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journal homepage: www.elsevier.com/locate/jasrepProvenance studies on *façon-de-Venise* glass excavated in PortugalI. Coutinho^{a,b,e,*}, T. Medici^a, L.C. Alves^c, B. Gratuze^d, M. Vilarigues^{a,e}^a Research Unit VICARTE, Vidro e Cerâmica para as Artes, Faculdade de Ciências e Tecnologia, Universidade NOVA de Lisboa, Campus de Caparica, 2829-516 Caparica, Portugal^b LAQV-REQUIMTE (Departamento de Química), Faculdade de Ciências e Tecnologia, Universidade NOVA de Lisboa, 2829-516 Caparica, Portugal^c C2TN, Instituto Superior Técnico, Universidade de Lisboa, E.N.10, 2695-066 Bobadela LRS, Portugal^d IRAMAT, Centre Ernest-Babelon, CNRS Université d'Orléans, 3D rue de la Ferrollerie, 45071 Orléans Cedex 2, France^e Department of Conservation and Restoration, Faculdade de Ciências e Tecnologia, Universidade NOVA de Lisboa, Campus de Caparica, 2829-516 Caparica, Portugal

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ABSTRACT

In this study *façon-de-Venise* glass objects from several Portuguese archaeological sites were studied aiming at characterising their chemical composition, discussing the raw materials and possible provenance. These objects were found during four archaeological excavations performed in Portugal (at Santa Clara-a-Velha Monastery (SCV) in Coimbra, São João de Tarouca Monastery in Lamego (SJT), Miguel Fernandes Square in Beja (PMF) and at the courtyard of the University of Coimbra (CPU)). Most fragments are dated to the 17th century, with only two objects being dated between the 14th and 15th centuries. These last two fragments, due to chronological reasons, can't be attributed to a *façon de Venise* production, but were included in this study for comparison. The glass composition was characterised by means of particle induced X-ray emission (μ-PIXE), laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS), and UV-Vis reflectance spectroscopy. All thirty-one objects are composed by soda-lime-silica glass and the use of coastal plants as raw materials is suggested by the contents of MgO, K₂O, P₂O₅ and chlorine. The observed greyish/bluish glass hue was also investigated and UV-Vis analysis allowed one to identify Co and Fe as the cations responsible for that hue.

Through the analysis of silica trace elements and of the flux agents it was possible to associate four objects, from the Santa Clara-a-Velha Monastery assemblage, to Venetian production (three objects of *crystallo* and one object of *vitrum blanchum*) and to identify two other distinct production lines.

One group comprising fragments from São João de Tarouca Monastery, presented medium alumina contents, differing from known *façon-de-Venise* production centres. The other group includes most fragments from Miguel Fernandes Square assemblage and has high alumina values, which, once again, is not consistent with any of the known *façon-de-Venise* production centres. For these reasons, the existence of new *façon-de-Venise* production centres is proposed.

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1. Introduction

Recent archaeological excavations in Portugal have yielded several glass sets dated between the 16th and 17th centuries. Amongst the assorted objects' types collected, it was possible to identify an important number of fragments with *façon-de-Venise* stylistic attributes (Medici, 2015).

From the 16th century onwards, *façon-de-Venise* glass was the manifestation of the Venetian taste, spreading in Europe throughout several production centres, mainly as a consequence of the Venetian glassmakers' emigration. A number of papers devoted to the analysis of

Venetian and *façon-de Venise* glass objects discussed not only the employed raw materials in the manufacture of these items, but also their probable production locations (De Raedt et al., 2001, 2002; Šmit et al., 2004, 2009; Verità and Zecchin, 2009; Moretti and Hreglich, 2013). Chemical analysis and research on ancient treatises (Verità and Zecchin, 2009) lead to the understanding that the raw materials employed in Venetian and *façon-de Venise* glass production were carefully selected, in order to accomplish the high quality glass that made it one of the most wanted luxury items throughout Europe. For example, during the 14th century Venetian glassmakers started to use quartz pebbles from the Ticino River as a silica source, replacing the use of impure sands.

Considering glass production in Portugal, documentary sources report that glassmakers from Italy (Venice and Altare) and from Antwerp were settled in the Portuguese territory from the 17th century onwards (Frothingham, 1941; Valente, 1950; Custódio, 2002; Amado Mendes, 2002). A glass furnace directly related to the Royal House of Bragança was built in the village of Vila Viçosa (Southeast of Portugal) and ruled

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by the Venetian Pero Paulo. Private letters mention the glass produced in this kiln, referring its great quality. Details about raw materials include references to the employment of both grounded and crushed quartz pebbles as the silica source (Custódio, 2002). Unfortunately, there is no archaeological data available for this furnace so far, and the objects resulting from this production are currently unknown. However, considering this documentary information, the possibility is raised that a *façon-de-Venise* production has occurred in Portugal.

The aim of this paper is to characterise a group of *façon-de-Venise* objects retrieved from four archaeological excavations in Portugal and to discuss their provenance by comparing the chemical compositions with both Venetian glass and glasses from known *façon-de-Venise* production centres. Glass natural hues will also be disclosed. Previous results regarding *millefiori* glass from Santa Clara-a-Velha Monastery (Lima et al., 2012) will be particularly relevant for this study due to correlations with the archaeological contexts approached here. For the first time an exploratory investigation is conducted on *façon-de-Venise* objects resulting from different Portuguese archaeological excavations, expecting to bring new information on both the national commercial relationships with other European centres and glass from possible national provenance.

1.1. Archaeological contexts and analysed samples

A set of thirty-one *façon-de-Venise* samples was selected from four archaeological sites (Table 1 and Fig. 1). The source of the assemblages (Fig. 1) under study are Santa Clara-a-Velha Monastery in Coimbra (SCV), São João de Tarouca Monastery in Lamego (SJT), the archaeological excavation at Miguel Fernandes Square in Beja (PMF), and the archaeological excavation at the courtyard of the University of Coimbra (CPU).

Santa Clara-a-Velha Monastery was built in the city of Coimbra between 1283 and 1286. Its closeness to Mondego River resulted in a constant flooding which led to the decision of abandoning the building and to construct a new monastery on a hill located nearby, further from the river bank (Trindade and Gambini, 2009). Regarding the excavated objects, several metal utensils (like spindles, needles, thimbles and scissors), jet adornments, and huge sets of glazed ceramics and Chinese porcelain of high quality were identified. The glass set retrieved from this excavation is dated to the 17th century. From the thousands of glass fragments found at SCV (Ferreira, 2004; Medici, 2015), a set of six objects characterised by their refinement, was selected for this study (photographs of fragments in Appendix A). Three of them show

Table 1
Inventory number, probable typology and applied decoration, colouration, part preserved and dating of the *façon-de-Venise* objects under study.

| Archaeological context | Fragment | Type | Colour | Part preserved | Age (century CE) | |
|------------------------|----------|--|---|---|------------------------------------|---------|
| SCV | SCV-V191 | Vessel with filigree decoration | Uncoloured with white filigree threads | Probably the top of a lid | 17th | |
| | SCV-V193 | Vessel with engraved decoration and an applied prunt (resembling a berry) | Uncoloured | Fragment with the prunt | 17th | |
| | SCV-V194 | Goblet with lion head on stem and covered with gilded decoration | Dark grey | Several fragments of rim walls, stem and foot | 17th | |
| | SCV-V195 | Vessel with engraved decoration | Uncoloured (slightly grey) | Wall and knobs | 17th | |
| | SCV-V404 | Vessel | Uncoloured | Foot and part of the attached body | 17th | |
| | SCV-V408 | Vessel with funnel mouth | Uncoloured | Mouth and part of the attached body | 17th | |
| | PMF0438 | Vessel with coloured rim | Uncoloured base glass with turquoise rim | Part of wall with rim | 14th–15th c. | |
| | PMF0517 | Vessel with coloured rim and mould-blown spiralled strings | Uncoloured base glass with blue rim | Part of wall with rim | 14th–15th c. | |
| PMF | PMF0527 | Drink glass with foot and mould-blown decorated with strings | Uncoloured with gray hue | Foot (base and stem) | 16th–17th c. | |
| | PMF0530 | Vessel with strings forming a large lozenge motif | Uncoloured glass with light blue hue | Part of wall | 16th–17th c. | |
| | PMF0540 | Vessel | Uncoloured | Fragment of wall and rim | 16th–17th c. | |
| | PMF0546 | Drinking glass | Green | Fragment of stem | 16th–17th c. | |
| | PMF0550 | Vessel with mould-blown strings | Uncoloured glass with light blue hue | Fragment of wall and rim | 16th–17th c. | |
| | PMF0556 | Vessel (probably drinking glass) | Uncoloured glass with light gray hue | Part of wall with rim | 16th–17th c. | |
| | PMF0568 | Vessel (probably drinking glass) with mould-blown decoration of vertical strings | Uncoloured glass with light gray hue | Part of wall with rim | 16th–17th c. | |
| | PMF0569 | Vessel (probably drinking glass) | Uncoloured glass with light gray hue | Fragment of folded base | 16th–17th c. | |
| | PMF0570 | Vessel with string (probably mould-blown) applied vertically in S-shape | Uncoloured glass with light blue hue | Part of wall with rim | 16th–17th c. | |
| | PMF0996 | Drinking glass | Uncoloured glass with light gray hue | Part of body with rim | 16th–17th c. | |
| | PMF1010 | Vessel | Uncoloured glass with light gray hue | Part of wall with rim | 16th–17th c. | |
| | PMF1023 | Vessel with wing | Dark blue | Wing and small wall part | 16th–17th c. | |
| | PMF1025 | Vessel (probably drinking glass) | Uncoloured glass with light gray hue | Part of wall with rim | 16th–17th c. | |
| | SJT | SJT0011 | Bottle or flask decorated with filigree | Uncoloured base glass with white filigree strings | Neck and rim | 17th c. |
| | | SJT0012 | Drinking glass with filigree applied | Uncoloured base glass with white filigree strings | Foot base and part of wall and rim | 17th c. |
| SJT0014 | | Vessel with applied filigree | Uncoloured base glass with white filigree strings | Part of wall and rim | 17th c. | |
| SJT0038 | | Vessel in truncated cone shape with white strings applied in spiral | Uncoloured with white strings | Part of wall and rim | 17th c. | |
| SJT0105 | | Vessel with engraved and gilded decoration | Uncoloured | Part of wall | 17th c. | |
| SJT0112 | | Vessel in ice glass (“ghiaccio”) | Uncoloured with a bluish hue | Part of base with applied cord | 17th c. | |
| SJT0122 | | Vessel with filigree or strings applied | Uncoloured base glass with white strings applied | Part of wall and rim | 17th c. | |
| SJT0123 | | Vessel with applied filigree | Uncoloured base glass with bluish hue and with white filigree strings | Part of wall | 17th c. | |
| CPU | SJT0135 | Vessel with strings applied near the rim | Uncoloured with white strings | Part of wall and rim | 17th c. | |
| | CPU0006 | Vessel with filigree decoration | Uncoloured base glass with white filigree strings | Part of wall | 17th c. | |

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