Maritime Archaeology Graduate Symposium

March 1st- 3rd, 2023. Short Report Series.

Doi: https://doi.org/10.33583/mags2023.02

Navigation and Maritime Trade Networks in the Aegean (9th–13th c.): The Evidence from Shipwrecks

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Keywords: Shipwrecks, Aegean, Byzantine, Trade networks, Pottery, Economy

Abstract

This paper focuses on the study of seventy-four shipwrecks as evidence for the understanding of complex navigation patterns and the formation of maritime trade networks in the Aegean during the Middle and Late Byzantine periods. An analysis based on the spatial and chronological distribution of wrecks and on the nature of their cargo has been followed. The aim of this study is to place the maritime archaeological data in the broader historical and archaeological context of the period, for the interpretation of the mechanisms of maritime trade activity and the distinguished characteristics they present.

Introduction

The importance of shipwrecks as the main source material for the study of navigation and maritime trade networks is known and well documented. Based on Muckelroy's definition (Muckelroy, 1978:157), shipwrecks are characterized by contemporality, and because of minimum secondary human action, they provide rich information about the circulation of certain cargo, the rhythm of growth or decline of maritime commercial activity and can be placed and analyzed against a broad backdrop of historical and archaeological data. Specifically the historic period under examination, 9th–13th c., is characterized by demographic increase, significant urbanization and subsequently an increase of agricultural and artisanal production, leading to movement of goods and people across the eastern Mediterranean. An important factor was the commercial privileges provided to the main Italian nautical cities, Venice, Pisa, and Genoa,

by a series of *chrysobulls* by the Comnenian emperors during the late 11th and the 12th c. and also the monetary reform introduced by the emperor Alexios I Comnenos in 1092 that allowed a relatively stable economical function.

The Aegean Sea, the *mare internum* of Byzantium, was chosen for this specific study as the main field of research as the number of shipwrecks that can be dated after the 8th c. is significant and higher than both the Hellenistic and Roman wrecks (Micha, 2005–2006), thus providing a rich repository (Map 1[1]). Although the maritime archaeological data are significant, they hadn't been studied extensively despite the rich depository of papers about specific amphora types, glazed tableware, and the evolution of shipbuilding technology. Alongside the data from the Aegean, other data that have been examined were taken from the Adriatic and the Black Sea. Specifically, these data concern the spatial distribution of certain Aegean products and the connectivity patterns between these three interconnected seaways.

Methodology and Limitations

In order to overcome certain methodological problems and to include wrecks in the final catalog for the present study, basic information about each site should be identified. These are: the exact geographical location and if possible, the coordinates of the wreck, photographs, photomosaics or other digital depictions of the site, description of the morphology of the site and the cargo and a suggested chronology by the author. As many new wrecks have been discovered recently but yet remain unpublished, archaeologists kindly provided information and new data for this study to be as up to date as possible.

It is important to note the certain factors and limitations that characterize maritime archaeological research and inevitability affect every study about wrecks. Firstly the conducted maritime archaeological surveys and subsequent excavations are limited, as only the 14% of the wrecks that are included in this study have been excavated. Subsequently and due to deficient documentation of the archaeological context, the provided chronological spectrum for many of the wrecks is broad, expanding from one to two or even three centuries. Clusters of wrecks have been discovered in areas where extensive maritime surveys have been conducted, such as the Pagasetic and Euboean Gulfs in Greece and the Sea of Marmara in Turkey, while areas of frequent maritime lanes that are known form the literary sources, such as the Thracian Sea or the Cyclades, provide limited to non-existent underwater data. As a result certain areas are underrepresented concerning underwater data and their role in the maritime trade is not clear yet. Lastly, it should be added that the slow and sometimes selective publication process constitutes an uneven corpus of literature.

Chronological and Spatial Distribution of Wrecks

Examination of the total number of wrecks in the eastern Mediterranean reveals a steady rise after the second half of the 1st c. BCE, reaching its peak during the 6th and 7th c. CE. It is important to note that the numbers differ regarding the geographical region under examination. The eastern part of the Mediterranean concentrates more wrecks during Late Antiquity than the western part, mainly because of

[1] See end of document for maps

the integration of the eastern markets in the maritime trade networks and the growing needs of the population, although the total numbers for the whole Mediterranean are less than the previous period (Leidwanger, 2020: 114–122). New discoveries of wrecks alter the percentages and since Parker's 1992 fundamental work where wrecks dating between the 7th and the 16th c. cover 7.5% of the total wrecks in the Mediterranean, 2008 Harvard's project *The Digital Atlas of Roman and Medieval Civilization* added 220 wrecks in Parker's catalog with wrecks dating between 1 and 1500 CE, 27% more to the previous percentage. Specifically for the Aegean, the amphora wrecks dating from 7th to 16th c. cover 26% of the total wrecks in the region (Micha, 2005–2006: 88–90).

After the 7th c., a period that is characterized by environmental instability, clashes against Persia and the newly founded Arab caliphates and the mobility of populations like the Slavs, maritime commercial activity declined. The number of wrecks gradually decreased for the next two centuries while the 8th c. is the period with the least wrecks for the whole first millennium CE. (McCormick, 2012: 84). Changes are noticed after the second half of the 9th c. with the military victories by the Macedonian emperors and the following economic regulation that was based on monetary and fiscal stability, factors that favor the rise of commercial activity (Dagron, 2002: 401). Wrecks that can be dated between the 9th and 10th c. are located mainly in the eastern Aegean, along the southwestern coast of Asia Minor and in some islands of the region such as Chios, Kasos, and Fournoi. Sporadic finds from the Saronic Gulf and Crete in the southern Aegean complete the corpus of wrecks for the period. The only wreck that is safely dated in the late 9th c. is located at the Bozburun cape in southwestern Turkey. These wrecks don't have an immediate geographical relevance and their cargo is attributed to many provincial workshops, as will be analyzed shortly, thus creating a broad chronological spectrum of two centuries.

The data for the 11th c. are plentiful due to systematic research, both on the maritime field but also concerning amphora production. Firstly, systematic survey revealed thirteen wrecks around the Proconnesos islands in the Sea of Marmara. Eight of these wrecks can be dated to the 11th c. and one to the 13th c. Extensive archaeological work showed that the region of Ganos was the main producer of the Günsenin type I amphora and all the wrecks dated to the 11th c. carried this amphora as their main cargo, creating a more specific chronological context for these wrecks. Günsenin type I amphorae were also produced elsewhere along the northern shores of the Marmara Sea, making the type the most mass produced for the whole Byzantine period and the wrecks carrying it the largest group for the period under examination. Twenty-one wrecks carried Güsnenin type I amphorae either exclusively or mixed with other cargo such as is the case for the Serçe Limani wreck dating to early 11th c. (Map 2). Seven of these wrecks are located along the western shores of Asia Minor, along the diachronically used sea lane that connected the Black Sea with the broader basin of the eastern Mediterranean, showing the regional and interregional aspect of commercial activity that derived from Constantinople. The city, besides being an administrative and economic center, was also a commercial transit center that connected the regions of the Black Sea, the Aegean and occasionally the Adriatic with the rest of the eastern Mediterranean.

Fifteen wrecks dated to the 12th and 13th c. are located in the western Aegean, mainly around the Pagasetic Gulf and the Sporades Islands in an intermediate relationship with the major cities of central Greece, like Almyros and Demetrias that were facing profound prosperity at the time due to, among other factors, the western presence. Additionally, three wrecks in the inner Euboean Gulf reveal the importance of the port city of Chalkis, medieval Negroponte, as a productive and distribution center, as it has been identified as the major production center for both Günsenin type III amphorae and most of the glazed tableware types

of the 12th and 13th c. The Gulf was the main sea lane that during Middle and Late Byzantine periods, connected the major productive centers, agricultural and artisanal, of central Greece and Thessaly either with the major cities of the north such as Thessaloniki and Constantinople, either with the ports of the broader southeastern Mediterranean, a region where the westerners, mostly the Venetians, conducted major commercial activities, especially after the first three Crusades. Additionally, three wrecks along this route have been revealed, at the island of Rhodes and along the shores of Cilicia. It is evident that the spatial distribution of wrecks for the period under examination is denser around the western Aegean, revealing the increased role of the major coastal cities in trade distribution, and while interactions with southeastern regions, mainly with Cyprus and Syro-Palestine had not stopped, were conducted more sporadically than the previous centuries (Map 3).

Concerning the data from the two main interconnected seaways to the Aegean, the Adriatic and the Black Sea, four wrecks dating from 9th to 13th c. have been discovered along the southern and eastern coast of the Adriatic and four more wrecks dating from 10th to 13th c. in the Black Sea mainly in the Crimea (Maps 4–5). Although the data are limited, the examination of their cargo allows us to make certain observations regarding the distribution of some cargo types and the character of the trade conducted.

Cargo

Amphorae

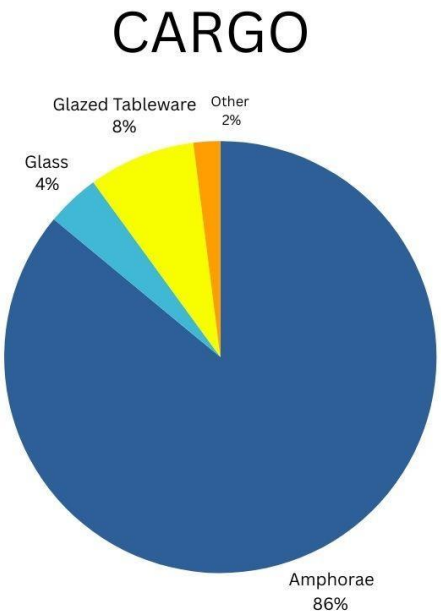

Figure 1 Cargo types per percentage (Kostageorgou 2023)

The examination of the cargo of these wrecks is one of the two major parameters for the analysis of the characteristics of maritime commercial activity along with the examination of the spatial and chronological distribution of wrecks. Amphorae are diachronically the most common finds at wreck sites as ceramic material is the most resistant to underwater environments. This is the case for the period under examination as amphorae represent 86% of the total cargo. Glazed tableware represent 8%, glass cullet or glass vessels 4%, and 2% represent sporadic finds, complementary to the main cargo, such as storage

vessels (*pithoi*) or roof tiles (Fig. 1). This cargo preserved in the underwater environment while other items that are known from literary sources as popular commercial products, such as leather, silk textiles, spices and wood, leave, in most cases, no underwater evidence. Also, it is important to note that wrecks from the Middle and Late Byzantine period diverge from ones from the Roman and Late Roman period, mainly due to the almost complete absence of wrecks that carried stone or other architectural parts and the wrecks that carried works of art, such as statues.[2]

The first evidence from 9th c. wrecks can be placed in the context of Byzantine Globular amphorae, deriving from LR1 and LR2 amphorae, characteristic for the transitional period between the 7th and 9th c. (Todorova, 2020: 405). These amphorae can be attributed to various workshops where it is difficult to recognize its main production. Again, the most distinctive case is the amphorae from Bozburun, divided into four classes with both the Crimea (McManamon and Hocker, 2020: 22–23) and the Aegean (Vroom, 2021: 52–-56) being proposed as a possible provenance. Similar to the Bozburun amphorae is the ceramic evidence from two unpublished wrecks from the eastern and southeastern Aegean, from the islands of Fournoi and Kasos respectively (Argiris, 2024), that are attributed also to the 9th c. Despite scarce evidence the 9th c., it can be characterized as an experimental and adaptive period to new economic conditions that eventually led to the mass amphorae production that occurred after the 10th c., responding to small scale regional trade with main concentrations in the southern and eastern Aegean.

For the period between 9th and 11th c., there are six wrecks carrying the first type of the Bakirtzis classification, also known as *magarika*, four of them located in the southern Aegean and three in the eastern Adriatic, at Cape Stoba, Oslak Islet and Pijan Bay (Map 6). The amphora, with an oblong and striped body, is distributed mainly along the northern shores of the Black Sea and the Adriatic while its provenance remains unknown. The amphorae from the Adriatic sites have a similar ovoid body like earlier amphorae of the 8th and 9th c. while they combine new technical characteristics such as a shorter body and neck and a generally rugged surface. Remaining in the Adriatic, the 10th–11th c. wreck at Cape Stoba, Mljet Island, was carrying nine different amphora types, products of various regions of the Black Sea and the Marmara Sea, and distributed broadly between the Black Sea, the Aegean and the Adriatic reflecting a link between these areas and an interregional aspect of its commercial activity (Zmaic-Kralj et al., 2016: 45–47).

As has already been mentioned, Günsenin type I is the most produced Byzantine amphora and the main cargo for the majority of the 11th c. wrecks. The production of Ganos was the main one and the demand for the wine of the area would have been relatively high, taking into consideration the wrecks around Proconessos and especially the Tekmezar I wreck, characterized as a *myriophoros*, and carrying approximately twenty thousand amphorae (Günsenin, 1999: 20–21). One of the basic characteristics of Günsenin I and its role in the maritime trade is its production according to a standardized metrology system that was based on the regulations cited in the Book of the Eparch (Das Eparchenbuch: 130 §19.1), as is evident after F. van Doorninck's study of the Günsenin I amphorae from the 11th c. Serçe Limani wreck

[2] In total, seventy-three wrecks carrying architectural or construction materials can be dated between the 2nd and 7th c. (Russel, 2011: 139–145). Mass transportation, mainly of marble, stops after the 7th c. but in some cases continues, and after that, mainly concerning *spolia*, such as is the case of the transportation of architectural parts and statues from Constantinople to Venice in 1204.

(Van Doorninck, 2015). The measuring unit was the *mina* and the amphorae were reused, characteristics that are known and from other wrecks of the period under examination.[3]

From the 10th and up to the 12th c., the next type of the Günsenin classification was being produced, and for a period of time the two types, I and II, circulated alongside each other (Günsenin, 2018: 98–99). Although Günsenin II couldn't reach the popularity of Günsenin I, it has been discovered in five wrecks, three of them on the northern shores of the Black Sea and two in the western Aegean (Map 7). The experimentation with a more user-friendly design, such as the longer handles above the amphora rim and the many subtypes circulating, are characteristic for this period. Concerning underwater data, the Günsenin IIb subtype has been the main cargo for two wrecks dated to the late 11th or 12th c., the one being the wreck from Balaklava, Crimea and the other the Kyra Panagia (Pelagonnesos) wreck, Northern Sporades.

This experimentation that can be seen with the production of the Günsenin II type was perfected at the workshops in Chalkis and the new Günsenin III type dominated the markets during the 12th and 13th c. Wrecks carrying this type were the second largest category of wrecks for the period under examination and dominated the western Aegean. The mass production of Günsenin III had its center in Chalkis (Waksman et al., 2018) and it was closely related to both the agricultural centers of central Greece, but also the main port cities that were controlled by Italians such as Almyros in Thessaly. Although the involvement of westerners in the production of the amphora remains uncertain, the spatial distribution of wrecks around the Pagasetic Gulf and the Sporades islands and along the southeastern coasts of Asia Minor and Cilicia, shows the flourishing commercial activity of the period that diversified from the closely operated Byzantine system and opened the space for traders from various socioeconomic backgrounds (Magdalino, 1993: 144). The huge quantities of amphorae that were exported from Chalkis can be seen at three wrecks at Galyfas (or Vasilikos) bay in Peristera islet, northern Sporades, that carried between one and three thousand amphorae and sunk almost simultaneously at the same depth (56–57 m) just some meters apart.[4]

By the end of the 11th c. Günsenin IV entered the markets, a type with a spherical body more suitable for controlled production of precise capacities (Van Doorninck, 2015: 46). Five wrecks have been discovered carrying the type, three in the western Aegean, one in the Marmara Sea, and one in Crimea (Map 8). The study of the amphorae from the Çamalti Burnu wreck, dated to shortly after 1204, showed that most of them were reused and their production followed a standardized volumetric system, representing multiples of the *mina* (Günsenin and Ricci, 2018: 138). Preliminary reports from the wrecks found in the western Aegean show that the amphorae diversify from the main production of Günsenin IV and future systematic research can reveal whether there is in fact a local production of Günsenin IV in Thessaly (Spondylis, 2002: 30). Lastly, there are three Aegean wrecks carrying rare amphora types, more specifically a wreck at Syrna Islet in the Dodecanese carrying Otrando 1 and 2 amphorae, a wreck at Fournoi in the eastern

[3] The production of amphorae based on a standardized volumetric system has been noted for some of the amphorae from the 7th c. Yassi Ada wreck as well.

[4] Another wreck carrying approximately one thousand Günsenin III amphorae has been discovered on the coast of Tartus, Syria (Gunsnenin, 2018: 102 n. 76).

Aegean carrying Günsenin XVI, and a Günsenin X or the 7th type of Bakirtzis classification wreck at Alepochori, in the northern Corinthian Gulf.

Glazed Tableware

The period between the middle 12th and early 13th c. is characterized by a growing maritime trade of glazed tableware, mainly deep and shallow cups and plates. Six wrecks dating to the period were carrying exclusively glazed tableware or mixed cargo including amphorae and other components. The popularity of these products led to an increased production and distribution, mainly via maritime routes, as is clear by the concentration at coastal sites or port facilities. The careful examination of the evolution of the decorative styles allows a specific date for these wrecks beginning from the Pelagonnesos wreck (mid-12th c.), Thorikos and Adrasan wrecks (3rd quarter of the 12th c.), Kavalliani (late 12th c.), continuing with the Kastellorizo wreck (early 13th c.) and lastly the Skopelos wreck (early 13th c.) (Map 9).[5] These vessels were part of the so called Middle Byzantine Production that had its center in Chalkis (Waksmann et al., 2014) and included among others the major decorative styles such as Fine and Incised Sgraffito Wares and Günsenin III amphorae as well as some transitional types such as Günsenin IIa and Günsenin I–III (Vroom, 2022: 456–462). By studying these wrecks, it is clear that by the late 12th and early 13th c. the quality of the products degraded, possibly due to the high demand and the consequent mass production that couldn't be covered by the operating workshops. Furthermore, there is an evident change in favor of deep cups in the cargo of the wrecks that is connected to the influence of western dietary habits, with soups and broths dominating everyday life, especially after 1204 (Papanikola-Bakirtzi, 2005: 121–122).

Glass

The last prominent cargo category concerns glass, either raw or glass vessels. Two trade practices can be distinguished, firstly the transportation of glass cullet from production sites of the eastern Mediterranean, mostly along the shores of Egypt and Syro-Palestine, to workshops of the Byzantine Empire in order to be upcycled into vessels and secondly the transportation of glass vessels from the same production sites to be sold to the rest of the Mediterranean. The first practice is represented by two wrecks at the Serçe Limani zone, and the second by the Cape Stoba wreck in the eastern Adriatic, all of them dated to the late 10th or 11th c. Wrecks that had been carrying glass can be documented from the 14th c. BCE (Uluburun wreck) and until the Renaissance (the Malamocco wreck), reflecting the demand for glass coming from workshops in the eastern Mediterranean as the quality was highly regarded. It is also the only type of cargo that was transported almost exclusively interregionally.

[5] Only these six wrecks are included in the present paper as their main cargo can be characterized by an Aegean provenance. Glazed tableware can be part of cargo dating before and after this specific chronological spectrum but they aren't the main cargo and in some cases they are products of various cultural traditions such as the Fatimid glazed tableware from the Serçe Limani wreck (Jenkins, 1992) and the "Novy Svet Ware" from the wreck of the same name in Crimea (Waksman and Teslenko, 2010).

Connectivity and Maritime Trade Networks

Every commercial activity can respond to a different geographical level of distribution, local, regional or interregional and international. This segregation is partly conventional as the limits for maritime distances can differ depending on various environmental factors. Nevertheless, every level responds to different demands and engages various productive forces and distribution modes. Typically, agricultural products and commonly used components such as ceramic or wooden vessels were the objects of local and regional transactions while more luxury or semi-luxury items such as silk or linen textiles and white ware ceramics were distributed more frequently interregionally. Again, this segregation is not absolute as a product, for example glazed tableware could be distributed locally, regionally or interregionally. The distinguishing feature was that interregional trade and especially the transactions between Byzantine and non-Byzantine merchants were subject to specific regulations cited by official statutes.It is mentioned in the Book of the Eparch that Bulgarians or any other non-Byzantine who wanted to trade textiles or honey in Constantinople should attain the consent of the Eparch of the city and specific requirements for the products should be estimated (Das Eparchenbuch: 40 §9.6). Those specific regulations and limitations didn't occur in regional or long distance trade (Laiou, 2012: 126). Another distinction can be made at the level of production and distribution as every region was an autonomous network that involved production sites, agricultural or artisanal, that could provide for the immediate countryside or serve as a distribution center, typically a port city such as the case of Chalkis in the 12th c. Furthermore, the mechanisms of maritime transport in the context of pre-modern societies differ. Coastal navigation was widespread and the use of a complex system of anchorages was a vital part of Aegean navigation, not only for the protection from intense environmental conditions and the access to fresh water but also for the exchange of products without official port taxation (Veikou, 2015: 52). Long distance travel also occurred mainly under state supervision and subsidy, such as the *annona* shipments, and later in the context of the *muda* system, introduced by the Venetians. A similar state-generated operation has been suggested for the three wrecks of the Galyfas or Vasilikos Bay in the northern Sporades Islands (Koutsouflakis, 2020: 454). Non-state institutions such as the church had also an important role in maritime trade. Literary sources indicate the involvement of various monastic centers with the production and distribution of wine. The ecclesiastical presence on board is evident in the case of the Bozburun wreck, as graffiti abbreviations of the word *Episkopos*, bishop, were found on at least six amphorae. The monastic centers of the region of Ganos appear to be predominant in the wine trade, especially during the 11th c., while others are mentioned regularly in the sources of the Late Byzantine period (Todorova, 2020: 409).

Considering the shipwrecks under examination, most of them can be attributed to regional trade, more specifically the ones with an intermediate relevance with the provenance of the highest percentage of their cargo. Two very distinguishing geographical zones can be seen, in the 11th c. in the Sea of Marmara and in 12th to early 13th c. in the western Aegean (Maps 10–11). These two categories reveal the immediate dependence of the main production line and subsequent maritime distribution on the major administrative or commercial centers for every period under examination. Up until the 11th c. the centralized Byzantine state controlled the production and distribution of products but also benefited from an organized fiscal system of benefits and regulations for merchants, Byzantine or non-Byzantine and from customs spots (Necipoglu, 2017: 440). After the loss of the major cities of Asia Minor and the growing presence and activity of the westerners in central Greece and Thessaly in the 12th c., commercial activity shifted to the western Aegean bringing along a growing agricultural and artisanal production and intense urbanization.

The gradual detachment of trade from the state and the increase of merchants from various socioeconomic backgrounds introduced new fiscal regulations that benefited those merchants and characteristics such as money loaning and the free operation of the markets emerged (Laiou, 2002: 1150–1152).

Alongside the regularity of regional trade, interregional trade was conducted to a lesser degree but steadily throughout the five centuries under examination. Wrecks carrying mostly mixed cargo reveal the passing from various ports and the redistribution along coastal sites and eventually the connectivity between regions such as the Aegean, the Adriatic and the Black Sea. Wrecks such as the ones from Serçe Limani, Cape Stoba, and Novy Svet reveal interregional connections between the three main interconnected seaways and the distribution patterns for various amphora types, glazed tableware or glass. Although deriving from various economic conditions, interregional trade was an important aspect of maritime commercial activity for Roman and Late Roman periods (Leidwanger, 2020: 218) and subsequently, as is evident from the archaeological evidence, for the Middle and Late Byzantine periods.

Conclusions

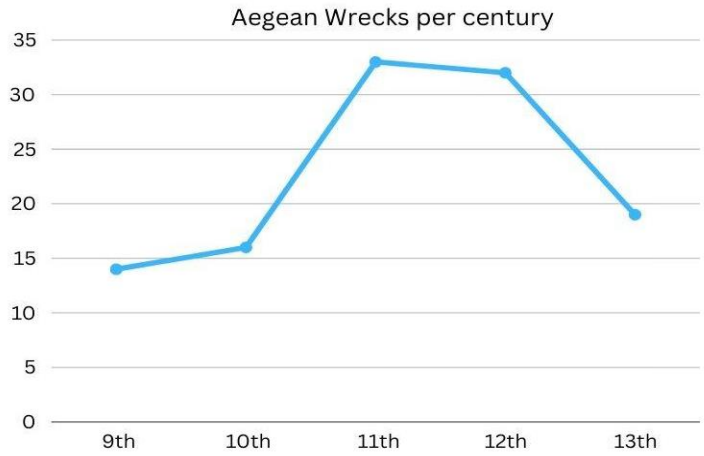

Figure 2 Chronological Distribution of wrecks 9th-13th (Kostageorgou 2023)

The study of shipwrecks that date between 9th and 13th c. reveals a regeneration of maritime commercial activity after the 9th c. that gradually reached its peak during the 11th and 12th c. (Fig.2). Maritime commercial activity depended significantly on the prevailing productive and administrative centers of each period. Furthermore, the organization of the production, the maritime distribution of products and the shifting of commercial activity, mainly the shift from the eastern to the western Aegean during the 12th c., is evident of the adaptability that leads to the successful operation of maritime trade activity. Maritime commercial activity was a part of an organized system that consisted of agricultural and ceramic production centers, transit centers mainly through the larger cities of the Empire such as Constantinople, and a strict system of regulations and benefits for traders. Primarily, every region depended on a local or regional network of land and maritime transport of both agricultural and artisanal products. As regional trade was an important factor for economic growth the majority of the wrecks examined in the present paper can be attributed to this level. Additionally, steady interregional maritime transport occurred throughout the period under examination that connected the three main seaways of the Aegean, the

Adriatic and the Black Sea and a variety of products circulated the markets. These wrecks reveal the integration of the eastern markets to the trade networks and a strong east to west orientation for certain cargo, such as glass and amphora types while the majority of the glazed tableware follows a west to east orientation. Maritime trade networks, as multidimensional and multidirectional mechanisms, have distinguishing characteristics and respond to different demands but also develop and operate in parallel ways, ultimately affecting one another (Laiou, 2012: 146)

Navigation as an empirical practice is expressed through the use of seaways that provided favorable environmental conditions for sailing. Broader historical and socioeconomic factors affect navigation, leading to regular or irregular use of certain seaways and eventually forming maritime trade networks with distinguishing characteristics. Ongoing and future systematic research can improve the understanding of the mechanisms that lead to the development and operation of maritime trade networks, especially for centuries that lack collective data such as the 9th or the 13th. Existing evidence could lead to the hypothesis that the decline of maritime activity that is based on the numbers of wrecks isn't so absolute and small scale or regional distribution continued.

Acknowledgements

I owe my sincere gratitude to my supervisors Prof. G. Koutsouflakis, G. Pallis and I. Varalis for their continuous support and useful observations. I also would like to thank X. Argiris, A. Manglis and N. Karatzas as they kindly provided information and documentation data about new wreck sites in Greece. For her helpful comments and recommendations I thank D. Kalogianni. Lastly, many thanks to the MAGS 2023 Organizing Committee for the wonderful experience and to fellow participants for the motivating conversations.

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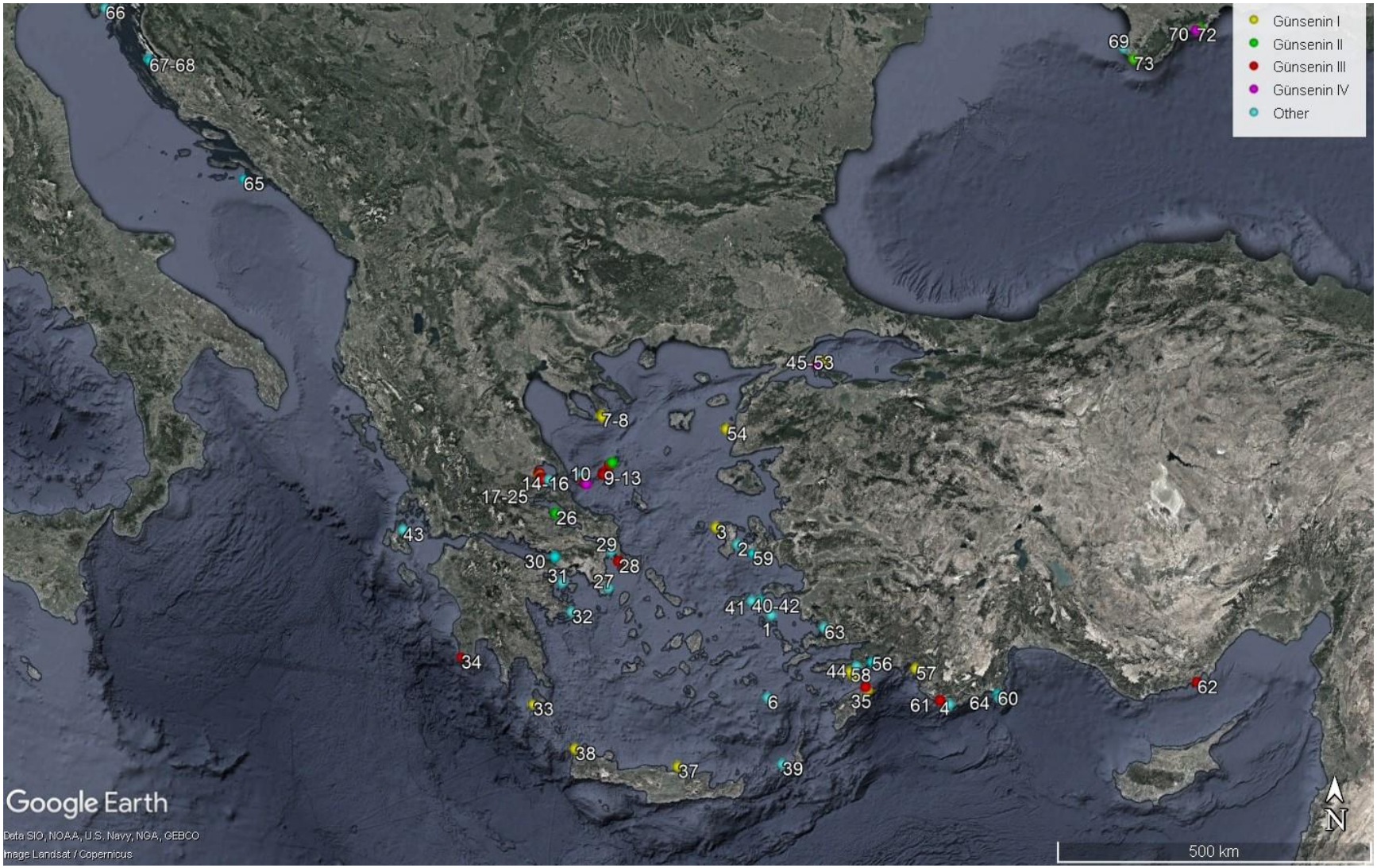
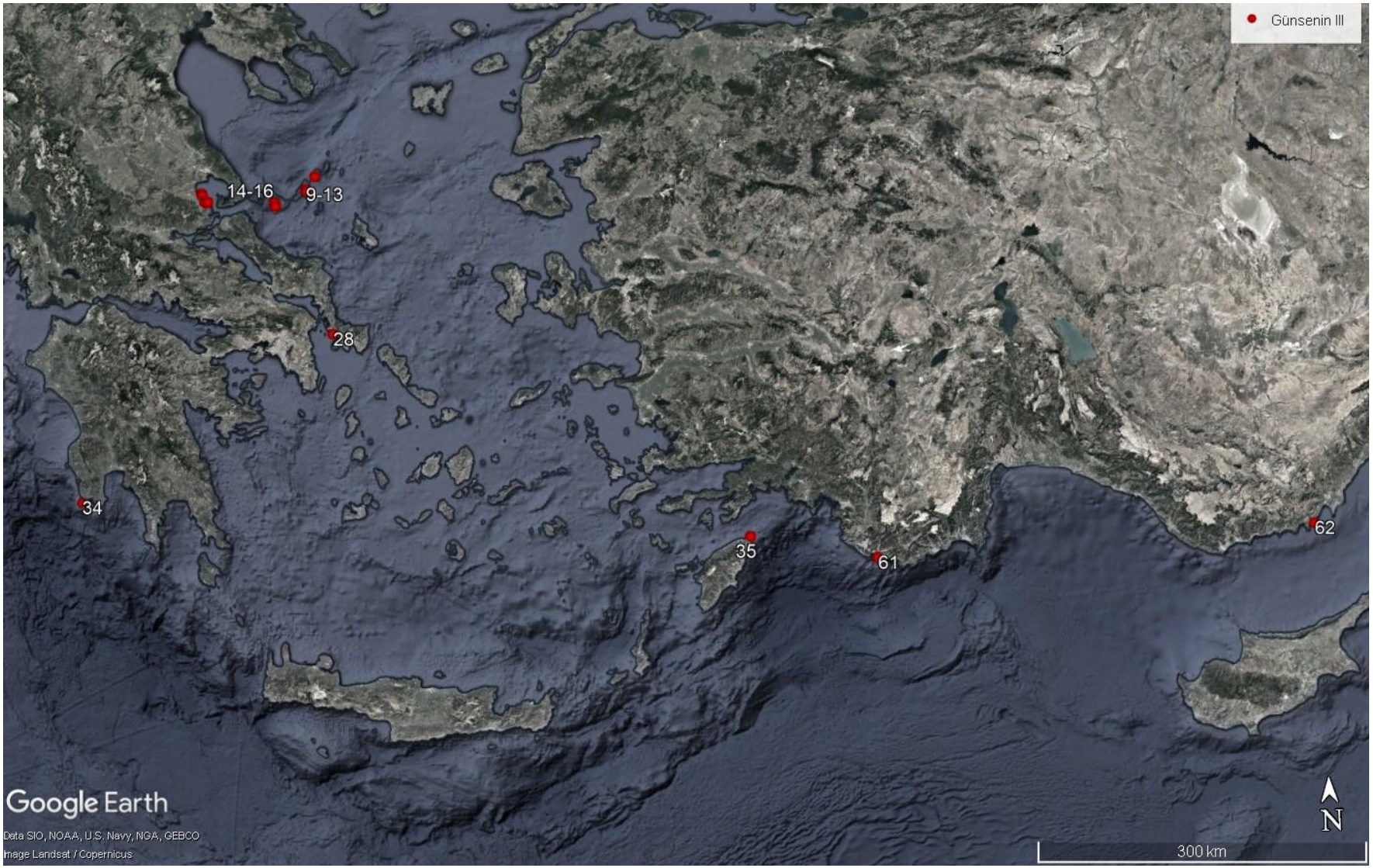
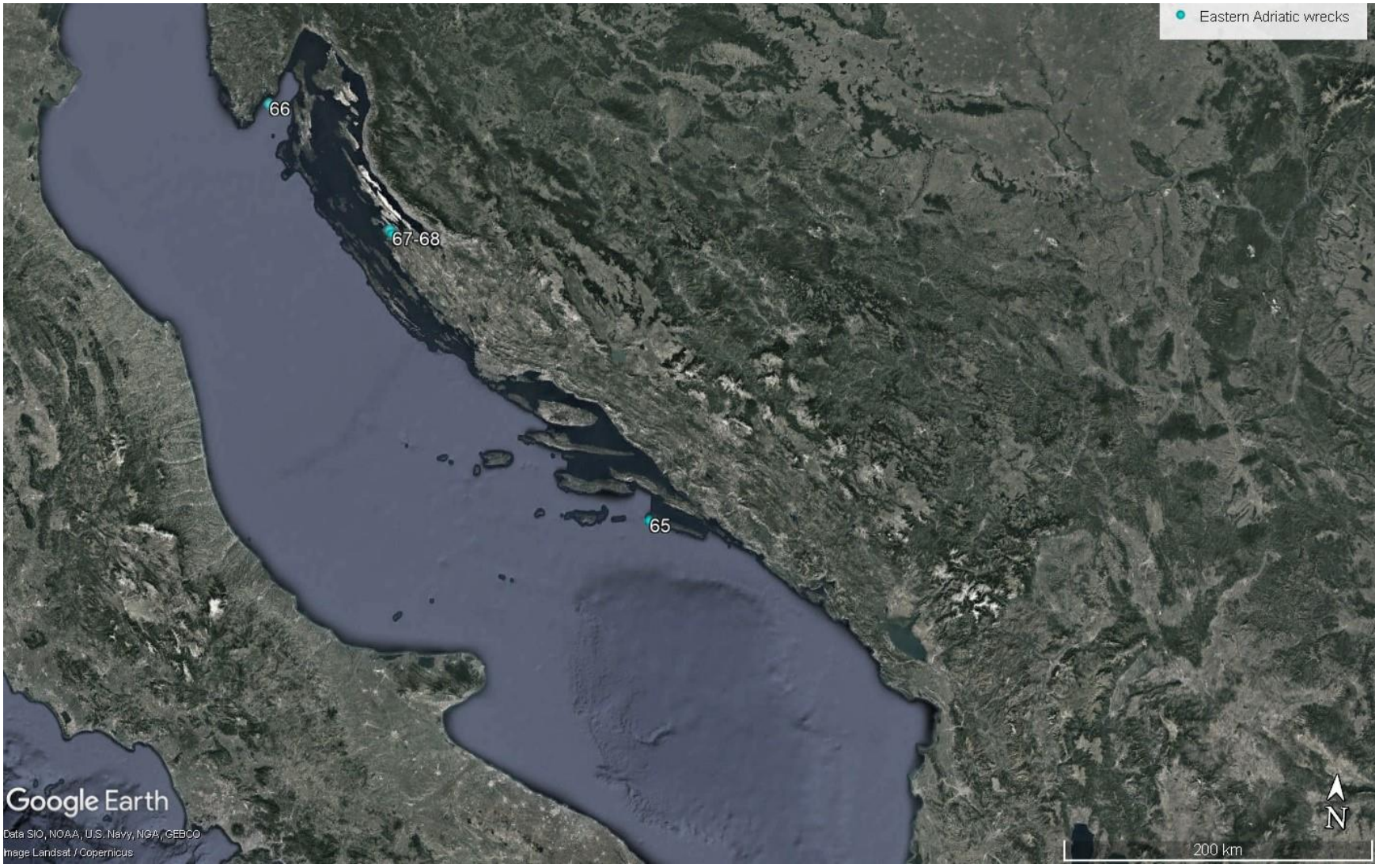


Map 1 Wrecks in the Aegean, the Adriatic and the Black Sea 9th-13th c. (Kostageorgou 20223)

Map 2 Distribution of Günsenin I wrecks 10th-11th c. (Kostageorgou 2023)

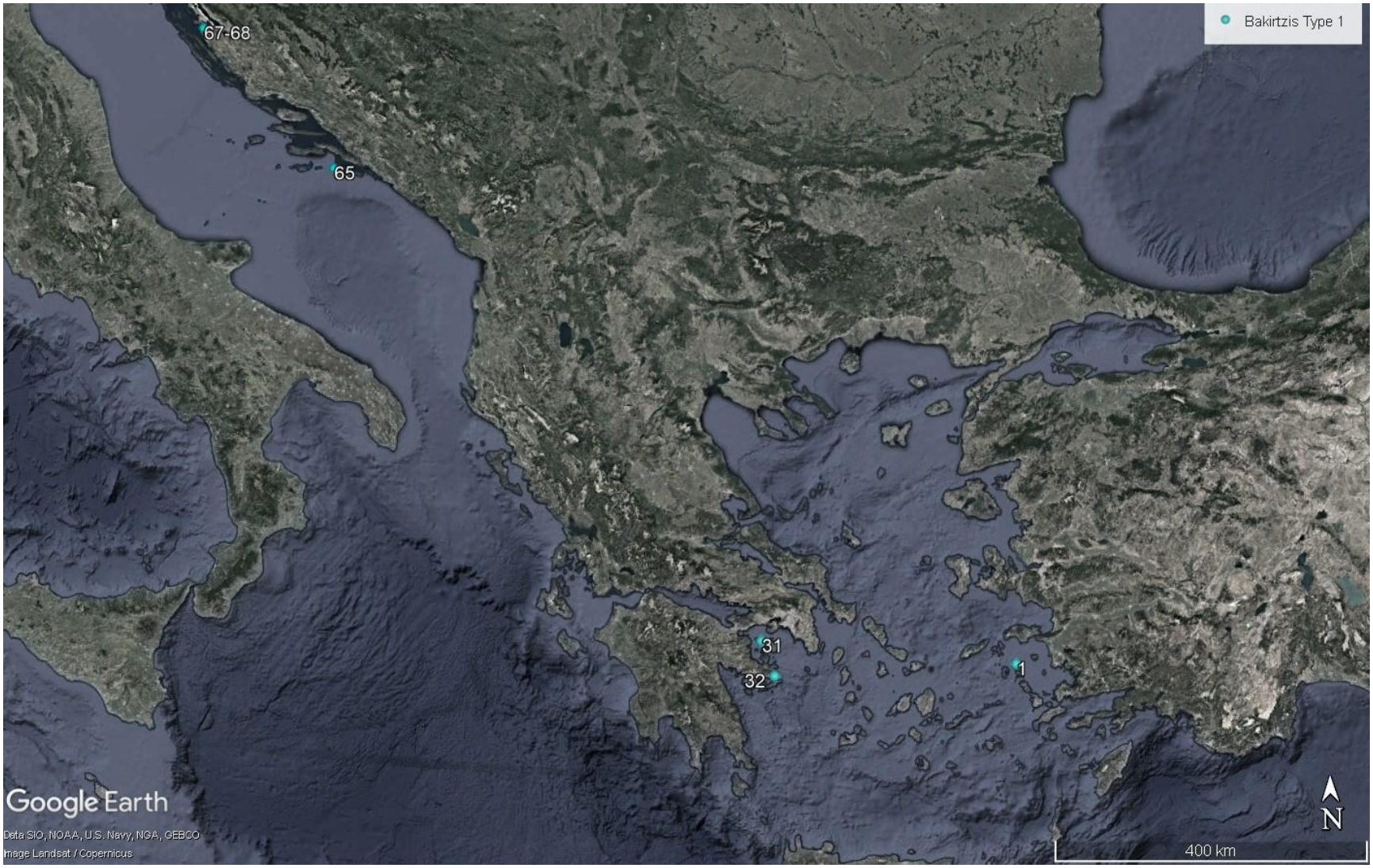


Map 3 Distribution of Günsenin III wrecks 12th-13th c. (Kostageorgou 2023)



Map 4 Wrecks in the eastern Adriatic 9th-12th c.(Kostageorgou 2023)

Map 5 Wrecks in the northern Black Sea 10th-13th c. (Kostageorgou 2023)



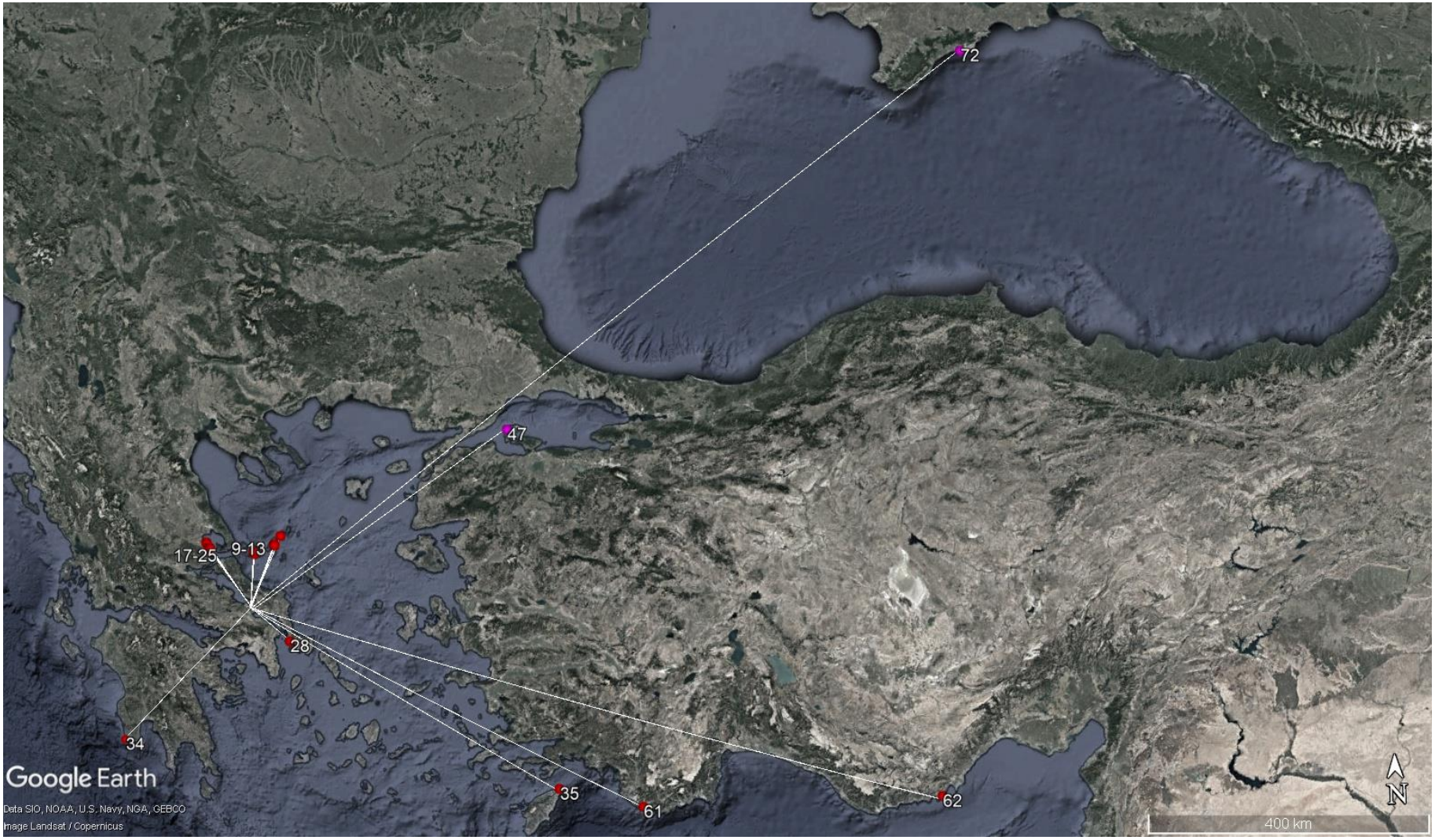
Map 6 Distribution of Bakirtzis Type 1 wrecks 9th-11th c. (Kostageorgou 2023)

Map 7 Distribution of Günsenin II wrecks 10th-12th c. (Kostageorgou 2023)

Map 8 Distribution of Günsenin IV wrecks 12th-13th c. (Kostageorgou 2023)

Map 9 Distribution of Glazed Tableware Wrecks middle 12th-early 13th c. (Kostageorgou 2023)

Map 10 Distribution of Günsenin I wrecks (Kostageorgou 2023)



Map 11 Distribution of Günsenin III wrecks (Kostageorgou 2023)