



Amorphous glass fragments from archaeological surface surveys: Potential chronological use of ion beam and isotopic analytical characterization



A. Zucchiatti^{a,e,*}, A. Climent-Font^{a,b}, P.C. Gutiérrez-Neira^a, I. Montero-Ruiz^c, J.M. Fuenlabrada^d, C. Galindo^d

^a Centro de Micro Análisis de Materiales, Universidad Autónoma de Madrid, Madrid, Spain

^b Dpto. Física Aplicada, Universidad Autónoma de Madrid, Madrid, Spain

^c Instituto de Historia, CCHS, CSIC, Madrid, Spain

^d Laboratorio de Geocronología y Geoquímica Isotópica, Universidad Complutense, Madrid, Spain

^e University of the Witwatersrand, School of Physics, Johannesburg, South Africa

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ABSTRACT

Analytical techniques have been used to implement the archaeological information from surface surveys. We have shown that the compositional comparison of amorphous samples, e.g. glass, can provide important chronological information when compared with findings from other sites. A group of 61 glass fragments, recovered from an archaeological surface survey at the site of the Roman city of Duratón (1st to 3rd century AD), near Segovia, Spain, have been analysed by combined Particle Induced X-ray/Gamma-ray Emission (PIXE-PIGE) techniques and by isotope dilution mass spectrometry. Four groups of objects were identified. The largest group by far, corresponds to the typical sodium-rich natron-made Roman glass. Compared with data reported in previous studies, including a few on the Iberian Peninsula, the composition of Duratón natron glass is similar to that of the widespread Roman 1st–3rd century AD glasses. The glasses of the nearby Patones, six of which have been analysed in this study, belong, on the contrary, to the so-called HIMT glass. This is compatible with the soda-lime-silica glass pattern observed in the Western Mediterranean. HIMT glass is dominant in this area from the 4th century onward. HIMT glass products are much easier to make and less expensive. Strontium and neodymium isotope analysis confirms the compositional proximity of the Duratón glasses to three groups of 1st–3rd century samples from Barcino, Lyon and the Iulia Felix wreck and point to a production of the glass in the Eastern Mediterranean. Pliny the Elder in his *Naturalis Historia* had specifically mentioned the glass production of Hispania and Gallia, which should hopefully be confirmed by the findings in the corresponding regional sites. This is the case for Gallia but not yet for the Iberian Peninsula, where few Roman glass analyses have been completed.

1. Introduction

Surface survey is an archaeological method to identify new sites and a powerful tool for achieving better knowledge of the spatial distribution of larger sites where extensive excavation programs would not be viable. Artefacts are often widely scattered over the surface and their identification can provide essential information about size, chronology and activities (functional areas) developed on the site (Banning, 2002). Pottery is the main guidance material used in such surveys. This is due to the frequency and easy recognition of type, fabrication technique and function of samples (e.g. domestic, storage or prestigious). This is the case of even small amorphous fragments. Glass is also a product of surface surveys. However, it is less abundant and found mainly, but not

only, as a luxury item (tableware, storage, vessels for toilet and ornaments). Given that glass surface is often corroded it is difficult to distinguish between modern and ancient glass, even by trained people. This is a problem in ploughed soils where modern items are mixed with old ones, carrying the risk of producing unconscious bias in the material recovered. If amorphous glass is recovered, little information can be extracted about chronology or function and use. Thus, amorphous glass is hardly useful in the interpretation of the surface surveyed sites, contrary to pottery and metals (i.e. coins).

A surface survey (an example is in Fig. 1) has been performed in the archaeological site of “Los Mercados”, located close to the small village of Duratón in the Segovia province (Spain), a few kilometres to the east of the city of Sepulveda. Glasses collected in this site have enabled and

* Corresponding author at: Centro de Micro Análisis de Materiales, Universidad Autónoma de Madrid, Madrid, Spain.

E-mail address: alessandro.zucchiatti@uam.es (A. Zucchiatti).

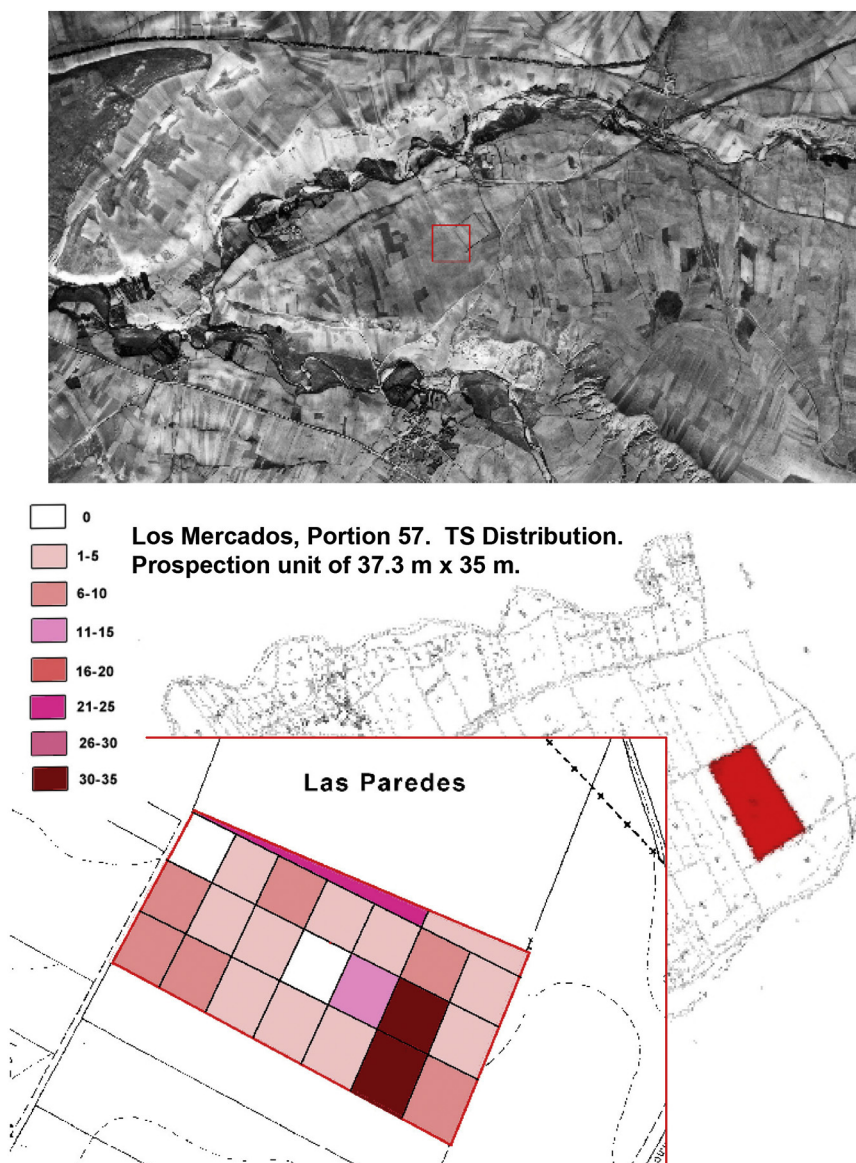


Fig. 1. An example of prospection unit in Duratón: portion 87 of Los Mercados, prospection units of $37.3 \times 35 \text{ m}^2$. Shown is an aerial view of the site (top) with the topographic map and the findings density (bottom). TS indicates the fragments of Terra Sigillata found on site.

are the object of the present study.

In the last decades, Roman and Early Medieval glass analytical characterization has allowed the compositional classification of Roman and Late Antique reference groups, (Foster and Jackson, 2009; Bayley et al., 2015). Studies based mostly on typo-chronologically classified objects and also on amorphous or diagnostic material within a clear archaeological context, have revealed regional compositional differences with a specific chronological, geographical and typological distribution. As regards the Iberian Peninsula, some of the studies are focused in the characterization of corrosion steps and other concern the analysis of late Roman glasses (Carmona et al., 2006a; Carmona et al., 2006b; Carmona et al., 2008; Carmona et al., 2009; Respalda et al., 2008).

However, analytical studies of provenance and classification of Roman glasses are quite limited for the Iberian Peninsula (Gómez-Tubío et al., 2006; Agua et al., 2015; Ganio et al., 2012; Petit-Domínguez et al., 2013; Schiavon et al., 2012). This is despite the fact that *Hispania* must have been important in primary glass production of the early Roman period. Glass production was mentioned specifically by Pliny the Elder in his *Naturalis Historia* (Gaius Plinius Segundus, 77 AD):

“...Then (the sand) gets mixed with three parts of soda by weight or volume and transformed into a liquid in various furnaces. There it becomes a mass, called *hammonitrum*, and this is baked again and becomes *vitrum purum*, i.e. a mass of clear glass. Even around *Gallia* and *Hispania* the sand is processed in a similar way”.

The first goal of this work is the characterization of Roman glasses in Duratón. This will extend the analytical database of Roman glass in Spain. The second goal is to test if amorphous glass fragments, without typological classification, could be useful in the chronological, topological and functional study of the site and in the explanation of the Roman territorial organization in Central Iberia. This includes a comparison with glass from the archaeological works in the neighbour site of Patones. This could also confirm the importance of the settlement by the identification of Roman products of different quality and different productions. The results are compared and linked to the abundant glass production in different parts of the Empire at different periods. Particular attention should be paid to Iberian sites. The third goal is to verify if Duratón glasses are similar to those described in Pliny's statement on glass production in *Hispania*. This has not been demonstrated thus far.

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