

# Vessels Within Vessels: Amphorae Concentration in the Northern Mediterranean Sea

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## Abstract

This study utilizes hotspot analysis to examine the spatial distribution of shipwrecks containing amphorae across the northern Mediterranean Sea from the 18th century BC to the 13th century AD. Unlike previous research that has largely concentrated on individual shipwrecks or generalized trade routes, this approach provides a more systematic method for detecting significant concentrations of maritime activity. This study maps the density of amphora-bearing shipwrecks and identifies several statistically significant hotspots in Spain, Italy, Croatia, Turkey, and Cyprus. These clusters highlight regions of intensive maritime commerce and offer new insight into ancient trade patterns within the broader Mediterranean Sea. These findings contribute to a more nuanced understanding of ancient maritime trade patterns and highlight regions for further archaeological investigation.

## Introduction

The Mediterranean Sea is notable for being a hub of trade and cultural exchange. Ceramic vessels like amphorae were used to transport goods such as olive oil, wine, and grain between ports, so their presence in abundance is indicative of ongoing trade. Questions about trade and exchange can be answered through hotspot analyses. Hotspot analyses are used to identify data clusters of particularly high or low values within a dataset. In this case, the hotspots identify areas having particularly high numbers of amphorae within shipwrecks. The northern Mediterranean is the primary focus of this study due to data access.



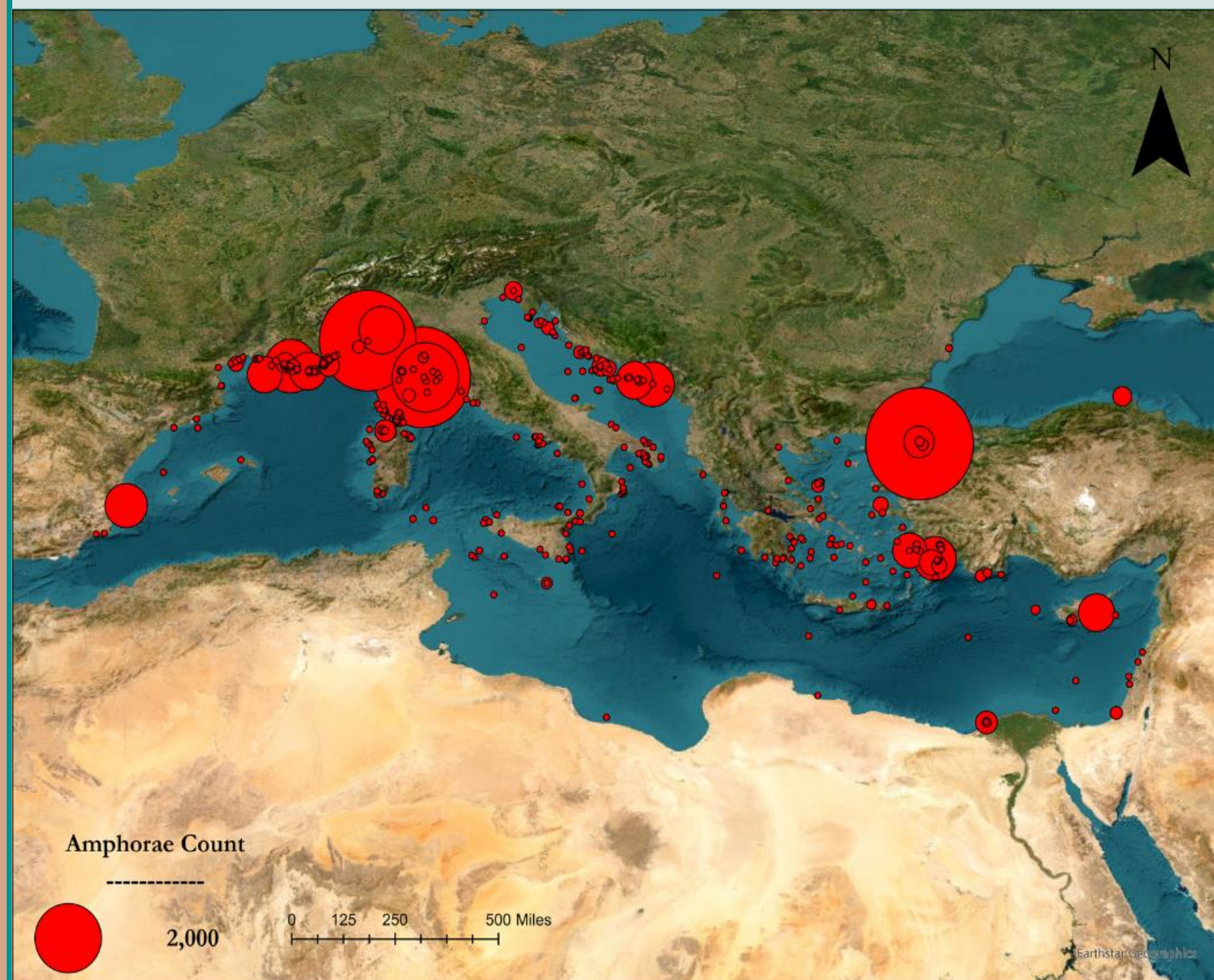
Amphorae found within the Ses Fontanelles Roman shipwreck (Credit: Sebastià Munar Llabrés)

## Background

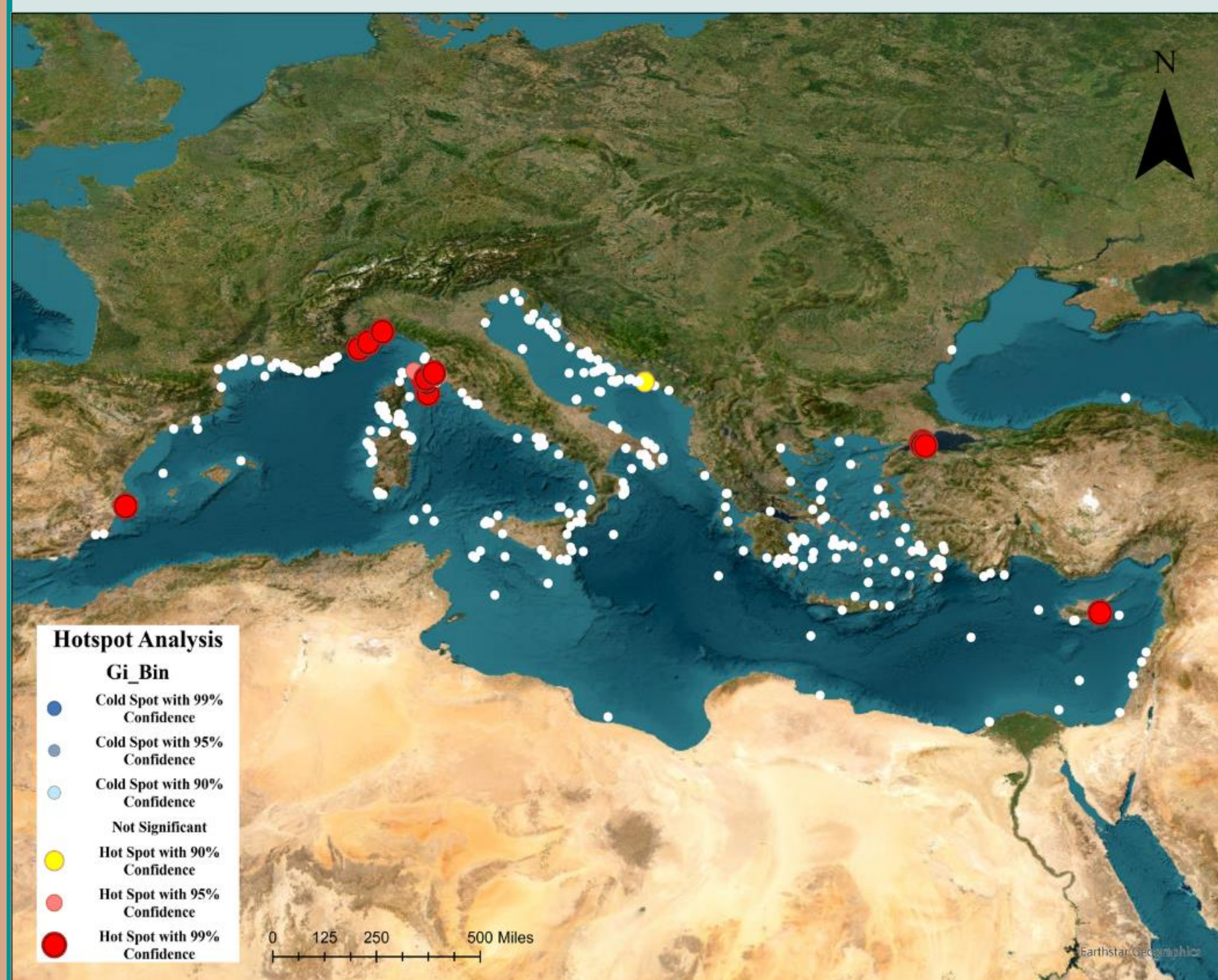
Many publications centered around shipwrecks focus on individual or small clusters of wrecks and their associated contents, such as Luaces and Saéz Romero (2019), Munar Llabrés et al. (2022), and others. Other publications investigate broader trade networks, such as Leidwanger (2020) and Öniz (2016). While many studies explore individual wrecks, there remains an opportunity for more comprehensive hotspot analyses across the wider shipwreck record.

## Methods

For this poster, databases from the Oxford Roman Economy Project and the Nautical Archaeology Digital Library were used to find shipwrecks containing amphorae with associated coordinates. The data were run through ArcGIS to create a cluster analysis and a hotspot analysis. The cluster analysis displays shipwrecks with larger counts of amphorae as larger than those with smaller counts. The hotspot analysis highlights areas with high concentrations of amphorae-containing shipwrecks located close to one another.



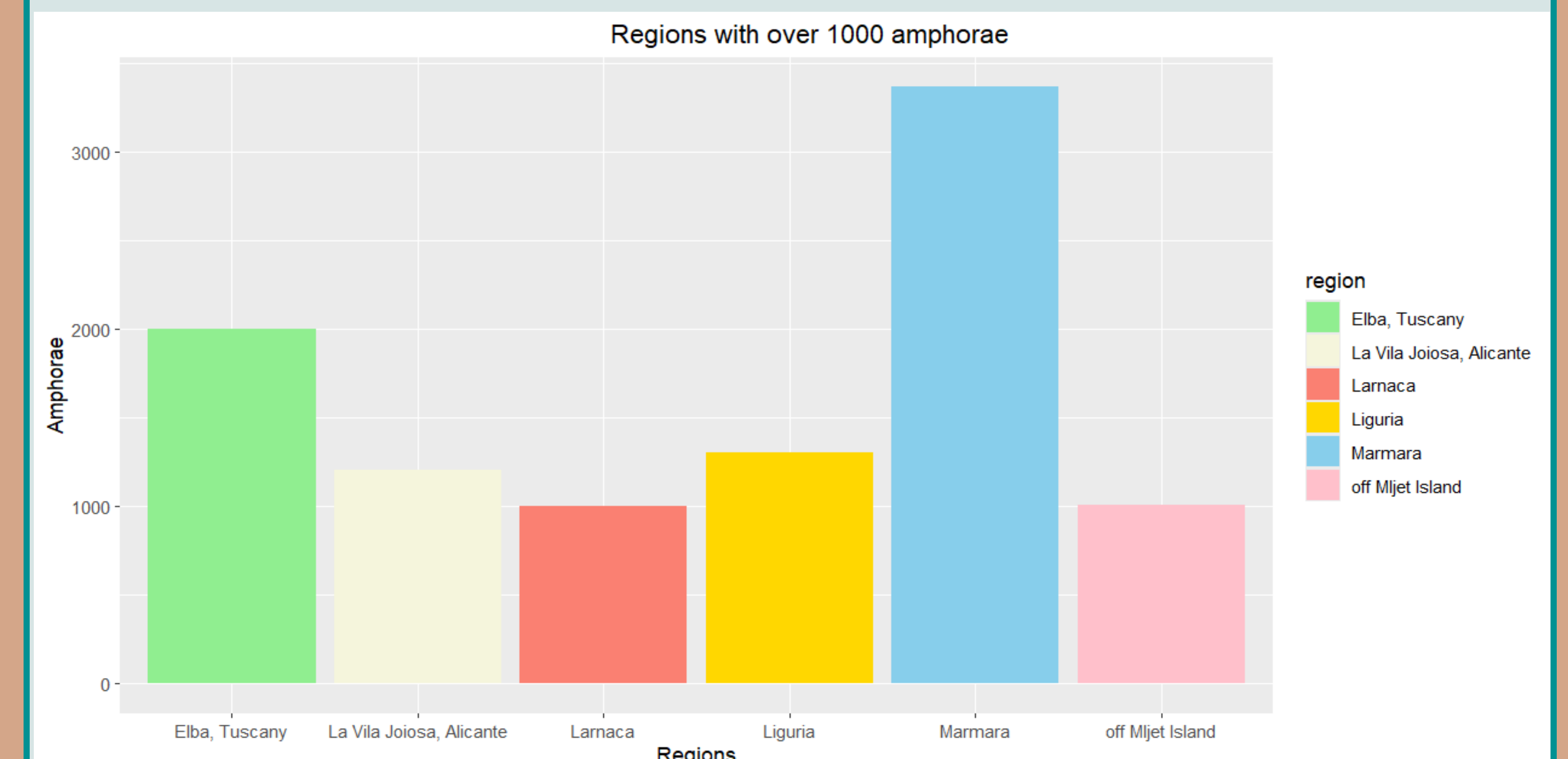
Proportional point map of shipwrecks with amphorae in the Mediterranean. Made by Bailey Stephenson using ArcGIS.



Hotspot analysis of shipwrecks with amphorae in the Mediterranean. Made by Bailey Stephenson using ArcGIS.

## Results

The spatial distribution identified in this analysis highlight six concentrations of amphora-carrying shipwrecks across the northern Mediterranean. The most significant of them occur in northern Italy, near the French border, and between Italy and Corsica. Other notable concentrations are present off eastern Spain, near southeastern Cyprus, within the Sea of Marmara, and off the southern coast of Croatia. This hotspot analysis corresponds with the documented shipwrecks containing over 1000 amphorae surrounding Italy.



Bar graph depicting regions of the Mediterranean with shipwrecks containing over 1,000 amphorae. Made by Cody Carr in RStudio.

## Discussion

The hotspots likely result from several factors. Their distribution aligns with major trade routes connecting key economic centers and regions of wine and olive oil production, as well as long-standing urban ports. However, detection bias may also play a role, as better-surveyed or better-preserved areas are more likely to yield shipwrecks, and absence does not necessarily indicate a lack of activity.

## Conclusion

The shipwreck concentrations revealed by the hotspot analysis illuminate key areas of ancient maritime trade and identify locations for continued archaeological inquiry. Future research should incorporate more data from the southern Mediterranean and narrow the chronological scope to allow for more targeted temporal analysis. Further research could also investigate oceanic topographical features that could contribute to shipwrecks.

## Acknowledgements

We would like to express our gratitude to Filipe Castro and the teams at La Universidade de Coimbra and Texas A&M University, as well as Julia Strauss and the Oxford Roman Economy Project for the use of their shipwreck databases. We would also like to thank D. Shane Miller, Jimmy Hardin, and Jeff Blakely for their guidance in the completion of this project. Finally, we would like to thank the Cobb Institute of Archaeology and the Department of Anthropology and Middle Eastern Cultures at Mississippi State University for their resources and continued support.

## Selected Bibliography

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