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Glass from Islamic Sicily: typology and composition from an urban and a rural site

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As part of the *Sicily in Transition* and *GlassRoutes* projects, glass artefacts from various medieval Sicilian sites have been analysed by LA-ICP-MS. This made it possible to collect data on the circulation of glass on the island in the Middle Ages. The comparison of the data from the coastal town of Mazara with those from the rural area of Castronovo di Sicilia allowed us to establish a continuity in the supply of fresh Levantine glass to the island as late as the end of the 7th century. The results also point to a possible role of urban centres in the redistribution of goods to the hinterland in the 8th century. During this period, the Castronovo area was supplied by imports of fresh glass from the Levant and Egypt, from regions that were part of the Umayyad caliphate. The 10th- to 11th-century glass assemblages from both sites shows a considerable Islamisation of Sicilian material culture, with typologies reminiscent of what is known from Egypt, Ifrīqiya and the Iberian Peninsula. The discovery of a compositional group at both Mazara and Castronovo, which differs from published data from other areas of the Mediterranean basin, also suggests a Sicilian origin of these objects. Islamisation is thus also evident in the adoption of production technologies typical of the Islamic world, such as the use of soda-rich plant ash as a fluxing agent.

Islamic Sicily, Glass production and consumption, Chemical analyses, Islamisation, Material culture.

INTRODUCTION

The increase in archaeometric and typological studies on glass in the last decades has highlighted the complexities of the manufacture and trade of ancient glass, and how little we still know about the transition from the centralised production and circulation system of the Roman age to the fragmented system of the Medieval period. In this context, the need to start collecting data on the regions of southern Italy has become increasingly evident. The research carried out in collaboration with the European projects *Sicily in Transition* and *GlassRoutes* are a step in this direction.¹

The regime changes that affected Sicily between the 6th and 13th centuries make the island a privileged place to study the impact that these

changes may have had on society, economy and networks. Moreover, understanding the effects of the Islamic conquest of Sicily on the artisanal manufacture of glass is particularly important because, as mentioned in the introduction to the book, between the 9th and 10th centuries several regions of the Islamic world adopted new ways of producing glass independently, especially through the replacement of natron with soda plant ash based fluxes.² In contrast, natron glass continues to be recycled in many regions of the Italian peninsula.³

In the following pages we will present the results of the typological and compositional study of the glass finds dated between the end of the 7th to the first half of the 8th century, and between the 10th and the 11th century from Casale San Pietro

1. This article is part of the PhD of Francesca Colangeli, who conducted the majority of the research and wrote the manuscript under the supervision of Nadine Schibille.

2. Schibille 2022.

3. Colangeli – Sacco in this volume.

and Kassar fortress (Castronovo di Sicilia – PA) and Via Romano (Mazara del Vallo – TP). As the end of the 7th and the 8th century marks an important turning point for the glass economy, it seemed important to consider this period even if it precedes the main focus of the conference (9th-11th centuries). It is indeed useful to grasp the changes that occurred in the Islamic period and, in a comparative way, to highlight the differences with other Mediterranean regions.

THE ARCHAEOLOGICAL CONTEXTS

The Via Romano site is located in the northern area of Mazara del Vallo city centre, on the Sicilian western coast (fig. 1). An emergency excavation was conducted in 1997 by the AR.CO cooperative that brought to light several structures and pits dated from the late 7th century to modern times.⁴ Medieval glass comes from late 7th-century frequentation layers and from 10th- to 11th-century latrines and wells.

The Castronovo area is the focus of the *Sicily in Transition* ERC project. The town is in the Sicilian hinterland between Palermo and Agrigento (fig. 1). From 2014 to 2019, surveys and excavations have been carried out in different parts of the territory. The glass finds analysed in this article come from two excavation areas: the Byzantine fortress of Mount Kassar and the Casale San Pietro, located in the Platani valley near the Palermo-Agrigento highway. Several excavations were carried out in different parts of the fortress. In this context, we will consider just the top site (intervention 6) excavated between 2014 and 2016. The operations revealed a rectangular structure built against the defensive wall of the fortress. In this building, a layer dated to the first half of the 8th century was discovered under the collapse of the walls and roof caused by the abandonment of the site. The chronology of the layer was determined by the typological study of pottery and metal finds and by the compositional analyses of the glass finds. Interestingly, the metal finds include a *Hyppo Regius* buckle (fig. 2), a type that spread in the central Mediterranean mainly during the 6th and

the 7th centuries,⁵ but that has been found also in some Sardinian and Spanish 8th-century contexts.⁶ In this specific case the redecoration marks suggest a long use of the object.



Fig. 1. Map of Sicily with the cities and towns cited in the paper (© F. Colangeli).

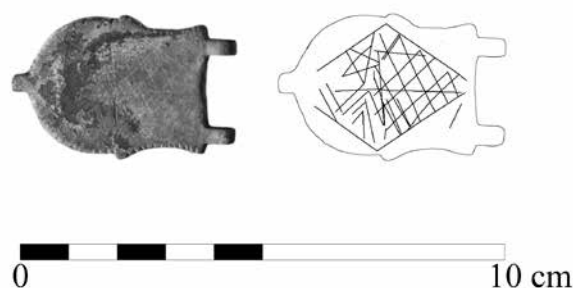


Fig. 2. Hyppo Regius buckle found in the excavation of the Kassar fortress (intervention 6) (© F. Colangeli).

Regarding Casale San Pietro, the extensive excavation area brought to light a stratification that ranges from the 2nd to the 13th centuries. In this context we will treat just the finds from the Islamic period (10th-11th century) and few specimens dated to the 8th century. The excavation brought to light tons of 10th- to 11th-century pottery (tableware, cooking pots, amphorae). Imports come mainly from Palermo. As capital of Islamic Sicily, the city was an important manufacture and commercial hub.⁷

4. Excavation data have been recently published in open access. See Molinari – Meo 2021.

5. Schulze-Dörrlamm 2009, tipo E17, p. 52

6. Muresu 2018, p. 120, fig.72; Ripoll – Velázquez 2013, p. 142 with references.

7. See Sacco – Meo – Capelli in this volume.

RESULTS

Typological study

17 individual glass objects have been identified from late Byzantine layers (10 from Via Romano, 4 from Kassari fortress and 3 from Casale San Pietro). In spite of the limited number, these finds have a high informative potential, due to their provenance from well-dated archaeological contexts. From a typological point of view, almost all of the Byzantine glass fragments are identifiable as goblets with an applied solid stem that is tapered in the middle⁸ (fig. 3a and 3l). Generally,

this type of stem (indicating a two-stage production) is dated between the 7th and 8th centuries, although it seems to appear as early as the 6th century.⁹ Disk feet usually have a tubular edge (fig. 3b, c, d, e, h). In addition to goblets, one beaker was also identified (fig. 3g). The base has some purple streaks that could be intentional, for a decoration purpose, or a possible production mistake in the colouring or decolouring practice. All the specimens have different shades of blue-green, ranging from light blue-green to darker aqua shades.

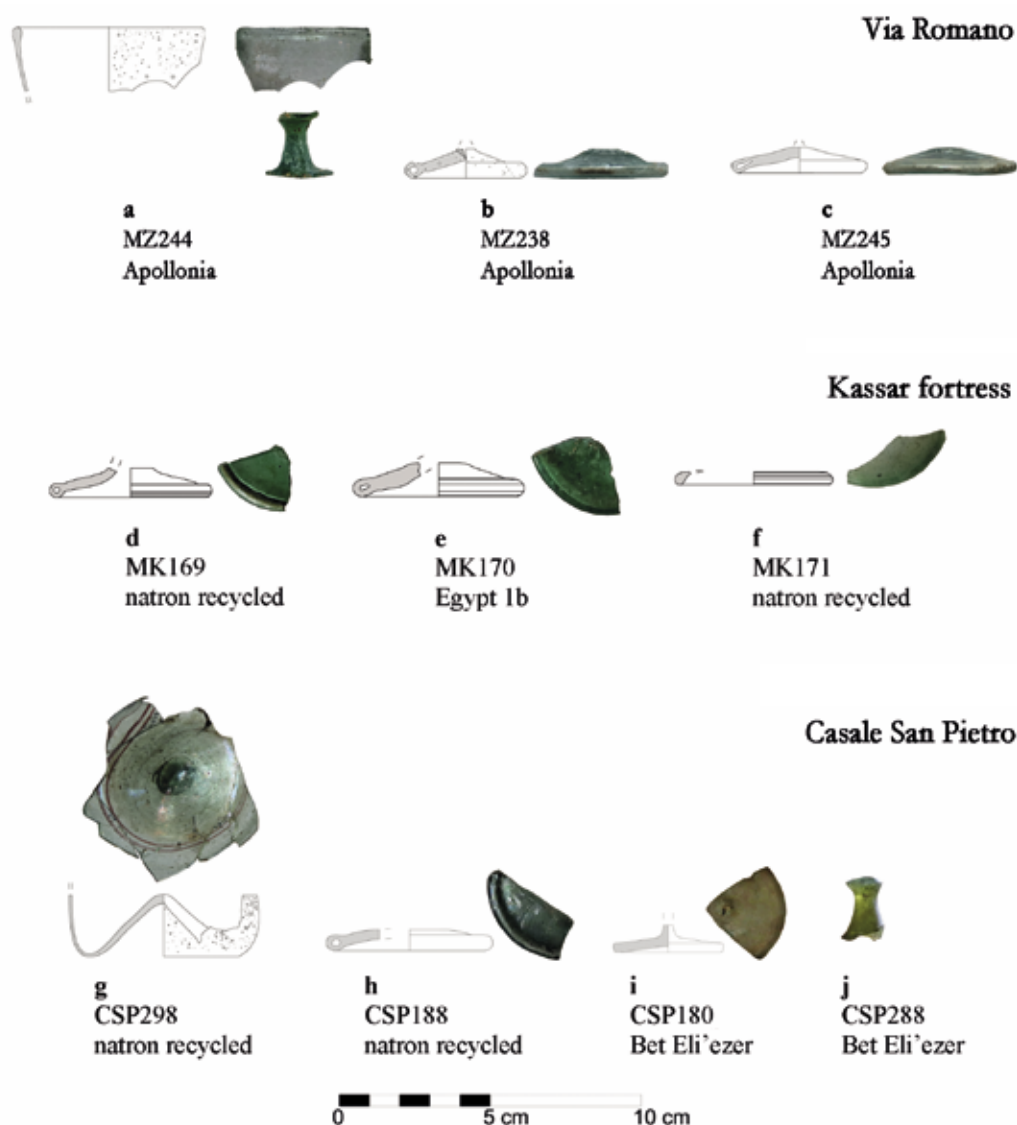


Fig. 3. 8th-century glass finds from Via Romano (Mazara del Vallo), Kassari fortress and Casale San Pietro (Castronovo di Sicilia) (© F. Colangeli).

8. Foy 2003, type C p.74 and p. 77, fig. 64-72.

9. For a summary of the geographical spread and dating of this type see Golofast 2009, p. 318-319.

9th-century glass finds are virtually absent, meaning there is no direct material evidence from the time of the Islamic conquest. Moreover, the investigations carried out in the fortress of Mount Kassari did not return any evidence of a frequentation of the area in the Kalbid period. In contrast, 10th- to 11th-century contexts present larger quantities of glass: 36 objects from Via Romano and 31 from Casale San Pietro.¹⁰ The glass artefacts are mostly related to vessels and they are mainly cosmetic objects or tableware (fig. 4). While the two categories seem to be more balanced in the Casale San Pietro site, in Via Romano there seems to be a clear predominance of vessels for cosmetic use (fig. 4). They are essentially small free-blown flasks that show signs of a fast and often inaccurate manufacture. When preserved, the rim is folded inwards and it is often irregular, while the bottom and the profile are often decentred and crooked. In most cases these objects are in the natural colours of glass.

Most of the balsamaries found in the Via Romano present a truncated cone body and a tubular neck (fig. 5m-n), but there are also specimens with a square section and two recessed sides (fig. 5o), as well as sporadic samples with a globular body. A possible microvase was also reported (fig. 5p). Some balsamaries with truncated-cone bodies had already been found in Palermo as well as at Villa del Casale.¹¹ However, given the contem-

poraneity and extent and richness of typological variety, the main reference material for all the identified types are the finds from the Tunisian site of Šabra al-Manšūriyya.¹²

The comparison between Via Romano and Casale San Pietro shows a lower amount of cosmetic and medicinal vessels (fig. 4) and also a lower typological variability for the latter. Specifically, only 9 balsamaries have been identified in Casale San Pietro and the majority of them belong to the type with a square section and two recessed sides (fig. 5c-d). These balsamaries are associated with a microvase and an everted rim (fig. 5f-e). This last object has a narrow neck with a central bulge (fig. 5e). The fragmentary nature of the piece impedes the identification of the body profile. However, the wall is slightly introflected suggesting a tubular body. The object is free-blown in a translucent glass with a yellow/brown colour. The typology has no published comparisons in Sicily. From an extra regional point of view, the specimen resembles two balsamaries found in Fustat dated to the 9th century.¹³ The type has also been found in al-Andalus in Alicante and at the castle of Silves, where it appears in brown glass with marbled decoration in 11th century layers.¹⁴ Although these comparisons are not precise and minor differences can be noted, the object would seem to resemble the same prototype.

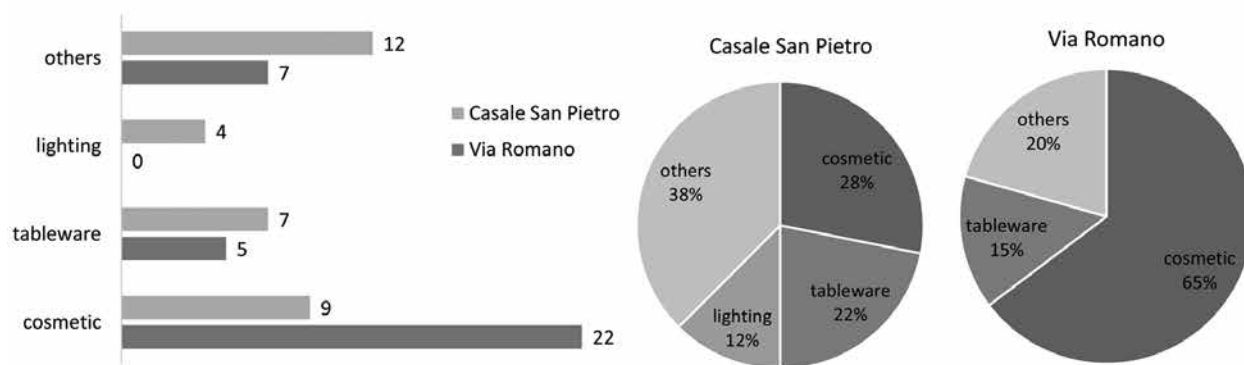


Fig. 4. Quantities of different vessel categories found in the Islamic layers of Via Romano (Mazara del Vallo) and Casale San Pietro (Castronovo di Sicilia) (© F. Colangeli).

10. For an in-depth analysis of the Via Romano Islamic specimens see Colangeli 2021, p. 473-474.

11. Specimens have been identified in the 1995 under the Regional Archaeological Museum "Antonio Salinas", see Tisseyre 1997. On the Villa del Casale see Colangeli – Vagni – Schibille forthcoming.

12. Foy 2020

13. Scanlon – Pinder-Wilson 2001, p. 43, fig. 18a-b

14. See respectively Puche Acien 2000, p. 157, fig. 1, no. 4 and Gomez 2012, Q282, p. 441 and p. 444, fig. 6



Fig. 5. Most representative types of the 10th -11th-century artefacts found in Via Romano (Mazara del Vallo) and Casale San Pietro (Castronovo di Sicilia) (© F. Colangeli).

Concerning tableware, the 6 objects found at Via Romano are essentially beakers and bottles. The beakers have a truncated cone profile and a flat or slightly umbonate base and they are free-blown or mould-blown. These objects can either be not decorated or with mould-blown or abraded decorations (fig. 5q). This is the case of the MZ247 specimen that, from a macroscopic point of view, differs also in terms of greater thickness, less surface alteration and colour (colourless/pale yellow). Among the Via Romano bottles, the most representative type is characterised by a pyriform body displaying a ribbed decoration obtained by mould-blowing (fig. 5r). For the moment, no comparisons has yet been found for this specimen. However, the archaeological context suggests a mid-11th-century date.¹⁵ 7 tableware specimens have been identified from Casale San Pietro and they consist of beakers with truncated cone profile and flat bases and goblets with short stems (fig. 5a-b).

Finally, only 3 fragments can be attributed to lighting devices, and they have been identified exclusively in Casale San Pietro (fig. 4). They include a lamp with a tubular rim and a horizontal handle applied directly to the rim (fig. 5g). This typology is known in the Mediterranean, and particularly in Southern Italy, from the 5th century¹⁶ but is still attested in the 10th -11th century in the Islamic Regions of the Western Mediterranean.¹⁷ Moreover, a piece of a possible Islamic/Mosque lamp has also been identified (fig. 5h). Finally, a tube probably represents a wick holder¹⁸ (fig. 5i).

Glass was not used just for vessels, but also for objects of personal adornment (beads and bracelets) as well as for architectural use and jetons (category 'other' in fig. 4). The majority of these finds comes from the Islamic layers at Casale San Pietro (fig. 4). In this respect, it is worth mentioning that the site revealed two glass jetons (fig. 5k-l) which based on

the stratigraphy can be dated to the second half of the 10th century.¹⁹

Compositional analyses

In order to investigate the composition and thus obtain information on the production technique, provenance and, in some cases, even the chronology, most of the finds just described have been analysed by LA-ICP-MS.²⁰ A total number of 32 and 15 samples dated between the end of the 7th and the 11th century have been analysed from Mazara del Vallo and Castronovo. Based on their level of sodium, potassium and magnesium, all analysed specimens are soda-lime-silica glass that can be divided into natron and soda plant-ash glass. Both natron and soda plant-ash groups show high soda levels, but they differ in terms of magnesium and potassium content (fig. 6). Compared with plant ashes, natron is a purer source of alkali, therefore natron glass is characterized by low levels of both these two elements, whereas plant ashes have high levels of MgO and K₂O.²¹

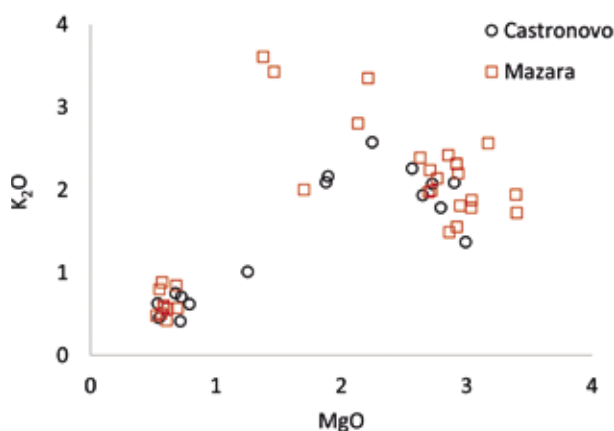


Fig. 6. MgO compared to K₂O to identify different fluxing agents (© F. Colangeli).

In order to detect the origin of natron glass finds, the samples have been compared with 7th- to 9th-century compositional groups produced in Egypt and in the Levant.²² The ratios of Al₂O₃/SiO₂

15. Colangeli 2021.

16. Giannetti – Giuliani – Turchiano 2017, p. 206-207; Ubaldi 1995, type I.4.

17. Lamps with a truncated cone or globular profile, a tubular rim and handles set on the rim have been identified at Šabra al-Manšūriyya and Madinat al-Zahra, see respectively Foy 2020, Sb59, p. 148 and 151; Rontomé Notario 2000, p. 109, fig. 2, n. 2.

18. For example, see Carboni 2001, p. 166-167; Rontomé Notario, 2000, p. 109, fig. 2, n. 2; Foy 1999, fig. 5.

19. On Sicilian glass weights see Balog 1975; D'Angelo 2005; Weiss 2011; D'Ottone Rambach 2017, p. 175-176.

20. Method is given in Schibille – Colangeli 2021.

21. Henderson 2013, p. 91-92 and 98; Sayre – Smith 1961.

22. Schibille *et al.* 2019; Phelps *et al.* 2016; Freestone – Gorin-Rosen – Hughes 2000.

and $\text{TiO}_2/\text{Al}_2\text{O}_3$ separate the groups according to the geographical origin of the silica source, because it is generally assumed that Egyptian silica sources have higher levels of titanium and zirconium compared to Levantine sands.²³ The plot clearly shows the Levantine origin of the natron-type glass samples from Mazara, as well as of two Casale San Pietro samples (fig. 7a). Specifically, they belong to the glass associated with the primary production installations at Apollonia (6th-7th century) and Bet Eli'ezer (8th century).²⁴ From a chemical point of view, these two groups are very similar. Both are characterized by mature high silica sands (Bet Eli'ezer shows highest silica levels) with relatively high alumina contents low in heavy elements such as titanium, iron, and zirconium.²⁵ One of the distinguishing features of Bet Eli'ezer glass is a significant decrease in the soda contents that has been linked to problems in the natron supply.²⁶ This is reflected in a comparison of the $\text{Na}_2\text{O}/\text{SiO}_2$ and $\text{CaO}/\text{Al}_2\text{O}_3$ ratios, which illustrates the changes in the composition of the silica source and the decline of soda content over time (fig. 7b). While Mazara samples clearly belong to the Apollonia glass group,²⁷ CSP288 and CSP180 show a higher

silica ($\text{SiO}_2 \approx 73\text{-}74\%$), and the lower soda content ($\text{Na}_2\text{O} \approx 13\%$), which corresponds to the typical characteristics of Bet Eli'ezer glass. They also share the lower calcium content ($\text{CaO} \approx 7\%$). Just one specimen coming from the Kassara fortress has an Egyptian signature, more specifically, it belongs to Egypt 1b dated between 720 and 780²⁸ (fig. 7a).

Magnesium and potassium oxide contents of the plant-ash glass mostly range between 1.5% and 3% (fig. 4), indicating the use of halophytic plant ash as fluxing agent.²⁹ Some Mazara specimens have higher potassium to magnesium levels that may have been caused by contamination by fuel ash.³⁰ For this reason and considering the variability of plant ash,³¹ the definition of the groups has mainly been based on the characteristics of the silica source. Compared to other Mediterranean groups, the 10th- to 11th-century samples from Mazara and Casale San Pietro clearly show differences in terms of the silica source related elements such as titanium and zirconium (fig. 8). The zirconium content in the majority of the samples range between 100 and 150 ppm which is higher than in Levantine glass, while the Ti to Zr ratios differ from both Egyptian and Iberian glass groups. Moreover,

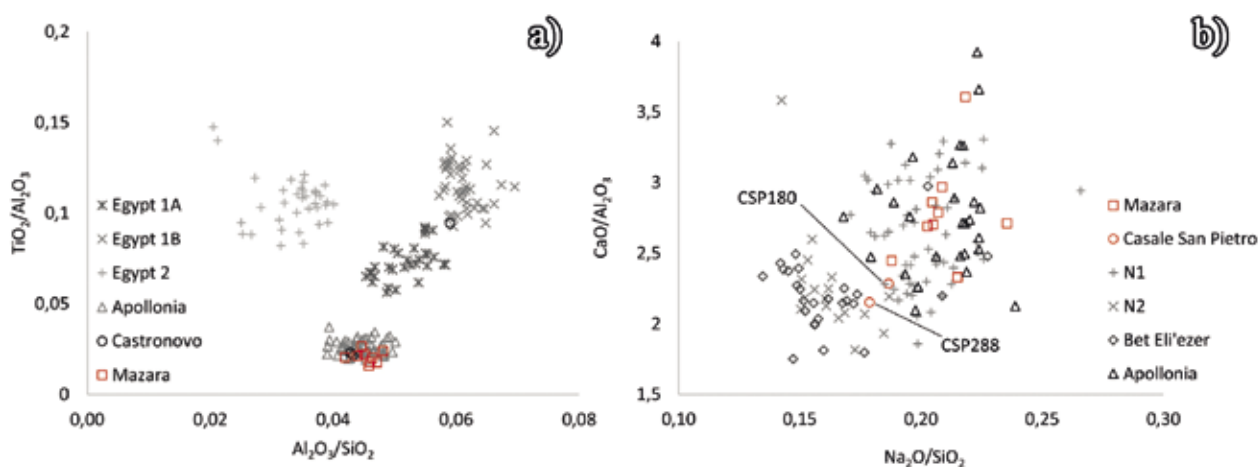


Fig. 7. Compositional characteristics of the natron glass from Via Romano (Mazara) and Casale San Pietro (Castronovo di Sicilia). (a) $\text{Al}_2\text{O}_3/\text{SiO}_2$ to $\text{TiO}_2/\text{Al}_2\text{O}_3$ show differences in the silica source and distinguish Levantine and Egyptian glass. (b) $\text{Na}_2\text{O}/\text{SiO}_2$ to $\text{CaO}/\text{Al}_2\text{O}_3$ highlight differences in the glass recipes. (Data source: Schibille *et al.* 2019; Phelps *et al.* 2016; Freestone – Gorin-Rosen – Hughes 2000. © F. Colangeli).

23. Foy *et al.* 2003.

24. Freestone 2020; Brems *et al.* 2018; Phelps *et al.* 2016.

25. Phelps *et al.* 2016, p. 60.

26. Ivi p. 65-66.

27. For an in-depth analysis of Mazara finds see Schibille – Colangeli 2021.

28. Schibille *et al.* 2019.

29. Freestone 2006; Lilyquist – Brill 1993; Sayre – Smith 1961.

30. Schibille – Colangeli 2021.

31. Henderson 2013 p. 23 and 48-49; Mirti *et al.* 2009.

titanium ranges between 600 and 1000 ppm which is higher than in the Samarra finds but at the same time significantly lower than in the Spanish samples.³² Except for the Levantine engraved beaker (fig. 5q – MZ247), and the Egyptian small flask (fig. 5e – CSP182) most of the glass falls into this new group, which can be identified with great probability as Sicilian production.³³

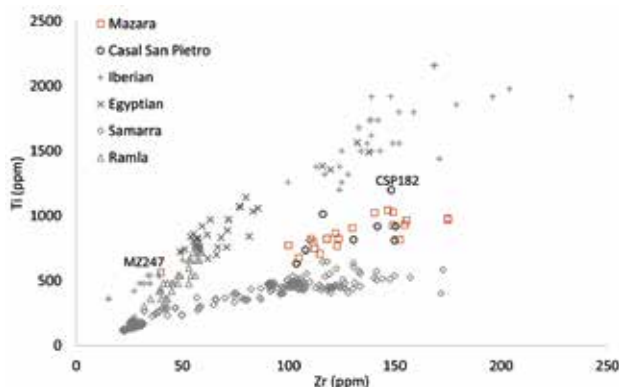


Fig. 8. Comparison of the Via Romano (Mazara) and Casale San Pietro (Castronovo di Sicilia) soda plant-ash glass with published data of early Islamic glass assemblages from Mesopotamia, the Levant, Egypt and the Iberian Peninsula. Zirconium and titanium contents reflect the silica source and highlight the compositional differences of the Sicilian samples (Data sources: Schibille *et al.* 2019 [Egypt]; Schibille *et al.* 2018 [Samarra]; Phelps 2018 [Levantine – Ramla]; De Juan Ares – Schibille 2017 [Spain]. © F. Colangeli).

CONCLUSION

The typological and compositional study of the two archaeological contexts makes it clear that not only the coastal towns of Sicily were probably still supplied with new glass as late as the end of the 7th century, but possibly also the inland centres until the 8th century. The identification of goblets made of Levantine glass from Bet Eli'ezer in Casale San Pietro and a sample of Egypt Ib glass in the Byzantine fortress of Kassar suggests a circulation of these goods within the island. Although studies conducted in different areas of the Mediterranean demonstrate the persistence of a Levantine (Apollonia) fresh glass trade even in

the late 7th century, it seems to be more common in Tunisia and eastern territories.³⁴ In contrast, the varying frequency and increasing recycling indicates that this type of glass does not arrive in large quantities in north-western Mediterranean cities.³⁵ As for Sicily, the close connection with North Africa and the arrival of goods from the eastern Mediterranean suggests that it would be easier to obtain this material for the island as well. Nevertheless, these data are consistent with the pattern of Sicily 'long late antiquity' already evidenced by ceramic studies.³⁶

Regarding the 8th century, however, it should be considered that the Castronovo area was closely linked to the Byzantine Empire, thanks to a fortress and a village that may have had a fiscal function. Consequently, the interests of the state may have facilitated the arrival of imports in these two centres, while other sites may have been excluded from redistribution circuits. It is important to note that Egypt and the Levant were part of the territories of the Umayyad Caliphate at the end of the 7th to the middle of the 8th century and that, even if the study of the Via Romano pottery had already shown the presence of imports from both Byzantine and Umayyad Caliphate territories (Egyptian amphorae),³⁷ the Levantine coast remained invisible.

The typological and compositional change that emerges from the 10th century onwards clearly shows the impact of the Islamisation³⁸ of the island. The extensive use of glass for cosmetics, as well as the morphological repertoire similar to other Islamic contexts (first and foremost

34. Foy *et al.* 2003; Gratuze 2000.

35. See for instance Rome and Comacchio, as well as recent research of the Iberian contexts of Gótzquez and El Pelicano. See respectively Mirti – Lepora – Saguì 2000; Mirti *et al.* 2001; Bertini – Henderson – Chenery 2020, p. 20; De Juan Ares *et al.* 2019.

36. Ceramic studies conducted in various areas of the region have revealed substantial continuity (albeit to a more limited extent) in the import of North African pottery until the end of the 7th century. For a synthesis of the North African pottery evidence in Sicily in the 7th century and the results that emerged from the study by Daniele Malfitana and Michel Bonifay on the circulation and different mechanisms of supply of African ceramics in Sicily between the 1st and 7th century, see Molinari 2019, p. 88-91.

37. Meo 2021a.

38. On the different uses of the term 'Islamisation' see Peacock 2017.

32. For a more detailed analysis of the composition of the Via Romano and Casale San Pietro medieval glass finds see Schibille – Colangeli 2021; Colangeli – Schibille forthcoming.

33. Schibille – Colangeli 2021.

Sabra al-Manṣūriyya) and the possible regional production of soda plant ash glass, illustrate Sicily's inclusion in the Islamic technical environment and networks.

Future research will seek to better understand Palermo's possible role in glass production. As ceramic studies show,³⁹ the city was not only the capital of Islamic Sicily, but also the main centre of production and trade until at least the middle of the 11th century. This is also evident in the contexts of Mazara and Casale San Pietro, where amphorae, cooking pots and glazed pottery from Palermo are strongly represented.⁴⁰ This could indicate that

glass production, at least until the mid-11th century, was also predominantly based in Palermo, from where glass was exported either as raw glass or as finished objects. For the time being, there is no archaeological evidence of glass production on the island during the Islamic period.⁴¹ Nonetheless the connection between Palermo and other centres may also have favoured the circulation of extra-regional imports. This is not so relevant for Mazara, which as the second most important port after Palermo certainly had a direct connection with Ifrīqiya and Egypt,⁴² but it was probably crucial for inland centres like Castronovo.

Bibliography

- Balog 1975 = P. Balog, *Fatimid and post-Fatimid glass jetons from Sicily*, in *Studi magrebini*, 7, 1975, p. 125-148.
- Bertini – Henderson – Chenery 2020 = C. Bertini, J. Henderson, S. Chenery, *Seventh to eleventh century CE glass from Northern Italy: between continuity and innovation*, in *Archaeological and Anthropological Sciences*, 12/120, 2020, <https://doi.org/10.1007/s12520-020-01048-8>.
- Brems *et al.* 2018 = D. Brems, I.C. Freestone, Y. Gorin-Rosen, R. Scott, V. Devulder, F. Vanhaecke, P. Degryse, *Characterisation of Byzantine and early Islamic primary tank furnace glass*, in *J. Archaeol. Sci. Rep.*, 20, 2018, p. 722-735.
- Carboni 2001 = S. Carboni, *Glass from Islamic lands*, London, 2001.
- Colangeli 2021 = F. Colangeli, *Produzione, consumo e commercio di vetro a Mazara nel medioevo. Lo studio del sito di via Romano per un inquadramento diacronico dei cambiamenti tipologici e tecnologici*, in A. Molinari, A. Meo (eds), *Mazara/Māzar: nel ventre della città medievale (secoli VII-XV). Edizione critica degli scavi (1997) in via Tenente Giuseppe Romano*, Sesto Fiorentino, 2021 (*Biblioteca di Archeologia Medievale*, 32), p. 465-486.
- Colangeli – Schibille forthcoming = F. Colangeli, N. Schibille, *Transition effects in glass production and trade: analytical investigations in Castronovo di Sicilia*, in M. Carver, A. Molinari, P. Orecchioni (eds), *Castronovo di Sicilia Archaeological Investigations and research 2014-2021*, forthcoming.
- Colangeli – Vagni – Schibille forthcoming = F. Colangeli, E. Vagni, N. Schibille, *Changes in the Sicilian glass economy between the 5th and the 11th century: the case of Via Romano (Mazara del Vallo – TP) and Villa del Casale (Piazza Armerina – EN)*, in *Annales du 22^e Congrès de l'Association internationale pour l'histoire du verre (Lisbon, 13-17 septembre 2021)*, forthcoming.
- D'Angelo 2005 = F. D'Angelo, *Analisi economiche e chimiche dei pesi monetali in vetro della Sicilia*, in *Rivista della Stazione Sperimentale del Vetro*, 2, 2005, p. 29-35.
- D'Ottone Rambach 2017 = A. D'Ottone Rambach, *Arabic Glasses (coin weights, jetons and vessel stamps) from Umayyad Syria*, in T. Goodwin (ed.), *Coinage and History in the Seventh Century Near East 5. Proceedings of the 15th Seventh Century Syrian Numismatic Round Table held at Corpus Christi College, (Oxford on 17th and 18th September 2016)*, London, 2017, p. 175-195.
- De Juan Ares – Schibille 2017 = J. De Juan Ares, N. Schibille, *Glass import and production in Hispania during the early medieval period: The glass from Ciudad de Vascos (Toledo)*, in *Plos one*, 12/7, 2017, <https://doi.org/10.1371/journal.pone.0182129>.
- De Juan Ares *et al.* 2019 = J. De Juan Ares, N. Schibille, A. Vigil-Escalera Guirado, Y. Cáceres Gutiérrez, *Changes in the supply of the eastern Mediterranean glasses to Visigothic Spain*, in *Journal of Archaeological Science*, 107, 2019, p. 23-31. <https://doi.org/10.1016/j.jas.2019.04.006>
- Foy 1999 = D. Foy, *Lampes de verre fatimides à Fostat : le mobilier des fouilles de Istabl'Antar*, in M. Barrucand (ed.), *L'Égypte Fatimide : son art et son histoire. Actes du colloque organisé à Paris (28-30 mai 1998)*, Paris, 1999, p. 179-196.
- Foy 2003 = D. Foy, *Le verre en Tunisie : l'apport des fouilles récentes tuniso-françaises*, in *JGS*, 45, 2003, p. 59-89.

39. Sacco forthcoming.

40. Meo 2021b.

41. A hypothesis has been put forward on the structures found at the Steri in Palermo, but the published evidence and production indicators are inconclusive Spatafora – Canzonieri 2012.

42. Goldberg 2012.

- Foy 2020 = D. Foy, *Le verre de Sabra al-Mansuriya – Kairouan, Tunisie – milieu X^e-milieu XI^e siècle. Production et consommation : vaisselle, contenants, vitrages*, Oxford, 2020 (*Archaeology of the Maghreb*, 1).
- Foy et al. 2003 = D. Foy, M. Picon, M. Vichy, V. Thirion-Merle, *Caractérisation des verres de la fin de l'Antiquité en Méditerranée occidentale : l'émergence de nouveaux courants commerciaux*, in D. Foy, M.D. Nenna (eds) *Échanges et commerce du verre dans le monde antique*, Montagnac, 2003, p. 41-85.
- Freestone 2006 = I.C. Freestone, *Glass production in Late Antiquity and the Early Islamic period: a geochemical perspective*, in M. Maggetti, B. Messiga (eds), *Geomaterials in Cultural Heritage*, London, 2006, p. 201-216.
- Freestone 2020 = I.C. Freestone, *Apollonia glass and its markets: an analytical perspective*, in O. Tal (ed.), *Apollonia-Arsuf: Final Report of the Excavations. Volume II: Excavations outside the Medieval Town Walls*, Tel Aviv, 2020.
- Freestone – Gorin-Rosen – Hughes 2000 = I.C. Freestone, Y. Gorin-Rosen, M.J. Hughes, *Primary Glass from Israel and the Production of Glass in Late Antiquity and the Early Islamic Period*, in M.D. Nenna (ed.), *La Route du verre. Ateliers primaires et secondaires du second millénaire av. J.-C. au Moyen Âge. Colloque organisé en 1989 par l'Association française pour l'archéologie du verre (AFAV) Lyon : Maison de l'Orient et de la Méditerranée Jean Pouilloux*, Lione, 2000 (*Travaux de la Maison de l'Orient méditerranéen*, 33), p. 65-83.
- Giannetti – Giuliani – Turchiano 2017 = F. Giannetti, R. Giuliani, M. Turchiano, *Late Antique and early medieval glass vessels from northern-central Apulia: productions, typologies, functions and circulation*, in *Annales du 20^e Congrès de l'Association internationale pour l'histoire du verre (Fribourg/Romont 7-11 septembre 2015)*, Nottingham, 2017, p. 203-208.
- Golberg 2012 = J.L. Goldberg, *Trade and Institutions in the Medieval Mediterranean: The Geniza Merchants and their Business World*, Cambridge, 2012.
- Golofast 2009 = L. Golofast, *Early Byzantine Glass from the Tauric Chersonesos (Crimea)*, in E. Laflh (ed.), *Late Antique/Early Byzantine Glass in the Eastern Mediterranean*, Izmir, 2009, p. 301-335.
- Gomez 2012 = R. Gomez, *Islamic glass from Silves' castle (Portugal)*, in *Annales du 19^e Congrès de l'Association internationale pour l'histoire du verre*, Piran, 2012, p. 438-445.
- Gratuze 2000 = B. Gratuze, *Étude chimique des verres de Beyrouth*, in Syria, 77, 2000, p. 291-296.
- Gratuze – Barrandon 1990 = B. Gratuze, J.-N. Barrandon, *Islamic Glass Weights and Stamps: Analysis Using Nuclear Techniques*, in *Archaeometry*, 32, 1990, p. 155-162.
- Henderson 2013 = J. Henderson, *Ancient glass. An Interdisciplinary Exploration*, Cambridge, 2013.
- Lilyquist – Brill 1993 = C. Lilyquist, R.H. Brill, *Studies in early Egyptian glass*, New York, 1993.
- Meo 2021a = A. Meo, *Al crepuscolo della tarda antichità: i consumi ceramici di prima età tematica (fine VII/inizi VIII secolo)*, in Molinari – Meo 2021, p. 113-157.
- Meo 2021b = A. Meo, *“Non ha pari né simile, se si guardi alla magnificenza del vivere”. I consumi ceramici di Mazara in età islamica (X-XI secolo)*, in Molinari – Meo 2021, p. 159-336.
- Mirti – Lepora – Saguì 2000 = P. Mirti, A. Lepora, L. Saguì, *Scientific analysis of seventh-century glass fragments from the Crypta Balbi in Rome*, in *Archaeometry*, 42, 2000, p. 359-374.
- Mirti et al., 2001 = P. Mirti, P. Davit, M. Gulmini, L. Saguì, *Glass fragments from the Crypta Balbi in Rome: the composition of eighth-century fragments*, in *Archaeometry*, 43/4, 2001, p. 491-502.
- Mirti et al., 2009 = P. Mirti, M. Pace, M. Malandrino, M. Negro Ponzi, *Sasanian glass from Veh Ardašīr: new evidences by ICP-MS analysis*, in *Journal of Archaeological Science*, 36, 2009, p. 1061-1069.
- Molinari 2019 = A. Molinari, *Sicily from Late Antiquity to Early Middle Ages: Resilience and Disruption*, in M.A. Cau Ontiveros, C. Mas Florit (eds), *Change and Resilience: The Occupation of Mediterranean Islands in Late Antiquity*, Oxford, 2019, p. 87-110.
- Molinari – Meo 2021 = A. Molinari, A. Meo (eds), *Mazara/Māzar: nel ventre della città medievale (secoli VII-XIV). Edizione degli scavi (1997) in Via tenente Gaspare Romano*, Sesto Fiorentino, 2021 (*Biblioteca di Archeologia Medievale*, 32).
- Muresu 2018 = M. Muresu, *La moneta “indicatore” dell'assetto insediativo della Sardegna bizantina (secoli VI-XI)*, Perugia, 2018.
- Peacock 2017 = A.C.S. Peacock (ed.), *Islamisation: comparative Perspectives from History*, Edimburgo, 2017.
- Phelps 2018 = M. Phelps, *Glass supply and trade in early Islamic Ramla: An investigation of the plant ash glass*, in D. Rosenow, M. Phelps, A. Meeks, I. Freestone (eds), *Things that Travelled: Mediterranean Glass in the First Millennium CE*, London, 2018, p. 236-282.
- Phelps et al. 2016 = M. Phelps, I.C. Freestone, Y.G. Rosen, B. Gratuze, *Natron glass production and supply in the late antique and early medieval Near East: The effect of the Byzantine-Islamic transition*, in *Journal of Archaeological Science*, 75, 2016, p. 57-71. <https://doi.org/10.1016/j.jas.2016.08.006>.
- Puche Acién 2000 = C. Puche Acién, *Los vidrios islámicos de Alicante*, in P. Cressier (ed.), *El vidrio en al-Andalus*, Madrid, 2000, p. 149-164.
- Riemer 2000 = E. Riemer, *Romanische Grabfunde des 5.-8.-Jahrhunderts in Italien*, Rahden/Westf, 2000.
- Ripoll – Velázquez 2013 = G. Ripoll, I. Velázquez, *Placa de broche de cinturón de tipo bizantino procedente del conjunto eclesiástico de Son Peretó (Mallorca)*, in Ch. Blondeau, B. Boissavit-Camus, V. Boucherat, P. Volti (eds), *Ars auro gemmisque prior. Mélanges en hommage à Jean-Pierre Caillet*, Zagreb, 2012, p. 139-150.
- Rontomé Notario 2000 = E. Rontomé Notario, *Vidrios califales de Madīnat al-Zahrā*, in P. Cressier (ed.), *El vidrio en al-Andalus*, Madrid, 2000, p. 103-115.
- Sacco forthcoming = V. Sacco, *Dalla ceramica alla storia economica: il caso di Palermo islamica*, Rome, 2024, forthcoming.

- Sayre – Smith 1961 = V. Sayre, R.W. Smith, *Compositional categories of ancient glass*, in *Science*, 133, 1961, p. 1824-1826.
- Scanlon – Pinder Wilson 2001 = G.T. Scanlon, R. Pinder Wilson, *Fustat glass of the early islamic period. Finds excavated by The American Research Center in Egypt 1964-1980*, London, 2001.
- Schibille 2022 = N. Schibille, *Islamic Glass in the Making. Chronological and Geographical Dimensions*, Leuven, 2022.
- Schibille – Colangeli 2021 = N. Schibille, F. Colangeli, *Transformations of the Mediterranean glass supply in medieval Mazara del Vallo (Sicily)*, in Molinari – Meo 2021, p. 491-505.
- Schibille et al. 2018 = N. Schibille, A. Meek, M.T. Wypyski, J. Kröger, M. Rosser-Owen, R. Wade Heddon, *The glass of Samarra (Iraq): Ninth-century Abbasid glass production and imports*, in *Plos One*, 13/8, 2018, <https://doi.org/10.1371/journal.pone.0201749>
- Schibille et al. 2019 = N. Schibille, B. Gratuze, E. Ollivier, É. Blondeau, *Chronology of early Islamic glass compositions from Egypt*, in *J. Archaeol. Sci.*, 104, 2019, p. 10-18, <https://doi.org/10.1016/j.jas.2019.02.001>.
- Schulze-Dörrlamm 2009 = M. Schulze-Dörrlamm, *Byzantinische Gürtelschnallen und Gürtelbeschläge. Kataloge Vor- und Frühgeschichtlicher Altertümer*, Mainz, 2009.
- Spatafora – Canzonieri 2012 = F. Spatafora, E. Canzonieri, *Un impianto artigianale per la produzione del vetro nella Palermo di età islamica e normanna*, in A. Coscarella (ed.), *Il vetro in Italia. Testimonianze, produzioni, commerci in età basso medievale*, Arcavacata, 2012, p. 259-270.
- Tisseyre 1997 = P. Tisseyre, *Alcuni vetri provenienti dallo scavo al museo archeologico regionale A. Salinas di Palermo*, in *Quaderni del Museo Archeologico regionale Antonino Salinas*, 3, 1997, p. 71-75.
- Uboldi 1995 = M. Uboldi, *Diffusione delle lampade vitree in età tardoantica e altomedievale e spunti per una tipologia*, in *Archeologia Medievale*, 22, 1995, p. 93-145.
- Weiss 2011 = C. Weiss, *Glass Jetons from Sicily – New Find Evidence from the Excavations at Monte Iato*, in N. Holmes (ed.), *Proceedings of the XIV International Numismatic Congress (Glasgow, 31 August-4 September 2009)*, Glasgow, 2011, p. 1897-1903.

