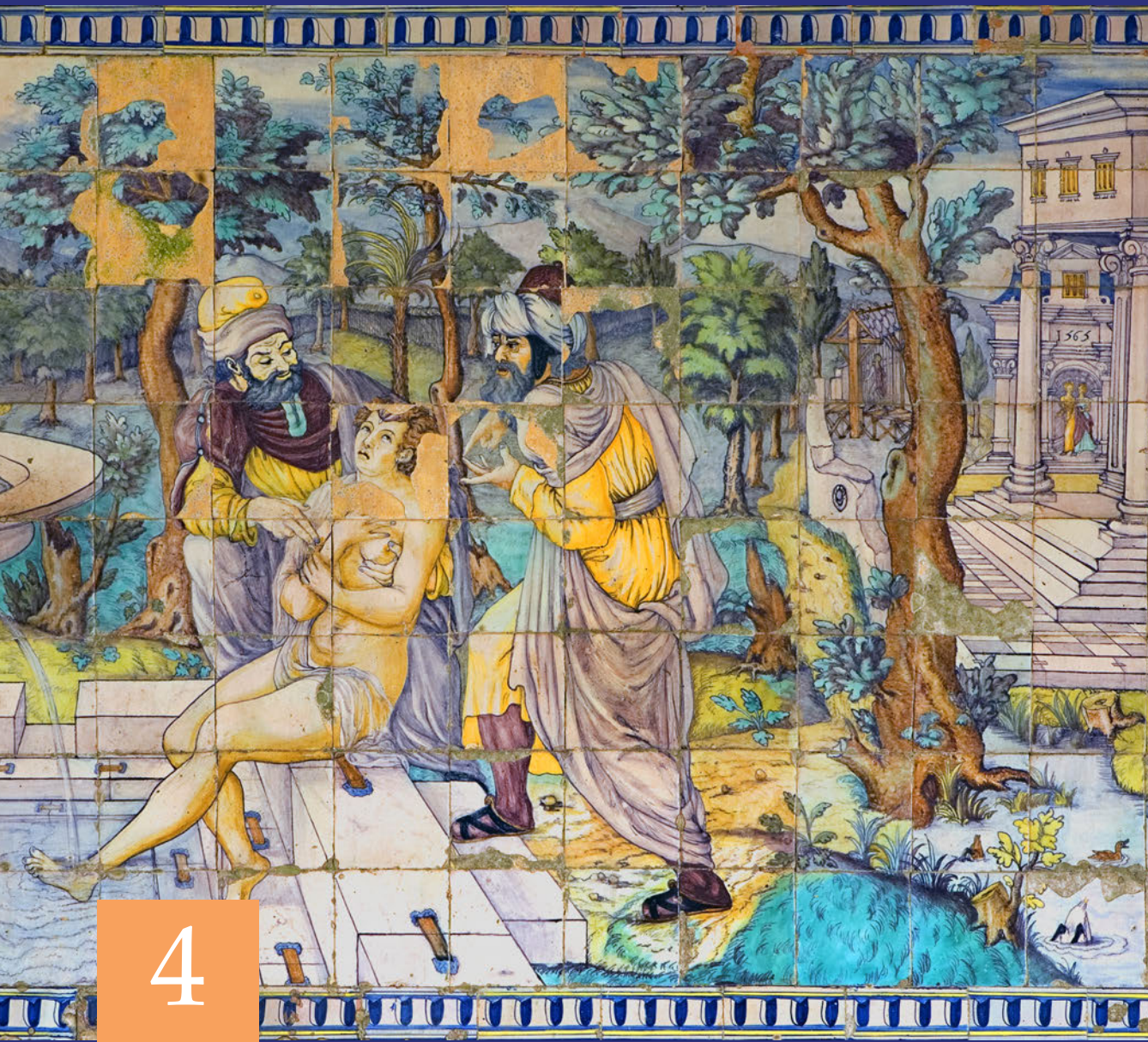


# Studies in Heritage Glazed Ceramics

The majolica azulejo heritage  
of *Quinta da Bacalhôa*



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Volume II



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## PREFACE

This is the second of a special series of four volumes of *Studies in Heritage Glazed Ceramics* dedicated to the renaissance majolica azulejo heritage of *Palácio e Quinta da Bacalhôa* in Azeitão, Portugal.

The azulejos of Bacalhôa have a legendary status in the studies of renaissance majolica in the Iberian Peninsula in general, because of their extraordinary variety and quality and the fact that its most mythical panel, representing the biblical episode of *Susanna and the Elders*, is dated “1565” – a chronology hardly compatible with the then-recent production of azulejos in Portugal. Several hypotheses were advanced over the years to cope with this seemingly impossibility, almost always involving Flemish potters immigrated to the Peninsula which the present study finally confirmed.

The first volume of the series dedicated to Bacalhôa, issued in December 2021, published three papers that established the pillars supporting the subsequent detailed study of the panels and patterned tiles: a study of the estate, locating its 16th century majolica azulejos; a study of the career and productions of Jan Floris de Vriendt of Antwerp (known in Spain as *Juan Flores*) who, according to the results, was likely the main potter, painter and pattern designer connected with the lining of Bacalhôa with majolica azulejos around 1565; and finally a systematization of the main types of 16th century majolica azulejos still extant in the Palace, the Pleasure House by the lake and the garden. That first volume was complemented by a study of the panels and tiles that, according to the previous results, had been manufactured in Talavera (Spain) and imported to Portugal, probably the earliest painted majolica to be applied at Bacalhôa.

This second volume of the series starts the presentation of the research results connected to panels and patterned tiles that were mostly produced in Portugal. The four articles cover in detail: the central room of the Pleasure House, where *Susanna and the Elders* is applied; the five panels of the *Loggia of the River Gods*; the very interesting and often belittled *Rape of Europa*; and the according to our knowledge until now unpublished floor of the oratory of the *piano nobile* of the Palace.

The scientific production stands on several pillars, one of them the peer-reviewers of the authors’ papers, whose names are often unknown but whose importance in the final output is singular. The editors wish to heartily thank the reviewers for this number: Doctor Alexandre Nobre Pais, Director of *Museu Nacional do Azulejo* and Doctor António dos Santos Silva of *Laboratório Nacional de Engenharia Civil* (LNEC) who have graciously accepted the hardship of the revisions.

Two more numbers of the journal dedicated to the azulejo heritage of Bacalhôa, with four new research papers in each, are expected to be published over the next 12 months.

LNEC thus presents No. 4 of *Studies in Heritage Glazed Ceramics*. Its 108 pages condense an important part of the results obtained over 20 months of multidisciplinary research, as befits the aims of this journal, aiming to clarify the early diffusion of majolica azulejos in Portugal.

The Editors

## EDITORS

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

## 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.



# The 16th century majolica azulejos of *Palácio e Quinta da Bacalhôa*: the *Rape of Europa* and related panels

João Manuel Mimoso, Alfonso Pleguezuelo, Maria Augusta Antunes, Sílvia Pereira, Álvaro Silva

## ABSTRACT

A water chest in the Boxwood Garden of the Palace of Bacalhôa, near Lisbon, is decorated with two 16th century panels of majolica azulejos, the upper one with a depiction of the abduction of Europa by Zeus, based on a print, and the lower one with three colourful mascarons. The edges of the chest are lined with green on white *alizares* (dihedral tiles) decorated with an arrow and egg pattern.

At the *Museu Berardo Estremoz* is displayed another panel with a single mascarón, originally part of a wainscot panel from a demolished house in Lisbon, in which the design and colours are practically identical to the panel cladding the lower part of the water chest in Bacalhôa.

Given the lesser artistic quality of these panels when compared with the tile decorations found e.g. in the central room of the Pleasure House of the estate, they never attracted much attention from art historians. Yet, it is precisely the fact that they are so clearly different that makes them interesting research subjects towards the establishment of the history of the early production of azulejos in Portugal.

This paper includes a brief iconographic scrutiny of the panels and an instrumental study of the tiles, towards an insight on their provenance.

## RESUMO

Um tanque de água no Jardim de Buxo do Palácio da Bacalhôa, perto de Lisboa, é decorado com dois painéis de azulejos de majólica do século XVI, o superior com uma representação do rapto de Europa por Zeus, baseado numa estampa, e o inferior com três mascarões pintados com cores vivas. As arestas do tanque são revestidas com cantoneiras decoradas a verde com um padrão de óvulos e setas.

No Museu Berardo Estremoz está exposto outro painel com um único mascarão, originalmente parte de um silhar de uma casa em Lisboa, cujo desenho e pintura são praticamente idênticos ao painel que reveste a parte inferior do tanque de água na Bacalhôa.

Dada a menor qualidade artística deste conjunto quando comparado com os painéis figurativos aplicados noutros locais da propriedade, nunca justificou um estudo detalhado por parte dos investigadores. No entanto, é precisamente o facto de serem tão claramente diferentes que os torna interessante tema de investigação para o estabelecimento da história da produção inicial de azulejos em Portugal.

Este trabalho inclui um breve estudo iconográfico dos painéis e os resultados de uma investigação analítica com vista a determinar a sua proveniência.

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**KEYWORDS:** Renaissance majolica; azulejos; Palace of Bacalhôa; João de Góis

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We are thankful to Mr. Joe Berardo and to Mr. Renato Berardo, who authorised the sampling of the unique azulejo heritage of *Palácio e Quinta da Bacalhôa*; and to *Associação de Coleções | The Berardo Collection* and *Bacalhôa Vinhos de Portugal* for their support to this project.

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## 1. INTRODUCTION

A water chest in the Boxwood Garden of the Palace of Bacalhôa, near Lisbon, is decorated with two 16th century panels of majolica azulejos, the upper one with a depiction of the abduction of Europa by Zeus, whose aquatic setting matches the location, and the lower one with three colourful mascarons (Figure 1). The edges of the chest are lined with green on white *alizares* (dihedral tiles) decorated with an arrow and egg pattern that were seemingly manufactured specifically for this application. There are also complementary decorative tiles (seen in Figure 1) that have biscuits of a different colour and are probably left-overs from earlier applications elsewhere in the estate. They will not be covered by this paper.

At the *Museu Berardo Estremoz* is displayed another panel with a single mascarón (Figure 2), part of a wainscot panel retrieved from a house in Lisbon before its demolition, which, except for its smaller length, is practically identical to the panel cladding the lower part of the water chest in Bacalhôa. All these panels and the green *alizares* have in common biscuits fired to a conspicuous terracotta colour.



**Figure 1.** The panels lining the water chest in the Boxwood Garden of Bacalhôa: *The Rape of Europa* and the three mascarons. The green-on-white arrow and egg *alizares* clad the edges of the water chest (image © Associação de Coleções | The Berardo Collection).

Given the lesser artistic quality and glamour of these panels, particularly when compared with the main panels found at the Palace and its Pleasure House [1], they never attracted much attention from art historians. Yet, it is precisely the fact that they are so clearly different that makes them interesting research subjects towards the establishment of the history of the early production of azulejos in Portugal.

This paper includes an iconographic and stylistic scrutiny of the panels and an analytical study of the tiles, towards an insight on their date and provenance.



**Figure 2.** The panel with a single mascarón displayed at the *Museu Berardo Estremoz* (image © Associação de Coleções | The Berardo Collection, Inv. 101-395).

## 2. ICONOGRAPHIC AND STYLISTIC STUDY OF THE PANELS

We do not know what this area of the Palace of Bacalhôa, now known as the Boxwood Garden, may have looked like in the successive phases of its long history. All we know about its vegetation is that it had orange trees, probably along the walls, and also that there was a time when it was planted with carnations, as is written in a description dated from 1631. Three of its walls are original while a fourth, the one on the west side, was removed in the past. The three benches that served and still serve today as resting places for visitors must also be original. Likewise, its central fountain, with a reservoir of Arrábida breccia and a central stem of white marble and elegant design, gives the impression of dating from the mid-16th century [1]. We know nothing about the original layout of its paths, which may have been peripheral, together with four paths that crossed the garden and joined in the centre, forming the classic four flower beds. Regardless of its primitive architectural layout, we also do not know if there were mural paintings in this garden or if there were other sculptures during the Renaissance, but those we see today have been placed there in recent times. The only iconic element that is certainly original from the 16th century is the water chest lined with tiles that we see today.

The reservoir itself may be coeval with the renovation of the Palace, completed in 1554, because one of its sides is still lined with Hispano-Moresque tiles,<sup>1</sup> likely the last vestige of its former more utilitarian self. Only later was it transformed into the decorative water chest we see today.

1 Their pattern is the same that was used to clad the sides of some of the benches in the garden [1, Fig. 17].



It is somewhat surprising how little artistic value has been attributed to this element in the past, and one of the reasons may be that the art historians who mentioned the tile panels did not consider the original function of the element on which they were applied. Joaquim Rasteiro in his 1895 monography about the estate refers to it as a seating bench, presumably because he did not examine it from nearby. Reynaldo dos Santos only refers to it in 1957 as “the mediocre Rape of Europa” [2, p. 59] without alluding to the function of the element it covers. Nor does Santos Simões seem to have taken much interest in this ensemble, which he interprets as a flowerbed [3, p. 106]. But noting the pipes visible at the bottom of the tank allows us to state, without doubt, that it is clearly a reservoir in which the water needed to irrigate the flowerbeds was stored. We believe that it is important to know this function because it may justify the choice of the motifs that decorate it.

It is worth remembering that in the 16th century, these reservoirs were called “water chests”. It is perhaps no coincidence, therefore, that their size and even their decoration simulate motifs that closely resemble that multi-functional container furniture that abounded in 16th-century European houses and palaces (Figure 3). Many of them were made of fine wood, decorated on their outer surfaces with ornamental motives carved in gilded and polychrome reliefs and with fine mythological paintings on the smooth surfaces of their interiors so as not to diminish their capacity to contain. This is probably the reason why this ‘water chest’ has three mascarons centred in oval cartouches formed by fittings of a clearly Flemish inspiration on its outer face and a mythological painting on the inner face of its lid as did the most precious chests of the time (Figures 15, 16). For the same reason, the surface on which *The Rape of Europa* is applied is not vertical or tilted backwards, as is usual for the backs of benches, but forwards, simulating that the lid is a tilting element which, in this case, is depicted as if it were already closing. It may have been precisely this practical function that led to the choice of the theme that decorates the lid of the ark: a mythological episode that takes place in a maritime setting.



**Figure 3.** A North Italian (?) renaissance chest dated 1500-1600 (image © Victoria & Albert Museum, London, Acc. Nr. 7224-1860).

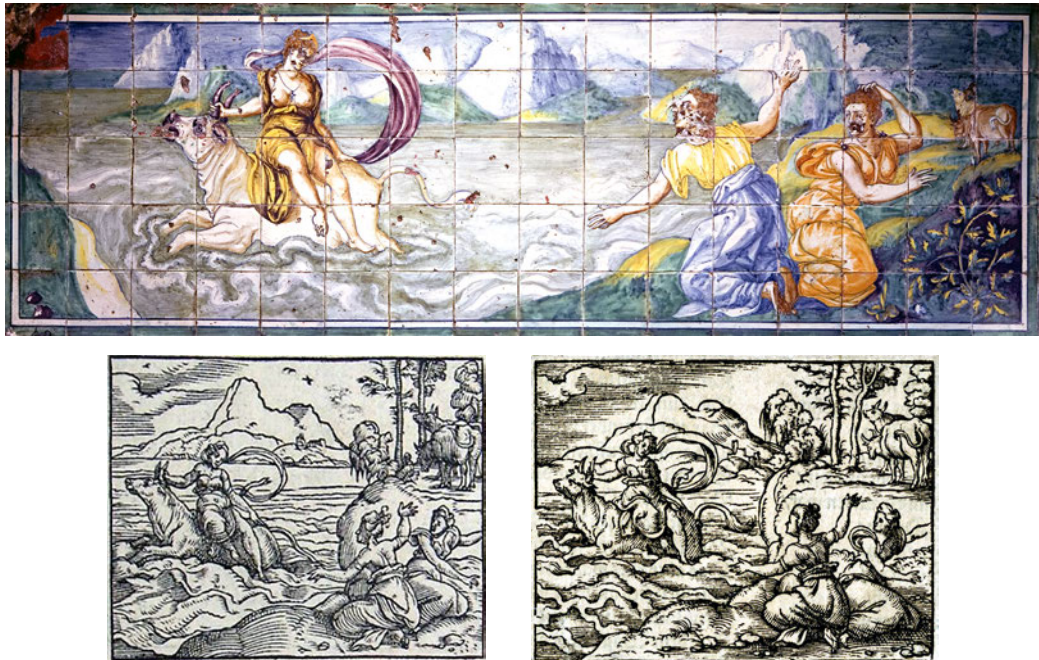
The Greek myth of Europa states that she was a Phoenician princess from Tyr whose beauty attracted Zeus himself. One day, when she was picking flowers near the shore with other maidens, Zeus took the shape of a bull and mingled with the herd of Europa's father. In time, she noticed the beauty of the bull and sat on its back, whereupon Zeus took to the sea and ran away with her to Crete. The Latin poet Ovid (43 BCE - c. 18) made of the legend one of the episodes of his masterwork *Metamorphoses*, a poem in fifteen books dealing with transformations in Greek and Roman mythology, in this case Jupiter (the Latin equivalent to Zeus) into a bull. The episode closes the second book of *Metamorphoses* and in its poetic rendition Ovid states that as she saw the land receding, Europa's right hand clasped one of the bull's horns, and her other hand gripped its back while her tunic fluttered in the wind. The fact that the name of the Tyrian princess would, in time, originate the name of the whole continent of Europe (while Zeus' avatar as a bull is at the origin of the constellation and western zodiac sign *Taurus*) suffices to make this an important legend.

Apart from the fact that this water-related myth was suitable for decorating a utilitarian garden element, its choice may also have had deeper motivations, related to history and, above all, to the interest of European humanist culture in alluding to myths of classical antiquity on which to base and legitimise the new forms of power of the then *Modern Age*. Europa, princess of the Phoenician kingdom of Tyr, became, through her unplanned betrothal to Zeus, the mother of the first three kings of Crete, a culture that is at the origin of Greece itself. The myth therefore alludes to Phoenicia, Crete and Greece, i.e. the first three known thalassocracies of the Mediterranean. It was easy to relate them to Portugal, a kingdom that by the mid-16th century had already formed the maritime trading empire that was the origin of its most brilliant historical period. In short, the myth made it easy to recognise Portugal as a New Greece. If Phoenicia, Crete and Greece were the masters of the Mediterranean of Old, Portugal and Spain were now the masters of the Atlantic, the Indian and the Pacific. No one more appropriate than Brás [Afonso] de Albuquerque, son of one of the protagonists of this colossal modern epic and then owner of the Bacalhôa estate, to leave in the garden of his palace a reminder of this idea that was surely very present in the minds of this humanist generation.

One of the earliest illustrated printed editions of the *Metamorphoses*, abridged and translated to French, was published in Lyon in 1557 and in it the episodes were illustrated by Bernard Salomon (Lyon c.1506- c.1561).<sup>2</sup> On the lower left side of Figure 4 is reproduced the original 1557 illustration from a woodcut by Salomon for this particular episode, flipped horizontally as if seen in a mirror. This edition, later also published in Dutch, was very successful, originating copies and forgeries from other editors. Of interest to us is a Latin edition published in Frankfurt in 1563 with very sharp illustrations by Virgil Solis (Nuremberg 1514-1562).<sup>3</sup> For the episode of "Jupiter into a bull", Solis used the original Salomon illustration, now inverted left to right, slightly altered and improved with more detail (reproduced at the lower right side of Figure 4).

2 For a review of the 1557 French edition of the *Metamorphoses* and its illustrations, as well as of previous editions, see *ICONOS* (Sapienza Università di Roma, site in Italian at: [www.iconos.it](http://www.iconos.it) – last visited September 30, 2021).

3 The 1563 edition was subsequently published in Latin and German. Information obtained from *The Ovid Collection*, University of Virginia (<https://ovid.lib.virginia.edu/index.html> – last visited September 30, 2021).



**Figure 4.** Top: *The Rape of Europa* before its recent conservation intervention. Lower left side: illustration in the 1557 abridged French edition of Ovid's *Metamorphoses* published in Lyon (image: UVa Library- illustration flipped horizontally to allow for an easier comparison); lower right side: illustration in the 1563 Latin edition published in Frankfurt (image © The Trustees of the British Museum).

Addressing the sources of the figurative representations in Bacalhôa, Ana Paula Correia [4] pointed to the use of the 1563 representation based on the similarity of the flying scarf and the position of the bull's tail, with which we agree, adding the rendition of the waves around the bull, graphically different in both prints. However, there is a detail that suggests that the illustration to Ovid's *Metamorphoses* was not the only source: the colours of Europa's garments. Figure 5 illustrates three Italian maiolica plates and although the colours of the maids' clothing vary, the colours of Europa's garments are similar to the panel: a *peplos* in hues of yellow / orange and a purple wimple. In Greek literature, Moschus' *Europé* states that the bull was of a light brown colour and Europa's *peplos* was purple, as befitted her royal condition,<sup>4</sup> and indeed in ancient representations Europa is usually vested in blue or purple. Ovid's poem states that the bull is white but offers no clue as to the colours of Europa's tunic. Therefore, in the panel in Bacalhôa the colours must have been copied from a painting, or else the print used was one illustrating a text other than Ovid's, from which the colours could be determined. An early such text is Jean-Antoine de Baïf's *Le Ravissement d'Europe* (published in Paris in 1552) of which the relevant parts read as follows: about Europa hurrying to join a group of girls who were going to pick flowers "...you tie your hair with a knot, and **for dress you put a silk garment stripped with gold** that waves shimmering"; about the colour of the bull,

4 For a translation to French of the Greek poem written by Moschus of Syracuse ca. 150 BCE, see MUSAGORA- Langues et Cultures de L'Antiquité in <https://www.reseau-canope.fr/cndpfileadmin/musagora/mondes-antiques-mondes-modernes/le-mythe-deurope-dans-la-litterature/litterature-grecque-ancienne/moschos-de-syracuse/> Nov 2021.



which is the only detail in Ovid's poem "...its gleaming hair was so white, more than the whitest of flowers"; about what happens immediately after the bull takes to the sea: "...Weeping she calls on her companions who follow her from the margin, and her bare arms towards them she tends, but her help in vain she awaits. Europa, seating on the bull, with one hand holds a horn, with the other, fearing the waves of the sea, **she holds up her purple drapery**. On her back, against her wimple, the wind blows as on a sail".<sup>5</sup> In the depictions, the colours of Europa's garments match this description, with yellow, ochre or orange used for the golden *peplos*, and purple for the wimple, and it is interesting to note that this is the first mention we know of a wimple- in the older pictorial depictions Europa was usually holding the folds of her tunic, or else a mantle of a different colour.



**Figure 5.** Mid-16th century Italian maiolica plates depicting *The Rape of Europa* having in common the colour of the bull and of Europa's *peplos* and wimple. Left side: LWL Museum für Kunst und Kultur Inv. Nr. O-188 LM; right side: Wikimedia Commons,<sup>6</sup> attribution to Sailko (bottom image from a plate at the Museo Civico di Palazzo Mosca, Pesaro).

The greatest problem the painter faced in adapting the composition of the print to his own work was the different proportions of the tile panel. Its lower height and greater horizontal extension constrained him to make several changes which he nonetheless

5 (...) "tu troussas en un neu simplement Tes crins espars, et pour abillement **Sur toy tu mis une cotte de soye Rayée d'or**, qui luyssamment ondoye Parmi l'éclat d'un serien satin"; (...) "Son poil luisant eust bien de sa blancheur Eteint le teint de la plus blanche fleur"; (...) "Elle, pleurant, crioit à ses compagnes, Qui la suyvoient à travers les campagnes: Et ses bras nus devers elles tendoit; Mais leur secours en vain elle attendoit... Europe, estant dessus le bœuf assise, D'une des mains une corne tient prise, D'une craignant les flots de la marine, **Elle troussoit sa vesture pourprine. Dessus son dos dans un guimpe de toyle Le vent s'entonne ainsi qu'en une voyle...**" - the simplified translation is ours, the full text is available at: <https://www.reseau-canope.fr/cndpfileadmin/musagora/mondes-antiques-mondes-modernes/le-mythe-deurope-dans-la-litterature/litterature-francaise/leurope-de-moschos-par-jean-antoine-de-baif/> (consulted in November 2021).

6 [https://commons.wikimedia.org/wiki/Category:Rape\\_of\\_Europa](https://commons.wikimedia.org/wiki/Category:Rape_of_Europa) . The images depict the full plates and were cropped to depict only the part relevant to the present argument.

managed to resolve with some skill. Firstly, he lengthened the landscape on the far left and right sides and increased the distance between the three main groups of figures: fleeing bull with Europa, gesticulating maidens, and finally the cattle of the herd. Secondly, he reduced the area of the background landscape and the sky in the panel, which forced him to place the herd at the level of the maidens and not above them as in the print. As a result, the maiden who in the print has her left arm stretched forward, in the tile panel has to give way to the animals and therefore her arm is now bent, touching her head in anguish. Other changes and additions were gratuitous contributions by the artist. For example, the small town in the background, perhaps Tyr, has disappeared from the panel. The trees in the print were converted into a formless mass of vegetation concealing their trunks and, finally, the lower corner at this end of the scene was filled by the painter with a thicket in which the leaves are painted in halves, green and yellow, a stereotypical formula that was frequently used in Italian ceramics and passed on to Flanders and the Iberian Peninsula.

The colouring used here is particularly vivid in the figures and somewhat more sombre in the landscape. The ochre and blue tunics of Europa and the maidens are particularly well resolved with a pictorial modelling of folds and well-studied shadows, especially in the case of the protagonist. It may be noticed from Figure 4 that Europa is more unveiled than in the print: her breast and right leg are now fully exposed, and her bare neck has a pendant with a cross made with six pearls. And this raises again the possibility that the source may have been, not the print directly, but rather a maiolica plate or an easel painting made after the print and depicting her similarly unrobed (as in one of the plates in Figure 5). Else this adaptation was done by the painter, likely at the client's request. In all cases, the finesse and sensuality with which Europa is depicted accentuates the profane character of this scene and reminds us of the tendency towards eroticism typical of Northern Mannerism, also evident in this scene in details such as the sophistication of the hairstyle or the capricious and forced position of the feet toes of the protagonist.

The landscape, on the other hand, is somewhat less detailed. The closest shots are painted in green and yellow, while the mountains in the background are rendered in faded blue, simulating the distance with the usual procedure established by atmospheric perspective. Maybe what create the stormy atmosphere that accentuates the drama of the episode are the absence of appeasing white clouds and, above all, the green colour of the water used by the painter to represent a rough sea that would have been cheerful and luminous if he had used blue. In the choice of this colour for the water, we perceive a certain parallel, perhaps accidental, with the representation of the river in the allegory of the Tagus in the Central Room of the Pleasure House.

The theme of the panel and the image of Europa are somewhat related to the depiction of female nudity in other panels in the House of Pleasure: *The Abduction of Hippodamia*, in which the female figure, now lost, was also unrobed, and *Susanna and the Elders* [1]. In all of them, the mythic context justifies the nudity, while the female figure personifies innocence. Together with the *Secret Garden* of fauns, the panels typify the profane part of the estate [1].

The direct or indirect inspiration of the Europa panel in a print by Bernard Salomon is of some interest for the history of the pictorial sources for tile panels in the Iberian context. A similar fact was confirmed in 1961 by Alice W. Frothingham [5] in one of the sets attributed with certainty to Cristóbal de Augusta, a tile painter with northern family antecedents, such as Juan Flores [6] and João de Gois [7]. The set is preserved in the

church of the *Convento de Madre de Dios* in Seville and is made of three panels decorating an altar with *The Four Horsemen of the Apocalypse* on the front, and on the sides *Babylon the Harlot* and *The Angel with the Key*. The composition of the three scenes is inspired by three woodcuts by Bernard Salomon illustrating the edition of Jean de Tournes' *Figures du Nouveau Testament*, published in Lyon in 1554. This coincidence proves that the Lyon editions illustrated by Salomon were widespread in the Iberian Peninsula, and that at least Cristóbal de Augusta used them in his panels painted in Seville sometime between 1569 and 1588, the latest known date of his productions.

The lower panel of the water chest has the same dimensions of *The Rape of Europa*, and seemingly the repeating design of mascarons was sketched so as to adapt its module to those set dimensions. The design of three heads in medallions may trace its ancestry to fronts of chests such as the ones illustrated in Figures 3 and 15. Mascarons were very often used in connection with other grotesque designs during the Renaissance (Figure 6). Observing the panel in Figure 1, there was obviously the intention to use many of the decorative elements also used to compose the design illustrated in Figure 6: female mascarons with a peculiar headdress, medallions set in *ferronerie*, festoons, foliage... Yet, in the panel the varied elements do not build up a balanced whole: *ferronerie* is seen both inside and outside the medallions, sometimes curled but with edges missing and without forming continuity. The design must have been adapted from one or more sources without the sense of proportion and of perspective needed for a good result. But in the end, the colourful paint - with the mascarons depicted against a dark yellow and orange shield - imparts a gaiety that distracts from the graphic failures.

A panel presently in the *Museu Berardo Estremoz* (in South Portugal) depicts one more module of the design, with a single mascarón (Figure 2). It is part of a longer wainscot panel removed from a house before its demolition [3] and a comparison with Figure 1 confirms that the design and colours show only minimal differences between the two panels. It is interesting to note that the module is the same, suggesting that the wainscot must have been made after the panel for Bacalhôa, likely by the same workshop and transposed from the exact same stencil.



**Figure 6.** A pattern of *groteschi* published ca. 1580 with *ferronerie* cartouches and two mascarons - one male, one female, by Theodor de Bry (Liège 1528 – Frankfurt 1598) (image: Metropolitan Museum of Art - The Elisha Whittelsey Collection).

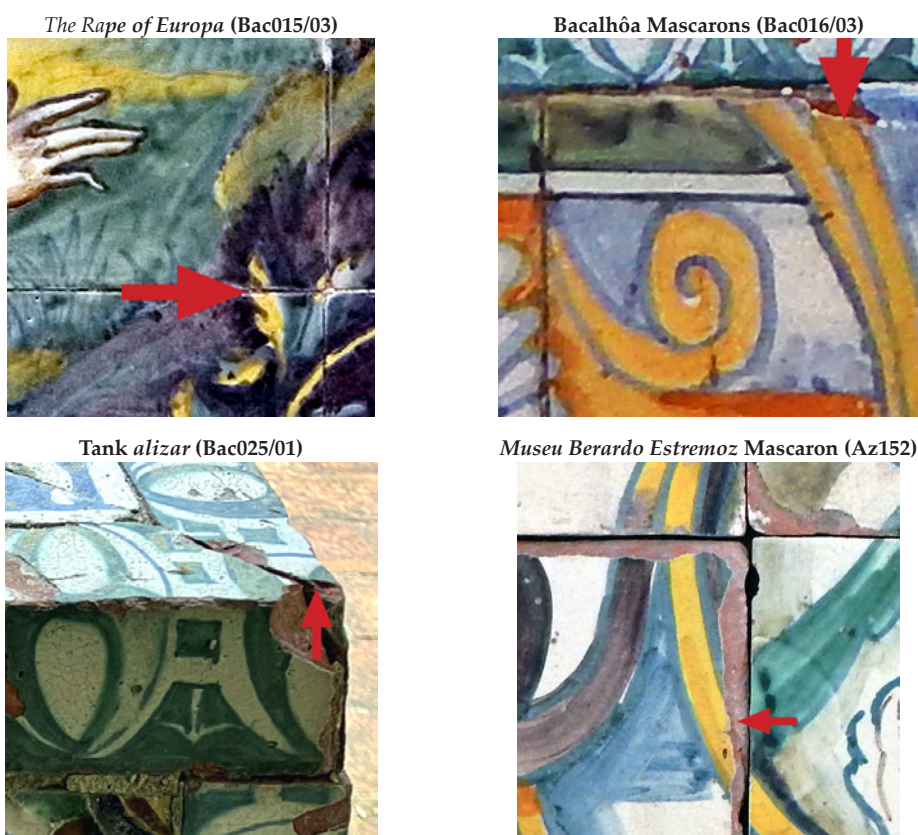


### 3. ANALYTICAL CHARACTERIZATION BY SEM-EDS

#### 3.1. Samples

Figure 7 illustrates some sampling spots and the codes attributed through which the samples were referenced. Sampling was done with a scalpel in areas already damaged. The images show that whenever the biscuit is clearly visible, its colour is of a hue of terracotta, at times quite dark. Actually, it was verified that the biscuits of all original tiles in the panels, as well as the *alizes*, are of this colour range.

Table 1 includes data on each item studied. The first column (*Identification*) includes the name of the panel or other similar exclusive labelling, by which the object will be identified. The second column (*Sample references*) includes the technical references of the items prepared for observations and analyses. The last column indicates how many measurements were averaged in the semi-quantification of the chemical composition of the glazes and biscuits of each item.



**Figure 7.** Examples of sampling spots on previously damaged areas of panels and tiles.

**Table 1.** Identification of items, sample references, and number of analytical results averaged

Identification	Sample References	Total nr. of results
<i>The Rape of Europa</i> panel	Bac015/02; -/03	6 (glaze); 2 (biscuit)
Bacalhôa Mascarons panel	Bac016/02; -/03	2 (glaze); 2 (biscuit)
Bacalhôa tank <i>alizes</i>	Bac025/01; -/02; -/03	5 (glaze); 4 (biscuit)
Museum Mascaron panel	Az152	1 (glaze); 1 (biscuit)

### 3.2. Methods and instrumental means

The azulejo samples were stabilized in epoxy resin, lapped and polished to obtain a flat cross-section for observation and analysis by scanning-electron microscopy coupled with an X-ray energy-dispersive spectrometer (SEM-EDS).

SEM observations and EDS analyses were made at LNEC using a TESCAN MIRA 3 field emission microscope combined with a BRUKER XFlash 6|30 EDS system. The samples were uncoated and the observations were made in backscattered electrons mode (BSE), with a chamber pressure of typically 10 Pa, at an accelerating voltage of 20 kV with the sample sections at a distance of  $14 \pm 1$  mm from the detector. SEM images were typically acquired at magnifications of 350 x and 700 x for the glaze and 1,000 x or over for inclusions in the biscuit.

The selection of areas for EDS quantification avoided large inclusions in the glaze or biscuit representing more than ca. 5% of the full selected area. From our previous experience, the adequate minimum measurement areas are  $200 \times 200 \mu\text{m}$  for glazes and  $500 \times 500 \mu\text{m}$  for biscuits. In general, multiple measurements were made and in such case the results are averages and smaller non-overlapping areas may be used to the same effect. Whenever possible, the analyses were performed on white glazes to avoid interference from elements diffused from the blue, green or violet pigments which, when present, were neglected. The yellow pigments remain at the surface and therefore do not entail the same problem. Still, in the case of zinc-bearing yellow pigments, the analyses must be performed at a safe distance from the colour.

Minor elements, usually representing less than 1% of the compositions, such as magnesium (Mg) and iron (Fe) in the glazes, or titanium (Ti) in the biscuits were not included in the tables of results.

The quantification of tin (Sn) in the glazes may be problematic because the aggregation of crystals often results in a large variance. That problem was dealt with by using larger areas whenever aggregation was visually detected in the SEM images or, when that was not possible, averaging the results of multiple analyses on different areas.

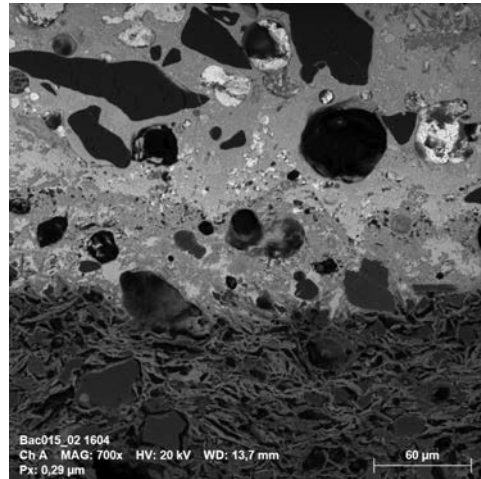
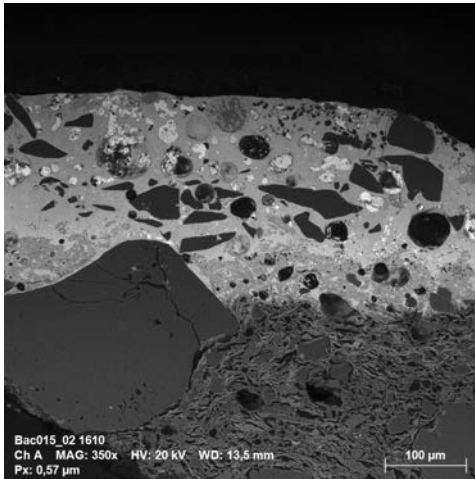
The amount of oxygen (O) was calculated through the remaining elements stoichiometry of their most commonly considered oxides ( $\text{Na}_2\text{O}$ ,  $\text{MgO}$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{SiO}_2$ ,  $\text{K}_2\text{O}$ ,  $\text{CaO}$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{SnO}_2$ ,  $\text{PbO}$ ) and the result was normalized to 100 %.

### 3.3. Results

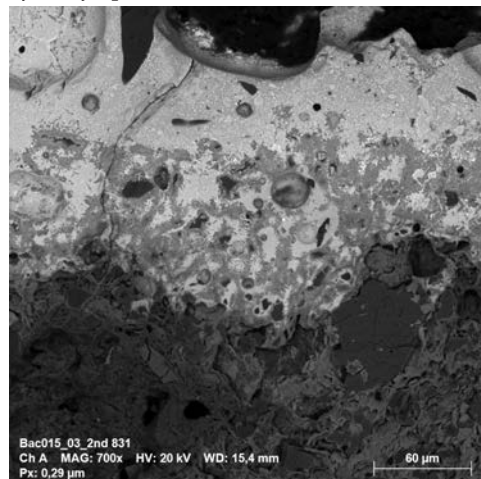
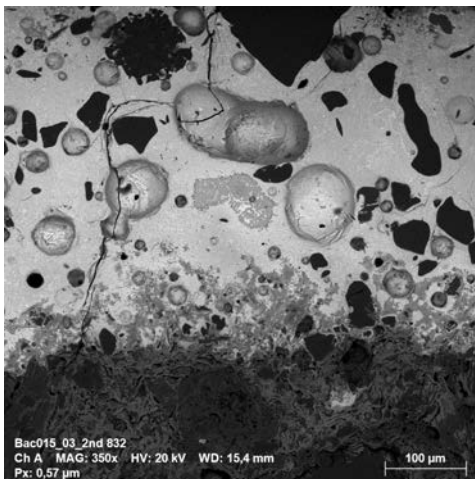
#### 3.3.1. Morphology of the glazes

Figure 8 depicts, at the same magnifications for comparison purposes, sectional SEM images of samples from all panels showing the main micro-morphological characteristics generally associated with the glazes and their interfaces. The light grey area on top is the glaze, while the dark grey area corresponds to the biscuit. Because of its colour, the inclusions in the glaze are conspicuous: gas bubbles retained in the glass, grains of sand (larger compact dark inclusions, usually with rounded edges) and bits of feldspars, often in disaggregation. The white spots in the midst of the glaze are crystals of the opacifier (tin oxide) while a continuity of similar white spots near the surface of Az152 corresponds to the lead-rich yellow pigments. It will be noticed that *coperta* (a layer of transparent glaze) was not applied over the yellow colour.

Bac015/02 (*The Rape of Europa* panel)

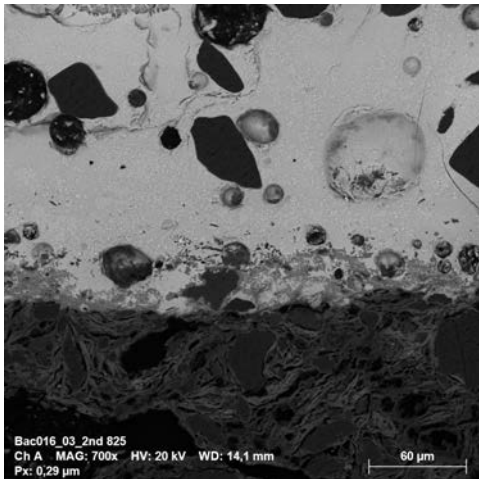
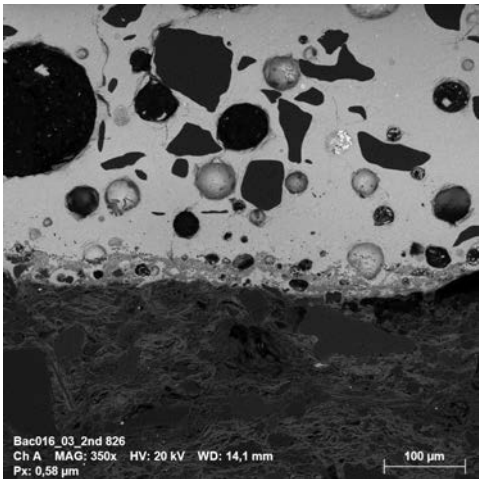


Bac015/03 (*The Rape of Europa* panel)

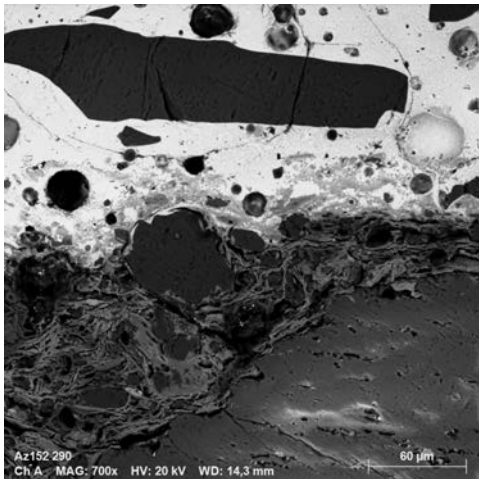
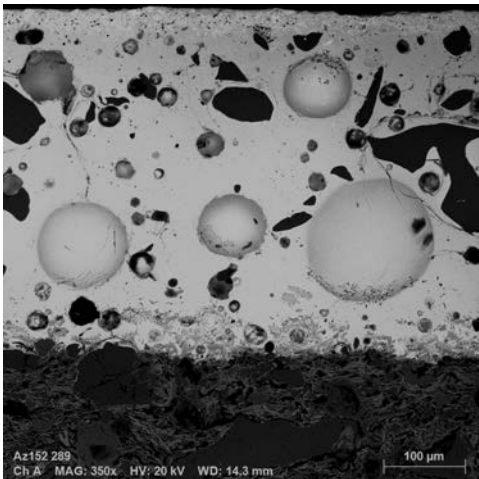




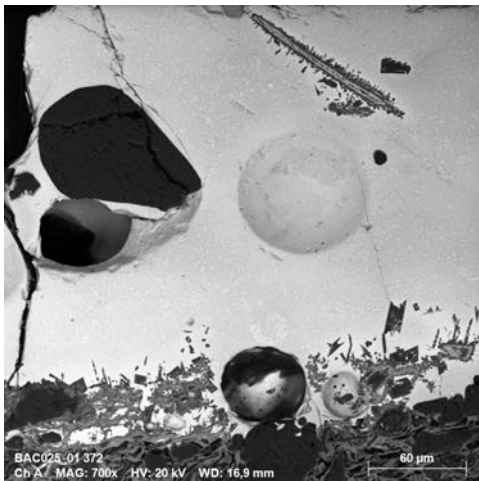
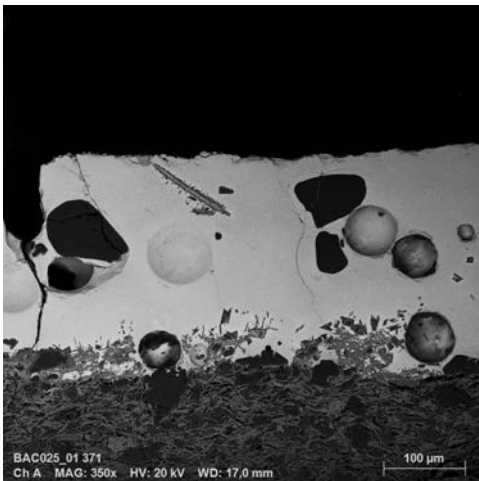
Bac016/03 (Bacalhôa Mascarons panel)



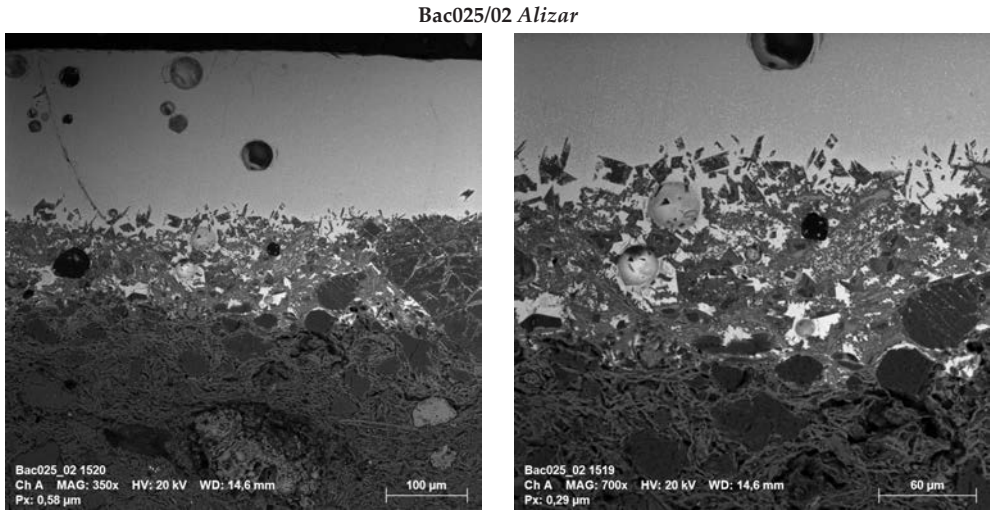
Az152 (Museum Mascaron panel)



Bac025/01 Alizar







**Figure 8.** SEM-BSE images showing the main micro-morphological characteristics of the tiles from *The Rape of Europa*, Mascarons panels and the tank *alizares*. Left side: glaze section at 350 x; Right side: detail of the biscuit-glaze interfaces at 700 x (images: LNEC).

### 3.3.2. Composition of the glazes

Table 2 includes the semi-quantitative results of analyses of the glazes by EDS in weight %. The silicon to lead ratios (Si/Pb) have been determined and are also included in the table. This ratio is a technological trait set by the glaze recipe and gives important information about the firing conditions in the kiln because the lower the ratio, the lower the temperature at which the glaze could be properly fired.

**Table 2.** Semi-quantitative composition of the glazes of the tiles studied, determined by EDS (values in wt. % with oxygen obtained by stoichiometry and sum of all elements normalized to 100%) with Si/Pb ratios included

Sample		O	Na	Al	Si	K	Sn	Pb	Si/Pb
<i>The Rape of Europa</i>	<b>average</b>	27.03	<b>0.25</b>	<b>3.09</b>	<b>14.65</b>	<b>1.01</b>	<b>16.26</b>	<b>37.71</b>	<b>0.39</b>
	st. deviation	-	0.04	0.40	1.42	0.13	2.81	6.10	
	cv	-	0.16	0.13	0.10	0.13	0.17	0.16	
Bacalhôa Mascarons	<b>average</b>	25.50	<b>0.16</b>	<b>2.60</b>	<b>14.16</b>	<b>0.67</b>	<b>12.84</b>	<b>44.07</b>	<b>0.32</b>
	st. deviation	-	0.07	0.39	0.26	0.08	0.19	0.99	
	cv	-	0.42	0.15	0.02	0.11	0.01	0.02	
Museum Mascaron	-	24.59	<b>0.15</b>	<b>2.21</b>	<b>13.42</b>	<b>0.66</b>	<b>13.49</b>	<b>45.48</b>	<b>0.30</b>
Edge <i>alizares</i>	<b>average</b>	27.75	<b>0.57</b>	<b>2.75</b>	<b>16.45</b>	<b>1.53</b>	<b>11.02</b>	<b>39.93</b>	<b>0.41</b>
	st. deviation	-	0.40	0.93	3.59	0.24	1.19	10.13	
	cv	-	0.71	0.34	0.22	0.16	0.11	0.25	

Note: *st. deviation* indicates the standard deviation of all values averaged in the result; *cv* indicates the coefficient of variation ( $cv = \text{st. deviation} / \text{average}$ )

### 3.3.3. Composition of the biscuits

Table 3 includes the semi-quantitative results of analyses of the biscuits by EDS in weight %. Lead occurs in most cases deriving from percolation into the biscuit when the raw glaze is applied. Its content was determined but not considered because it is not part of the natural composition of the biscuit and depends on the proximity to the interface. The presence of lead renders the quantification of sulphur doubtful because of a superposition of spectrographic peaks and therefore it too was not considered, as well as elements of contents often below 1% such as phosphorus, chlorine and titanium. The distinctive calcium to silicon ratios (Ca/Si), related with the appetite for tin-glazing and the colour of the biscuit when fired in an oxidation atmosphere, was determined and is included in the table.

**Table 3.** Semi-quantitative composition of the biscuits of the tiles studied, determined by EDS (values in wt. % with oxygen obtained by stoichiometry and sum of all elements normalized to 100%) with Ca/Si ratios included

Sample		O	Na	Mg	Al	Si	K	Ca	Fe	Ca/Si
<i>The Rape of Europa</i>	<b>average</b>	46.56	<b>1.17</b>	<b>1.29</b>	<b>10.52</b>	<b>27.54</b>	<b>3.79</b>	<b>4.26</b>	<b>4.87</b>	<b>0.15</b>
	st. deviation	-	0.23	0.60	0.09	1.43	1.05	2.28	0.00	
	cv	-	0.19	0.47	0.01	0.05	0.28	0.54	0.00	
<b>Bacalhôa Mascarons</b>	<b>average</b>	46.39	<b>0.97</b>	<b>1.22</b>	<b>9.81</b>	<b>27.41</b>	<b>2.65</b>	<b>6.86</b>	<b>4.69</b>	<b>0.25</b>
	st. deviation	-	0.09	0.11	0.14	0.14	0.35	0.11	0.43	
	cv	-	0.09	0.09	0.01	0.01	0.13	0.02	0.09	
<b>Museum Mascaron</b>	-	47.00	<b>1.22</b>	<b>1.77</b>	<b>10.57</b>	<b>27.92</b>	<b>2.67</b>	<b>4.80</b>	<b>4.05</b>	<b>0.17</b>
<b>Edge alizares</b>	<b>average</b>	47.39	<b>0.91</b>	<b>1.66</b>	<b>10.64</b>	<b>28.77</b>	<b>3.38</b>	<b>2.36</b>	<b>4.90</b>	<b>0.08</b>
	st. deviation	-	0.27	0.50	0.45	1.02	0.34	1.22	0.66	
	cv	-	0.30	0.30	0.04	0.04	0.10	0.52	0.14	

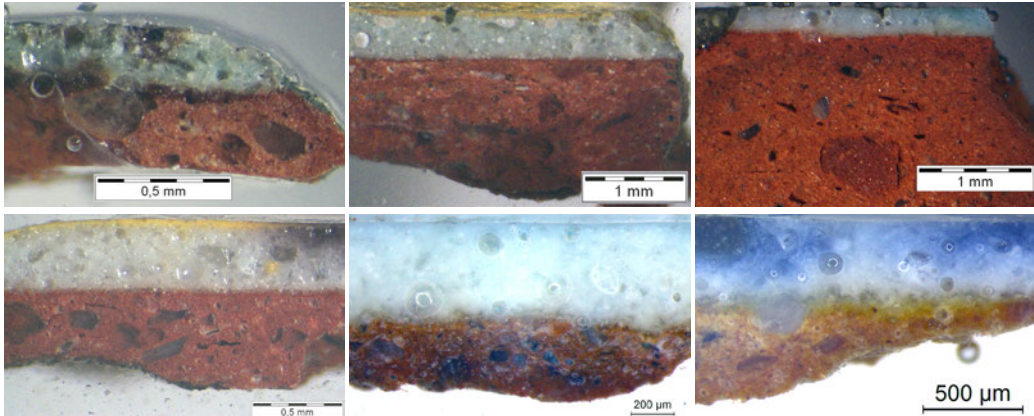
## 4. DISCUSSION OF THE INSTRUMENTAL RESULTS

The biscuits of all tiles are the colour of terracotta, particularly intense in the case of the *alizares*. This colour results from firing calcium-poor clays in an oxidation atmosphere, but such clays are generally considered unsuited for majolica, where a relatively high content in calcium results in cream biscuits to which glazes connect easily, also needing less of the expensive tin oxide for proper opacification. And yet, for several years, maybe for an extended period of more than two decades, terracotta was precisely the colour of many of the biscuits of the circle of João de Góis, such as the panel *Nossa Senhora da Vida* (Figure 10) and the lining of *Capela de São Roque* dated “1584” [8]. Concerning *São Roque*, José Queirós remarked in 1913 about the unsuitability of low-calcium clays: “The tiles [...] are of red clay. The red clay, when not from Vale do Pereiro,<sup>7</sup> more or less drives the tin-glaze out” [9].<sup>8</sup> Another disadvantage is that those biscuits need a glaze with a high

<sup>7</sup> *Vale do Pereiro* is an area in Lisbon, now urbanized, from where, at the time of the author’s writing, were extracted clays from a Miocene layer called “Argila dos Prazeres” which, probably, was not the exact clay used in the panels addressed by Queirós.

<sup>8</sup> “Os azulejos [...] são de barro vermelho. O barro vermelho, quando não tem as qualidades do do Valle do Pereiro, atira mais ou menos com o esmalte fóra”.

content in expensive tin, otherwise the dark biscuit colour will come through and taint the whiteness of the glaze. Figure 9 depicts the range of hues, comparing optical images of samples from the panels presently studied with samples of panels by the workshop of João de Góis and, possibly, associates sharing the same technology.



**Figure 9.** From left to right, upper row: Bac015/02 (*The Rape of Europa*); Bac016/03 (*Bacalhôa Mascarons*); Bac025/01 (*Alizar*); lower row: Az152 (*Museum Mascarons*); Az032/01 (*Nossa Senhora da Vida*); Az068/05b (*Capela de São Roque*,<sup>9</sup> Lisbon).

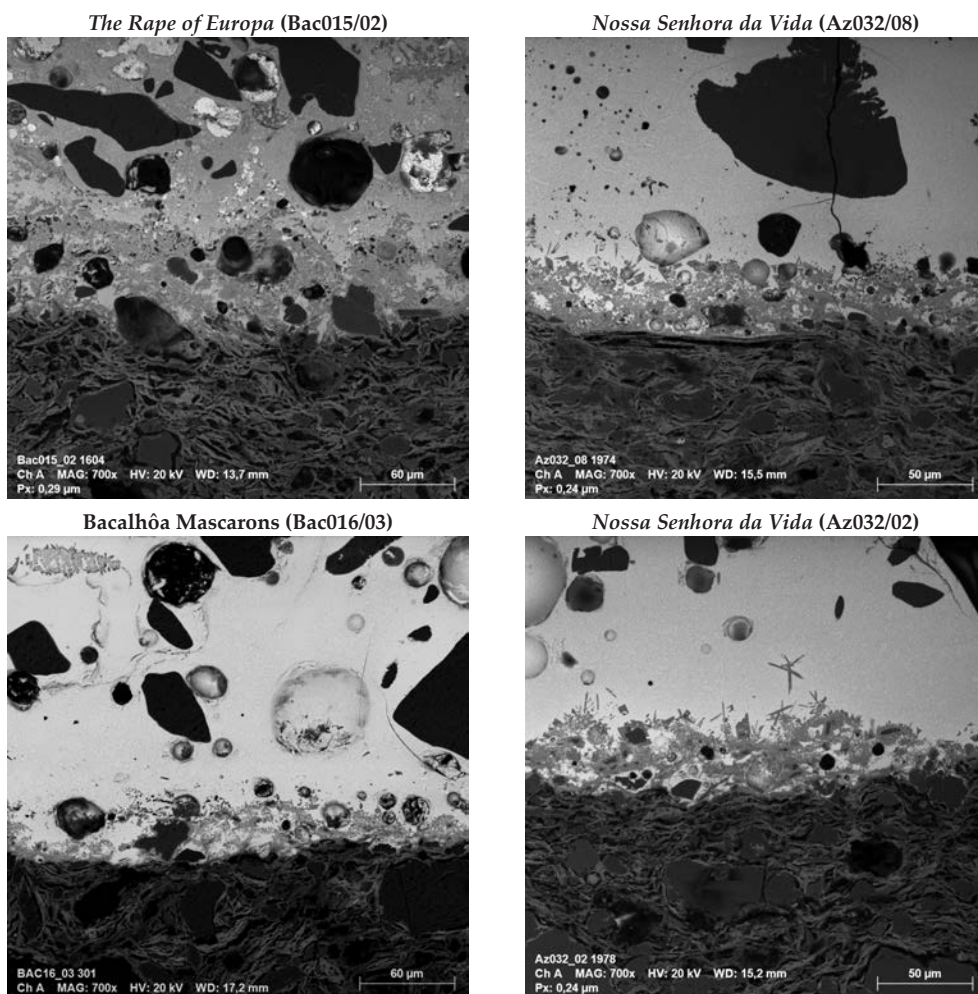


**Figure 10.** The lower part of the panel *Nossa Senhora da Vida* (image © Museu Nacional do Azulejo, Lisbon).

9 In this case, some samples are of a cream colour, not because of a recurring high content in calcium, but because the kiln atmosphere must have been better controlled by 1584, when the panel was manufactured.



The fact that these calcium-poor clays, used in Lisbon in the 1560s until at least the 1580s, are difficult and expensive to tin-glaze and therefore rarely used elsewhere for majolica, points immediately to a local production when such biscuits are found in 16th century tiles. The earliest known tiles by the workshop of João de Góis are those in the signed panel of *Igreja da Graça*, very likely connected to the burial of Afonso de Albuquerque there in 1566 [10] but they depict several shades of biscuit colours from cream to terracotta, likely derived from the use, at this time, of clay from a thin Miocene sublayer richer in calcium albeit with very variable composition [to be published]. The earliest known panel to depict in general the same range of biscuit colours seen in *The Rape of Europa* and the Mascarons panels is *Nossa Senhora da Vida*, once at *Igreja de Santo André* in Lisbon and presently in *Museu Nacional do Azulejo* (Figure 10). This is attributed to the workshop of João de Góis based on an incomplete signature and presumed to date from the second half of the 1570s to 1581 [11]. Figure 11 compares the interfaces of several glaze sections of this panel with those of tiles of the panels presently studied, showing that they have a comparable development and morphology.



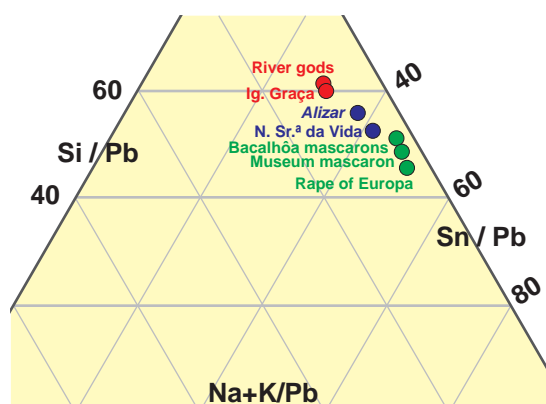
**Figure 11.** Comparison of the interfaces of samples from *The Rape of Europa* and Mascarons (left side) with *Nossa Senhora da Vida* (right side) (images: LNEC).

Table 4 compares the average glaze compositions of all panels with the tiles in *Igreja da Graça* signed by João de Góis, the panel *Nossa Senhora da Vida* and, for good measure, the five river god panels of the west loggia of the Palace of Bacalhôa [12].

**Table 4.** Comparison of the average glaze semi-quantitative compositions by EDS of the panels and tiles studied with samples from the panel in *Igreja da Graça* signed by João de Góis, the panel *Nossa Senhora da Vida* and the five river god panels of the west loggia of the Palace of Bacalhôa

Sample	O	Na	Al	Si	K	Sn	Pb	Si/Pb
<i>The Rape of Europa</i>	27.03	0.25	3.09	14.65	1.01	16.26	37.71	0.39
Bacalhôa Mascarons	25.50	0.16	2.60	14.16	0.67	12.84	44.07	0.32
Museum Mascaron	24.59	0.15	2.21	13.42	0.66	13.49	45.48	0.30
Edge alizares	27.75	0.57	2.75	16.45	1.53	11.02	39.93	0.41
João de Góis <i>Igreja da Graça</i>	29.83	0.83	3.27	18.35	2.11	9.22	36.39	0.50
<i>Nossa Senhora da Vida</i>	24.84	0.81	2.34	13.83	0.79	11.09	46.30	0.30
Loggia river gods	28.10	0.71	1.92	17.76	2.12	8.66	40.72	0.44

The results in Table 4 show that the characteristic traits of the glaze formulations associated to the productions of the workshop of João de Góis: relatively low contents in sodium (Na) and potassium (K); and high contents in tin (Sn) and lead (Pb) with a Si/Pb ratio of around  $0.4 \pm 0.1$  [13, p.40] are present in all panels. To assess graphically the relative standing as pertains to the percent contents in the relevant elements, towards a possible finer discrimination, Figure 12 depicts the ratios Si/Pb, (Na+K)/Pb and Sn/Pb in a ternary plot. The normalization to the content in lead was made so that the other contents might be comparable with the very important silica to lead ratio.



**Figure 12.** Ternary plot of ratios related to relevant elemental contents in the glazes.

Figure 12 confirms graphically the proximity of all compositions as pertains the elements considered. It may, however, be noted that *The Rape of Europa* and the Mascarons panels are closer to *Nossa Senhora da Vida* than to the panels of *Igreja da Graça* and the river gods.

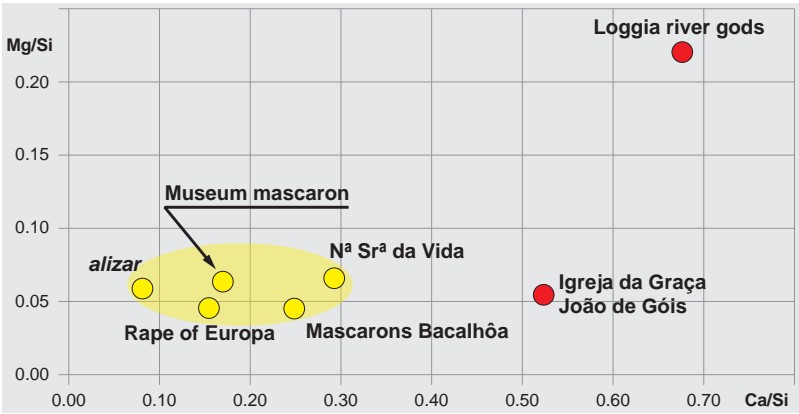
Table 5 compares the average biscuit compositions of all panels with the tiles in *Igreja da Graça* signed by João de Góis, the panel *Nossa Senhora da Vida* and, again, the five river god panels of the west loggia of the Palace of Bacalhôa.

**Table 5.** Comparison of the average biscuit semi-quantitative compositions by EDS of the panels and tiles studied with samples from the panel in *Igreja da Graça* signed by João de Góis, the panel *Nossa Senhora da Vida* and the five river god panels in the loggia of the Palace of Bacalhôa

Sample	O	Na	Mg	Al	Si	K	Ca	Fe	Ca/Si
<i>The Rape of Europa</i>	46.56	1.17	1.29	10.52	27.54	3.79	4.26	4.87	0.15
Bacalhôa Mascarons	46.39	0.97	1.22	9.81	27.41	2.65	6.86	4.69	0.25
Museum Mascaron	47.00	1.22	1.77	10.57	27.92	2.67	4.80	4.05	0.17
Edge <i>alizes</i>	47.39	0.91	1.66	10.64	28.77	3.38	2.36	4.90	0.08
João de Góis, <i>Igreja Graça</i>	44.44	0.90	1.33	8.37	24.85	3.30	13.02	3.79	0.52
<i>Nossa Senhora da Vida</i>	45.37	1.35	1.70	10.24	25.27	3.52	7.44	5.11	0.29
Loggia river gods	43.49	0.87	4.75	8.31	21.59	2.27	14.55	4.18	0.67

Of the characteristics of the clay used in Lisbon at the time: relatively low content in magnesium (Mg), relatively high content in potassium (K) and very low content in calcium, with Ca/Si ratios around 0.3 but, in some instances, lower [8; 13], all are present in *The Rape of Europa*, both Mascarons panels and *Nossa Senhora da Vida*. The edge *alizes* also comply with these characteristics but have an unusually low Ca/Si ratio (highlighted in Table 5 against a blue background). The signed panel at *Igreja da Graça* differs only in the unusually high content in calcium (yellow cells in Table 5), while the clay used in the biscuits of the river god panels differs on all counts (purple cells in Table 5), but particularly in the relatively high content in magnesium, highlighted in red on Table 5.

Based on the most remarkable distinguishing characteristics, the contents in magnesium and calcium, Figure 13 plots the ratio Mg/Si against the ratio Ca/Si of the biscuits of all panels and the *alizes*. The loggia river god panels and the signed panel of *Igreja da Graça* are clearly separated, but all the other panels and the *alizes* may be clustered together. Again in this case the panel *Nossa Senhora da Vida* is seen to be particularly close to *The Rape of Europa* and the Mascarons panels.



**Figure 13.** Scatter plot of ratios related to relevant elemental contents in the biscuits.

The analytical similarity with the panel *Nossa Senhora da Vida* suggested a comparison of the paintings, resulting in a few hints of affinity, but nothing conclusive. For instance, considering the colours of the garments, nothing may be inferred from colours obtained

from a single pigment, such as the manganese purple used in Europa's wimple, but the tunic of Europa is painted in two colours (saffron yellow and brown) that can only be obtained by mixing pigments, and similar colours are used in *Nossa Senhora da Vida* for the same purpose. There is also a small plant, sketched with a distinctive morphology, occurring in both panels (Figure 14).



**Figure 14.** The use of similar colours for the golden garments of Europa (left side) and St. Luke from the panel *Nossa Senhora da Vida* (centre). Right side: depiction of an unclassified similar plant in *The Rape of Europa* (top) and *Nossa Senhora da Vida*.

## 5. CONCLUSIVE NOTES

The panel *The Rape of Europa* was (directly or indirectly) sketched after an illustration in a book first published in 1563 in Frankfurt, therefore its chronology must be more recent, probably by several years. The technical characteristics of the panels studied correlate with the characteristics of panels attributed to the workshop of João de Góis, or his close associates [8; 13] of which the technical similarity with the panel *Nossa Senhora da Vida*, dated from the second half of the 1570s up to 1581 [11] is particularly remarkable. But, although *The Rape of Europa* is not actually as mediocre as a superficial assessment may lead to believe, its artistry is certainly inferior to *Nossa Senhora da Vida*.

The main lining of Bacalhôa with majolica tiles dates from around 1565 and the death of Brás [Afonso] de Albuquerque in 1581 sets a limit to the purchase of tiles [1]. When trying to ascribe the panel within that period, considering that Albuquerque was born in 1500, one is tempted to presume that he would more likely make new purchases earlier in the period, then at a time when he was already over 70 and with diminishing life prospects. That piece of logical reasoning may, however, be unsuited in this case because Albuquerque was seemingly undeterred by his age and, even though he was wealthy enough to live in idle retirement, he occupied a number of important and demanding positions in public service until 1574, when he sought excuse as president of the Lisbon Senate justifying his request with the excessive work for his age... Still, in



1578 he represented Lisbon in the *Cortes*<sup>10</sup> for which he had been elected and he was a defeated candidate for the same office in the 1579 election, when he was 78 or 79 years old [14]. Brás [Afonso] de Albuquerque's wife Maria de Noronha died during the 1570s and maybe that was the reason why he sought excuse from his post in Lisbon because notwithstanding his age, he wooed a lady of noble birth, Catharina de Menezes, who was 40 or more years his junior, and with whom he re-married. Therefore, age does not seem an obstacle in this case, and the water chest may plausibly have been commissioned during the 1570s, even in the late years of the period.

There is a detail that remains unexplained: what may have prompted such a unique design for a water tank? In Renaissance Italy the family of a bride used to offer a special chest called *cassone* with a dowry (Figure 15). A rich *cassone* might be decorated inside with a painted scene symbolically related to marriage (Figure 16). A conceivable hypothesis is that the chest may be related with the re-marriage of Albuquerque. If it was made on that occasion, then the scene depicted may also be freely interpreted as Brás [Afonso] eloping with his young bride over the Tagus to Bacalhôa. Did he order the chest himself? Or was it offered as a dowry by the bride's family because of his fondness for majolica tiles?<sup>11</sup> We cannot know unless some documental evidence is one day found, but although the exact date of his second marriage is as yet unknown, a connection would place the panels well into the 1570s and that date would indeed fit with the technical proximity to the panel *Nossa Senhora da Vida*.



**Figure 15.** An Italian renaissance *cassone*, typically a marriage chest given at the time of the wedding by the family of the bride (image: Wikimedia Commons, picture taken at *Palazzo Vecchio*, Florence, Italy, by JoJan).

<sup>10</sup> A national legislative assembly usually convened by the king or to recognize a new king.

<sup>11</sup> Just such an instance occurred in 1602 when the Duke of Frías, Juan Fernández de Velasco y Tovar, father of Ana de Velasco y Téllez-Girón, acquired figurative wainscot panels to the Loayza workshop in Talavera [3, p.88], presumably as part of the dowry for his daughter's marriage in 1603 to the Duke of Bragança D. Teodósio II. The panels still grace two of the rooms of the ducal palace in Vila Viçosa.



**Figure 16.** A panel for (presumably) the inner lid of a *cassone*, with a scene from the moral tale of Penelope and Ulysses (Italy, ca. 1475, image © Victoria & Albert Museum, London, acc. Nr. 5792-1860).

The *alizares* are interesting on their own, because the clay is not exactly the same, and in terms of aptitude for tin-glazing, for which a relatively high content in calcium was always considered desirable [15], their clay should be considerably worse than the clay used for the panels. And maybe for that reason the *alizares* have, today, large lacunae and restored areas because of the detachment of glaze. There are several Miocene clay layers in the region of Lisbon, one of which has for long been used by red-clay potters because it crops in the castle hill. We explored that layer and researched the composition of its ca. 21 m thickness.<sup>12</sup> Most of its sublayers are calcium-poor, corresponding to the biscuit of the *alizares*, while the sublayers corresponding to clays similar to those used in the panels are narrower and the sublayers producing clay with higher calcium contents, as found at *Igreja da Graça*, are thin and with a very variable composition. If to the quality of the clays was attached a price tag, the *alizares* were manufactured with a cheaper clay, either because they were considered work of a lesser responsibility or, as seems more likely, because the manufacture of the shaped dihedral biscuits was sourced out to a different potter's workshop where that particular sort of clay was used. Still, the glazing, painting and almost surely the firing was done at the same workshop that manufactured the panels, because the glaze composition and the morphology of the glaze-biscuit interfaces are very similar to those of the panels.

If future research contributes results towards the narrowing of the date estimate for *The Rape of Europa* and the Mascarons, it may prove of great interest towards the definition of the evolution over time of the productions of the workshop of João de Góis. If a date in the second half of the 1570s may be confirmed, then *The Rape of Europa* and the Mascarons were likely the last majolica tiles applied in the estate during the life of Brás [Afonso] de Albuquerque while, on the other side, the dihedral *alizares*, which became common in Portugal during the 17th century, are certainly among the earliest produced in Portugal.

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<sup>12</sup> This is the *Forno do Tijolo* clay and the results will be published when the research is concluded.

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