introduced with the sand) similar crystals grow out from them resulting in a characteristic centipede morphology (Figure 10) that has been found in several of the samples observed.

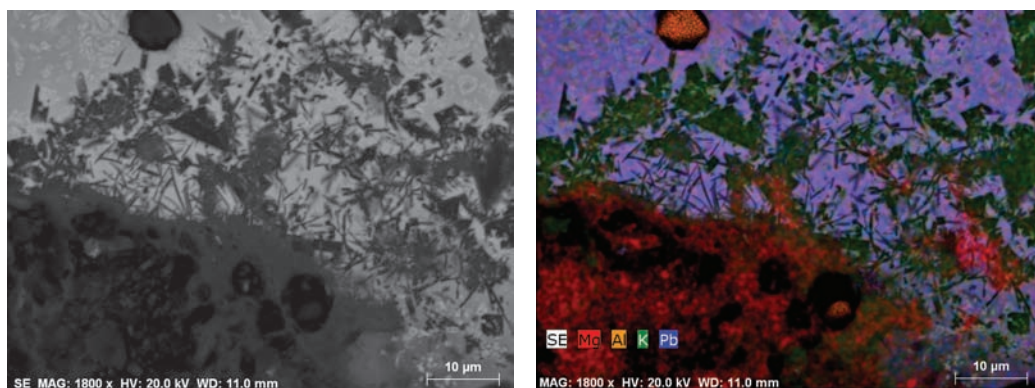


Figure 9. Detailed view of the interface in sample Az013/T1 showing the outgrowth of crystals rich in Al and K

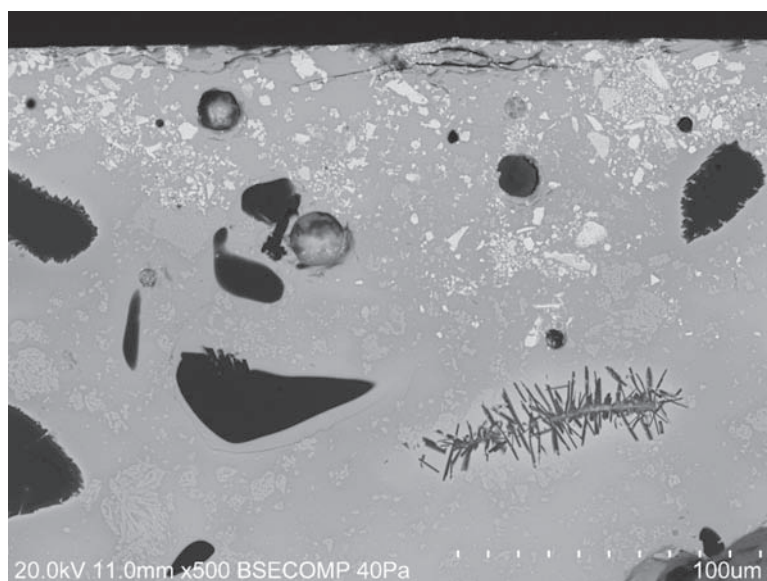


Figure 10. The presence of thin scales of a K-rich mineral in the glaze, possibly a mica, originates crystalline outgrowths with a very characteristic centipede-like morphology (seen here in Az013/04)

2.3.2. Glaze composition

Table 2 includes the semi-quantitative results of analyses of the glazes by EDS in weight %. Sn was excluded for the reasons pointed out in section 2.2. The amount of oxygen was calculated through the remaining elements stoichiometry considering their most commonly considered oxides (Na_2O , MgO , Al_2O_3 , SiO_2 , K_2O , Fe_2O_3 and PbO). The results were normalized to 100 % and the table also indicates the ratios Si/Pb.

Table 2. Semi-quantitative composition (% w/w) of the glazes determined by EDS (weight of the elements normalized to 100 %) and Si/Pb ratio

Sample	Na	Mg	Al	Si	K	Fe	Pb	O	Si/Pb
Az013/01	1.6	0.3	2.3	23.2	2.9	0.7	36.0	32.9	0.64
Az013/03	1.9	0.8	4.3	17.9	1.6	1.6	42.0	29.8	0.43
Az013/04	1.9	0.9	3.5	16.3	1.4	1.2	47.4	27.4	0.34
Az013/07	1.8	0.8	2.4	21.1	2.4	0.8	39.5	31.2	0.53
Az013/T1	1.0	0.3	2.7	17.9	1.0	0.7	48.7	27.6	0.37
Az013/T2	1.7	0.7	3.2	19.4	2.2	0.6	42.2	30.0	0.46
Az013/L1	1.2	0.4	2.9	19.5	1.7	0.5	44.2	29.5	0.44
Az013/L2	1.1	0.5	3.3	20.2	1.9	1.1	41.2	30.7	0.49
Az013/L3	1.3	0.5	3.3	19.0	1.6	0.8	44.1	29.4	0.43

Figure 11 shows the results of a log-based principal component analysis (PCA) of the glazes of all samples, considering the analytical results in Table 2, through a plot in the plane of the two first principal components (PC1 and PC2). PC1 explains 50 % of the variation and is controlled in the positive sense mostly by the contents in Al, Fe, Mg and Pb, and in the opposite sense by the contents in Si and K as can be seen from the loadings plot of Figure 12 in which the projections of the vectors on an axis show the contribution of each element to the respective principal component. PC2 explains 33 % of the variation and is controlled in the negative sense by the content in Pb (Figure 12).

The PCA analysis also determines the correlation between the variables considered and Table 3 presents the correlation matrix obtained for the elements quantified in the glazes. A high correlation between Si and K is to be noted, meaning that both elements increase and decrease in line, while between Si and Na the correlation is practically nil meaning that the variation of each element is irrespective of the variation of other.

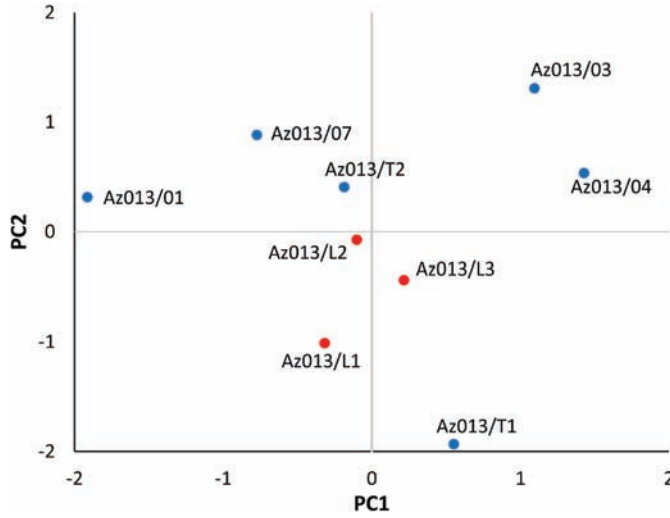


Figure 11. Score plot of the PCA analysis of the glazes in which the reference samples Az013/L1, /L2 and /L3 are depicted in red. The results do not suggest any evident clusters

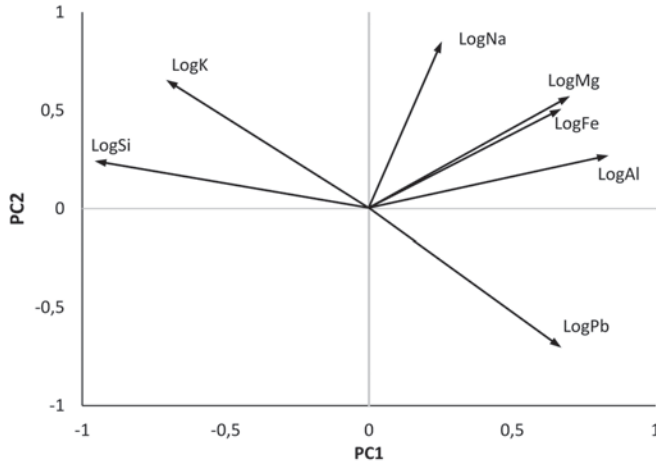


Figure 12. Loadings plot of the PCA analysis of the glazes

Table 3. Correlation matrix for the analysis of the glazes

	LogNa	LogMg	LogAl	LogSi	LogK	LogFe	LogPb
LogNa	1.0	0.65	0.21	-0.04	0.46	0.38	-0.36
LogMg		1.00	0.57	-0.51	-0.03	0.53	0.18
LogAl			1.00	-0.68	-0.39	0.61	0.38
LogSi				1.00	0.83	-0.39	-0.88
LogK					1.00	-0.17	-0.94
LogFe						1.00	0.02
LogPb							1.00

2.3.3. Biscuit composition

Table 4 includes the semi-quantitative results of analyses of the biscuits by EDS in weight %. Pb was excluded for the reasons pointed out in section 2.2. The amount of oxygen was calculated through the remaining elements stoichiometry considering their most commonly used oxides (Na_2O , MgO , Al_2O_3 , SiO_2 , K_2O , CaO and Fe_2O_3). The results were normalized to 100% and the table also indicates the ratios Ca/Si.

Table 4. Semi-quantitative composition (% w/w) of the biscuits determined by EDS (weight of the elements normalized to 100 %) and Ca/Si ratio

Sample	Na	Mg	Al	Si	K	Ca	Fe	O	Ca/Si
Az013/01	1.8	4.2	8.4	21.1	2.1	15.0	4.2	43.2	0.71
Az013/03	1.9	2.6	9.4	20.4	2.4	17.0	3.5	42.8	0.83
Az013/04	1.6	1.6	8.4	26.5	2.5	10.8	3.2	45.5	0.41
Az013/07	1.4	3.9	8.6	23.8	1.4	12.5	3.7	44.7	0.52
Az013/T1	1.5	1.6	8.4	26.2	3.4	10.2	3.5	45.2	0.39
Az013/T2	1.3	2.2	9.3	21.4	1.4	17.0	4.1	43.4	0.79
Az013/L1	1.3	1.7	8.4	26.5	2.6	10.6	3.3	45.5	0.40
Az013/L2	1.2	1.4	8.3	26.8	3.2	9.2	4.4	45.5	0.34
Az013/L3	1.4	1.7	8.3	25.5	2.5	12.2	3.6	44.9	0.48

Figure 13 shows the results of a log-based principal component analysis of the biscuits, considering the analytical results in Table 4, through a plot in the plane of the two first principal components (PC1 and PC2). PC1 explains 57 % of the variation and is controlled in the positive sense mostly by the contents in Na, Al, Mg and Ca; and in the opposite sense by the contents in Si and K, as can be seen from the loadings plot of Figure 14. PC2 explains 19 % of the variation and is controlled in the positive sense by the contents in Na and K and in the opposite sense by the content in Fe (figure 14).

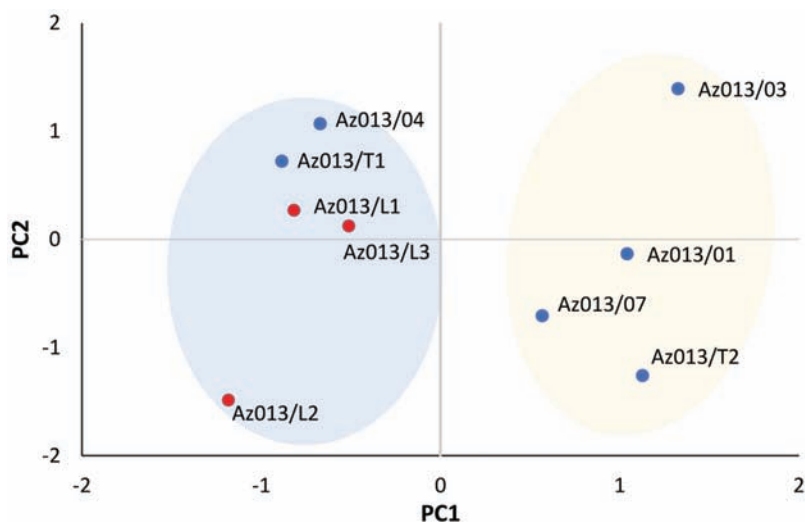


Figure 13. Score plot of the PCA analysis of the biscuits in which the reference samples Az013/L1, /L2 and /L3 are represented as red dots. The results suggest two different clusters, indicated in blue and yellow

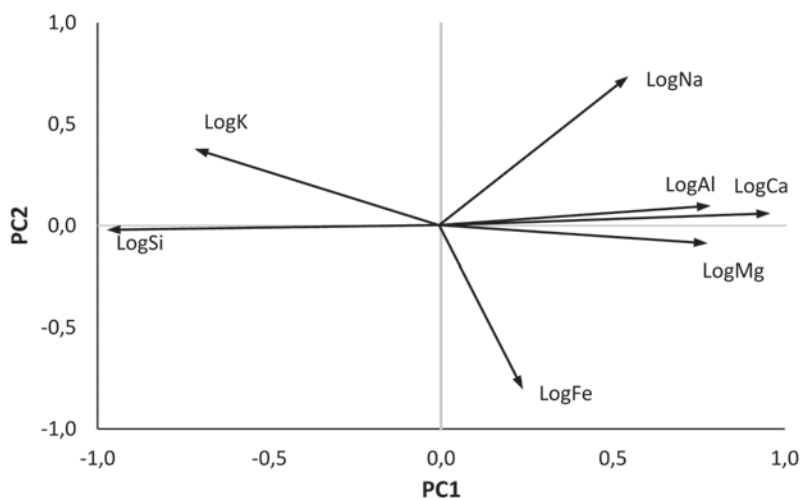


Figure 14. Loadings plot of the PCA analysis of the biscuits

3. DISCUSSION

All the samples are closely related in the fact that the glaze morphology and composition are similar (Figure 8 and Table 2). The low Si/Pb ratios separate them clearly from the typical 17th century compositions [8] while the interfacial morphologies (Figure 8) suggest they were all fired in similar conditions, likely in the same kiln. We have not found these combined characteristics in Portuguese productions of later centuries [8], nor in 16th century Seville productions [14; and our own results to be published],

or in Antwerp azulejos [8; 13], granting a possible recognizable characteristic for tiles produced within the same technological circle.

For the biscuits, two different sets are clearly apparent and their clusters are conveniently separated by the vertical PC2 axis of Figure 13. One comprises all of the reference samples Az013/L1, /L2 and /L3 as well as Az013/T1 and Az013/04 (blue area in Figure 13). All these are characterized by simultaneously a Ca/Si ratio under 50 %, a relatively high content in K and, in average, a lower content in Mg and Ca (Table 4). The other set is formed by Az013/01, Az013/03, Az013/07 and Az013/T2 (yellow area in Figure 13) and includes biscuits with Ca/Si ratios above 50% and higher Ca and Mg contents. The differences between the two clusters are clearly seen graphically in the representative biscuit EDS spectra shown in Figure 15.

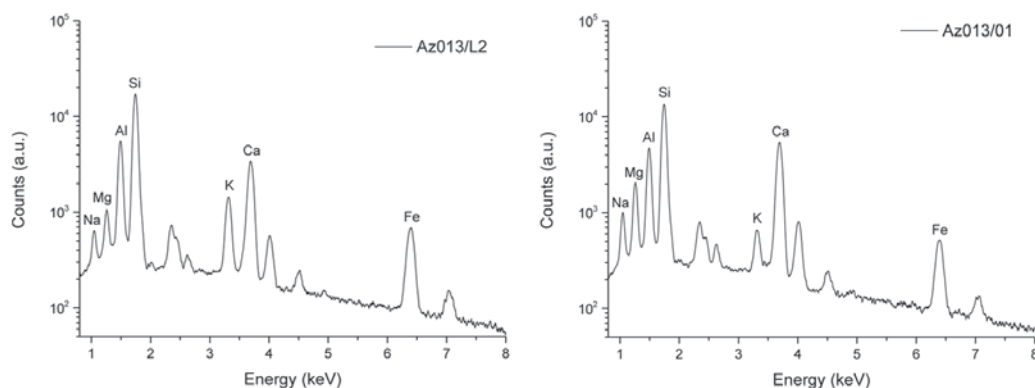


Figure 15. Relevant parts of the biscuit spectra of Az013/L2 (left) compared to Az013/01 (right) depicting the clear differences in the relative contents of Ca, Mg and K that characterize the two clusters of Figure 13

The biscuit is the part of the tiles usually produced exclusively from local materials. The two separated clusters of Figure 13 may result from the use of two different marls for the preparation of the paste, or else from a mixture of two clays/marls, one of which richer in Ca, Mg and Na but poor in K, in two different proportions.

Considering the analytical results of the glazes through Table 2 and Figure 11 and the reference values of Az013/L1, /L2 and /L3, there are no correspondingly clearly separable clusters for the glazes. However, it may be noted that the samples that in Figure 13 are clustered in the yellow area lie, in the glaze scatter plot of Figure 11, predominantly on the upper side. This means that albeit not so clearly separable, the composition of the glazes of those samples is nevertheless also somewhat different.

Table 3 shows a strong correlation between Si and K, but not between Si and Na. On dealing with the preparation of the glazes in his 16th century treatise *Li tre libri dell'arte del vasaio* (The three books of the potter's art), Cipriano Piccolpasso describes the preparation of the *marzacotto* for the raw glaze following several recipes. Those more often mentioned are: i) a mixture of sand with calcined lees or tartar (potassium carbonate); or ii) the same with a third component- sea salt [15, pp. 62-81]. The correlations found mean that a recipe of the first type was probably used by the workshop of João de Góis, notwithstanding the local availability of sea salt.

The differences observed in the biscuits do not seem compatible with what could be

expected from tiles manufactured by the same workshop to fulfil a single order. The results obtained suggest that the tiles sampled were produced in at least two different instances. All can be set in the 16th century because later azulejos usually had a different composition [8] and through the observation of the changing interface morphologies we can state that the firing cycles of later tiles were also different [8; 11]. This fact may also explain the differences in colour and final result seen in adjacent tiles (e.g. as in the two tiles in Figure 6b from which samples Az013/T1 and Az013/T2 were collected and which, significantly, fell into different clusters).

Macroscopic observations concur with a production at different instances. Figure 16 depicts a close-up of the lobster figure and its chequered appearance shows that the tiles do not actually fit together. The outlines are the same because the same drawing was used on both cases but the fine details and colours are different suggesting that some tiles were painted in the workshop when the others were already applied on a wall. Whether two complete figures were made or a number of tiles was needed to repair an already existing lining remains unclear at the moment.

A confirmation of how many panels were there, what was their original size and, eventually, which were the original and earliest tiles, calls for a removal of the azulejos from the wall and a study of the marks on their backs that indicated their relative placement. It is hoped that such work may be done soon, aimed at repositioning the tiles correctly, and that then a more exhaustive sampling, better directed to the different chronologies, may be made.



Figure 16. The lobster figure as is today, seemingly assembled from two different sets of tiles

4. WHEN THERE ARE NO DOCUMENTS...

When there are no documents, hypotheses abound. If the elements in these grotesque decorations were meant to be references to a mortuary chapel, the most probable candidate in this church should be the chapel dedicated to Afonso de Albuquerque, the strategist of the Portuguese power in the Indian Ocean. Having died in 1515 in Goa, his remains only came to Portugal in 1566, through the efforts of his son Brás de Albuquerque (1500-1580). Probably because his grandfather and great-grandfather were already buried in this church, Brás de Albuquerque obtained an authorization for the remains of his father to be laid in its main chapel and in May 1566 he was buried there [16]. We have not yet found any reference to the decoration associated with the chapel but it seems likely that Brás de Albuquerque would be willing to pay whatever was needed, including a lavishly decorated azulejo lining, to make everything worthy of the glorious memory of his father of which he was justly proud. It is interesting to note that, although not unique in books at this time, the frontispiece of his capital work *Comentários de Afonso de Albuquerque*, first published in 1557, is decorated with a grotesque design (Figure 17). We should also keep in mind that in his villa and gardens of *Bacalhoa*, in *Azeitão*, a series of azulejo panels from the same period (one of them dated 1565) can still be seen [1, EST. XXXVIa] making it more plausible the possibility that the original renaissance panels of Graça were indeed commissioned by him.



Figure 17. Frontispiece of the first edition of the *Comentários de Afonso de Albuquerque* (Biblioteca Nacional de Portugal)

The remains of Afonso de Albuquerque were removed from the main chapel in 1635 due to the lack of payment for maintenance [16] and are still unaccounted to this day. The chapel was prepared for a new occupant who died in Madrid in 1640 but in the end was not laid there. Afterwards (at an unknown time) the chapel and the whole interior of the church were renewed [16]. Maybe at one of those instances the panels were dismantled from their original emplacement.

The finding of the monogram endowed these often-overlooked panels with a special value and allowed for an approximate dating. If one day they can be proved to be indeed related to the celebratory memory of Afonso de Albuquerque then a last remaining remembrance of his presence in the public area of Igreja da Graça has not been lost.

BIBLIOGRAPHIC REFERENCES

1. SANTOS SIMÕES, J.M. – *Azulejaria em Portugal nos séculos XV e XVI*. 2ª edição. Fundação Calouste Gulbenkian, Lisbon, Portugal, 1990.
2. PAIS, A. et al. – *Graça Church Revisited* in Proc. Int. Conf. Glazed Ceramics in Cultural Heritage (GlazeArch2015), LNEC, Lisbon, 2015.
3. PAIS, A. et al. – *The beginning of the production of majolica azulejos in Portugal- João and Filipe de Góis in 16th century Lisbon* in Studies in Heritage Glazed Ceramics, Nr. 1, pp. 1-24, LNEC, Lisbon, February 2019.
4. LISBON TOWN HALL – *Livro do lançamento e serviço que a Cidade de Lisboa fez a el' Rei Nosso Senhor no ano de 1565: documentos para a história da cidade de Lisboa*. Volume II, Câmara Municipal de Lisboa, pp. 267, Lisbon, 1947.
5. MIMOSO, J. et al. – *A research on the azulejo panels of the São Roque chapel in Lisbon* in Studies in Heritage Glazed Ceramics, No. 1, pp. 93-112, LNEC, Lisbon, February 2019.
6. PAIS, A. et al. – *An unknown jigsaw in the Cathedral of Setúbal* in Proc. Int. Conf. Glazed Ceramics in Cultural Heritage (GlazeArt 2018), pp. 21-22, LNEC, Lisbon, 2018.
7. MOREL, P. – *Les grotesques. Les figures de l'imaginaire dans la peinture italienne de la fin de la Renaissance*, coll. Idées et Recherches, p. 30, Flammarion, Paris, France, 1997.
8. MIMOSO, J. et al. – *A comparison of the earliest faience tiles produced in Lisbon with earlier and later type* in Studies in Heritage Glazed Ceramics, Nr. 1, pp. 25-46, LNEC, Lisbon, February 2019.
9. COENTRO, S. – *An Iberian Heritage: Hispano-Moresque architectural tiles in Portuguese and Spanish collections*, <http://hdl.handle.net/10362/24220> PhD thesis, Universidade Nova de Lisboa, Lisbon, 2017.
10. MOLERA, J. et al. – *Interactions between Clay Bodies and Lead Glazes*, Journal of the American Ceramic Society, Vol. 84, Nr. 5, pp.1120-1128, 2001.
11. PEREIRA, S. et al. – *Influence of the production technology on the morphological characteristics of azulejos* in Proc. Int. Conf. Glazed Ceramics in Cultural Heritage (GlazeArt 2018), pp. 140-149, LNEC, Lisbon, 2018.
12. MOLERA, J. et al. – *The growth of sanidine crystals in the lead of the glazes of Hispano-Moresque pottery*, App. Clay Science 7, pp. 483-491, 1993.
13. MIMOSO, J. et al. – *Analytical study of tiles of presumed Flemish origin from the Palace of the Dukes of Braganza in Vila Viçosa*, in "From Flanders. The azulejos commissioned by D.Teodósio I, 5th Duke of Braganza, pp. 64-74, Museu Nacional do Azulejo & Fundação da Casa de Bragança, Lisbon, 2012.
14. GOMEZ MÓRON, A. et al. – *Ceramics by Niculoso Pisano and quantitative analysis of glazes using portable XRF*, in "ph investigación", No. 6, pp. 1-23, Universidad de Sevilla, Spain, 2016.

15. PICCOLPASSO, C. – *The three books of the potter's art*, transl. and ed. R. Lightbown & A. Caiger-Smith, Editions La Revue de la Céramique et du Verre, Vendin-le-Vieil, France, 2007.
16. BAIÃO, A. – *Alguns ascendentes de Albuquerque e o seu filho à luz de documentos inéditos. A questão da sepultura do Governador da Índia*, Imprensa da Universidade, Coimbra, Portugal, 1915.

The 16th century Nativity azulejo panel called “de Nossa Senhora da Vida”

Alexandre Pais, João Manuel Mimoso, Victor Filipe, Maria de Lurdes Esteves, Maria Antónia Pinto de Matos

ABSTRACT

One of the jewels in the collections of the Museu Nacional do Azulejo (National Museum of Azulejo) is a Nativity painted in renaissance style and colours, topped by an Annunciation and flanked by the images of two Apostles, originally from the Nossa Senhora da Vida (Our Lady of Life) chapel of the now demolished Santo André (Saint Andrew) church in Lisbon. These azulejos were already specifically mentioned in 1721 for their exquisite quality in the important work *Santuário Mariano*, a collection of books by Fr. Agostinho de Santa Maria (1642-1728).

This communication reviews the oldest known written sources on the panel and presents new research results on one of the most important testimonies of a technological continuity respecting the first decades of the production of majolica tiles in Portugal.

RESUMO

Uma das jóias da coleção do Museu Nacional do Azulejo é uma natividade pintada ao gosto e nas cores do Renascimento, encimada por uma anunciação e ladeada pelas imagens de dois apóstolos. Pertenceu à Capela de Nossa Senhora da Vida, outrora da Igreja de Santo André, em Lisboa, entretanto demolida. O painel já havia sido referido em 1721 pela sua requintada qualidade na importante obra *Santuário Mariano*, uma coleção de livros redigidos por Fr. Agostinho de Santa Maria (1642-1728).

Esta comunicação revê as fontes documentais mais antigas atualmente conhecidas que referem este painel e apresenta novos resultados na investigação de um dos mais importantes testemunhos de continuidade tecnológica referente às primeiras décadas de produção de azulejos de faiança em Portugal.

Alexandre Pais

Museu Nacional do Azulejo, Lisbon, Portugal, apais@mnaz.dgpc.pt

João Manuel Mimoso

LNEC - Laboratório Nacional de Engenharia Civil, Lisbon, Portugal

Victor Filipe

Uniarq - Centro de Arqueologia da Universidade de Lisboa, Portugal

Maria de Lurdes Esteves

Museu Nacional do Azulejo, Lisbon, Portugal

Maria Antónia Pinto de Matos

Museu Nacional do Azulejo, Lisbon, Portugal

KEYWORDS: Renaissance majolica / Azulejo panel Nossa Senhora da Vida / João de Góis / / Francisco de Matos / Early Portuguese azulejos / Museu Nacional do Azulejo

ACKNOWLEDGEMENTS

Paper produced as an output of Project FCT-AzuRe - Estudos no Azulejo Português para Candidatura a Património da Humanidade (PTDC/EPH-PAT/5096/2014) funded by FCT, the Portuguese Foundation for Science and Technology.

LNEC Research Project 0202/111/19747.

Aviso legal

As opiniões manifestadas no *Studies in Heritage Glazed Ceramics* são da exclusiva responsabilidade dos seus autores.

Legal notice

The views expressed in the *Studies in Heritage Glazed Ceramics* are the sole responsibility of the authors.

1. THE WINDING PATH FROM SANTO ANDRÉ CHURCH

Santo André (Saint Andrew) church, once head of a parish of the same name in Lisbon, was built between 1334 and 1340 following a land donation by the king and queen of Portugal to Ayres Martins and his wife Maria Esteves. The church had a single nave that extended to the main chapel and four small side chapels, among which, near the entrance, was the Nossa Senhora da Vida (Our Lady of Life) chapel. This had been instituted by Bartholomeu Vaz de Lemos, who had been parish-priest in this church. Inside the chapel laid the tomb of João Pedro Soares da Veiga and although a sculpture of the Virgin reputed to be miraculous was also there (the image still exists and can today be seen in the nearby Graça church) it was the azulejo panel lining the back of the chapel that was always described as an exceptional piece. These azulejos were considered unparalleled in Lisbon, and they represent in *trompe l’oeil* a large stone retablo with two niches for the statues of two Evangelists (John and Luke). At the centre is a representation of the Nativity with Shepherds (Figure 1) topped by a semi-circular pediment with a curious frame reminiscent of a Della Robbia *tondo* superimposed to an Annunciation having in the middle an opening that once framed a window.



Figure 1. The superlative Nossa Senhora da Vida azulejo panel

One of the inspirational sources has been identified: the print by Caraglio of an Annunciation by Titian (Figure 2). Since the figures reproduced and their context do not follow exactly the print, it may be supposed that the painters used several sources but rearranged the individual figures throughout the panel with considerable freedom.



Figure 2. Caraglio print of a lost Annunciation by Titian – one of the sources for the composition of Nossa Senhora da Vida

The first known reference to these azulejos dates from 1712 in a description of the chapel by Padre António Carvalho da Costa (1650-1715). In the last volume of his *Corografia Portuguesa* he states that the chapel “is tiled with such an azulejo that is reputed to be unique” (*he azulejada de hum tal azulejo, que tem nome de ser singular*) [1]. Nine years later, in 1721, when the 7th tome of an important work in ten volumes describing all the churches, chapels and sanctuaries dedicated to the Virgin Mary in Portugal and its overseas territories was published, its author, Frei Agostinho de Santa Maria (1642-1728), also describes the Nossa Senhora da Vida chapel [2]. He says that “among the chapels of this church, that of the greatest notoriety is Nossa Senhora da Vida” (*entre as Capellas desta Igreja, a de mayor nome he a da Senhora da Vida*). It is through this testimony that we know that the man who instituted in his lifetime this chapel, Bartolomeu Vaz de Lemos, had been parish priest of the church and he had nominated João Pedro Soares da Veiga its administrator, explaining why Da Veiga’s tomb was there. The author does not mention the date of the institution of the chapel, but we know from another source that by the end of 1582 Bartolomeu Vaz de Lemos had already died. José Maria António Nogueira, cited by Ribeiro Guimarães in 1872 [3], refers to a document with his *post-mortem* dispositions dated from the 30th May of 1582, an element that can narrow the period when the panel was made and the chapel consecrated.

Returning to Agostinho de Santa Maria’s description, he praises the fact that “this Chapel is tiled with an ancient azulejo, but excellent, where one can see painted some mysteries

of Our Lady, who is represented in the middle of the retable, and albeit very old is very perfect” (*está esta Capella azulejada de hum azulejos antigo, mas excellente, aonde se vèm pintados alguns mysterios de Nossa Senhora, a qual se vê collocada no meyo do retabolo, que ainda que antigo, he muyto perfeyto*) [2]. Two aspects stand from this description: that, from his experience, the writer seems suspicious of the quality of ancient paintings (*albeit very old is very perfect*); and also that he does not stand as particularly interested in azulejos (*tilled with an ancient azulejo, but excellent*). This is supported by the fact that amidst the 2,393 items he describes in the ten volumes of his work, the only azulejo panel to which he refers in some detail is precisely this one, notwithstanding the fact that by his time there were many other Marian representations in azulejo panels, testifying on the noteworthiness that Nossa Senhora da Vida still had in the religious decorative context. An interesting aspect that Santa Maria refers is that not long before the writing of his book “there was occasion for the renewal and painting of the vaulted ceiling of the chapel, a work already completed without too much expense” (*ocasião de se lhe renovar e pintar o tecto da sua Capela, que he de abbada; e estando ja pintada sem ser obra de muyto custo*).

Three years after the catastrophic earthquake of 1755, in August 1758, there was an inquiry made to the condition of the church [4]. In the description that was made about the Nossa Senhora da Vida chapel is referred that “it is tiled with an ancient azulejo that according to what we see and is said, is peerless in this city” (*azulejada de hum azulejo antigo que segundo se vê, e se diz não há outro semelhante nesta cidade*). It is also referred that following the earthquake there was “ruin all over the church and because of the lack of means and a poor parish it has not yet been rebuilt” (*padeceo ruína no Corpo todo da Igr.^a e por falta de meios e freguesia pobre se não têm adiantado em reedificação*). And it remained in that condition until 1835 when it was definitively closed and the medieval tombs, statues and other objects considered precious and that could be transported, were moved to the nearby Graça church, where they remain to this day.

The demolition of the church started in 1845 but through the efforts of a man called José Valentim, who mentioned the panel to Malaquias Ferreira Leal, a municipal architect, the opinion of an influent professor of sculpture of the Academy of Fine Arts, Francisco de Assis Rodrigues, was sought and at his advice the panel was saved [3]. The removal of the azulejos started on the 7th January 1845, with the assistance of José Valentim, following which they were boxed and kept in storage until 1861.

In 1861 an Englishman proposed to acquire the panel and once again José Valentim intervened, writing to a curator of the Biblioteca Nacional (National Library), then lodged in the ancient São Francisco convent in Chiado. He alerted the Head Librarian, Mendes Leal, who claimed the panel to be installed in the Library. The boxes were transferred to this new place on the 6th April of the same year and in 1863 they started to be restored because “before they were removed from the chapel where they belonged they were decayed and after being poorly removed and with the transportation they deteriorated further. The first damage started with the nails that were hammered into the joints between the tiles for the worshippers to hang gifts offered to Our Lady of Life... this way the edges of many cracked, and some tiles even broke” (*antes de serem arrancados da capella onde estiveram, se achavam deteriorados, depois mal levantados e com as conduções, foram-se deteriorando mais. O primeiro estrago começou com os pregos que se pregavam entre os azulejos, para dependurar as oferendas que os devotos levavam à Senhora da Vida... d’este modo estalaram as arestas de muitos d’elles, e alguns até se quebraram*). At this point it was intended to make new tiles to replace those in worse condition or that were missing but “those who work in this industry declared a good reproduction to be impossible because they ignored the

process of painting that allowed the tiles to be fired without the fading of the colours” (*os artifices, que se empregam n’esta industria, lhe declararam que éra impossível a imitação, por quanto ignoram o processo da pintura de modo que indo os azulejos ao forno, ella se não perca*) [3].

Nevertheless, the panel was restored and laid on the wall of the National Library in 1865. Some new azulejos were made and missing areas filled with stucco but the restoration was not considered as good as was desired. A small panel was made to fill the area of the former window in the top and in it the known history of the panel was narrated. This panel was framed in an imitation of a reddish limestone (*litoz vermelho*) because this was the material framing the original chapel window. In 1961, when the National Library was transferred to its present Lisbon location in Campo Grande, there was a request for the panel to be integrated in the collection of the *Museu Nacional de Arte Antiga* (National Museum of Ancient Art) to be subsequently passed to the *Museu Nacional do Azulejo*, then about to open [5]. And so, in 1969, the panel was transferred to the old Madre de Deus convent, where the museum was to be installed, and since its opening is on display there as one of the prize pieces of its collections.

We do not have information on who the painters of the Nossa Senhora da Vida panel were but Ribeiro Guimarães stated in 1865 that one could recognize “at least two hands, because there are parts that are better finished and others imperfect” (*obra pelo menos de dois artistas, porque há partes melhor acabadas e outras imperfeitas*) [3]. After inspecting the painting we can state that it is indeed possible to recognize several styles (for instance in the two angels of Figure 2) and maybe up to four different painters worked in the panel, pointing to a workshop important enough to command the work of a number of artists. But if, at least for now, we cannot name any of the painters, we may nevertheless hypothesize on when the panel was made.

We already know that the chapel was instituted during the life of Bartolomeu Vaz de Lemos who was already dead in mid-1582. Ribeiro Guimarães, based on the testimony of José Valentim, states in his text of 1865 that there was another set of azulejos in the building and “in the painting that was in the other side of the chapel, and was of lesser quality, one could read the date 1580” (*no quadro que ficava do outro lado da capella, e que era de somenos merecimento, lia-se a data de 1580*). So the author believes that “it is likely they were from the same time although the others were not as valuable, being less well sketched and of inferior colours” (*é de crer que seja d’esse tempo, com quanto os outros não tivessem tanto valor, por serem mais incorrectos e de inferior colorido*). The date given (1580) is consistent with the other information and the technical quality of Nossa Senhora da Vida is also level with the panels lining São Roque chapel in Lisbon, one of which dated “1584” [6].

2. SUDDENLY IN 2018...

A peculiar aspect of the Nossa Senhora da Vida panel is that instead of depicting the Four Evangelists, only two are shown, which is very unusual in this type of representation. When we look at the representation in this panel we see the Annunciation on top and the Adoration of the Shepherds in the centre. These two moments of the narrative of the life of Mary and Jesus were only addressed in the Gospels of Luke and to a lesser

degree Matthew (in this case only the Annunciation is indirectly mentioned). Indeed, in the panel we can see the figure of Luke on the right side of the panel, recognisable through the ox that stands by him, but on the left side, instead of Matthew, we see John who never even mentions these events. This is one of the most puzzling aspects of the panel: why John and not Matthew, who was always depicted as a middle aged or elderly man escorted by an angel?

One should keep in mind that José Valentim said that there was a second set of azulejos on the other side of the chapel where one could read the date “1580”. What “the other side of the chapel” means is not very clear: was it on the walls of the same chapel, but facing the panel of Nossa Senhora da Vida? But Nossa Senhora da Vida lined the back wall of the chapel... This would presumably mean that the chapel was not fully open to the main body of the church and there were walls on both sides of its entrance. Or did he mean “on the other side of the church”?

In an archaeological excavation held during the year 2018 at a building in the nearby Travessa do Açougue, where it is still possible to see the remains of Santo André church, five fragments of majolica azulejos from a figurative panel were discovered (Figure 3). Among these, part of the face of an elderly man and the locks of hair of a child suggested a hypothesis: that the remains discovered in the recent excavation were part of the lost panel “on the other side of the chapel”, maybe two panels on both sides of the entrance, representing the two other Evangelists, Matthew and Mark, and completing the narrative. It was very common to have images or symbols of the Evangelists in the four corners of cloisters and chapels and if this was the case it would be a correct and usual way of presenting them. The elderly man would be Matthew and the child his angel.

But if this was the case and the azulejos referred by José Valentim with the date “1580” belonged to the same chapel and were part of the narrative, why were they not saved? He himself tells us that both in design and colours they were of inferior quality and the fragments found, maybe the product of a different workshop, seem to agree with his statement.

The description of the removal of Senhora da Vida and the information that the numbers used to mark the individual tiles for ulterior re-assembling was faulty point to work done hastily, possibly under pressure from the demolition team. We shall probably never know for sure unless more fragments are found or the engravings used as a basis for the Adoration and the Four Evangelists are identified. If the elements discovered in the excavation match any of the absent figures, it would add weight to the hypothesis.

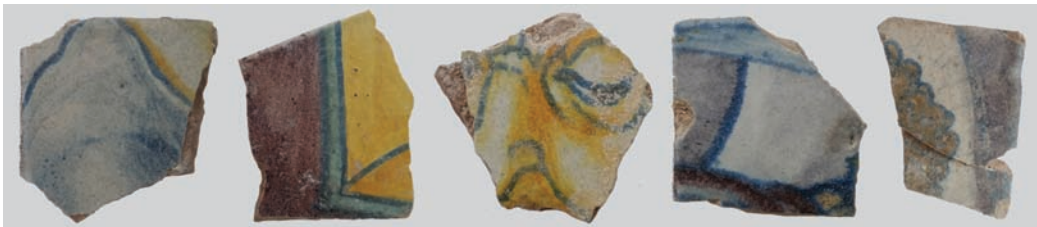


Figure 3. Azulejo fragments found during an archaeological excavation in the grounds of the demolished Santo André church and thought to have been part of a former panel

3. TO CONCLUDE WITH A FEW SURPRISES

The superb artistic achievement represented by the Nossa Senhora da Vida panel cannot be overstated but the technological mastery of the workshop should not be forgotten either. The quality of the tiles, notwithstanding the tortuous history of the panel, which conserved to this day the gloss and the fullness of the colours is certainly of technical note.



Figure 4. John the Evangelist, patronym saint of João de Góis

Studying Nossa Senhora da Vida, we ended up with the feeling that the panel was a quite unique job, either because the patron ordered and paid for a masterpiece, or because the workshop master wanted it to be a crowning achievement by which he should be recognized by his peers. But should he not have left his signature on such a timeless piece of artwork and craftsmanship? On one side of the Nativity is Luke who, maybe by coincidence, was the patron saint of Flemish *potbackers*, those who worked with clay, and everywhere the patron saint of painters because he himself had been one. On the other side is John and, again, why John and not Matthew? John is writing and the first line of his text was written over to try and make it more legible but actually garbled words that went unnoticed until now (Figure 4). It reads “F(e)ita em lisb (por?) Joao (de?)” (Made in Lisbon (by?) Joao ...). The second line is cut at mid height by an edge and was damaged and restored. The restorer scribbled some apparently meaningless signals as part of his work but it may still be seen that the first word has four letters, the first is a capital, maybe a “G” and the last a “s” followed by maybe numbers amidst which we can still make what seems to be, either a “3” or an “8”.

Feita em Lisboa por João de Góis (made in Lisbon by João de Góis) is the likely transcription and now we can hypothesise why John and not Matthew: the master signed his great work at the hands of his patronym saint. It had to be John because that was his own name! But young St. John is always represented as a beardless young man. However, João de Góis himself was “blond with a blond beard” as stated in his inquisitorial process [7]. Furthermore we suggest that the master may have lent John some characteristics of his own physiognomy. It is also likely that he was the painter of John and of the best sketched figures in the panel some of which may have been painted to the resemblance of actual people.

João de Góis seemingly had a flair for messages that no one read but he, as happened with the panels in Graça church where his monogram was also identified only recently [8]. Considering again the St. John in the panel, we notice that the light on his vest outlines the letter “G” on the right side of the chest (Figure 4). Maybe a coincidence; probably not... what other surprises await in Nossa Senhora da Vida?

BIBLIOGRAPHIC REFERENCES

1. COSTA, António Carvalho da – *Corografia Portuguesa e descripçam topográfica do famoso Reyno de Portugal*, Tomo III, p. 354, Officina de Valentim da Costa Deslandes, Lisbon, Portugal, 1712.
2. SANTA MARIA, Agostinho de – *Santuário Mariano, e História das Imagens milagrosas de Nossa Senhora*, Tomo VII, pp. 71-75, Officina de Antonio Pedrozo Galram, Lisboa, 1721.
3. GUIMARÃES, Ribeiro – *Summario de varia historia. Narrativas, lendas, biographias, descripções de templos e monumentos, estatísticas, costumes civis, políticos e religiosos de outras eras. Por...* vol. II, pp. 103-111, Rolland & Semiond, Lisboa, 1872.
4. ARCH. TORRE DO TOMBO – *Memórias paroquiais (1722/1832)*, *Dicionário geográfico de Portugal*, Tomo 20, L.2, Santo André, Lisboa, 1758-1758.
5. SANTOS SIMÕES, J. – *Azulejaria em Portugal nos séculos XV e XVI*, *Corpus da Azulejaria Portuguesa*, Fundação Calouste Gulbenkian, Lisboa, 1969.
6. MIMOSO, J. et al. – *A research on the azulejo panels of the São Roque chapel in Lisbon* in *Studies in Heritage Glazed Ceramics*, No. 1, pp. 93-112, LNEC, Lisbon, February 2019.
7. PAIS, A. et al. – *Study of the azulejo panels in Graça church signed by João de Góis* in *Studies in Heritage Glazed Ceramics*, No. 1, pp. 47-66, LNEC, Lisbon, February 2019.

8. PAIS, A. et al. – *Graça Church Revisited* in Proc. Int. Conf. Glazed Ceramics in Cultural Heritage (GlazeArch2015), LNEC, Lisbon, 2015.

Analytical study of the 16th century azulejo panel “Nossa Senhora da Vida” and related archaeologic findings

João Manuel Mimoso, Alexandre Pais, Victor Filipe, Maria de Lurdes Esteves, Sílvia R. M. Pereira, Maria Antónia Pinto de Matos, Ana Margarida Cardoso, António Candeias

ABSTRACT

One of the jewels in the collections of the Museu Nacional do Azulejo (National Museum of Azulejo) is a renaissance azulejo panel representing the Annunciation and the Adoration of the Shepherds, originally from Nossa Senhora da Vida (Our Lady of Life) chapel of the now demolished Santo André (Saint Andrew) church in Lisbon. Before the chapel was demolished, in 1845, the panel was removed and put in storage, while a second panel, considered of lesser value, was left in place and presumably destroyed. An archaeological excavation in 2018 on the site of the church unearthed fragments of figurative azulejos, thought to be part of the lost panel.

This paper includes the results of an analytical study of azulejos from both the Nossa Senhora da Vida panel and from the excavated shard, compares the results and discusses the possibility that the findings were indeed once part of the lost azulejo panel.

RESUMO

Uma das joias das coleções do Museu Nacional do Azulejo é um painel de azulejos renascentista, com representações da Anunciação e da Adoração dos Pastores, originário da Capela de Nossa Senhora da Vida na já demolida Igreja de Santo André em Lisboa. Antes da demolição da capela, em 1845, o painel foi removido e colocado em depósito, enquanto um segundo painel, considerado de menor valor, foi deixado no lugar e presumivelmente destruído. Uma escavação arqueológica realizada em 2018 no local da igreja recuperou uma série de fragmentos de azulejos de um ou mais painéis figurativos.

Este artigo inclui os resultados de um estudo instrumental dos azulejos do painel de Nossa Senhora da Vida e dos fragmentos encontrados no sítio da antiga Igreja de Santo André. Os resultados são comparados e discute-se a possibilidade de os fragmentos encontrados terem pertencido ao painel perdido.

João Manuel Mimoso

LNEC - Laboratório Nacional de Engenharia Civil, Lisbon, Portugal, jmimoso@lnec.pt

Alexandre Pais

Museu Nacional do Azulejo, Lisbon, Portugal

Victor Filipe

Uniaeq - Centro de Arqueologia da Universidade de Lisboa, Portugal

Maria de Lurdes Esteves

Museu Nacional do Azulejo, Lisbon, Portugal

Sílvia R. M. Pereira

LNEC - Laboratório Nacional de Engenharia Civil, Lisbon, Portugal / Laboratório HERCULES - Universidade de Évora, Portugal

Maria Antónia Pinto de Matos

Museu Nacional do Azulejo, Lisbon, Portugal

Ana Margarida Cardoso

Laboratório HERCULES - Universidade de Évora, Portugal

António Candeias

Laboratório HERCULES - Universidade de Évora, Portugal

KEYWORDS: Renaissance majolica / Azulejo panel Nossa Senhora da Vida / João de Góis /
/ Early Portuguese azulejos / Museu Nacional do Azulejo

ACKNOWLEDGEMENTS

Paper produced as an output of Project FCT-AzuRe - Estudos no Azulejo Português para Candidatura a Património da Humanidade (PTDC/EPH-PAT/5096/2014) funded by FCT, the Portuguese Foundation for Science and Technology.

LNEC Research Project 0202/111/19747.

Aviso legal

As opiniões manifestadas no *Studies in Heritage Glazed Ceramics* são da exclusiva responsabilidade dos seus autores.

Legal notice

The views expressed in the *Studies in Heritage Glazed Ceramics* are the sole responsibility of the authors.

1. INTRODUCTION

The Santo André (Saint Andrew) church, near the old Graça convent and church in Lisbon, was founded in the 14th century. At the end of the 16th century it had a number of small side chapels among which, near the entrance, was the Nossa Senhora da Vida (Our Lady of Life) chapel. This had been instituted by Bartholomeu Vaz de Lemos (?- ca. 1582) and was lined on the back by a panel of azulejos known by the name of the chapel. Possibly the utmost work of art of this type produced anywhere in Europe in its time, the technical quality and enduring aesthetic appeal of Nossa Senhora da Vida (Figure 1) granted its preservation when the church was demolished and the panel is now on display at the Museu Nacional do Azulejo (National Museum of Azulejo).

The historical information concerning the church and the panel, as well as its sources can be found in [1].



Figure 1. The superlative Nossa Senhora da Vida azulejo panel

Nossa Senhora da Vida was saved through the efforts of a man named José Valentim, who called attention to it and then assisted with its removal in January 1845. He left a testimony of the joint efforts to save the panel and keep it in the country, mentioning that it was not dated but that *in the painting that was on the other side of the chapel and was of lesser quality one could read “1580”*. So, he believed that *it is likely they were from the same time although the others were not as valuable, being less well sketched and of inferior colour* [2].

From his comparison of the quality of the sketch and colours, we may conclude that there was indeed at least one other azulejo panel, to which was associated the date “1580”. The mention to inferior colours suggests that the panel or panels might be from a different workshop or chronology.

In 2018 an archaeological excavation in grounds that may be associated to the former Santo André church, found six fragments of faience azulejos some of which – part of the face of an elderly man and the locks of hair of, maybe, a child – are certainly from a figurative panel (Figure 2) and the reference to another early panel in the church at the time of its demolition came to mind: could these fragments be part of it?

In this paper we report the results of an analytical study of the Nossa Senhora da Vida panel and of the fragments found, comparing the results based on the assumption that they are coeval and were produced by the same workshop.

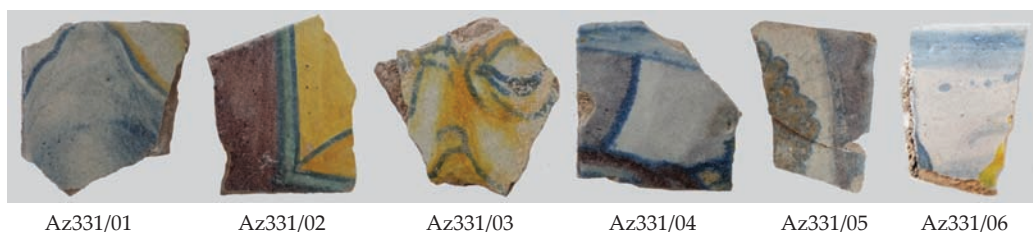


Figure 2. Azulejo fragments found during an archaeological excavation in the grounds of the demolished Santo André church and thought to have been part of one or more azulejo panels from the church

2. EXPERIMENTAL

2.1. Samples

Samples were carefully collected from various tiles of Nossa Senhora da Vida by removing small fractions of the glaze and biscuit with a scalpel from areas where it was already partially detached. The samples were identified with the reference Az032 (corresponding to this panel) plus an additional code to identify each sample. Some of the sampling locations are shown in Figure 3 but because the panel made up a single unit, at this phase the samples were chosen without any particular intention except that they should include a section of white glaze and a selection of colours, including the dark outline used to define many of the figures, to investigate the technique used. Table 1 includes a list of samples and their locations and colours.

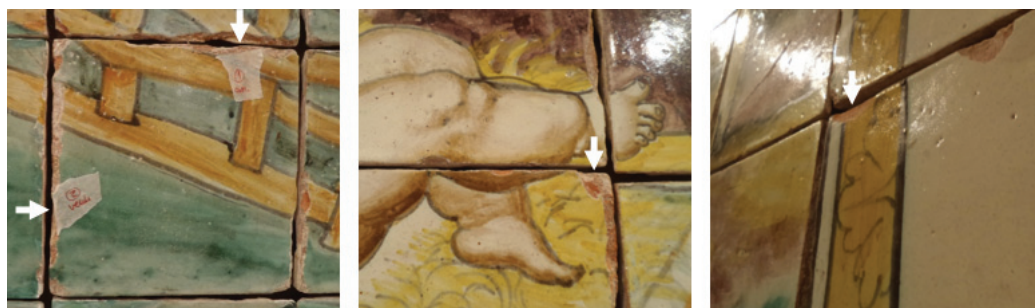


Figure 3. Some areas from where samples were collected – from left to right: Az032/01 and Az032/02; Az032/05; Az032/08

The shard recovered during the excavation of the former Santo André church bear the reference Az331 and the samples collected from the six fragments were identified as indicated in Figure 2. The glaze of these fragments is in excellent condition when compared to other similar shards recently recovered [e.g. 3] suggesting that the soil from which they were excavated was dry throughout the year.

Table 1. Samples from Nossa Senhora da Vida

Sample	Panel / Location	Colour
Az032/00	Child Jesus elbow / arm	white
Az032/01	crib	fawn
Az032/02	crib	green
Az032/04	Mary's mantle	blue
Az032/05	crib straw	yellow
Az032/06	above Jesus' feet	purple
Az032/08	protruding vertical line of the frame	dark purple / black

2.2. Equipment and technical methodology

The fragments detached from the azulejos were stabilized in epoxy resin, lapped and polished to obtain a flat surface for observation and analysis by scanning electron microscopy coupled with an X-ray energy-dispersive spectrometer (SEM-EDS).

The optical acquisition of sample images was made with a Leica DFC295 digital camera attached to a Leica M205C stereomicroscope.

SEM-EDS observations and analyses were made at the HERCULES Laboratory in Évora using a HITACHI 3700N SEM coupled to a BRUKER XFlash 5010 EDS. The specimens were uncoated and the observations were made in backscattered electrons mode (BSE) with the chamber at a pressure of 40 Pa and at an accelerating voltage of 20 kV. The acquisition of X-ray spectra was done with the detector set at ca. 8 mm working distance.

The selection of areas for EDS analysis avoided inclusions in the glaze or biscuit representing more than ca. 5 % of the full area analysed. The area sizes were ca. 200 x 200 μm^2 for glazes and 500 x 500 μm^2 for biscuits but acceptable repeatability was

verified in areas four times smaller. For comparison purposes, only the elements usually representing the major contents were considered, excluding tin (Sn) in the glaze and lead (Pb) in the biscuit due to their variability with the area chosen (in the case of Sn because of local aggregations of SnO₂ crystals; in the case of Pb because its content in the biscuit increases with proximity to the interface with the glaze). The results of the EDS analyses are given in weight % of each element identified.

Principal component analysis (PCA) was made of EDS results using the SPSS® software platform by IBM Analytics.

3. RESULTS

3.1. Glaze morphology

Figure 4 illustrates microscopic images of three of the sections prepared from Nossa Senhora da Vida. No *coperta* (a transparent glaze layer sprinkled on top of the painted glaze) was used, as testified by the section of Az032/03 in Figure 4. All biscuits are of a dark red colour.

It is particularly remarkable that on sample Az032/08 (right side of Figure 4) the dark outline is very well defined in section: it remains coherent and protruding from the glaze with very little spread of the pigments present in the dark colour, down into the glaze under it. This sample corresponds to cases as in Figure 5 in which the outline stands clearly out of the face of the tiles.



Figure 4. Polished sections of the azulejo panel Nossa Senhora da Vida observed at the optical microscope – left to right: Az032/00; Az032/03; Az032/08

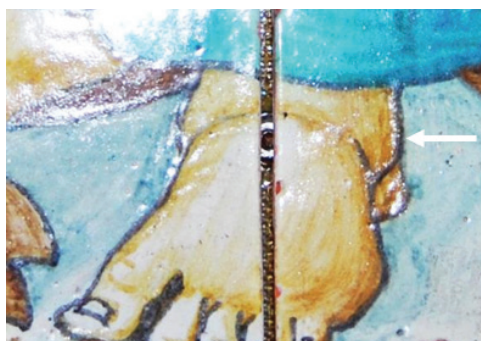


Figure 5. Part of the sketch of the azulejo panel Nossa Senhora da Vida showing how some dark outlines protrude from the face of the tiles

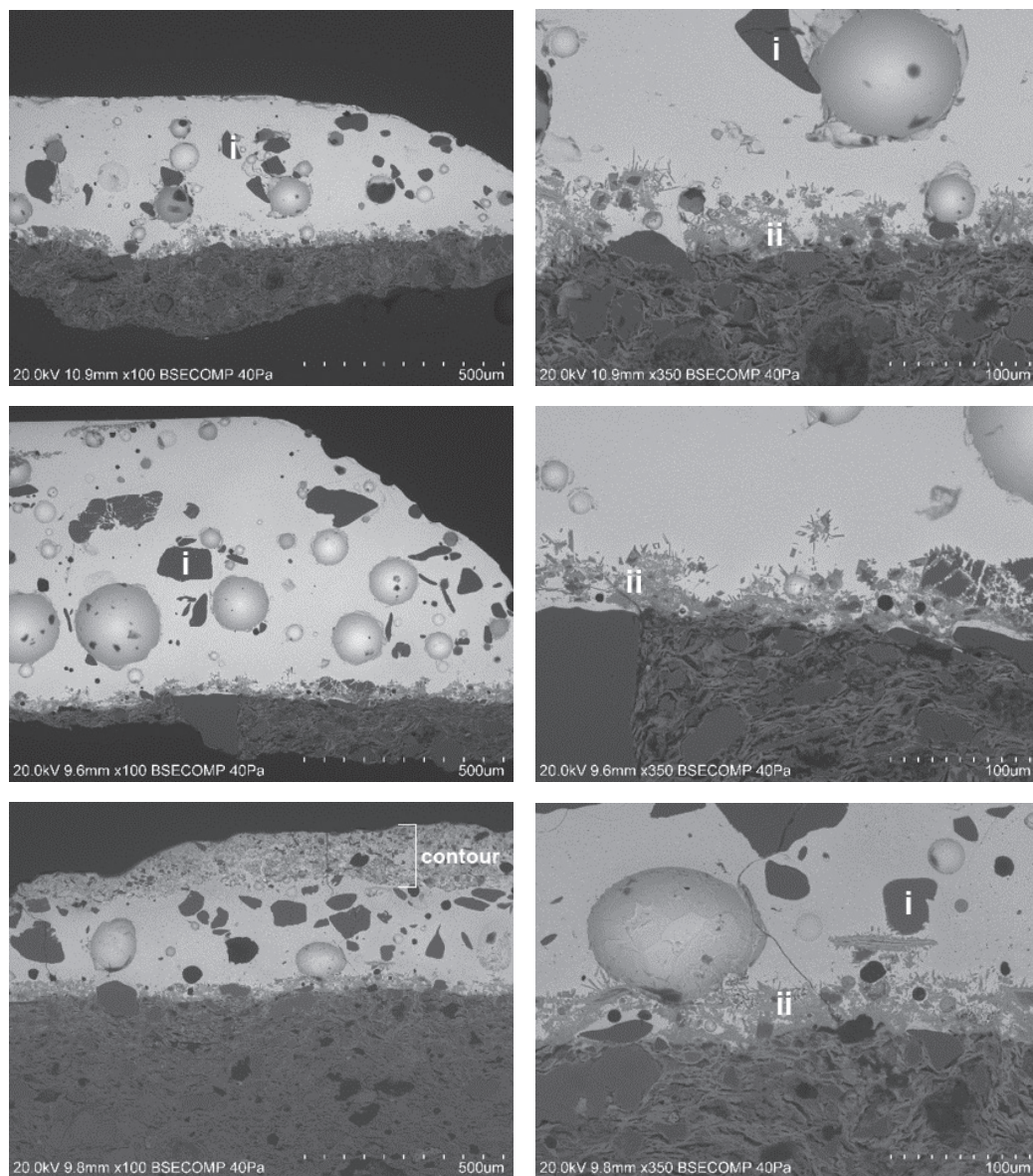


Figure 6. SEM images of samples of Nossa Senhora da Vida panel at lower and higher magnification – from top to bottom: Az032/01; Az032/02; and Az032/08, that exemplify the main micro-morphologic characteristics generally associated with the glazes of this panel. *i* - Sand grain; *ii* - neo-formation interfacial K-feldspar crystals; “contour” – protruding outline in section

Figure 6 depicts SEM images of samples Az032/01, Az032/02 and Az032/08 that exemplify the main micro-morphologic characteristics generally associated with the glazes of this panel: relatively few inclusions, mostly large-sized grains of sand; interface glaze-biscuit with abundant K-feldspar crystals formed during the second firing [4]. Both can be considered distinctive and the interfacial outgrowth is a particularly striking one that we had only previously seen with similar profusion in white glazes in some

Hispano-Moresque tiles [5]. This morphology likely results from the firing technology used, with long firing and cooling times [6; 7]. The glazes of all samples studied were morphologically similar with minor variations in the size and shape of the interfacial outgrowths.

In sample Az032/08 the section of the protruding outline depicts many small inclusions, probably added to the smalt to make a paste with which the contour lines were painted. EDS analyses of the inclusions were attempted and three sorts of particles were identified (Figure 7): *a* - particles that look light-coloured in BSE mode and were tentatively identified as lead arsenate whose crystals may also be seen inside the bubbles, prompted by the use of arsenic-rich blue cobalt pigment to make the colour; *b* - particles with sharp edges that look almost black in BSE mode and are small grains of sand; and *c* - particles that look grey in the image. A high content in Ca was found in these particles, together with a higher content in Si than can be explained by the glass matrix. Their mineralogy has not yet been identified but they may be a calcium silicate.

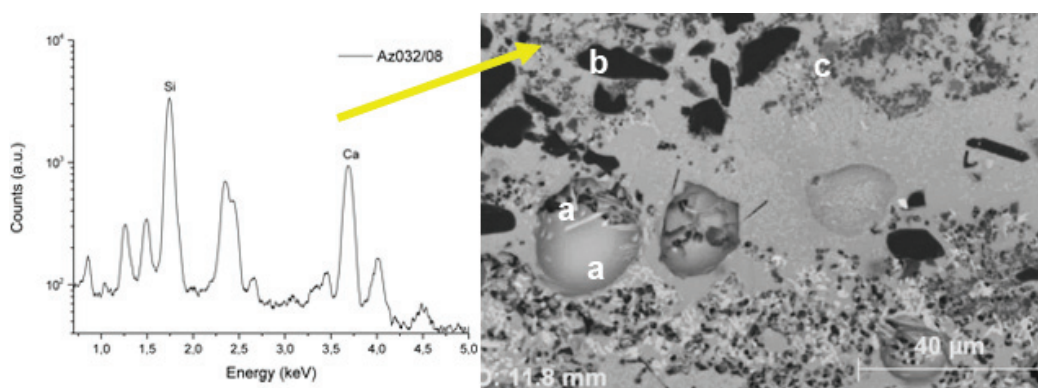


Figure 7. EDS spectrum of the grey inclusions in the protruding outlines. Besides the matrix and the gas bubbles, the sectional image depicts: *a* - “white” particles and crystals of lead arsenate; *b* - sand grains; *c* - grey particles of, maybe, a calcium silicate

Figure 8 illustrates microscopic images of three of the sections prepared from the excavated fragments from Santo André church. All biscuits are of a cream colour and again no coperta was used.

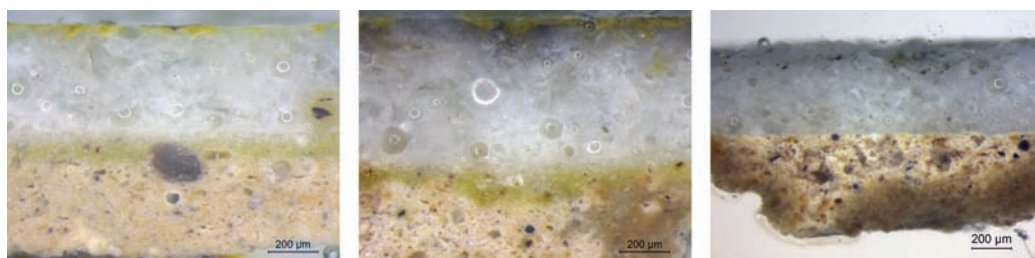


Figure 8. Polished sections of samples from the Santo André shard observed at the optical microscope. Left to right: Az331/03; Az331/05 and Az331/06

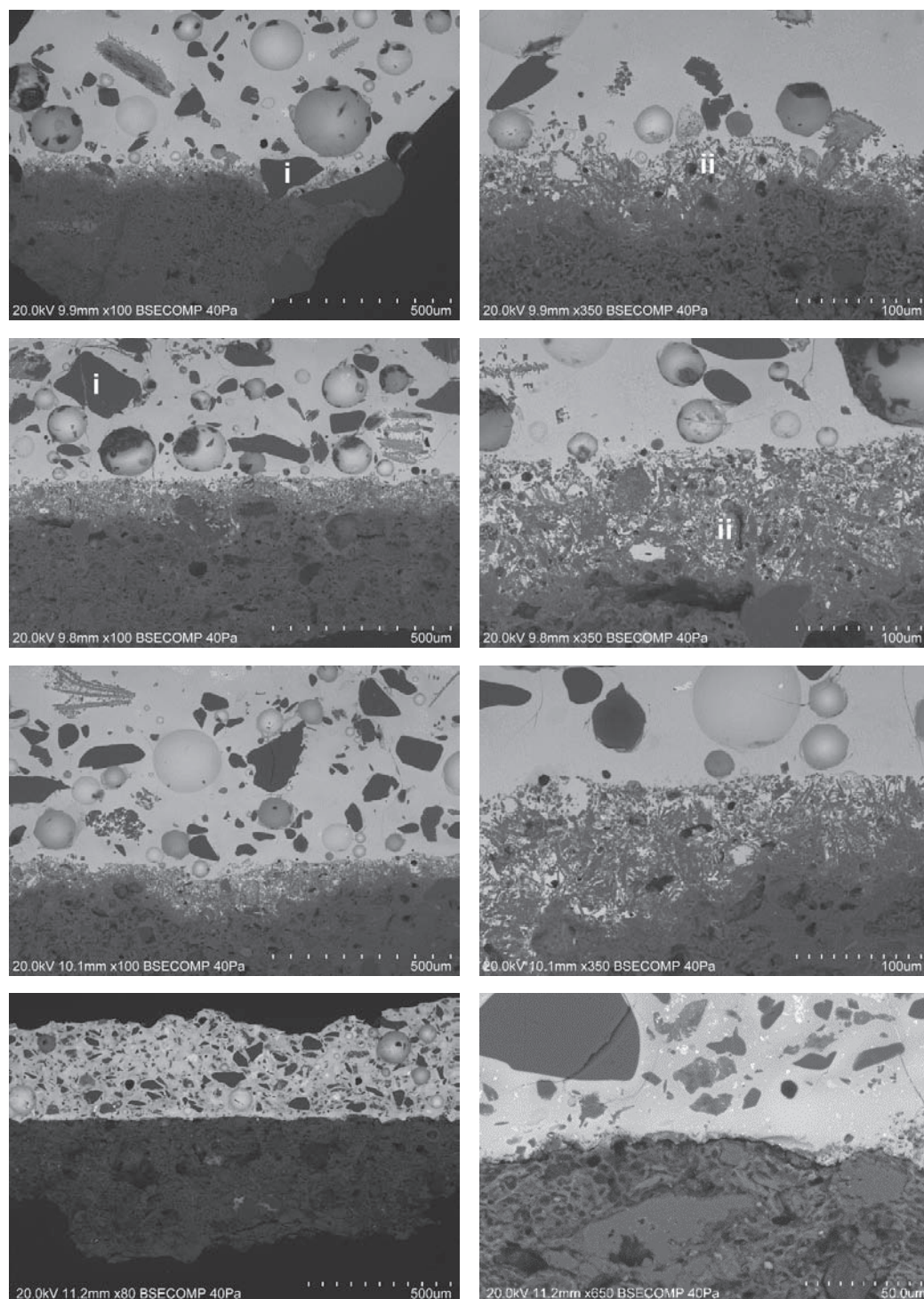


Figure 9. SEM images of the samples from the shard found at the site of Santo André church, exemplifying the main micro-morphologic characteristics generally associated with them. From top to bottom: Az331/02; Az331/03; Az331/05; and Az331/06. **i** - Sand grain, **ii** - neo-formation K-feldspar crystals

Figure 9 illustrates SEM images of samples Az331/02; Az331/03; Az331/05 and Az331/06 from the shard excavated at the grounds of Santo André church. They depict glaze-biscuit interfaces with, in general, abundant crystallizations comparable to the samples from the Nossa Senhora da Vida panel in Figure 6. However, although the glaze inclusions are also similar to those seen in Figure 6, they are often more numerous per unit sectional area. But there is a remarkable exception to this general similarity: sample Az331/06 depicts a completely different morphology of the inclusions and, at the stated scale, only minor outgrowths from the biscuit in its interface with the glaze.

3.2. Glaze composition

Table 2 includes the semi-quantitative results of analyses of the glazes by EDS in weight %. Sn was excluded for the reasons pointed out in section 2.2. The amount of oxygen was calculated through the remaining elements stoichiometry of their most commonly considered oxides (Na_2O , MgO , Al_2O_3 , SiO_2 , K_2O , Fe_2O_3 and PbO). The results were normalized to 100 % and the table also indicates the ratios Si/Pb.

Table 2. Semi-quantitative composition (% w/w) of the glazes determined by EDS (weight of the elements normalized to 100 %) and Si/Pb ratio for Nossa Senhora da Vida and the shard from Santo André church

Sample	Na	Mg	Al	Si	K	Fe	Pb	O	Si/Pb
Nossa Senhora da Vida									
Az032/00	0.9	0.5	2.4	14.5	0.9	0.6	56.1	24.1	0.26
Az032/01	1.4	0.7	2.6	15.3	0.8	0.6	53.3	25.3	0.29
Az032/02	0.8	0.7	2.9	16.5	1.2	0.6	50.6	26.6	0.33
Az032/04	0.7	0.2	3.7	23.8	2.6	1.1	33.6	34.4	0.71
Az032/05	0.9	0.5	2.7	15.0	0.7	0.8	54.5	24.9	0.28
Az032/06	1.1	0.5	2.3	15.6	1.0	0.7	53.5	25.2	0.29
Az032/08	0.7	0.2	4.2	20.5	1.5	1.0	40.5	31.4	0.51
Shard Santo André church									
Az331/01	1.0	0.4	2.6	16.7	1.6	0.6	50.7	26.4	0.33
Az331/02	1.3	0.6	3.0	17.4	1.5	1.3	47.0	27.9	0.37
Az331/03	1.0	0.5	2.8	14.6	0.9	0.7	54.8	24.6	0.27
Az331/04	1.3	0.5	2.8	18.4	2.9	0.8	44.6	28.7	0.41
Az331/05	1.3	0.6	2.3	16.5	1.2	0.8	51.1	26.2	0.32
Az331/06	3.4	0.8	3.6	21.9	3.6	1.3	31.8	33.6	0.69

Figure 10 shows the results of a log-based principal component analysis (PCA) of the glazes of all samples, considering the analytical results in Table 2, through a plot in the plane of the two first principal components (PC1 and PC2). PC1 explains 61 % of the variation and is controlled in the positive sense mostly by the contents in Al, Si, K and Fe and in the opposite sense by the content in Pb, as can be seen from the loadings plot of

Figure 11 in which the projections of the vectors on an axis show the contribution of each element to the respective principal component. PC2 explains 26 % and is controlled in the positive sense mostly by the contents in Na and Mg and in the opposite sense mostly by the contents in Al and Pb (Figure 11).

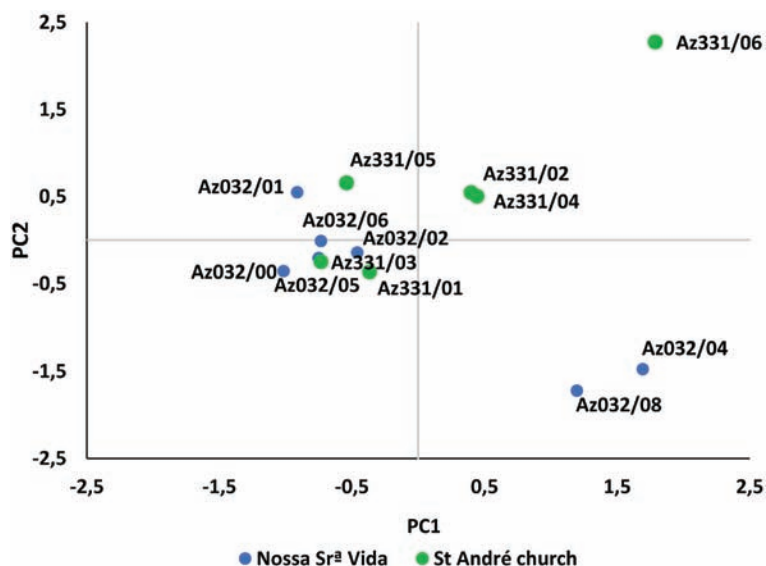


Figure 10. Score plot PC1 vs. PC2 of the PCA analysis of the glazes

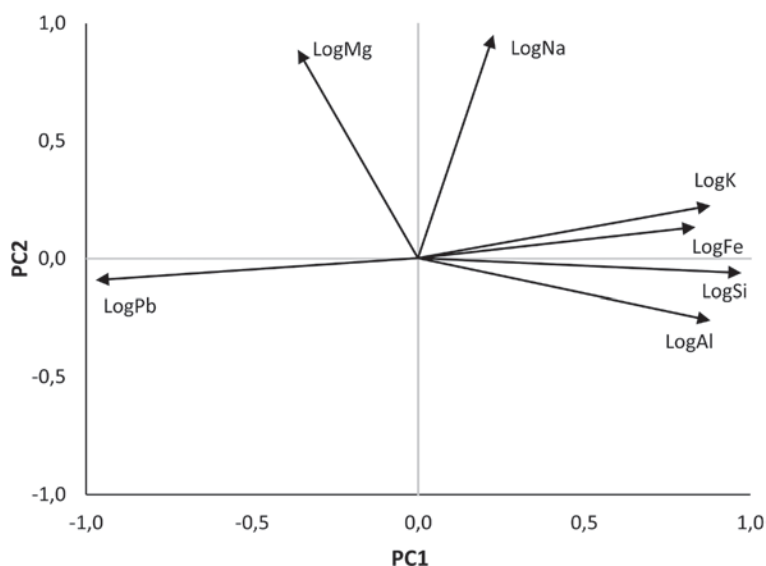


Figure 11. Loadings plot of the PCA analysis of the glazes

Considering the score plot of Figure 10, the samples are similar and those from the Nossa Senhora da Vida panel cannot be clustered together in a way that separates them squarely from the shard samples. However, sample Az331/06, with a higher content in Na and K and lower in Pb (Table 2), is clearly separated from all others. This is meaningful because

Az331/06 is the sample that was seen to be morphologically dissimilar from the rest (Figure 9 bottom). The glazes of samples Az032/04 and Az032/08 are also compositionally different from the remaining, mostly due to a higher Si/Pb ratio. The tiles from which those samples were collected were macroscopically examined and no peculiarity has been found in them that could point to a later incorporation or restauration. The difference may result from the natural compositional variability of the glazes, particularly at the small scale at which they are analysed.

3.3. Biscuit composition

Table 3 includes the semi-quantitative results of analyses of the biscuits by EDS in weight %. Pb was excluded for the reasons pointed out in section 2.2. The amount of oxygen was calculated through the remaining elements stoichiometry considering their most commonly used oxides (Na_2O , MgO , Al_2O_3 , SiO_2 , K_2O , CaO and Fe_2O_3). The results were normalized to 100 % and the table also indicates the ratios Ca/Si.

Table 3. Semi-quantitative composition (% w/w) of the biscuits determined by EDS (weight of the elements normalized to 100 %) and Ca/Si ratio for Nossa Senhora da Vida and the shard from Santo André church

Sample	Na	Mg	Al	Si	K	Ca	Fe	O	Ca/Si
Nossa Senhora da Vida									
Az032/00	1.5	1.7	10.5	25.3	3.8	6.4	5.3	45.4	0.25
Az032/01	1.2	2.2	9.1	24.6	2.7	9.5	5.9	44.9	0.39
Az032/02	1.1	1.5	8.7	28.8	2.7	6.9	3.5	46.7	0.24
Az032/04	1.8	1.4	9.7	23.2	4.0	10.8	5.2	44.0	0.47
Az032/05	1.2	1.7	12.7	25.4	4.2	2.6	6.0	46.2	0.10
Az032/07	1.3	1.5	10.3	25.9	3.8	6.5	5.1	45.7	0.25
Az032/08	1.4	1.8	10.7	23.6	3.6	9.3	4.8	44.7	0.39
Shard Santo André church									
Az331/01	0.8	1.7	7.0	15.6	0.7	31.2	3.6	39.5	2.00
Az331/02	1.1	1.9	7.0	15.9	1.0	30.5	3.1	39.6	1.92
Az331/03	0.6	1.6	6.9	16.0	0.8	30.4	4.0	39.6	1.90
Az331/04	0.7	1.9	7.0	15.1	0.4	31.9	3.7	39.3	2.11
Az331/05	1.0	1.9	7.6	18.0	0.9	25.7	3.9	41.0	1.43
Az331/06	2.0	2.1	8.2	13.5	1.1	29.9	4.4	38.8	2.21

Figure 12 shows the results of a log-based principal component analysis of the biscuits, considering the analytical results in Table 3, through a plot in the plane of the two first principal components (PC1 and PC2). PC1 explains 68 % of the variation and is controlled in the positive sense mostly by the contents in Al, Si, K, Na and Fe and in the opposite sense mostly by the content in Ca, as can be seen from the loadings plot of Figure 13. PC2 explains 16 % of the variation and is controlled in the positive sense mostly by the content in Mg and the opposite sense by the content in Si (Figure 13).

In the score plot of Figure 12, it can be seen that the samples from Nossa Senhora da Vida and the Santo André shard are clearly separated and may be aggregated in two different clusters mostly due to their relative contents in Ca, the samples from the excavated fragments having a much higher Ca/Si ratio than the rest.

It is interesting to note that neither Az032/04 and Az032/08 singled by the score plot of Figure 10, are separated from their respective clusters when the biscuits are considered.

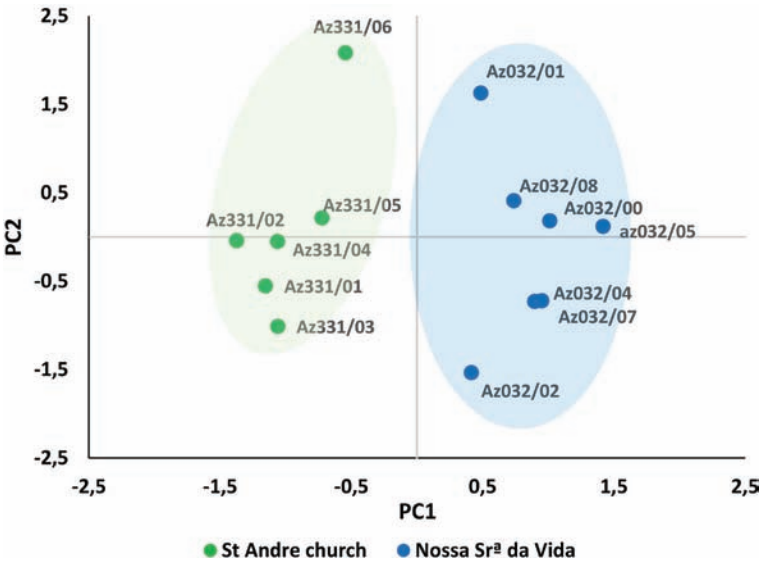


Figure 12. Score plot (PC1 vs. PC2) of the PCA analysis of the biscuits of Az032 and Az331 samples

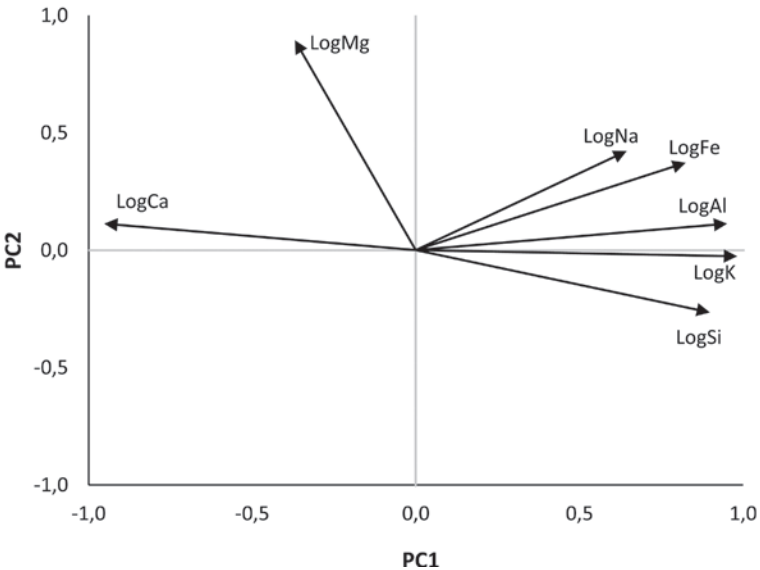


Figure 13. Loadings plot of the PCA analysis of the biscuits

4. DISCUSSION

All tiles except that represented by Az331/06 seem to have been fired in a cycle including a long cooling period, maybe using the same kiln that fired the tiles of other panels presenting similar morphologies [8]. Such a firing cycle results in a characteristically well-developed interface with extensive growth of K-feldspars already found by other authors and by us in reproduction studies [4; 6; 7].

Considering the morphological characteristics of the glazes (Figures 6; 9), their compositions (Table 2), and PCA results (Figure 10), the samples can be considered to form two groups: Senhora da Vida (minus eventual uncharacteristic outliers) and the fragments Az331/01 to Az331/05 from the site of Santo André church make up a first group, while Az331/06 is different. Albeit similar, the inclusions and interfacial growth of Senhora da Vida and of the five fragments mentioned are not an exact match. Such situation is what might be expected from the application of the same broad technology at two different and possibly distant chronologies. In the case of Az331/06, not only the nature and density of the inclusions are diverse but also the interface, largely devoid of outgrowths when considered at the same scale as the other samples, is completely different. Compositionally, Az331/06, in which the glaze contents in Na and K, as well as the ratio Si/Pb are much higher, is also distinct.

Table 3 and the PCA results in Figure 12 compare the composition of Nossa Senhora da Vida biscuits with the shard of Santo André and they are seen to be very different. Indeed, against a Ca/Si ratio under 0.4 for Senhora da Vida, all the samples from Santo André church present ratios five times higher. The excellent condition of the glazes shows no lixiviation of the lead in the presence of water [3] and therefore the fragments were probably buried in an essentially dry soil. Therefore, the possibility of substantial deposition of alien calcium carbonate in the excavated fragments can be refuted. Actually, the compositions of the biscuits of the Santo André shard are similar to those of 17th century Portuguese tiles [5]. It is also noteworthy that, in the case of the biscuits, Az331/06 is close to the other fragments from Santo André church, even though the glazes are very distinct. The separation derives only from the lesser PC2 component.

Referring to samples Az331/01 to Az331/05 we may put forward that the panel which they represent stems from the same technological circle as Senhora da Vida, using a similar glaze formulation and a similar firing cycle. All may even have been fired at the same kiln. The glaze, poor in alkalis and with a low Si/Pb ratio, fired in a long cycle that promoted the interfacial growth is a typical 16th century trait of the workshops of Lisbon that may have spanned to the early 17th century but was not enduring [5]. However, the biscuits tell a completely different story: Senhora da Vida used a ceramic paste low in Ca that fired to a reddish colour with the cycle used, while the panels (at least two) from Santo André chapel, represented by the six fragments studied, used a paste high in Ca that characterizes later productions in which the Ca/Si ratios are well above 1.0 [5]. This paste fired to cream biscuits, even when a firing cycle similar to that of Senhora da Vida was used.

A discussion of the chronology of the panel from Santo André church represented by the fragments from which samples Az331/01 to Az331/05 were taken should now be tried based on the analytical results. Advancing as a hypothesis that all extant Lisbon azulejo workshops (if more than one) were using a similar technology in the 1580s, then based on the present information about the productions of which a date is (at least approximately) known [8] we are induced to place the panel represented by those fragments after the lining of São Roque chapel, dated “1584” [9]. The assumption that they might be coeval

with Senhora da Vida is therefore remote. This conclusion stems from the composition of the biscuits, with high Ca/Si ratios, similar to 17th century productions. If we recall Mr. José Valentim’s documented testimony that he saw associated to another now lost panel the date “1580”, then it is unlikely that the fragments recovered may be from that exact panel.

The glaze of fragment Az331/06, with a higher Si/Pb ratio, can be associated to a different and very likely even later production, given the morphology of the glaze and the small crystalline development of the glaze-biscuit interface, characteristic of the 17th century [5].

The unusual addition of finely ground minerals to a smalt used to paint outlines (Az032/08 in Figures 6 and 7), presumably to give them body and avoid the running of the colour over firing, may characterize a single painter or workshop. The dark lines remain protruding from the glaze with very little spread of the blue or violet pigments down into the glaze under it (Figure 4). This suggests that the protruding outlines were painted over an already fired glaze which was subsequently re-fired at a lower temperature to avoid the spread of the colours. This technique would certainly add to the cost and is quite unexpected. It may have also been used in the 1558 tiles from Antwerp applied in the *Palácio de Vila Viçosa* in South Portugal, in which slightly protruding dark lines and outlines can also be seen, but in that case no similar mineral inclusions were observed in the smalt [10]. A final conclusion on the technology used for this purpose needs to be based on the making of reproductions.

5. CONCLUSION

Based on the results of this study, the fragments represented by Az331/01 to Az331/05 stem from the same technological circle as the panel Nossa Senhora da Vida and the panel or panels they represent may even have been produced at a later time by the same workshop that made Nossa Senhora da Vida. But the biscuits are different and their similarity to later types points to a date after 1584. Therefore, these should not be part of another panel in the same church said to be dated “1580”. Until more archaeological finds are made, we have to consider the search for the lost panel as an open case.

These fragments may, however, be highly important because they seemingly testify to a transition. Their glaze composition and firing cycle are “ancient” in the sense they represent the earliest faience azulejo technology known from Portugal, but their biscuits are “modern” in the sense their composition is what could be expected in a 17th century tile. They are a hybrid link that mark a time as yet undated when an important technological transition was taking shape, that would endure through the 17th and 18th centuries.

BIBLIOGRAPHIC REFERENCES:

1. PAIS, A. et al. – *The 16th century nativity azulejo panel called “de Nossa Senhora da Vida”* in *Studies in Heritage Glazed Ceramics*, No. 1, pp. 67-76 , LNEC, Lisbon, Portugal, February 2019.
2. GUIMARÃES, Ribeiro – *Summario de varia historia. Narrativas, lendas, biographias, descripções de templos e monumentos, estatísticas, costumes civis, políticos e religiosos de outras eras. Por...* vol. II, pp. 103-111, Rolland & Semiond, Lisbon, 1872.

3. PAIS, A. et al. – *16th century azulejos – what lies beneath the ground of Lisbon?* in Proc. Int. Conf. Glazed Ceramics in Cultural Heritage (GlazeArt 2018), LNEC, Lisbon Oct. 29-30, pp. 298-312, LNEC, Lisbon, 2018.
4. MOLERA, J. et al. – *The growth of sanidine crystals in the lead of the glazes of Hispano-Moresque pottery*, App. Clay Sc. 7/1993, pp. 483-491, 1993.
5. MIMOSO, J. et al. – *A comparison of the earliest faience tiles produced in Lisbon with earlier and later types* in Studies in Heritage Glazed Ceramics, No. 1, pp. 25-46, LNEC, Lisbon, February 2019.
6. MOLERA, J. et al. – *Interactions between Clay Bodies and Lead Glazes*, Journal of the American Ceramic Society, Vol. 84, No. 5, pp. 1120-1128, May 2001.
7. PEREIRA, S. et al. – *Influence of the production technology on the morphological characteristics of azulejos* in Proc. Int. Conf. Glazed Ceramics in Cultural Heritage (GlazeArt 2018), LNEC, Lisbon Oct. 29-30, pp. 140-149, LNEC, Lisbon, 2018.
8. MIMOSO, J. et al. – *A technical comparison of three renaissance azulejo panels from the workshops of Lisbon* in Studies in Heritage Glazed Ceramics, No. 1, pp. 113-132, LNEC, Lisbon, February 2019.
9. MIMOSO, J. et al. – *A research on the azulejo panels of the São Roque chapel in Lisbon* in Studies in Heritage Glazed Ceramics, No. 1, pp. 93-112, LNEC, Lisbon, February 2019.
10. MIMOSO, J. et al. – *Analytical study of tiles of presumed Flemish origin from the Palace of the Dukes of Braganza in Vila Viçosa*, in “From Flanders. The azulejos commissioned by D.Teodósio I, 5th Duke of Braganza, pp. 64-74, Museu Nacional do Azulejo & Fundação da Casa de Bragança, Lisbon, 2012.

A research on the azulejo panels of the São Roque chapel in Lisbon

João Manuel Mimoso, Alexandre Pais, Teresa Morna, João Miguel Simões, Maria de Lurdes Esteves, Ana Margarida Cardoso, Sílvia R. M. Pereira, António Candeias

ABSTRACT

The azulejos of the São Roque (Saint Roch) chapel, in the church dedicated to the same saint in Lisbon, are justly considered one of the major majolica works made anywhere during the last quarter of the 16th century. This earliest known surviving ensemble of Portuguese manufacture signed and dated (“Francisco de Matos : 1584”) has long puzzled art historians mostly because it seems to be a quite unique case in Portugal.

In this paper we consider the individual panels that make up the lining, pointing to the fact that at least two painters worked on them. We also review José Queiroz’ references to the panels made in 1913, when a hitherto unknown part of the lining was uncovered, and his information is compared with what is visible today. Finally, we use analytical means to characterize the tiles and based on the results we discuss whether the panels are all coeval or eventually have different chronologies. The information obtained points to a definite technological affiliation.

RESUMO

Os azulejos da capela de São Roque, na igreja da mesma invocação em Lisboa, são justamente considerados uma das maiores obras de arte em majólica produzidas no último quartel do século XVI. Este conjunto azulejar é a mais antiga produção portuguesa presentemente conhecida que está assinada e datada (“Francisco de Matos : 1584”) e tem confundido os historiadores por parecer um caso único no País.

Neste artigo, consideramos os painéis individuais que compõem o revestimento parietal notando que pelo menos dois pintores terão trabalhado nele. Também revemos as notas de José Queiroz, escritas em 1913 quando uma parte dos painéis até então desconhecida foi descoberta, e as informações que dá são comparadas com o que é visível hoje. Finalmente, usamos meios instrumentais para caracterizar os azulejos e, com base nos resultados, discutimos se os painéis são todos coevos ou, eventualmente, têm cronologias diferentes.

Sob o ponto de vista da tecnologia empregue na sua produção, a informação obtida afasta a noção de que os painéis azulejares que revestem a Capela de São Roque são um caso único.

João Manuel Mimoso

LNEC - Laboratório Nacional de Engenharia Civil, Lisbon, Portugal, jmimoso@lnec.pt

Alexandre Pais

Museu Nacional do Azulejo, Lisbon, Portugal

Teresa Morna

Museu de São Roque, Lisbon, Portugal

João Miguel Simões

Museu de São Roque, Lisbon, Portugal

Maria de Lurdes Esteves

Museu Nacional do Azulejo, Lisbon, Portugal

Ana Margarida Cardoso

Laboratório HERCULES - Universidade de Évora, Portugal

Sílvia R. M. Pereira

LNEC - Laboratório Nacional de Engenharia Civil, Lisbon, Portugal / Laboratório HERCULES - Universidade de Évora, Portugal

António Candeias

Laboratório HERCULES - Universidade de Évora, Portugal

KEYWORDS: Renaissance majolica / Portuguese azulejos / Francisco de Matos / João de Góis / Igreja de São Roque in Lisbon

ACKNOWLEDGEMENTS

André Martins da Silva and the remarkable Irmandade de São Roque are gratefully acknowledged for authorizing a limited sampling of the magnificent panels at the São Roque chapel. Father Rui Rosmaninho of the Setúbal Cathedral.

Fernando Duarte, Father Rui Augusto Jardim Gouveia and Ana Clara Pacheco for information and support in relation with the tiles conserved in the Theological Seminar of St. Paul in Almada.

Communication produced as an outcome of Project FCT-AzuRe - Estudos no Azulejo Português para Candidatura a Património da Humanidade (PTDC/EPH-PAT/5096/2014) funded by FCT, the Portuguese Foundation for Science and Technology. S. Pereira also acknowledges FCT for her Post-Doc Grant (SFRH/BPD/116807/2016).

Aviso legal

As opiniões manifestadas no *Studies in Heritage Glazed Ceramics* são da exclusiva responsabilidade dos seus autores.

Legal notice

The views expressed in the *Studies in Heritage Glazed Ceramics* are the sole responsibility of the authors.

1. INTRODUCTION

The azulejo panels lining the São Roque (Saint Roch) chapel in the church dedicated to the same saint in Lisbon are justly considered one of the major majolica works of art made anywhere during the last quarter of the 16th century [1]. The earliest known surviving group of Portuguese azulejos signed and dated (“Francisco de Matos / 1584”) has long puzzled art historians mostly because their magnificence seems to be an almost unique case with no predecessors and few immediate successors in Portugal.

The set may be considered composed of four panels: two lower panels, facing each other, have the attributes of the saint painted on them. One of these, on the Gospel side of the chapel, depicts the most recognizable attribute: a dog with a loaf in the mouth (we call it *panel of the dog*) and it bears the date and signature on the lower left side (Figure 1). The panel is 17 tiles high and at its top seems to call for a continuation because the design is not concluded and the frame is not closed but the upper wall is covered by a large painting.

Although the design is not actually symmetrical, the facing panel is a sort of mirror image of the first and depicts another attribute: the staff of a pilgrim (we call it *panel of the pilgrim*).



Figure 1. The signed panel of the dog on the Gospel side of São Roque chapel



Figure 2. The lower panel of the pilgrim, the panel of the cardinal over it (the white arrows mark the boundary) and the panel of the putti over the door

As we look up, this panel is not interrupted and continues to the ceiling depicting the miraculous cure of the English cardinal by St. Roch (the *panel of the cardinal*). Side by side with this panel, over a door, is the fourth panel depicting two winged children looking back to the chapel (the *panel of the putti*) – Figure 2.

Until 1913 only the two lower panels were visible but at the insistence of José Queiroz, a noted artist and historian of Portuguese ceramics, a large painting that covered both the panels of the cardinal and of the putti was removed in that year and the upper side of the lining was thus discovered [2]. The same was attempted on the Gospel side of the chapel, but only an empty wall was found under the painting and it was subsequently re-applied.

Queiroz reported that the panels of the cardinal and of the putti were damaged because of the careless perforations needed to support the heavy painting and a restoration of all the panels was entrusted to António Luis de Jesus, an aged third-generation master painter much praised by Queiroz who also states that all fragments of the cut and perforated tiles that could be saved were reapplied by the restorer, but yet 47 reproduction tiles had to be made plus a number of fragments and that, although the blue and violet were satisfactorily reproduced, the yellow and green did not match the original [2, p. 110]. An observation of the panels confirms his statements (Figure 3).



Figure 3. A detail of the panel of the putti showing two restored areas repairing a perforation (1) and evincing the different hue of the yellow pigment used (2)

2. MACROSCOPIC OBSERVATION OF THE PANELS

Observing the lining carefully, it will be noted that the panels facing each other (dog and pilgrim) are identical in style and colours. However, the panels of the cardinal and of

the putti show some remarkable differences: their background colour is of a noticeably darker yellow than the panel of the pilgrim and the motives are painted in a softer manner with, seemingly, a less concentrated blue. The apparent border line between the two hues of yellow is noted by white arrows in Figure 2 and the image clearly shows that the upper panels were very likely painted by a different hand. If we examine the corresponding area in the panel of the dog, a similar boundary will be recognized (white arrows in Figure 1) and it may be noticed that the floral designs below the boundary actually terminate shortly above this line and are independent of the “upper” design – only the vase connects both (Figure 4). But on both sides of the chapel the “lower” and “upper” designs are interlocked in the sense that even if the motifs do not connect, the design itself flows across the boundary as a whole.



Figure 4. The red line shows that the upper and lower floral designs do not actually connect except through the vase (boundary band seen here in the panel of the dog)

When the upper and lower yellow hues, that are noticeably different from a distance, are inspected at close range they are seen to be a consequence of the painting technique rather than derive from different pigments. In some cases, as in Figure 5, both hues seem to co-exist in the same tile depending on the number of superimposed brushstrokes or the pigment concentrations used in two instances or by two painters.



Figure 5. Boundary band in the panel of the dog depicting darker (D) and lighter (L) yellow areas in the same tile

The close observation of the panel of the dog also reveals technical issues during production including staining of some tiles, possibly caused by contamination by copper pigment for being fired in the same kiln as green-glazed pottery, and running of some

dark outlines (Figure 6), showing that many, if not all, azulejos were fired in an upright position, also attested by the agglomeration of glaze often seen along one edge. The panel of the pilgrim only shows a slight greenish staining of some tiles and those problems are seemingly absent from the other panels.



Figure 6. Evidence of technical issues in the panel of the dog: 1) running of the dark blue outlines; 2) blue or green staining

At this instance, a question inevitably comes to mind: if the panel of the dog (and presumably the panel of the pilgrim) were painted in 1584 and the other two panels (cardinal and putti) are different and were only brought to light in 1913, when were they painted? Do they even date from the 16th century? Or are they a much more recent addition to the original lining? The research was aimed to clarify these important questions as well as determine technical characteristics that might establish an eventual affiliation with other productions already known through the instrumental observation and analysis of samples from the panels of the dog, cardinal and putti.

3. EXPERIMENTAL

3.1. Samples

A total of fourteen samples (Table 1) were carefully collected with a scalpel from spots where the glaze was already detaching or from edges of incomplete tiles, including the panel of the dog, the panel of the cardinal, the panel of the putti and the pattern tiles that frame the panels. All samples were identified with the reference Az068 (corresponding to the lining of São Roque chapel) plus an additional numeric code to individualize each sample. Examples of the exact sampling locations are shown in Figure 7.

Samples Az068/04 and Az068/07 are from restoration fragments made in 1913. Sample Az068/03 (panel of the dog) and Az068/11 (cardinal) included the dark blue outlines of the designs. Sample Az068/08 (the left side of the loaf carried by the dog) is from a tile of a darker yellow (Figure 7) whose sketch does not exactly match the surrounding tiles. Samples Az068/12 and Az068/14 are from fragments (patches) used to bridge the distance from the panel of the dog and the altar (lower right side of Figure 1) and the top

of the panel of the putti (Figure 2). Samples Az068/01/02/03/13 from the dated panel of the dog were used as reference for comparison purposes.



Figure 7. Locations from where samples were collected - from left to right and top to bottom – Az068/01 and Az068/02 (dog near the signature); Az068/03 (dog); Az068/08 and Az068/13 (dog); Az068/04 and Az068/05 (cardinal); Az068/06 and Az068/07 (putti)

Table 1. Samples collected from the São Roque chapel azulejo panels

Sample ref.	Panel	Notes
Az068/01	Dog	white
Az068/02	Dog	yellow
Az068/03	Dog	blue outline
Az068/08	Dog	yellow
Az068/13	Dog	dark blue
Az068/05	Cardinal	yellow
Az068/11	Cardinal	dark blue outline
Az068/06	Putti	light blue
Az068/14	Patch right of Dog	dark blue
Az068/12	Patch over Putti	dark blue
Az068/09	Frame of Dog panel	frame tile- purple
Az068/10	Frame between Cardinal & Putti	frame tile- blue / purple
Az068/04	Cardinal (restoration)	restoration tile (blue/white)
Az068/07	Putti (restoration)	restoration tile (yellow)

3.2. Equipment and analytical methodology

The fragments detached from the azulejos were stabilized in epoxy resin, lapped and polished to obtain a flat surface for observation and analysis by scanning electron microscopy coupled with an X-ray energy-dispersive spectrometer (SEM-EDS).

Optical images of cross sections were obtained with a Leica DFC295 digital camera coupled to a Leica M205C stereomicroscope.

SEM-EDS observations and analyses were made at the HERCULES Laboratory in Évora using a HITACHI 3700N SEM coupled to a BRUKER XFlash 5010 EDS. The specimens were uncoated and the observations were made in backscattered electrons mode (BSE) with a chamber pressure of 40 Pa and at an accelerating voltage of 20 kV. The acquisition of X-ray spectra was done with the detector set at ca. 8 mm working distance.

The selection of areas for EDS analysis avoided inclusions in the glaze or biscuit representing more than ca. 5 % of the full area analysed. The area sizes were ca. 200 x 200 μm^2 for glazes and 500 x 500 μm^2 for biscuits but acceptable repeatability was verified in areas four times smaller. For comparison purposes, only the elements usually representing the major contents were considered, excluding tin (Sn) in the glaze and lead (Pb) in the biscuit due to their variability with the area chosen (in the case of Sn because of local aggregations of SnO_2 crystals; in the case of Pb because its content in the biscuit increases with proximity to the interface with the glaze). The results of the EDS analyses are given in weight % of each element identified.

The pigmented glaze was analysed *in situ*, over the face of the tiles, by energy-dispersive X-ray fluorescence (ED-XRF) with a hand-held Bruker Tracer III spectrometer at 40 kV and 30 μA over 180 s acquisition times. Spectra were interpreted with the ARTAX software.

Principal component analysis (PCA) was made of EDS results using the SPSS® software platform by IBM Analytics.

3.3. Results

3.3.1. Glaze and interface morphology

Figure 8 illustrates microscopic images of four of the sections prepared. All biscuits are of a reddish colour. No *coperta* (a transparent glaze layer sprinkled on top of the painted glaze [3]) was used over the yellow painting.

Samples Az068/03 and Az068/11, from different panels, correspond to dark outlines and although these are not markedly protruding, it is seen that the sections have patches of a brownish colour, indicated by arrows in Figure 8.

Figure 9 shows SEM images of sections of samples Az0068/02 (panel of the dog / yellow); Az068/11 (panel of the cardinal); and Az068/06 (panel of the putti) exemplifying the main micro-morphologic characteristics generally associated with the glazes: relatively few inclusions, mostly large-size grains of sand and some feldspars; glaze-biscuit interface with many crystals of neoformation.

The interfacial outgrowth is a particularly striking characteristic that up to recently we had seen only in some Hispano-Moresque tiles [4; 5]. All the sections from the samples (except the restoration tiles) are morphologically similar irrespective of the panel, although the profusion of the interfacial crystals and their exact shape may vary, as seen in Figure 9.

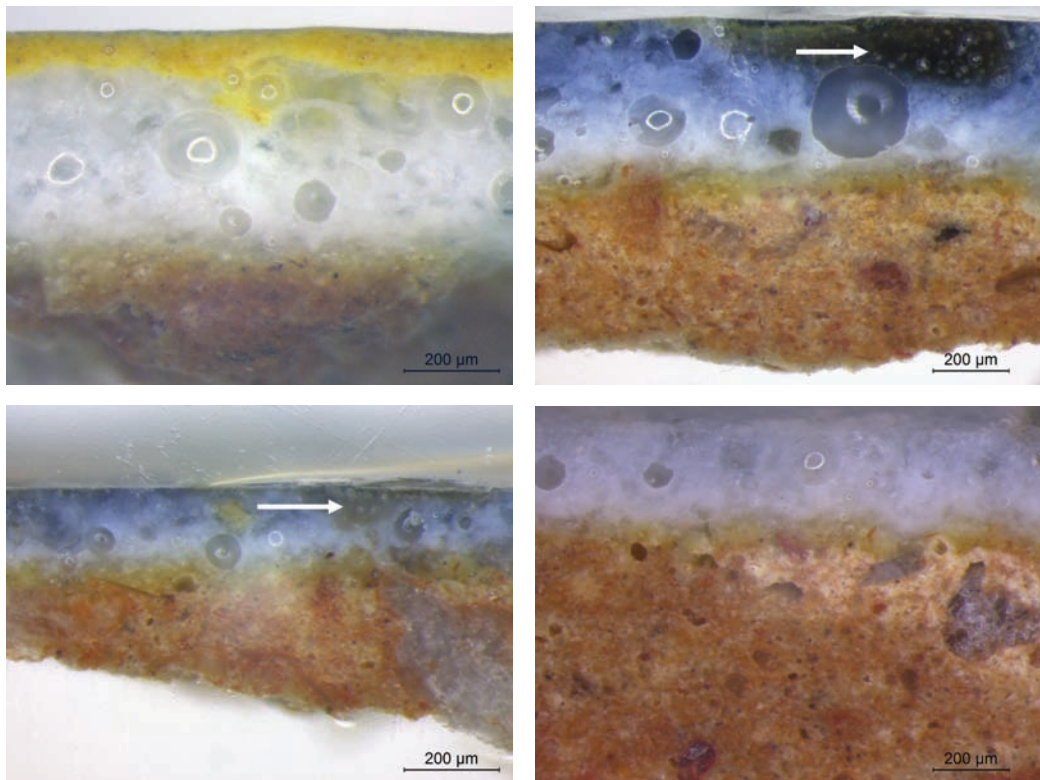


Figure 8. Sample sections in optical microscopy – top to bottom and left to right: Az068/02 and Az068/03 (dog); Az068/11 (cardinal) and Az068/06 (putti)

When observing the sections of samples Az068/03 (panel of the dog) and Az068/11 (panel of the cardinal) under the SEM, the brownish areas seen in Figure 8 resolved into many small inclusions of a mineral apparently added to the smalt with which the dark outlines were painted, possibly to give it body and oppose the running of the colour when the tiles were fired upright. Figure 10 shows a detail of Az068/03 and the spectrum of a point analysis of one of the inclusions. A high content in Ca was found, together with a higher content in Si than can be explained by the glass matrix. The same result was obtained for Az068/11. The mineralogy of the inclusions has not yet been identified but may correspond to a calcium silicate.

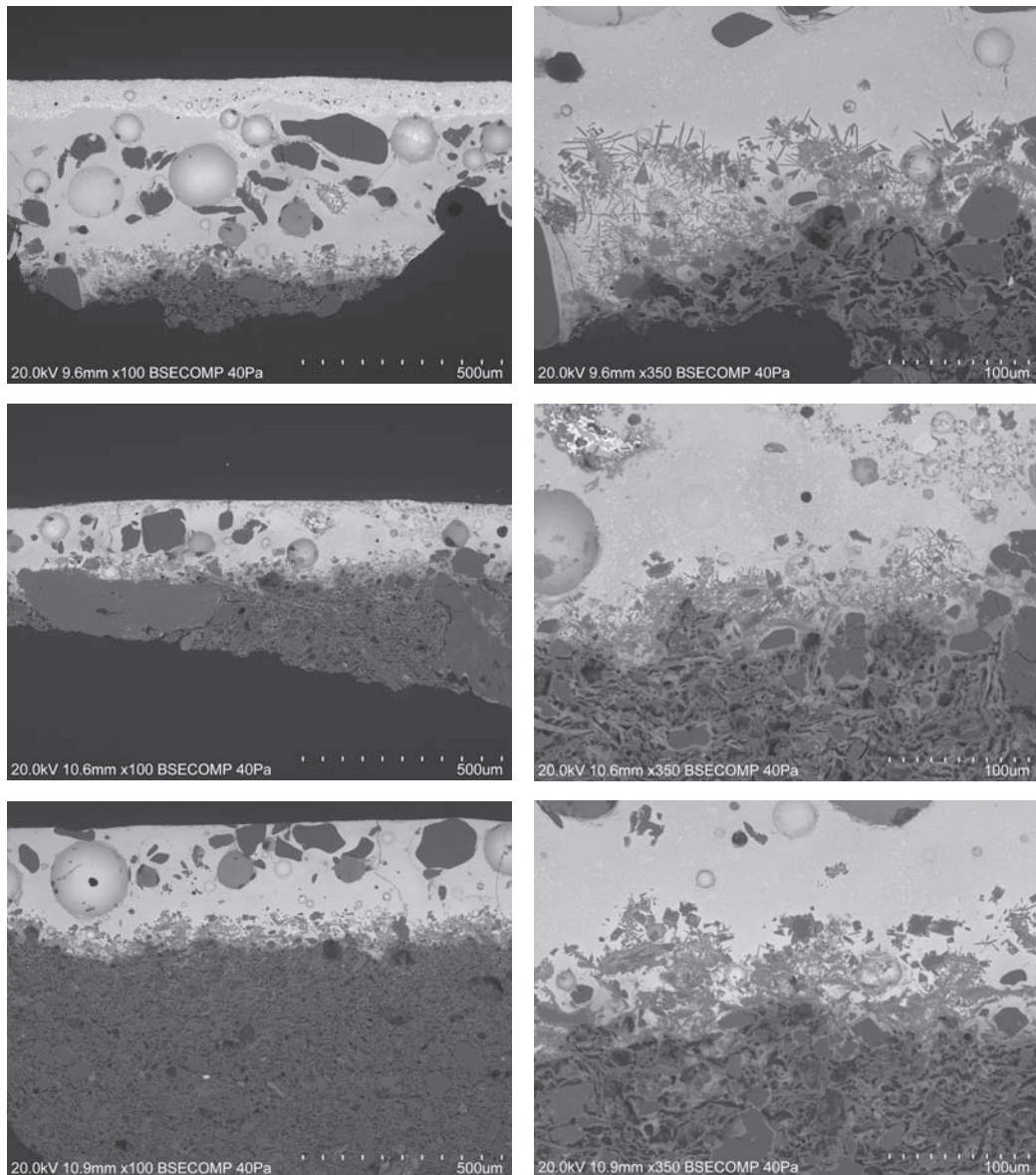


Figure 9. SEM images of samples exemplifying the main micro-morphologic characteristics generally associated with the glazes of these panels. From top to bottom, on the left a view of the glaze and on the right a close-up of the interface of each sample: Az0068/02 (panel of the dog); Az068/11 (cardinal); Az068/06 (putti)

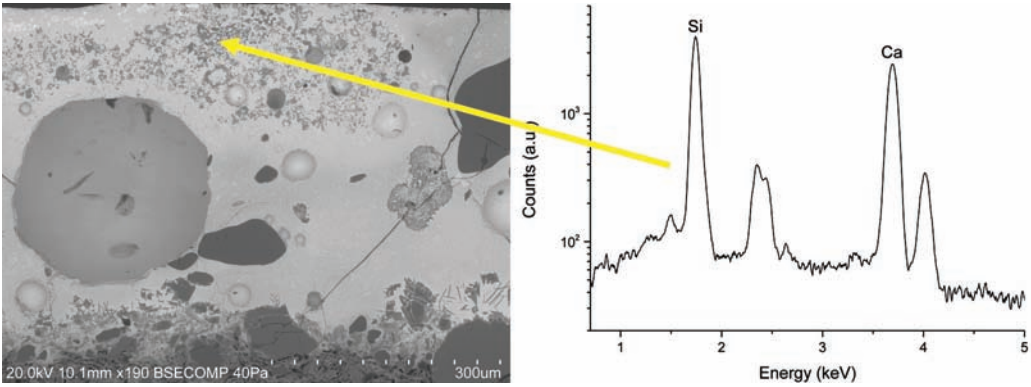


Figure 10. Selection of an inclusion of the dark outline in Az068/03 (panel of the dog) and relevant part of the resulting EDS spectrum

3.3.2. Glaze composition

Table 2 includes the semi-quantitative results of analyses of the glazes by EDS in weight %. Sn was excluded for the reasons pointed out in section 3.2. The amount of oxygen was calculated through the remaining elements stoichiometry of their most commonly considered oxides (Na_2O , MgO , Al_2O_3 , SiO_2 , K_2O , Fe_2O_3 and PbO). The results were normalized to 100 % and the table also indicates the ratios Si/Pb.

Table 2. Semi-quantitative composition (% w/w) of the glazes determined by EDS (weight of elements normalized to 100 %) and Si/Pb ratio

Samples	Panel	Na	Mg	Al	Si	K	Fe	Pb	O	Si/Pb
Az 068/01	Dog	1.2	0.7	2.7	18.3	1.9	0.5	46.5	28.3	0.39
Az 068/02	Dog	1.2	0.8	3.3	18.6	2.0	0.8	44.3	29.1	0.42
Az 068/03	Dog	1.3	0.8	3.5	17.6	1.9	0.9	45.6	28.4	0.39
Az 068/08	Dog	1.1	0.6	4.2	19.2	2.2	1.2	41.0	30.5	0.47
Az 068/13	Dog	0.7	0.1	2.3	19.4	1.4	0.8	46.6	28.7	0.42
Az 068/05	Cardinal	0.8	0.5	3.0	18.3	1.6	0.7	46.6	28.4	0.39
Az 068/11	Cardinal	1.0	0.3	4.3	21.9	1.9	1.1	36.7	32.9	0.60
Az 068/06	Putti	1.0	0.5	2.7	18.7	1.4	0.6	46.8	28.5	0.40
Az 068/14	Patch right of Dog	1.0	0.4	2.7	18.7	2.0	0.5	46.2	28.5	0.40
Az 068/12	Patch over Putti	0.8	0.1	3.8	19.0	2.7	1.1	42.8	29.7	0.44
Az 068/09	Frame Dog	0.9	0.4	2.4	16.2	0.8	0.7	53.1	25.7	0.30
Az 068/10	Frame between Cardinal & Putti	0.8	0.4	3.7	19.4	1.2	1.0	43.8	29.9	0.44
Az 068/04	Restoration	1.2	0.3	2.1	19.3	1.6	0.6	46.3	28.6	0.42
Az 068/07	Restoration	1.0	0.2	2.8	21.6	3.2	0.7	39.2	31.5	0.55

Figure 11 shows the results of a log-based principal component analysis (PCA) of the glazes of all samples, considering the analytical results in Table 2, through a plot in the plane of the two first principal components (PC1 and PC2). PC1 explains 45 % of the variation and PC2 explains 26 %. The PC1 vs. PC2 plot of Figure 11 does not suggest separate clusters for the different panels nor for the frame tiles. Also, the restoration tiles are not separated.

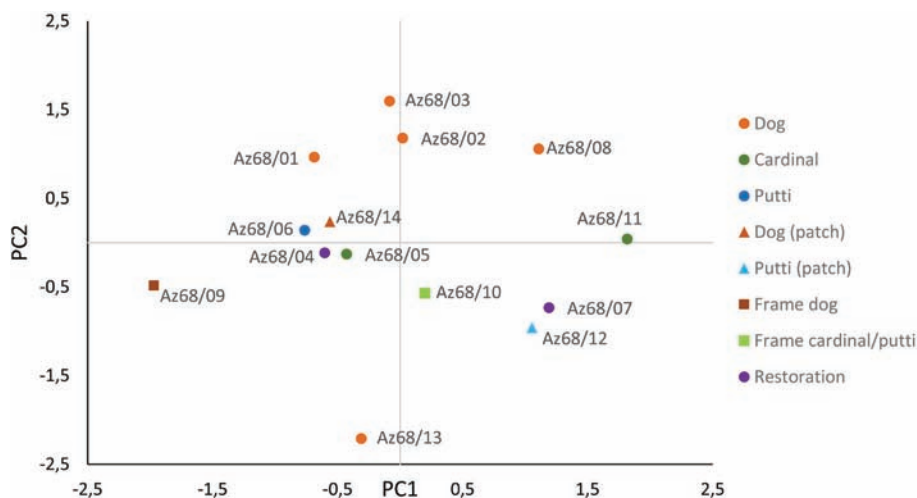


Figure 11. Score plot PC1 vs. PC2 of the PCA analysis of the glazes

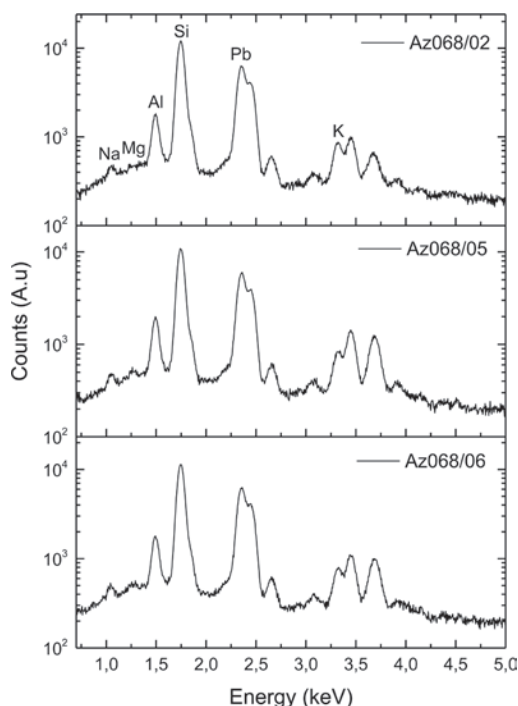


Figure 12. Comparison of EDS spectra of the glazes of Az068/02 (panel of the dog), Az068/05 (panel of the cardinal), and Az068/06 (panel of the putti). The low Na and Mg peaks impart an easily recognizable configuration to all three spectra

The low content of the glazes in Mg and, particularly, in Na is noteworthy, resulting in spectra with a very characteristic profile (Figure 12) and easily separable from later Portuguese productions [4].

3.3.3. Biscuit composition

Table 3 includes the semi-quantitative results of analyses of the biscuits by EDS in weight %. Pb was excluded for the reasons pointed out in section 3.2. The amount of oxygen was calculated through the remaining elements stoichiometry considering their most commonly used oxides (Na_2O , MgO , Al_2O_3 , SiO_2 , K_2O , CaO and Fe_2O_3). The results were normalized to 100% and the table also indicates the ratios Ca/Si.

Table 3. Semi-quantitative composition (% w/w) of the biscuits determined by EDS (weight of the elements normalized to 100 %) and Ca/Si ratio

Samples	Panel	Na	Mg	Al	Si	K	Ca	Fe	O	Ca/Si
Az68/01	Dog	1.0	1.1	9.2	25.3	5.0	8.7	4.8	44.7	0.34
Az68/02	Dog	1.4	1.3	8.9	27.5	3.4	8.6	2.9	46.0	0.31
Az68/03	Dog	1.3	1.3	7.7	28.9	2.5	8.7	3.2	46.4	0.30
Az68/08	Dog	1.5	1.3	9.3	24.9	3.7	10.2	4.4	44.7	0.41
Az68/13	Dog	0.7	0.9	7.9	28.5	4.0	8.7	3.2	46.0	0.31
Az68/05	Cardinal	1.0	1.1	7.3	27.8	3.0	10.7	3.4	45.6	0.39
Az68/11	Cardinal	1.4	1.7	10.0	23.0	3.5	12.5	3.7	44.1	0.54
Az68/06	Putti	1.3	1.4	8.5	27.9	2.6	9.0	3.3	46.1	0.32
Az68/14	Patch right of Dog	1.4	1.2	8.3	29.9	3.4	6.1	2.8	47.0	0.20
Az68/12	Patch over Putti	1.3	1.6	9.1	24.1	2.9	12.4	4.2	44.4	0.52
Az68/09	Frame Dog	1.7	1.8	9.1	27.1	2.9	7.1	4.3	46.0	0.26
Az68/10	Frame between Cardinal & Putti	1.7	1.4	10.0	26.2	3.2	7.2	4.5	45.7	0.28
Az68/04	Restoration	1.2	2.5	7.8	20.6	1.6	20.3	3.6	42.4	0.99
Az68/07	Restoration	1.1	2.3	7.6	23.1	1.5	17.1	3.6	43.7	0.74

Figure 13 shows the results of a log-based principal component analysis (PCA) of the biscuits of all samples, considering the analytical results in Table 3, through a plot in the plane of the two first principal components (PC1 and PC2). PC1 explains 45 % of the variation and is controlled in the positive sense by the contents in Mg and Ca and in the opposite sense by the contents in K and Si, as can be seen from the loadings plot of Figure 14 in which the projections of the vectors on an axis show the contribution of each element to the respective principal component. PC2 explains 32 % of the variation and is controlled in the positive sense mostly by the contents in Al, Fe and Na and in the opposite sense by the contents in Ca and Si (Figure 14).

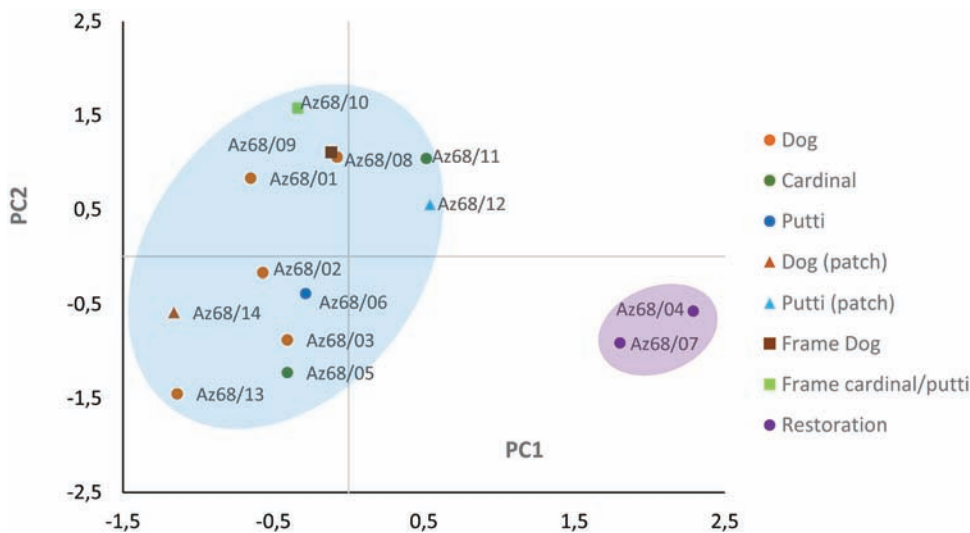


Figure 13. Score plot (PC1 vs. PC2) of the PCA analysis of the biscuits

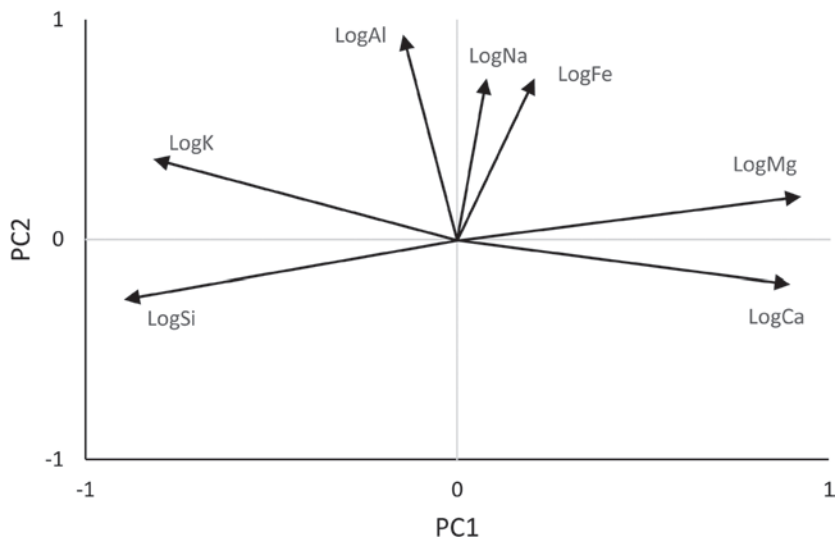


Figure 14. Loadings plot of the PCA analysis of the biscuits

3.3.4. Analyses of pigments under and above the colour boundary

Figures 15 and 16 compare ED-XRF spectra obtained of yellow and blue areas in the panel of the pilgrim (under the colour boundary) and in the panel of the cardinal (above the colour boundary).

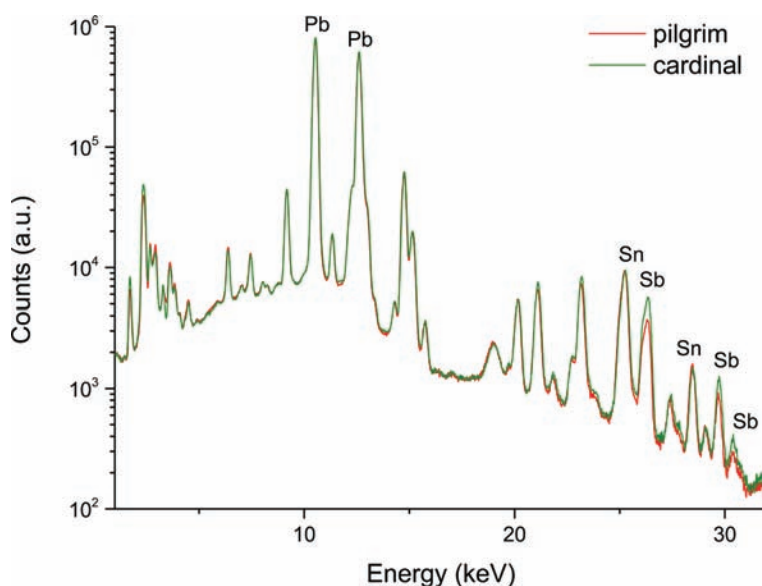


Figure 15. Comparison of XRF spectra of the yellow background colour in the panel of the pilgrim (red spectrum) and in the panel of the cardinal (green spectrum)

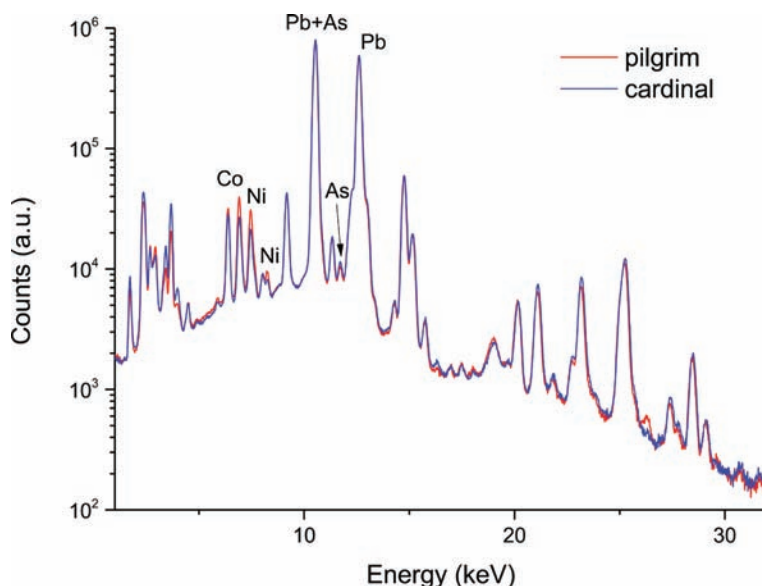


Figure 16. Comparison of XRF spectra of the blue colour in the panel of the pilgrim (red spectrum) and in the panel of the cardinal (blue spectrum)

4. DISCUSSION

Given the necessity to limit the sampling, both in number and dimension of the fragments taken, and choose accessible areas in which the glaze was already detaching, the material available for study was limited except in the panel of the dog where the easy accessibility allowed a detection of suitable sampling points. Therefore, the discussion has to be based on a small number of results.

The morphology observed in the interface of the glazes (Figure 9) strongly suggests that the tiles were fired in a cycle including a long cooling period resulting in a characteristically well-developed interface with extensive growth of K-feldspars already found by other authors as well as by us in reproduction studies [6; 7]. The SEM images of sections from all the panels reveal very similar morphologies, an affinity usually associated to the work of a single workshop. No sign of *coperta* could be seen over the colours in any of the panels.

The analytical results of the glazes (Table 2) do not show substantial differences between the panels. The Si/Pb ratio is distributed around an average of 0.4 and even the restoration tiles fall in line with the rest.

However, as regards the biscuits a clear difference was found between the restoration tiles (Az068/04 and Az068/07) and the others, mainly resulting from their higher content in Ca and Mg (Table 3 and Figure 13) as was normal in later production tiles [4]. The score plot of Figure 13 also shows that the biscuits of the remaining tiles can be joined in a single cluster. Some of the samples are positioned above the others according to PC2 but the differences can be ascribed to the variability of the clays. However, the separation does not correspond directly to different panels, as may be seen from Figure 13, and therefore it does not substantiate a chronological difference in the manufacture of the panels.

The ED-XRF spectra of the colours in the glaze matrices are remarkably similar when acquisitions from the panel of the pilgrim are compared with corresponding spectra acquired from the panel of the cardinal (Figures 15, 16) suggesting that the same or very similar batches of pigments were used. The discrepancies seen in the superimposed spectra (content in Sb in the yellow areas and coincident contents in Co and Ni in the blue areas) suggest that the only differences lay in the pigment concentrations corresponding to lighter or darker hues. In particular the content in antimony is higher above the boundary marked in Figure 2 coinciding with the darker yellow of the upper panel.

Therefore, all present results point to a coeval production of all panels, or else to a production within a relatively short lapse of time, but the analysis of a more extensive set of samples, particularly collected from the panels of the putti and of the pilgrim, is recommendable to further validate this result.

5. CONCLUSIONS

Authors [e.g. 2; 8] praised Francisco de Matos both for his painting skills and for the technical quality of the tiles in the panels. However, the painter and the workshop master may well be two different persons and there are reasons to believe that the workshop master signed the work, as shown by panels involving the skills of several painters that

in the end are signed by a single person [3; 9]. In this case, the observations revealed two different painting styles in the panels while the analytical results did not discriminate between them, indicating that their chronologies should not be very different and that all panels may even have been made in succession. Even if a more extensive research is recommended to give weight to this conclusion, São Roque was very likely the work of at least two different painters.

The observations suggest, as a working hypothesis on the phases of the lining of São Roque, that initially only the two lower panels were ordered of which the panel of the dog was the first to be executed. But soon after, probably before the panel of the pilgrim was applied, the order was amplified to include full linings. On both sides a transition affecting two or three lines of tiles was sketched, which in the panel of the dog is noticeable because the new tiles were grafted on to the already completed sill panel. Maybe because the panel of the pilgrim was still in the workshop, the side of the Epistle was the first to be continued upwards and was duly completed, but for some reason the work was interrupted and although the connection was prepared, the panel lining was never prolonged on the Gospel side of the chapel.



Figure 17. Remains of two panels with similar floral ornaments on a yellow background: left side, Cathedral of Setúbal; right side, framed loose tiles conserved in the Theological Seminar of Almada

The panels of São Roque do not stand alone, either technologically, or artistically. Technologically they can be related with several others including those at Graça church, signed with the monogram of João de Góis [3] and the panel Nossa Senhora da Vida, which we believe is also signed by João de Góis [9]. Artistically, we came to recognize through a number of new findings that in the 16th century there seemingly was a demand in Portugal for azulejo linings with blue ornaments on a yellow ground, as prove the panels recently identified at Sé de Setúbal [10] and the few remains of another panel

conserved at the Theological Seminar of São Paulo in Almada – Figure 17. Both can also be technologically related to São Roque [to be published] but depict different styles of painting.

The painting that inspired the scene inside the medallion in the panel of the cardinal is known – it was identified by José Queiroz after its unveiling [2] and is today on display at *Museu de São Roque* (Saint Roch Museum) – Figure 18. This was once part of the altarpiece of the São Roque chapel and therefore two graphic representations of the same event (the miraculous cure of the English cardinal) were laid within the same religious enclosure – a very unusual feature at that time that may have justified the fact that a similar undertaking was interrupted on the side of the Gospel and the posterior covering of the panel of the cardinal as something superfluous. However, the painter of the panel of the cardinal did not follow exactly the earlier painting, particularly in the facial representation of Saint Roch (Figure 18) and in it lays an important connection because the drawing used for the face of St. John in the panel *Nossa Senhora da Vida*, conserved at the *Museu Nacional do Azulejo*, was also used for the face of St. Roch (Figure 19). The sketches for the panels were usually done on paper and the lines were perforated with pins so that the drawing could be passed on to the raw glaze with carbon black. Seemingly, in this case the stencil was conserved and the same drawing was used on both panels.

The panel *Senhora da Vida* is believed, on documental grounds, to have been made before 1582 [9] and therefore, either the artist himself, or (more likely, because the painters were seemingly different) the workshop conserved the drawing and used it once again in the ulterior panel of the cardinal. The fact that the same stencil was used connects indissociably both panels, suggesting independently that the panel of the cardinal, albeit older, should not be much older than *Senhora da Vida* itself.



Figure 18. Miracle of the English Cardinal (Jorge Leal / Cristóvão de Utreque ca. 1520) vs. panel of the cardinal (Image source: Museu de São Roque)

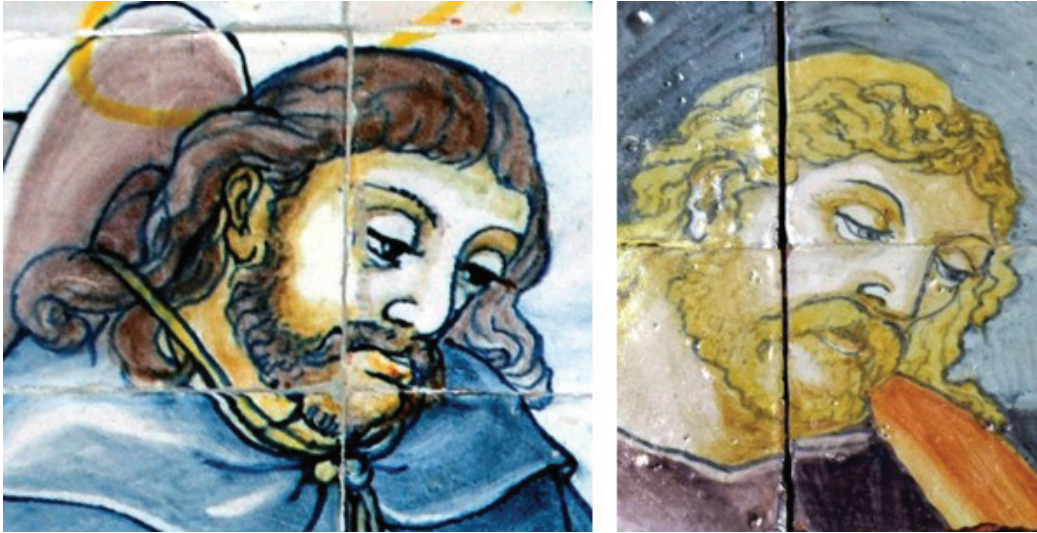


Figure 19. The remarkable resemblance between the paintings representing the face of Saint Roch (left side) and St. John in the panel Nossa Senhora da Vida (right side) is not coincidental: although the head of St. John looks larger on account of the beard and hair, both faces have the same size and were seemingly transposed from the same stencil

BIBLIOGRAPHIC REFERENCES

1. MECO, J. – *O azulejo em Portugal*. Publicações ALFA, p. 195, Lisbon, Portugal, 1993.
2. QUEIROZ, J. – *Olarias do Monte Sinay*. Typographia Castro Irmãos, pp. 15-18; 103-115, Lisbon, 1913.
3. PAIS, A. et al. – *Study of the azulejo panels in Graça church signed by João de Góis* in *Studies in Heritage Glazed Ceramics*, No. 1, pp. 47-66, LNEC, Lisbon, February 2019.
4. MIMOSO, J. et al. – *A comparison of the earliest faience tiles produced in Lisbon with earlier and later types* in *Studies in Heritage Glazed Ceramics*, No. 1, pp. 25-46, LNEC, Lisbon, February 2019.
5. COENTRO, S. – *An Iberian Heritage: Hispano-Moresque architectural tiles in Portuguese and Spanish collections*, PhD thesis, Universidade Nova de Lisboa, pp. 60-62 & 132-135, Lisbon, 2017.
6. MOLERA, J. et al. – *Interactions between Clay Bodies and Lead Glazes*, *Journal of the American Ceramic Society*, Vol. 84, No. 5, pp. 1120-1128, May 2001.
7. PEREIRA, S. et al. – *Influence of the production technology on the morphological characteristics of azulejos* in *Proc. Int. Conf. Glazed Ceramics in Cultural Heritage (GlazeArt 2018)*, pp. 140-149, LNEC, Lisbon, 2018.
8. SANTOS SIMÕES, J.M. – *Azulejaria em Portugal nos séculos XV e XVI*. 2ª edição. Fundação Calouste Gulbenkian, pp. 112-113, Lisbon, 1990.
9. PAIS, A. et al. – *The 16th century nativity azulejo panel called “de Nossa Senhora da Vida* in *Studies in Heritage Glazed Ceramics*, No. 1, pp. 67-76, LNEC, Lisbon, February 2019.
10. PAIS, A. et al. – *An unknown jigsaw in the Cathedral of Setúbal* in *Proc. Int. Conf. Glazed Ceramics in Cultural Heritage (GlazeArt 2018)*, Book of Abstracts pp. 21-22, LNEC, Lisbon, 2018.

A technical comparison of three renaissance azulejo panels from the workshops of Lisbon

João Manuel Mimoso; Sílvia R. M. Pereira; Alexandre N. Pais; Maria Augusta Antunes; Ana Margarida Cardoso; Maria de Lurdes Esteves; António Candeias

ABSTRACT

This study of the early production of faience azulejos in Lisbon relies on three panels or groups of panels of known Portuguese origin: the incomplete and dispersed panels in Graça church, signed by João de Góis and presumably datable to 1560-1570, the panel called Nossa Senhora da Vida today conserved in the Museu Nacional do Azulejo (National Azulejo Museum) bearing a text that we believe identifies João de Góis as the workshop master and datable to ca. 1580, and the panels that line São Roque chapel in Lisbon, dated "1584" and signed "Francisco de Matos".

In this article we compare the information obtained from the microscopic observations and instrumental analyses of samples collected from tiles of the several panels aiming to determine their common characteristics and most relevant differences.

RESUMO

Este estudo da produção inicial de azulejos de faiança em Portugal toma como referência três painéis ou grupos de painéis de origem comprovadamente portuguesa: os painéis dispersos e incompletos da antessacristia da Igreja da Graça em Lisboa, assinados com o monograma de João de Góis e presumivelmente datáveis entre cerca de 1560-1570, o painel da antiga Capela de Nossa Senhora da Vida da demolida Igreja de Santo André, hoje conservado no Museu Nacional do Azulejo, onde existe um texto que acreditamos identifica João de Góis como o mestre da oficina que o produziu e datável a cerca de 1580, e os painéis que ainda hoje revestem a Capela de São Roque na Igreja da mesma invocação em Lisboa, datados de 1584 e assinados "Francisco de Matos".

Neste artigo comparam-se as informações obtidas num estudo realizado sobre os três conjuntos, utilizando observações de microscopia eletrónica e análises instrumentais de amostras de azulejos dos vários painéis, tendo como objetivo a determinação de características comuns e das diferenças mais relevantes.

João Manuel Mimoso

LNEC - Laboratório Nacional de Engenharia Civil, Lisbon, Portugal, jmimoso@lnec.pt

Sílvia R. M. Pereira

LNEC - Laboratório Nacional de Engenharia Civil, Lisbon, Portugal / Laboratório HERCULES - Universidade de Évora, Portugal

Alexandre N. Pais

Museu Nacional do Azulejo, Lisbon, Portugal

Maria Augusta Antunes

LNEC - Laboratório Nacional de Engenharia Civil, Lisbon, Portugal

Ana Margarida Cardoso

Laboratório HERCULES - Universidade de Évora, Portugal

Maria de Lurdes Esteves

Museu Nacional do Azulejo, Lisbon, Portugal

António Candeias

Laboratório HERCULES - Universidade de Évora, Portugal

KEYWORDS: Renaissance majolica / Early azulejo production in Lisbon / João de Góis /
/ São Roque church in Lisbon / Characterization of early Portuguese azulejos

ACKNOWLEDGEMENTS

The parish Priest of Santo André e Sta. Marinha à Graça Jorge Tomaz Dias, and Miguel Ângelo da Silva of Graça church are gratefully acknowledged for supporting this research.

Teresa Morna, Director of the Museu de São Roque, João Miguel Simões of Museu de São Roque, the remarkable Irmandade de São Roque represented by André Martins da Silva, are gratefully acknowledged for supporting and authorizing a limited sampling of the magnificent panels of the São Roque chapel in São Roque church.

Communication produced as an outcome of Project FCT-AzuRe - Estudos no Azulejo Português para Candidatura a Património da Humanidade (PTDC/EPH-PAT/5096/2014) funded by FCT, the Portuguese Foundation for Science and Technology. S. Pereira also acknowledges FCT for her Post-Doc Grant (SFRH/BPD/116807/2016).

LNEC Research Project 0202/111/19747.

Aviso legal

As opiniões manifestadas no *Studies in Heritage Glazed Ceramics* são da exclusiva responsabilidade dos seus autores.

Legal notice

The views expressed in the *Studies in Heritage Glazed Ceramics* are the sole responsibility of the authors.

1. INTRODUCTION

In the Holy Inquisition process against the Flemish João de Góis, he is specifically referred in 1561 as “oleiro de Málaga e azulejos” (potter of faience and azulejos) [1]. This is the first presently known reference in Portugal to such a craft and he, said to have arrived in Lisbon a few years before, the earliest faience azulejo manufacturer in the country whose signed production has been identified.

A study of the beginning of the production of faience azulejos in Lisbon may rely on three early panels or groups of panels of confirmed Portuguese origin: the incomplete and dispersed panels at Graça church signed by João de Góis and presumably datable to the mid-1560s [2]; the panel of the demolished Nossa Senhora da Vida chapel bearing a text found by us that seemingly identifies João de Góis as the workshop master and datable to ca. 1580 [3]; and the panels that line São Roque chapel in Lisbon, of which the presumably oldest panel is dated “1584” and signed “Francisco de Matos” [4]. Thus the three groups are presumed to represent a span of ca. 20 years at a time when the Portuguese inclination for faience azulejos was gaining roots.

The present article presents a technical comparison of those three groups aiming to establish common characteristics with which other productions may be compared, towards the establishment of a comprehensive list of productions of the same workshop or technological circle.

2. TECHNOLOGICAL NOTES

2.1. The glaze of azulejos

The main components of the staniferous glaze used in faience azulejos since their early manufacture in Portugal, during the third quarter of the 16th century, are: sodium (Na, a fusing agent); silicon (Si, the main component of the glaze); potassium (K, also a fusing agent); tin (Sn, the opacifier promoting the whiteness of the otherwise transparent glaze); and lead (Pb, the other main component of the glaze acting as the principal fusing agent that lowers the fusion temperature of silica from ca. 1700 °C to less than half that value) [5]. Other elements routinely found in the glazes in contents higher than 1 wt. % are: magnesium (Mg); aluminium (Al); and iron (Fe).

Three points to note when studying glazes are: i) the all-important Si/Pb ratio, a parameter that determines the temperature at which the glaze can be fired (the lower the ratio, the lower the temperature needed); ii) the nature and size of the inclusions in the glaze, such as feldspars and grains of sand, which are digested during firing in a way that the remainders left in the glaze are related with their initial content, granulometry and firing conditions (it should be noted that the degree of digestion is also reflected in the final composition of the glaze); and finally iii) the digestion by the molten glass of clay minerals in the contact area with the biscuit leading, over cooling, to crystalline growths of lead-rich K-feldspars in the interface whose magnitude depends on the compositions and firing cycle [6; 7].

2.2. The biscuit of azulejos

The biscuit is rather more complicated than the glaze because the raw materials are sedimentary clays/marls in which many chemical elements are found, including rare-earth elements. The major elements routinely found are: calcium (Ca); the main components of sodium/potassium aluminium-silicate minerals (Na, Al, Si and K); and also Mg, Fe and titanium (Ti). The biscuit may also incorporate up to 10 % in weight of Pb, particularly in the region nearest to the interface with the glaze.

When there was not a suitable marl with the appropriate characteristics of moldability and thermal retraction over cooling to be compatible with the glaze, the pastes were prepared by mixing clays, marls and possibly a source of calcium until a proper result was achieved [8].

2.3. The technology of faience azulejos

Faience azulejos are a layered material in which a previously fired ceramic base (the biscuit) is overlaid by a layer of raw glass, which may be painted with pigments able to withstand temperatures of over 1000 °C, and is subsequently fired a second time to a white opaque colour. During this second firing, the glass becomes a glaze by connecting to the biscuit in a very durable manner as long as there is a degree of compatibility between them. That compatibility stems from both the compositional possibility for a strong bond to develop over firing, and a similar thermal retraction rate of both materials on cooling after the glaze hardens, otherwise the glaze would either crack (crazing) or peel (shivering).

It is reasonable to suppose that once a workshop had one or more viable formulations, either by trial-and-error or because its master brought with him the “secret” from his apprenticeship in some other workshop, it would stick to them unless better formulations were later acquired [8; 9]. Such approach is also mentioned with contempt by Bastenaire-Daudenet looking back at his experience as head of a French workshop in the late 18th century when trial-and-error was being supplanted by the scientific approach [10].

In the Hispano-Moresque tiles (mostly from the first three quarters of the 16th century) the low Si/Pb ratio in glazes, often less than 50% [11; 12], means that they could be successfully fired at a relatively low temperature. It can also be noted that, in some Hispano-Moresque tiles, there are very noticeable crystalline outgrowths from the biscuit to the glaze [11; 12]. These neo-formed crystals are a consequence of the glaze composition and firing cycle (temperature and duration) and have been duplicated in reproduction studies [6; 7]. As the manufacture of azulejos in Portugal progressed from the 16th to the 17th centuries, the ratio Si/Pb increased [11]. This development likely derived from an improved firing technology at higher temperatures and, by using less lead for the same weight of cheaply available siliceous sand, the production costs were

lowered. Concomitantly, the Ca/Si ratio in the biscuits is seen to increase as well, possibly to adjust to the new glaze formulations, also allowing to reduce the content in expensive tin – a light cream biscuit requires less tin to form a perfectly white glaze than the brown-red biscuits often seen in 16th century tiles.

Of the utmost importance when studying geographical provenance of glazed ceramics is the notion that there were only two materials almost certainly of local origin, as long as they were available, as was the case in Lisbon: i) siliceous sand for the glazes; and ii) suitable marl and clays for the biscuits. Therefore, the biscuit is of prime interest for geographical provenance studies because it should be fully local while the glaze incorporates local sand but also materials eventually imported from afar. To complicate matters, the glaze also digests and incorporates material from the biscuit over firing [7]. Any particular composition of the local sand beds may still stand against this background but it may also be lost in such a diverse glassy matrix.

When there were several workshops in the same vicinity, they would likely source marl and clay from the same geological strata and consequently the biscuits are good indicators of geographical provenance but do not necessarily allow the singling out of workshops. But since glaze compatibility was required and it could be achieved in a number of ways by varying the relative contents of the raw materials, the composition of glazes as well as the morphology of inclusions may help identify specific workshops. Finally, the firing cycle imparts to the glaze inclusions and to the glaze/biscuit interfaces distinct morphologies that may be correlated with specific kilns.

3. EXPERIMENTAL

3.1. Samples

The samples used in this study formed three groups collected from:

- the renaissance panels of Graça church (Figure 1). Samples from this group bear the reference Az013;
- the Nossa Senhora da Vida panel from the collection of Museu Nacional do Azulejo (Figure 2). Samples from this group bear the reference Az032;
- the lining of São Roque chapel dated “1584” (Figure 3). Samples from this group bear the reference Az068.

The individual test items from each group were assigned an alphanumeric identification added to the reference.

Details about the sampling locations in the panels may be found, respectively, in references [2], [3] and [4].



Figure 1. Two aspects of the azulejo panels in Graça church from where samples Az013 were collected



Figure 2. The lower part of the Nossa Senhora da Vida azulejo panel from which samples Az032 were collected

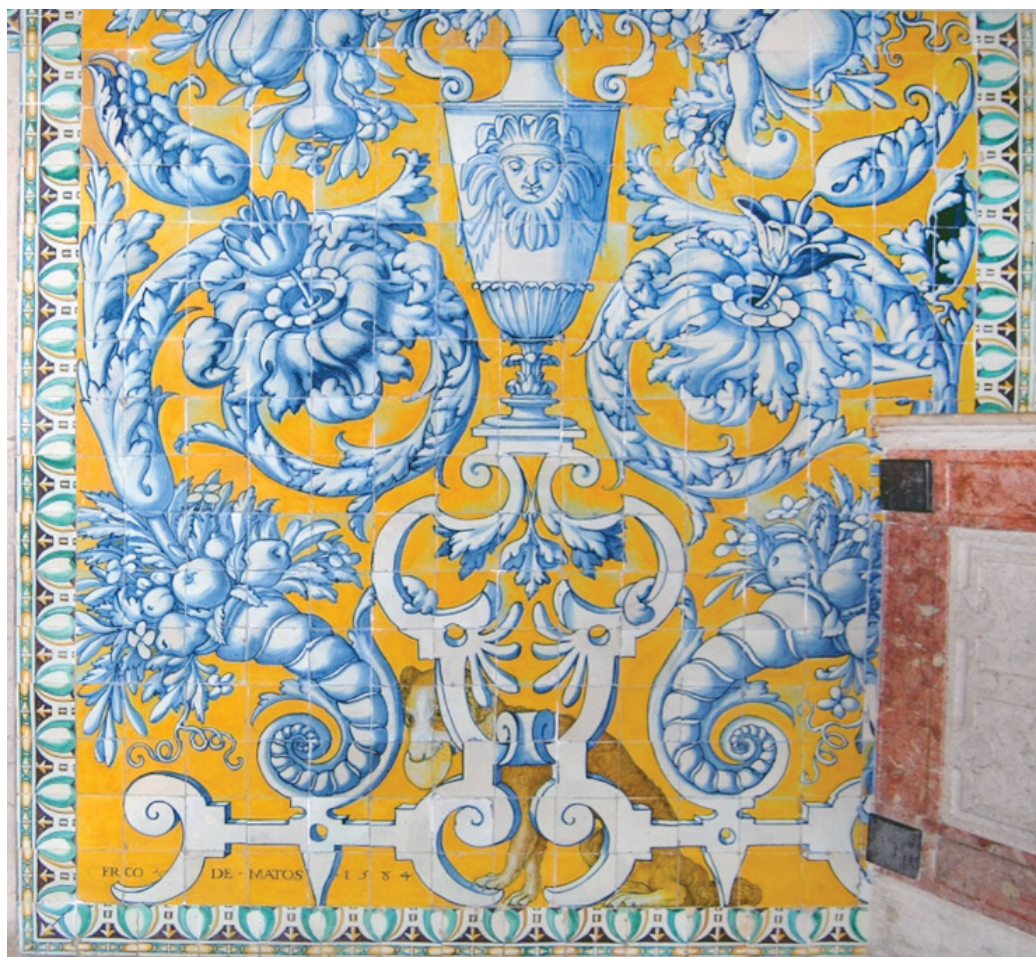


Figure 3. The signed panel on the Gospel side of São Roque chapel from which samples Az068 were collected

3.2. Equipment and technical methodology

The small samples detached from the azulejos with a scalpel were stabilized in epoxy resin, lapped and polished to obtain a flat surface for observation and analysis by scanning electron microscopy coupled with an X-ray energy-dispersive spectrometer (SEM-EDS).

Optical observation and acquisition of sample images used a Leica DFC295 digital camera attached to a Leica M205C stereomicroscope.

SEM-EDS observations and analyses were made at the HERCULES Laboratory in Évora using a HITACHI 3700N SEM coupled to a BRUKER XFlash 5010 EDS. The specimens were uncoated and the observations were made in backscattered electrons mode (BSE) with a chamber pressure of 40 Pa and at an accelerating voltage of 20 kV. The acquisition of X-ray spectra was done with the detector set at ca. 8 mm working distance.

The selection of areas for EDS analysis avoided inclusions in the glaze or biscuit representing more than ca. 5 % of the full area analysed. The preferred area sizes for

analytical purposes were ca. $200 \times 200 \mu\text{m}^2$ for glazes and $500 \times 500 \mu\text{m}^2$ for biscuits but acceptable repeatability was verified in areas four times smaller. For comparison purposes, only the elements usually representing the major contents were considered, excluding tin (Sn) in the glaze and lead (Pb) in the biscuit due to their variability with the area chosen (in the case of Sn because of local aggregations of SnO_2 crystals; in the case of Pb because its content in the biscuit increases with proximity to the interface with the glaze). The results of the EDS analyses are given in weight % of each element identified.

Principal component analysis (PCA) was made of EDS results using the SPSS® software platform by IBM Analytics.

3.3. Results

3.3.1. Glaze morphology

Figure 4 compares sections of samples with yellow or orange paint from all panels. The transparent areas seen over the paint in sections prepared from the Az013 Graça church samples reveal the use of *coperta*, a final layer of transparent glaze sprinkled over the rather dull yellow or orange areas to restore the gloss and protect the superficial colour from abrasion. The sections of samples from the São Roque church and Nossa Senhora da Vida panels do not depict any *coperta*.

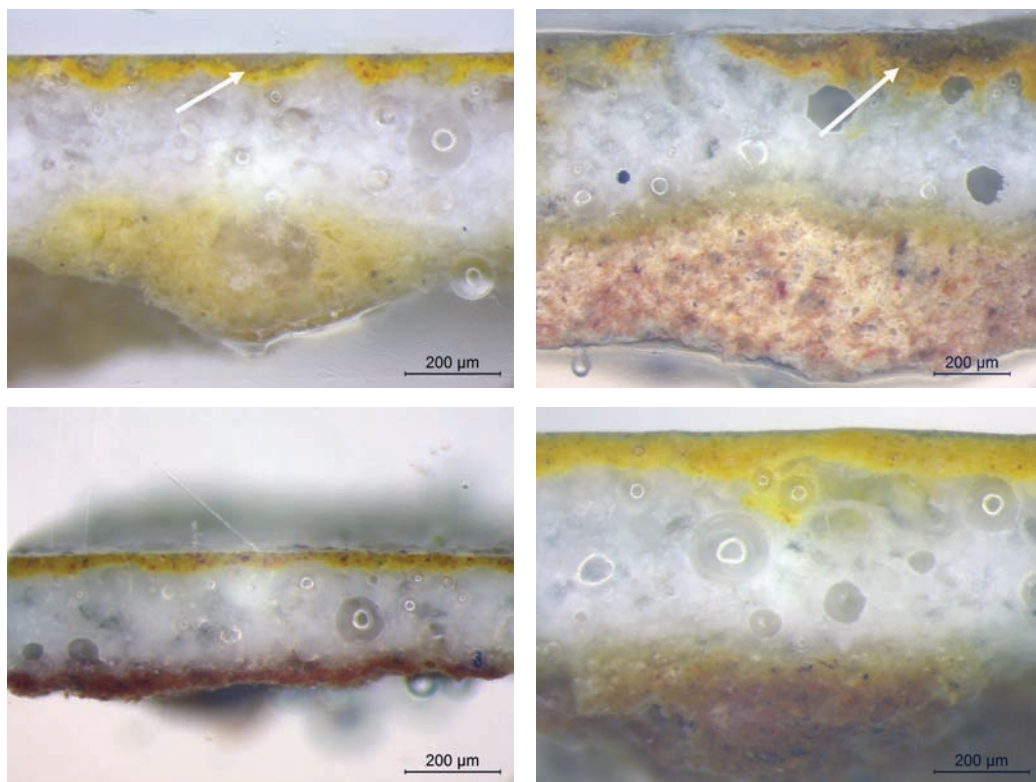


Figure 4. Top to bottom: use of sprinkled *coperta* in samples Az013/01 (left side) and Az013/L3 (right side) – the arrows indicate spots where drops of transparent glaze fell; absence of *coperta* in samples Az032/03 (left side) and Az068/02 (right side)

Figures 5, 6, and 7 illustrate SEM images of sample sections from the several panels, establishing the main micro-morphologic characteristics associated with the glazes. All depict in common the presence of few inclusions in the glazes, predominantly grains of silica, often large, and a glaze-biscuit interface characterized by the presence of abundant crystals of neoformation.

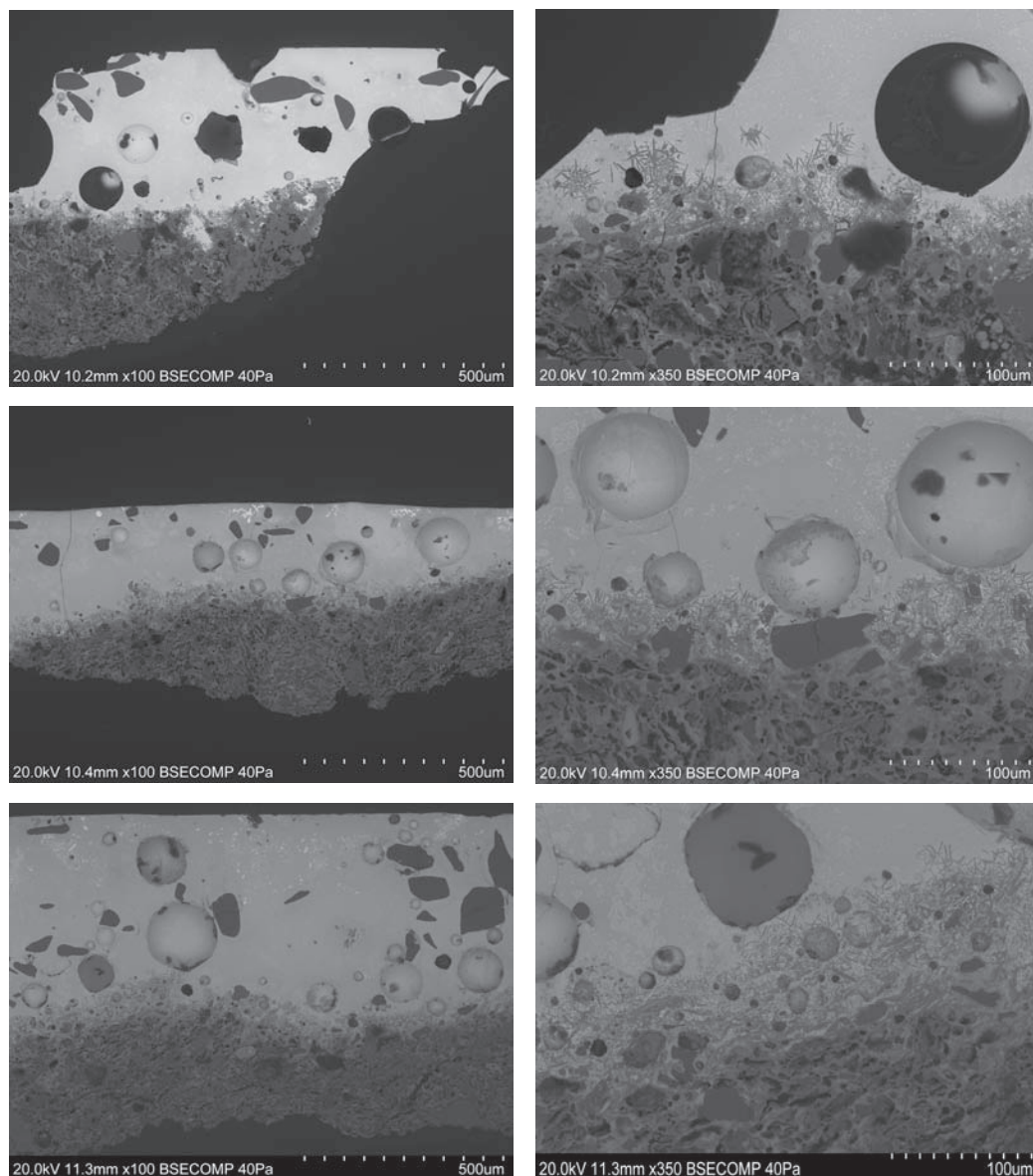


Figure 5. SEM images showing the glaze and the interfacial micro-morphology in azulejos of Graça church panels – from top to bottom: samples Az013/L1; Az013/L2; and Az013/L3 from tiles adjoining the monogram of João de Góis

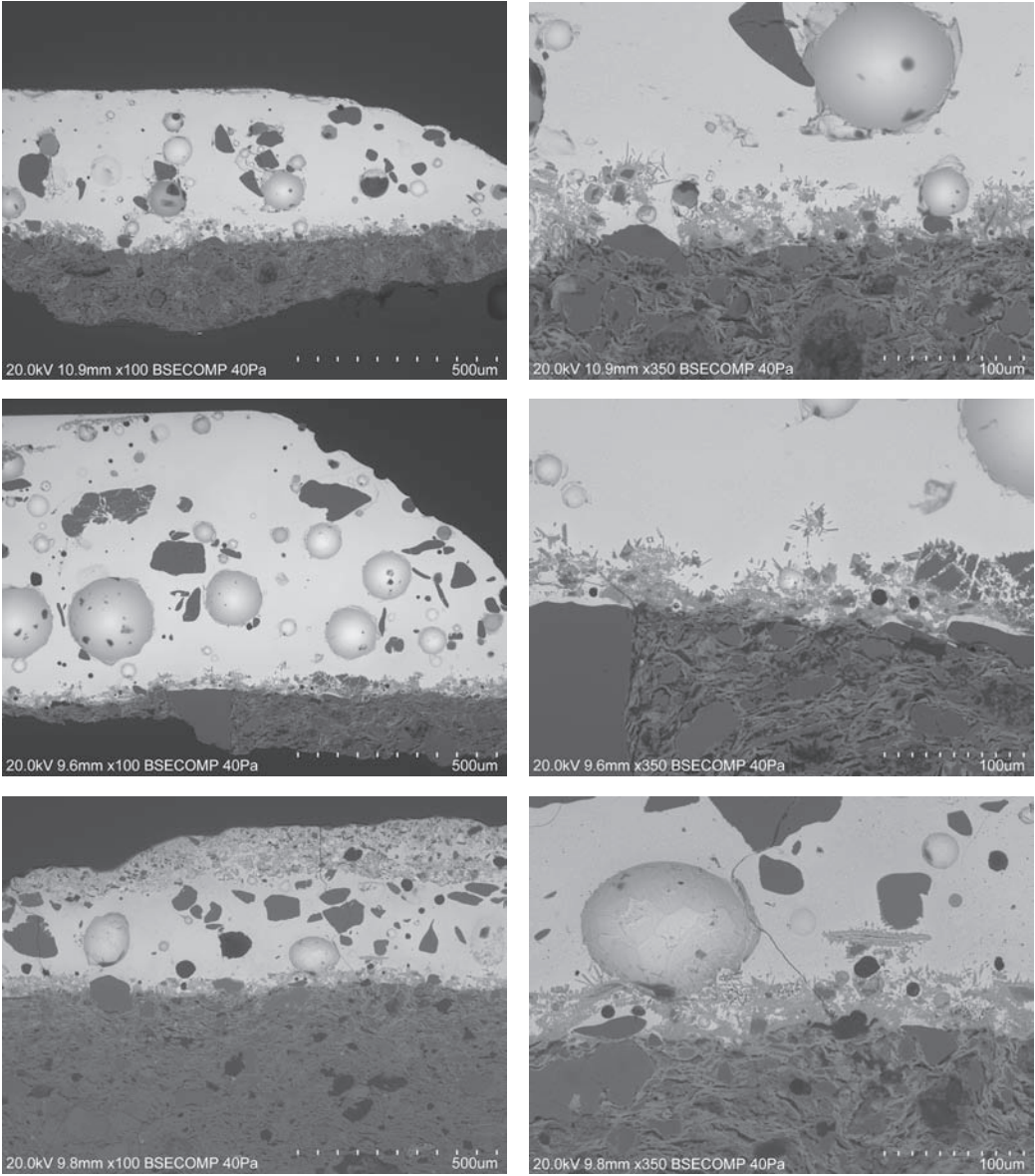


Figure 6. SEM images showing the glaze and the interfacial micro-morphology in azulejos of Nossa Senhora da Vida – from top to bottom: samples Az032/01; Az032/02; and Az032/08

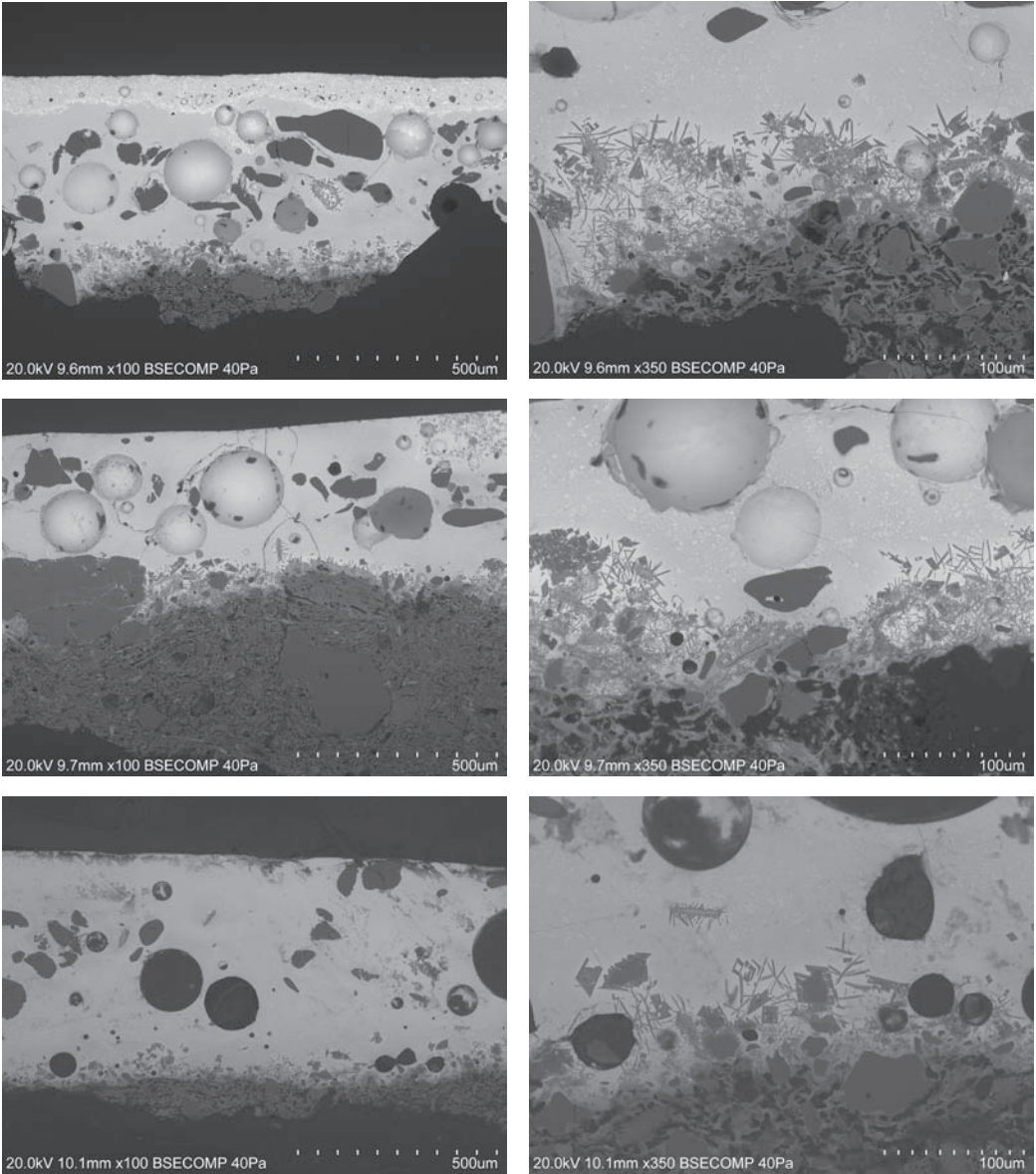


Figure 7. SEM images showing the glaze and the interfacial micro-morphology of azulejos from São Roque chapel – from top to bottom: samples Az068/02; Az068/03; and Az068/13 from tiles of the signed panel

3.3.2. Glaze composition

Table 1 includes the semi-quantitative results of glaze analyses by EDS in weight %. Sn was excluded for the reasons pointed out in section 3.2. The amount of oxygen was calculated through the remaining elements stoichiometry considering their most commonly considered oxides (Na_2O , MgO , Al_2O_3 , SiO_2 , K_2O , Fe_2O_3 and PbO). The results were normalized to 100 % and the table also indicates the ratios Si/Pb.

Table 1. Semi-quantitative composition (% w/w) of the glazes determined by EDS (weight of the elements normalized to 100 %) and Si/Pb ratio

	Sample	Na	Mg	Al	Si	K	Fe	Pb	O	Si/Pb
Graça church	Az013/01	1.6	0.3	2.3	23.2	2.9	0.7	36.0	32.9	0.64
	Az013/03	1.9	0.8	4.3	17.9	1.6	1.6	42.0	29.8	0.43
	Az013/04	1.9	0.9	3.5	16.3	1.4	1.2	47.4	27.4	0.34
	Az013/07	1.8	0.8	2.4	21.1	2.4	0.8	39.5	31.2	0.53
	Az013/T1	1.0	0.3	2.7	17.9	1.0	0.7	48.7	27.6	0.37
	Az013/T2	1.7	0.7	3.2	19.4	2.2	0.6	42.2	30.0	0.46
	Az013/L1	1.2	0.4	2.9	19.5	1.7	0.5	44.2	29.5	0.44
	Az013/L2	1.1	0.5	3.3	20.2	1.9	1.1	41.2	30.7	0.49
	Az013/L3	1.3	0.5	3.3	19.0	1.6	0.8	44.1	29.4	0.43
Nossa Senhora da Vida	Az032/00	0.9	0.5	2.4	14.5	0.9	0.6	56.1	24.1	0.26
	Az032/01	1.4	0.7	2.6	15.3	0.8	0.6	53.3	25.3	0.29
	Az032/02	0.8	0.7	2.9	16.5	1.2	0.6	50.6	26.6	0.33
	Az032/04	0.7	0.2	3.7	23.8	2.6	1.1	33.6	34.4	0.71
	Az032/05	0.9	0.5	2.7	15.0	0.7	0.8	54.5	24.9	0.28
	Az032/06	1.1	0.5	2.3	15.6	1.0	0.7	53.5	25.2	0.29
	Az032/08	0.7	0.2	4.2	20.5	1.5	1.0	40.5	31.4	0.51
São Roque chapel	Az068/01	1.2	0.7	2.7	18.3	1.9	0.5	46.5	28.3	0.40
	Az068/02	1.2	0.8	3.3	18.6	2.0	0.8	44.3	29.1	0.40
	Az068/03	1.3	0.8	3.5	17.6	1.9	0.9	45.6	28.4	0.39
	Az068/05	0.8	0.5	3.0	18.3	1.6	0.7	46.6	28.4	0.39
	Az068/06	1.0	0.5	2.7	18.7	1.4	0.6	46.8	28.5	0.40
	Az068/08	1.1	0.6	4.2	19.2	2.2	1.2	41.0	30.5	0.47
	Az068/09	0.9	0.4	2.4	16.2	0.8	0.7	53.1	25.7	0.30
	Az068/10	0.8	0.4	3.7	19.4	1.2	1.0	43.8	29.9	0.44
	Az068/11	1.0	0.3	4.3	21.9	1.9	1.1	36.7	32.9	0.60
	Az068/12	0.8	0.1	3.8	19.0	2.7	1.1	42.8	29.7	0.44
	Az068/13	0.7	0.1	2.3	19.4	1.4	0.8	46.6	28.7	0.42
	Az068/14	1.0	0.4	2.7	18.7	2.0	0.5	46.2	28.5	0.40

Figure 8 shows the results of a log-based principal component analysis (PCA) of the glazes of all samples, considering the analytical results in Table 1, through a plot in the plane of the two first principal components (PC1 and PC2). PC1 explains 48 % of the variation and is controlled in the positive sense by the contents in Si, K, Al and Fe and in the opposite sense mostly by the content in Pb, as can be seen from the loadings plot of

Figure 9 in which the projections of the vectors on an axis show the contribution of each element to the respective principal component. PC2 explains 24 % of the variation and is controlled in the positive sense mostly by the contents in Na and Mg and in the opposite sense mostly by the content in Si (Figure 9).

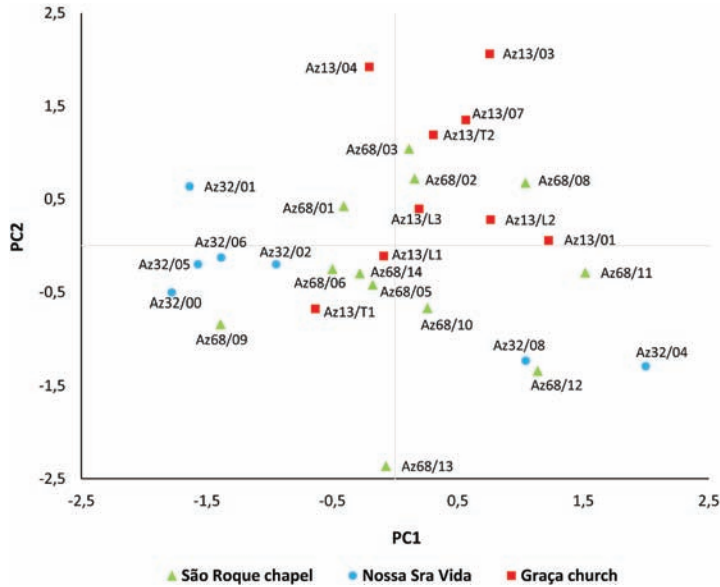


Figure 8. Score plot of PCA analysis of the glazes in which samples are code-coloured according to their origin

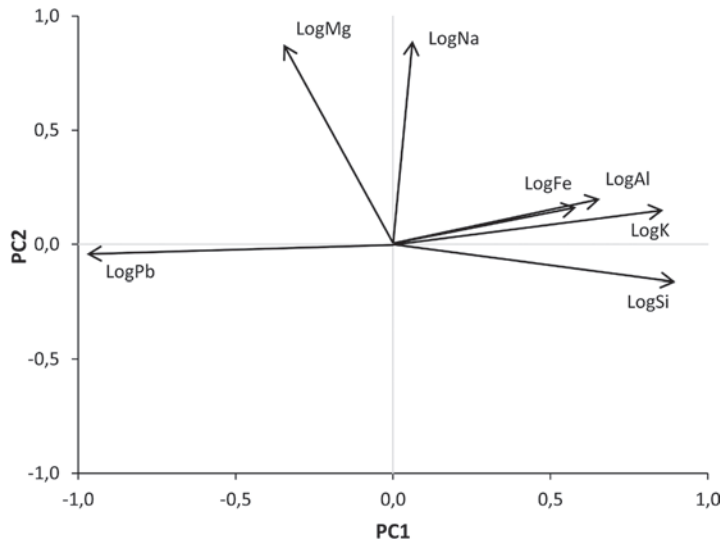


Figure 9. Loadings plot of PCA analysis of the glazes

3.3.3. Biscuit composition

Table 2 includes the semi-quantitative results of biscuit analyses by EDS in weight %. Pb was excluded for the reasons pointed out in section 3.2. The amount of oxygen

was calculated through the remaining elements stoichiometry considering their most commonly used oxides (Na_2O , MgO , Al_2O_3 , SiO_2 , K_2O , CaO and Fe_2O_3). The results were normalized to 100 % and the table also indicates the ratios Ca/Si.

Table 2. Semi-quantitative composition (% w/w) of the biscuits determined by EDS (weight of the elements normalized to 100 %) and Ca/Si ratio

	Sample	Na	Mg	Al	Si	K	Ca	Fe	O	Ca/Si
Graça church	Az013/01	1.8	4.2	8.4	21.1	2.1	15.0	4.2	43.2	0.71
	Az013/03	1.9	2.6	9.4	20.4	2.4	17.0	3.5	42.8	0.83
	Az013/04	1.6	1.6	8.4	26.5	2.5	10.8	3.2	45.5	0.41
	Az013/07	1.4	3.9	8.6	23.8	1.4	12.5	3.7	44.7	0.52
	Az013/T1	1.5	1.6	8.4	26.2	3.4	10.2	3.5	45.2	0.39
	Az013/T2	1.3	2.2	9.3	21.4	1.4	17.0	4.1	43.4	0.79
	Az013/L1	1.3	1.7	8.4	26.5	2.6	10.6	3.3	45.5	0.40
	Az013/L2	1.2	1.4	8.3	26.8	3.2	9.2	4.4	45.5	0.34
	Az013/L3	1.4	1.7	8.3	25.5	2.5	12.2	3.6	44.9	0.48
Nossa Senhora da Vida	Az032/00	1.5	1.7	10.5	25.3	3.8	6.4	5.3	45.4	0.25
	Az032/01	1.2	2.2	9.1	24.6	2.7	9.5	5.9	44.9	0.39
	Az032/02	1.1	1.5	8.7	28.8	2.7	6.9	3.5	46.7	0.24
	Az032/04	1.8	1.4	9.7	23.2	4.0	10.8	5.2	44.0	0.47
	Az032/05	1.2	1.7	12.7	25.4	4.2	2.6	6.0	46.2	0.10
	Az032/07	1.3	1.5	10.3	25.9	3.8	6.5	5.1	45.7	0.25
	Az032/08	1.4	1.8	10.7	23.6	3.6	9.3	4.8	44.7	0.39
São Roque chapel	Az068/01	1.0	1.1	9.2	25.3	5.0	8.7	4.8	44.7	0.34
	Az068/02	1.4	1.3	8.9	27.5	3.4	8.6	2.9	46.0	0.31
	Az068/03	1.3	1.3	7.7	28.9	2.5	8.7	3.2	46.4	0.30
	Az068/05	1.0	1.1	7.3	27.8	3.0	10.7	3.4	45.6	0.39
	Az068/06	1.3	1.4	8.5	27.9	2.6	9.0	3.3	46.1	0.32
	Az068/08	1.5	1.3	9.3	24.9	3.7	10.2	4.4	44.7	0.41
	Az068/09	1.7	1.8	9.1	27.1	2.9	7.1	4.3	46.0	0.26
	Az068/10	1.7	1.4	10.0	26.2	3.2	7.2	4.5	45.7	0.28
	Az068/11	1.4	1.7	10.0	23.0	3.5	12.5	3.7	44.1	0.54
	Az068/12	1.3	1.6	9.1	24.1	2.9	12.4	4.2	44.4	0.52
	Az068/13	0.7	0.9	7.9	28.5	4.0	8.7	3.2	46.0	0.31
	Az068/14	1.4	1.2	8.3	29.9	3.4	6.1	2.8	47.0	0.20

Figure 10 shows the results of a log-based principal component analysis of the biscuits, considering the analytical results in Table 2, through a plot in the plane of the two first principal components (PC1 and PC2). PC1 explains 42 % of the variation and is controlled in the positive sense by the contents in Mg, Ca and Na and in the opposite sense by K and Si, as can be seen from the loadings plot of Figure 11. PC2 explains 33 % of the variation and is controlled in the positive sense mostly by the contents in Al and Fe, and in the opposite sense by Si and Ca (Figure 11).

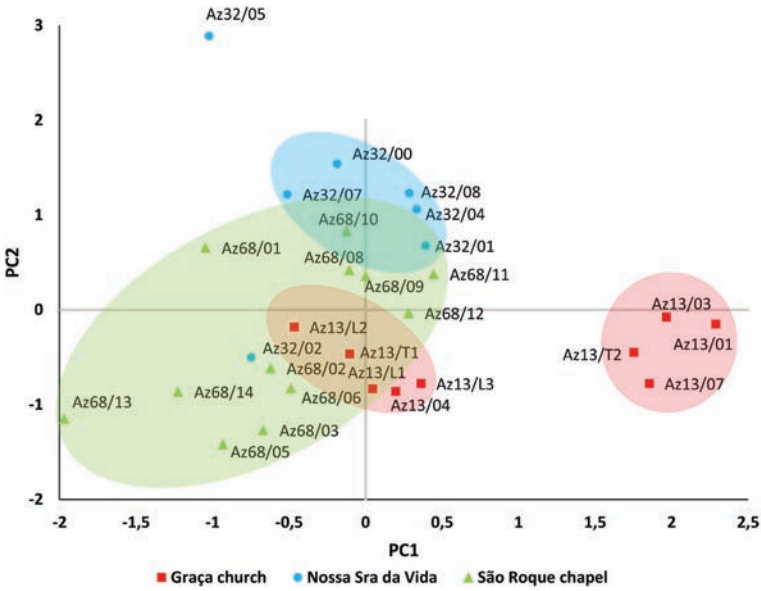


Figure 10. Score plot of the PCA analysis of the biscuits with tentative clustering

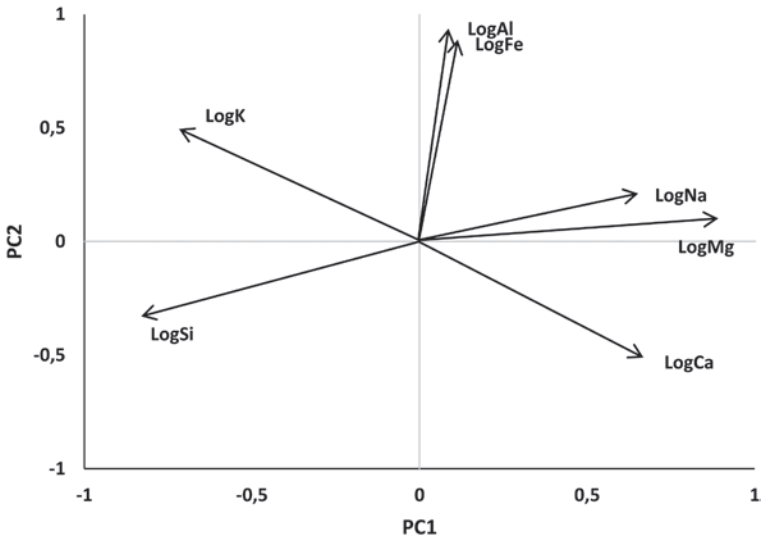


Figure 11. Loadings plot of the PCA analysis of the biscuits

3.3.4. The dark outlines of figures

The outlines of figures in the panels of Graça church (not illustrated) are sketched with a dark paint that does not offer any particularly remarkable morphology, either under the optical microscope, or the SEM. However, the dark outlines in the other two panels, exemplified by samples Az32/08 and Az068/03 of which Figure 12 illustrates sections in optical microscopy, have a peculiarity that we had not found before. In the corresponding SEM-BSE images (Figures 6 bottom left and 13 left) they are seen to contain a large number of small particles made up of low atomic weight elements (and for that reason seen as dark inclusions).

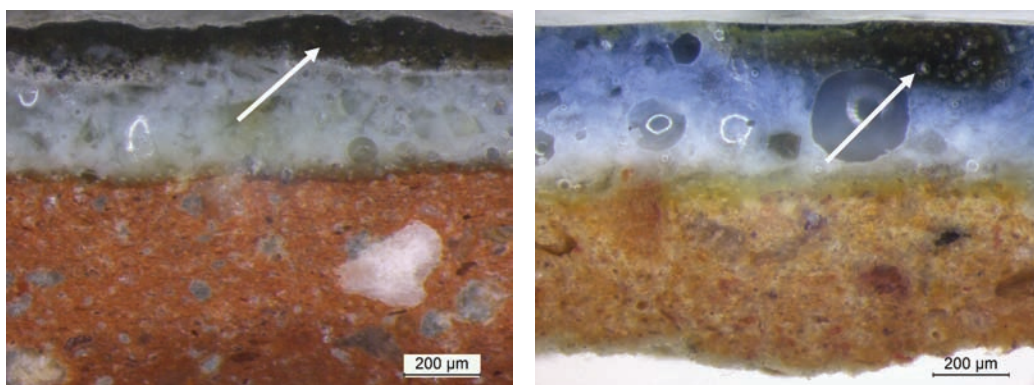


Figure 12. Optical microscopic images of cross sections of samples Az032/08 (left side) and Az068/03 (right side) depicting areas corresponding to the dark outlines (white arrows)

The particles in the outline paints (left side of Figure 13) were likely added to a smalt containing the pigments to make a paste with which the lines were painted. Besides the elements of the matrix, a high content in Ca was found in these particles, together with a higher content in Si than can be explained by the matrix (right side of Figure 13). Analyses by Raman spectrometry were inconclusive, however the calcium silicate *wollastonite*, presumed to be a possible mineral composition of the inclusions, was not detected. For the moment we may only state that the particles are of a mineral rich in Si and Ca.

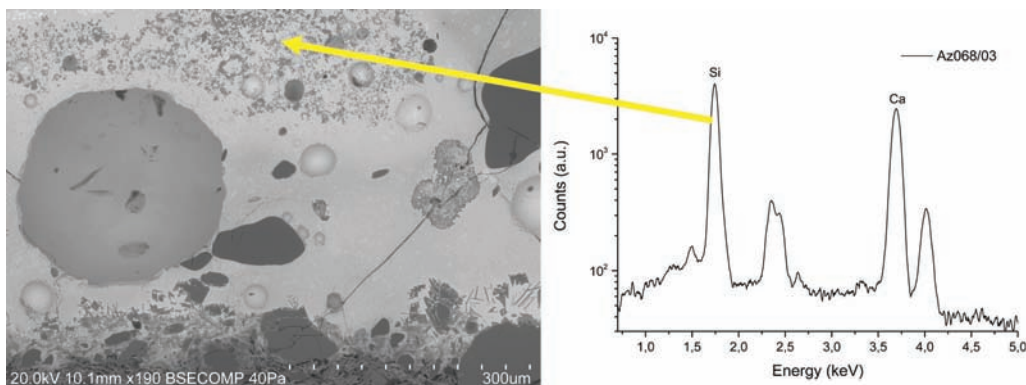


Figure 13. Selection of a particle of the inclusions added to the pigment in Az068/03 and relevant part of the resulting EDS spectrum

It will be noted that, in the São Roque panel, the outlines are largely level with the glaze surface (right side of Figure 12 and Figure 13) as is expected of a sketch on a raw glaze. However, in Nossa Senhora da Vida, some outlines are clearly protruding from the glaze surface (left side of Figure 12 and bottom left of Figure 6). The dark inclusions in this sample were also analyzed with similar results [3] but the fact that the outline protrudes from the glaze surface suggests that it may have been painted over an already fired glaze, which was then re-fired.

The mineral addition represents the sort of technological resource that may help pinpoint the production of a single workshop. Besides the two cases referred, we also found the same mineral additions when we studied azulejo-plaques from the garden of *Palácio e Quinta da Bacalhoa* in Azeitão [13]. Figure 14 depicts one such plaque and a SEM-BSE image of a section in which inclusions with the same analytical signature are seen spread this time through the whole glaze, presumably to increase the viscosity of the molten glass.

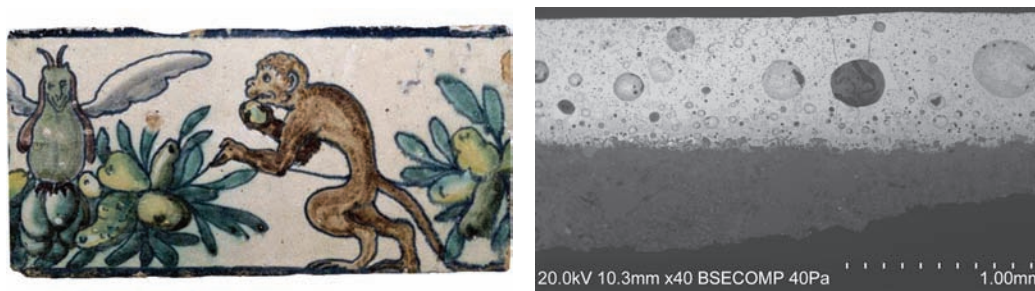


Figure 14. Azulejo plaque from *Quinta da Bacalhoa* (coll. Museu Nacional do Azulejo, inv. MNAz 53) and SEM-BSE image of a section in a white area of the same plaque

3.3.5. The yellow pigments

An extensive study of the pigments used will be published hereafter, however it must be noted that in both Graça church and Nossa Senhora da Vida we identified the use of a Sb+Pb+Sn light yellow pigment [14] that we have also found in azulejos imported from Antwerp [15]. Figure 15 depicts EDS spectra corresponding to yellow areas in each panel covered by the present study. In both Graça church and Nossa Senhora da Vida the unusual Sb+Pb+Sn yellow pigment was found, as seen by the presence of the conspicuous Sn peak, while in São Roque the only yellow found was the common Sb+Pb *Naples Yellow*.

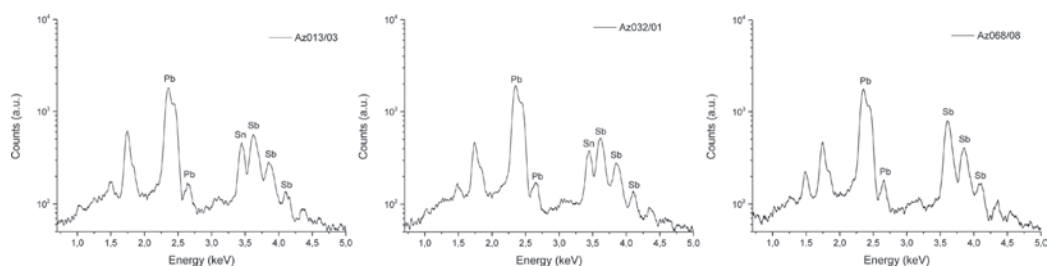


Figure 15. Partial EDS spectra of the yellow pigment in samples of the three panels covered by the present study – notice the lack of the Sn peak in the yellow used at São Roque

It should also be noted that in the first two panels mentioned a remarkable wealth of colours and hues was used, particularly greens, blues and yellow/oranges (Figures 1 and 2). Not on the panels of São Roque, where the colours are the plain Naples yellow and then the usual cobalt blue, manganese violet and copper green with a few other (such as the brown of the dog fur or the greenish dark blue of some outlines) obtained from simple mixtures of pigments. Actually, the palette depicted by the whole lining of São Roque chapel is basically the same that would be used in Portuguese azulejos throughout the 17th century.

4. DISCUSSION

The glazes of all samples studied are closely related by their low Si/Pb ratio (usually under 0.5) and comparable morphologies (Figures 5, 6, 7). The low Si/Pb ratios separate them clearly from the typical 17th century compositions which usually have Si/Pb ratios around or over 1.0 [11] while the inclusions and interfacial morphologies suggest they were all fired in similar conditions, possibly even in the same kiln. The composition of the glazes of all three panels is also comparable, notwithstanding the extended chronology they represent. Up to now we have not encountered the combined characteristics found here in any other group of faience azulejos we have studied, neither Portuguese productions of later centuries, nor 16th century Seville productions¹ or azulejos from the workshops of Antwerp [11; 15], granting a marked difference for tiles produced in Lisbon at this time, seemingly stemming from the technology introduced by the workshop of João de Góis [1; 2] and which we may therefore take together as *the technological circle of João de Góis*. Accordingly, the PCA of the glazes does not allow a clear clustering: samples from the three panels are mixed together (Figure 8). Still, the distribution is not wholly random and the Nossa Senhora da Vida samples (except Az032/04 and Az032/08) are seen to be slightly skewed to the left of the PCA1 vs. PCA2 plot when compared to the rest (Figure 8). This results from these samples having, in average, a higher content in Pb and a correlated lower content in Si and K (Table 1) than samples from the other panels. A higher content in Pb would be expected from an older production because it could then be fired at a lower temperature, but Nossa Senhora da Vida is not the oldest in the group. This fact suggests that Nossa Senhora da Vida may have been produced to a more exacting specification and the high content in Pb that certainly lead to a higher cost may have been intended to ensure a reduction of defects of the surface that might impair the overall aspect, combined with higher gloss [16; 17].

The use of *coperta*, as seen in the panels of Graça church (Figure 4 top), was probably superseded by the use of better yellow smalts (a mixture of the pigment with finely ground glass or its components, giving the result seen in the bottom row of Figure 4) and *coperta* was considered superfluous by the time the other two panels were produced.

For the biscuits, an aggregation in clusters seems feasible. The fact that the biscuits from different panels are not identical is what may be expected from their diverse chronologies and the natural variability of the marls or clays used in the preparation of the ceramic pastes. Clustering in PCA plots is always the result of subjective decisions and in this case,

1 A comparative study with 16th century faience azulejo productions of Seville will be published at a later time, but a number of samples have already been studied, the oldest of which a pattern used in *Santa Clara* convent in Seville, dated from 1576, that depicted a completely different glaze morphology.

bearing in mind the uncertainty on the quantification of the composition of the biscuits particularly at the scale of our study, we considered Az032/02 and Az032/05 as outliers, left out of the four proposed clusters in Figure 10. It is remarkable that, although samples from both the panels of Nossa Senhora da Vida and São Roque chapel can be aggregated in individual clusters, Graça church can better be represented by two different clusters of which that at the right side of the plot of Figure 10 includes Az013/01, Az013/03, Az013/07 and Az013/T2. These four samples are characterized by biscuits with Ca/Si ratios above 0.5, higher Ca and Mg and lower K contents than the average. Those relevant disparities suggest that the azulejos that make up the Graça church panels may actually represent two different chronologies [2].

The peculiar addition of a finely ground mineral to form a paste with which the dark outlines of figures are painted, suggests independently a connection between Nossa Senhora da Vida and São Roque and also with the azulejo plaques that decorate the garden of Palácio da Bacalhoa in Azeitão.

The use of a rare yellow pigment including tin in its composition connects Graça church with Nossa Senhora da Vida and suggests that the pigment may have been purchased from Antwerp [15]. The fact that by 1584, when the lining of São Roque was started, the pigment, together with a wealth of hues of other colours, seemingly was no longer available, may be connected with the so-called *Sack of Antwerp* on November 1576 that laid the city waste, cut short its economic prosperity, and very likely interrupted the supply of art materials.

5. CONCLUSIVE NOTES

The results presented here demonstrate that there are collective attributes allowing to group 16th century azulejos produced by the workshops of Lisbon within what we may call *the circle of João de Góis*. This is not an artistic circle, but rather a technological one, highlighting the fact that at this time, when the manufacture of faience azulejos in Lisbon was in its early years, there might be a considerable number of painters but likely few potters mastering the means needed to produce quality panels. Those workshop masters (if indeed more than one) shared a common technique (glaze compositions and firing cycle) which identifies *the Circle*.

The results have shown that there is significant variation in the composition of the biscuits, maybe stemming from the fact that the ceramic pastes were produced from marls or clays from different pits and varying depths. However, the composition of the glazes remains stable throughout the period, probably because it represented a reasonable assurance of good results when firing the tiles according to a set cycle involving a single kiln. The very distinctive morphology of the glazes, particularly as pertains the development of neoformed crystals in the glaze-biscuit interface, is probably more a consequence of the firing cycle than of the composition of the glaze itself. This point has to be borne in mind when assessing later productions that lack the same interfacial development: different glaze morphologies may result from diverse firing cycles in different kilns, rather than characterize singly a workshop.

The morphology of the glazes will likely be immediately affected when a different firing cycle is adopted, but the elemental composition of the glazes and biscuits does not change substantially when a different kiln is used. However, when a higher firing

temperature is obtained, the ratio Si/Pb may be increased to save on the cost of lead. Once more results become available, these and similar considerations may help establish the progressions and chronological sequences that marked the spread of the production of faience azulejos in Portugal.

BIBLIOGRAPHIC REFERENCES

1. PAIS, A. et al. – *The beginning of the production of majolica azulejos in Portugal – João and Filipe de Góis in 16th century Lisbon* in Studies in Heritage Glazed Ceramics, No. 1, pp. 1-24, LNEC, Lisbon, Portugal, February 2019.
2. PAIS, A. et al. – *Study of the azulejo panels in Graça church signed by João de Góis* in Studies in Heritage Glazed Ceramics, No. 1, pp. 47-66, LNEC, Lisbon, February 2019.
3. PAIS, A. et al. – *The 16th century nativity azulejo panel called “de Nossa Senhora da Vida”* in Studies in Heritage Glazed Ceramics, No. 1, pp. 67-76, LNEC, Lisbon, February 2019.
4. MIMOSO, J. et al. – *A research on the azulejo panels of the São Roque chapel in Lisbon* in Studies in Heritage Glazed Ceramics, No. 1, pp. 93-112, LNEC, Lisbon, February 2019.
5. RAVAGLIOLI, A. & KRAJEWSKI, A. – *Chimica Fisica Tecnica e Scienza dei Materiali Antichi Ceramiche e Vetrosi*, Museo Internazionale della Ceramiche, pp. 219-229, Faenza, Italy, 1989.
6. PEREIRA, S. et al. – *Influence of the production technology on the morphological characteristics of azulejos* in Proc. Int. Conf. Glazed Ceramics in Cultural Heritage (GlazeArt 2018), pp. 140-149, LNEC, Lisbon, 2018.
7. MOLERA, J. et al. – *Interactions between Clay Bodies and Lead Glazes*, Journal of the American Ceramic Society, Vol. 84, No. 5, pp. 1120-1128, May 2001.
8. ESTEVES, M. – *Estudo do fabrico e da degradação de azulejos portugueses históricos*, PhD thesis, pp. 41-49, Universidade Évora, Portugal, 2016 (available through the Internet).
9. CAMPAGNE, C. – *Een verkeerde loop in ‘t vuur: an initial investigation into what Dutch archival sources can tell us about techniques and problems in the production of 17th and 18th century Dutch tin-glaze tiles*, in Proc. Int. Conf. Glazed Ceramics in Architectural Heritage (GlazeArch 2015), LNEC, Lisbon, 2015.
10. BASTENAIRE-DAUDENET, F. – *L’Art de Fabriquer la Faïence Recouverte d’un Émail Opaque Blanc et Coloré*, pp. 11-13 & 27-32, Paris, France, 1828.
11. MIMOSO, J. et al. – *A comparison of the earliest faience tiles produced in Lisbon with earlier and later types*, in Studies in Heritage Glazed Ceramics, No. 1, pp. 25-46, LNEC, Lisbon, February 2019.
12. COENTRO, S. – *An Iberian Heritage: Hispano-Moresque architectural tiles in Portuguese and Spanish collections*, PhD thesis, pp. 60-62 & 132-135, Universidade Nova de Lisboa, 2017 (available through the Internet).
13. RASTEIRO, J. – *Inícios da Renascença em Portugal – Palácio e Quinta da Bacalhoa*, Estampa XXVII, Figura 22, Lisboa, 1898.
14. SECCARONI, C. – *Giallorino – Storia dei pigmenti gialli di natura sintetica*, pp. 78-90 & 180-211, De Luca Editori D’Arte, Roma, Italy, 2006.
15. MIMOSO, J. et al. – *Analytical study of tiles of presumed Flemish origin from the Palace of the Dukes of Braganza in Vila Viçosa* in “From Flanders. The azulejos commissioned by D. Teodósio I, 5th Duke of Braganza, pp. 64-74, Museu Nacional do Azulejo & Fundação da Casa de Bragança, Lisbon 2012.
16. WACHTMAN, J. – *Materials and Equipment – Whitewares Manufacturing*, p. 146, John Wiley & Sons, 2009.
17. NORSKER, H. & DANISCH, J. – *Glazes for the self-reliant potter*, Deutsches Zentrum für Entwicklungstechnologien (GATE-GTZ), Eichborn, 1993.



LABORATÓRIO NACIONAL
DE ENGENHARIA CIVIL

Studies in Heritage Glazed Ceramics is dedicated to the results of scientific studies in the field with a particular emphasis on analytical results, conservation issues and historical studies and very specially to multidisciplinary research in the domain.

The contents will include:

- Archaeometry studies, namely the application of analytic methods to the identification of materials and the establishment of technologies, provenance or the setting of chronologies;
- The artistic and historical context of productions, materials and evolving technologies, as well as the origin, preparation and trade routes of pigments and other raw materials;
- Decay of glazed ceramics, techniques and materials for conservation;
- Other innovative research results in the field.

<http://glazedceramics.lnec.pt/>

ISBN 978-972-49-2307-9



AV DO BRASIL 101 • 1700-066 LISBOA • PORTUGAL
tel. (+351) 21 844 30 00 • fax (+351) 21 844 30 11
lnec@lnec.pt www.lnec.pt

