

# Technological transfer: technologies in transition

Comparing glass and glazed ceramic productions to analyse long-term changes in Sicilian manufacturing (8<sup>th</sup> to 13<sup>th</sup> CE).

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## Introduction and Purpose

This poster illustrates a doctoral project recently launched at the Università di Roma Tor Vergata and developed in collaboration with the CNRS in Orléans (IRAMAT - Centre Ernest-Babelon).

The research aims to investigate the changes in the organisation and production techniques of the glass and ceramics industry in medieval Sicily (8<sup>th</sup>-13<sup>th</sup> centuries) through an **interdisciplinary** and **archaeometric approach**. By analysing the **petrography** and **composition** of fragments sampled from various urban and rural sites across the island (eg. Castronovo, Mazara, Agrigento, Colmitella and Lentini), we intend to shed light on the integration of different production traditions and assess the timing and methods of assimilating new technical knowledge over the long term. In addition, the **comparison** between glass and glazed compositions specifically could allow us to trace possible **technical transfers** from glassmaking to ceramics (as in the case of al-Andalus) or vice versa.

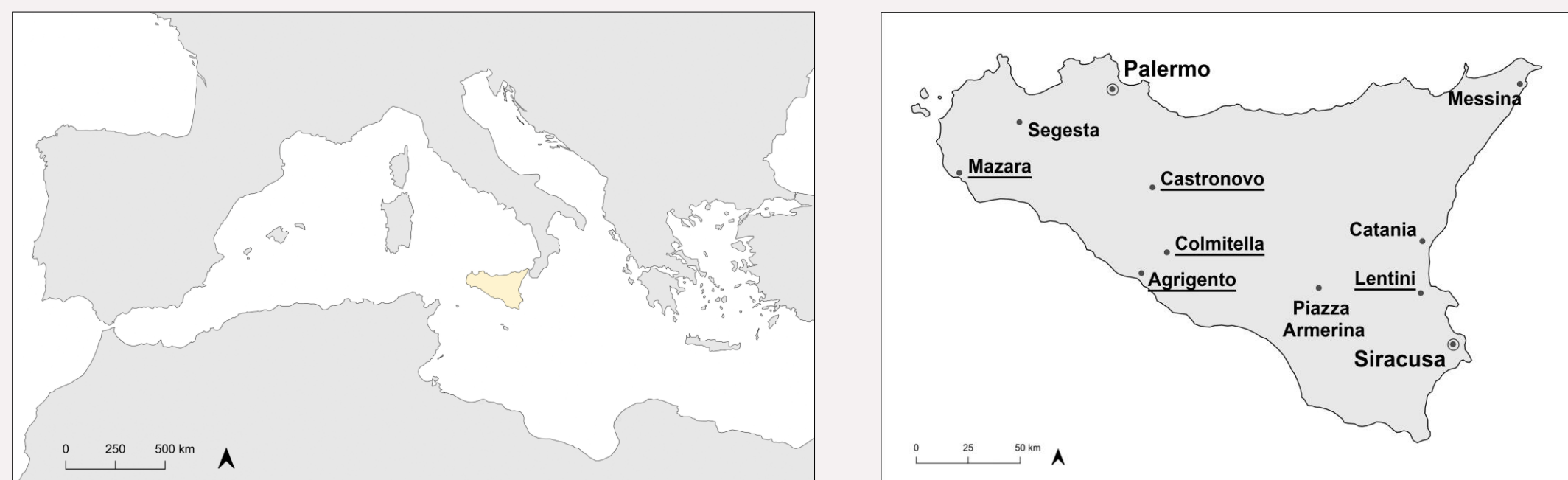


Fig. 1 – left: Sicily in the western Mediterranean; right: some medieval Sicilian centers.

## Research background

In the past decade, large-scale projects on medieval Sicily invested heavily in analysis, leading to increased archaeometric studies. However, there is a lack of information on Sicilian glass compositions from the late 7<sup>th</sup> to early 9<sup>th</sup> century, a period of great economic and technological change in the Mediterranean glass industry. It is unclear whether **fresh glass** continued to arrive in Sicily or how much was **recycled**. Moreover, the gradual decrease of glass finds from the 8<sup>th</sup> century onwards may be somehow related to the contemporary local production of monochrome glazed ceramics known as “**vetrina pesante**”.

Recent research on mid-9<sup>th</sup> to 11<sup>th</sup> century artefacts from Palermo shows significant **technological innovations** during the Islamic period of Sicily, but the full complexity of this change remains elusive. Local production of **soda ash glasses** seems to begin in the late of the 9<sup>th</sup> century. **Lead underglaze-painted** ceramics emerged in Palermo in the late 9<sup>th</sup> century, as a probable **tin-glazed** production from the mid-10<sup>th</sup> century. It indicates the coexistence of different technological traditions in Sicily and the beginning of experimental endeavours with tin-glazed vessels, which currently appear to be isolated.

Towards the end of the 12<sup>th</sup> century there were significant improvements in Sicilian glass manufacturing techniques, as well as in the ceramic industry with the advent of early **Protomaioica** with **tin glazes** (Gela Ware) at the early 13<sup>th</sup> century. The extent to which technical knowledge from the Islamic period persists in the Sicilian tradition remains unclear, but these new technologies appear to mark a departure.

## References

- Capelli, C., Arcifa, L., Bagnera, A., Cabella, R., Sacco, V., Testolini, V., Waksman, Y., 2020, *Caratterizzazione archeometrica e archeologica della ceramica invetriata di età islamica a Palermo (fine IX-metà XI secolo): nuovi dati e problemi aperti*, in “Archeologia Medievale”, XLVII, pp. 249-273
- Colangeli F., c.s., *Il riflesso dei vetri: oltre la ceramica per la comprensione dei mutamenti culturali ed economici. Il caso della Sicilia nei secoli VI-XIII*, Sesto Fiorentino.
- Salinas E., De Juan J., Piñero J. M., Casal M. T., Schibille N., Pradell T., *From glass to glaze in al-Andalus: Local invention and technological transfer*, in “European Journal of Archaeology”, 25, pp. 22-41.



Fig. 2 – Examples of the artefacts mentioned in the text. **Mazara**: 1. Goblets (late 7<sup>th</sup> CE); 2. Printed beaker (13<sup>th</sup> - 14<sup>th</sup> CE); 5. Gela's Protomaioica pitcher (second half 13<sup>th</sup> CE); 6. Palermo's *Graticcio ware* bowl (first half/mid-11<sup>th</sup> CE). **Piazza Armerina**: 3. *Mallet-Shaped bottle* (late 10<sup>th</sup> - mid 11<sup>th</sup> CE). **Castronovo**: 4. *Vetrina pesante chafing dishes* (9<sup>th</sup> - 10<sup>th</sup> CE). © F. Colangeli, A. Meo and P. Orecchioni

## Research queries

- Did Egyptian and Levantine fresh glass still reach Sicily between the end of the 7<sup>th</sup> and the beginning of the 9<sup>th</sup>? How widespread is the glass recycling during this period? Did one or more Sicilian plant-ash glass productions exist before the 9<sup>th</sup> century?
- How complex and diverse was glass and glazed ceramic production during the Islamic period in terms of circulating recipes, techniques and raw materials used?
- How did Islamic technological innovations impact the Sicilian manufacturing traditions, and to what extent has this technical knowledge been preserved? Were specific recipes and techniques adapted in the later medieval production?

## Methods

The glass fragments will be analysed by 'laser ablation inductively coupled plasma-mass spectrometry' (**LA-ICP-MS**) at the **IRAMAT - CEB** in Orléans (CNRS, Université d'Orléans). This method is widely used by scholars as it is minimally invasive and allows the detection of numerous components, as well as trace elements, providing highly accurate sample characterization.

To ensure consistency in data accuracy and thus facilitate comparisons between vitreous components, LA-ICP-MS will also be applied experimentally to analyse glaze chemical compositions. Ceramic samples will also be subjected to optical (**OM**) and to a scanning electron microscopy with energy-dispersive spectroscopy (**SEM-EDS**), to investigate the microstructure and chemical composition of the glaze and body as well. These methods will enable the selection of the most suitable fragments for laser ablation analysis.



Fig. 3 – a. LA-ICP-MS at IRAMAT; glass samples in blocks and cell; b. SEM-EDS at MaDe lab, Università degli studi di Roma Tor Vergata.